

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

[Docket No. FAA-2000-8490; Amdt. No. 91-271]

RIN 2120-AH12

**Reduced Vertical Separation Minimum (RVSM)**

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

**SUMMARY:** This final rule amends the list of airspace locations where Reduced Vertical Separation Minimum (RVSM) may be applied to include the New York Flight Information Region (FIR) portion of West Atlantic Route System (WATRS) airspace. RVSM is the reduction of vertical separation between aircraft at certain higher altitudes. RVSM is applied only between aircraft that meet stringent altimeter and auto-pilot performance requirements. The introduction of RVSM in WATRS airspace will save operators fuel and time and will enhance airspace capacity. This rule also requires any aircraft that is equipped with Traffic Alert and Collision Avoidance System version II (TCAS II) and that is flying in RVSM airspace to incorporate a version of TCAS II that is compatible with RVSM operations.

**EFFECTIVE DATE:** December 10, 2001.

**FOR FURTHER INFORMATION CONTACT:** Dave Maloy, Flight Technologies and Procedures Division, Flight Standards Service, AFS-400, Federal Aviation Administration, 600 Independence Avenue, SW., Washington, DC 20591, telephone (860) 654-1006.

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**Background**

This final rule is based on Notice of Proposed Rulemaking (NPRM) No. 00-16 published in the **Federal Register** on December 18, 2000 (65 FR 79283). That NPRM proposed to amend Appendix G of 14 CFR part 91, Operations within Airspace designated as Reduced Vertical Separation Minimum (RVSM) Airspace. RVSM is the reduction of vertical separation between aircraft from 2,000 feet to 1,000 feet at flight levels (FLs) between FL 290 (29,000 feet) and FL 410 (41,000 feet).

*Statement of the Problem*

Air traffic in WATRS airspace has increased steadily in the past few years and is projected to continue to increase. Between 1997 and 1999, the annual traffic count in the WATRS airspace increased from 72,020 to 109,044 flights. This represents an increase of 51 percent. This is a result of a resurgence of activity after several years of economic downturn. The Office of International Operations for the FAA's New York Enroute Air Traffic Center estimates a similar increase over at least the next several years, assuming the economy stays healthy. A substantial portion of the increase is the Europe to Caribbean traffic that overflies the WATRS airspace.

Unless efficiency is improved, the FAA may not be able to accommodate

these greater numbers of aircraft without altitude restrictions that can result in traffic delays and fuel penalties. RVSM alleviates the limitation on air traffic management at high altitudes imposed by the conventional 2,000-foot vertical separation standard. Increasing the number of flight levels available in the WATRS airspace is projected to provide operator benefits similar to those achieved in the North Atlantic (NAT) and Pacific (PAC). Operators will save fuel and time by using optimum altitudes and tracks.

In the WATRS airspace, the FAA plans to initially implement RVSM between FL 310 and FL 390 (inclusive). This is in line with the altitudes in the NAT.

*Oversight for Implementation*

The New York Oceanic Capacity Enhancements Task Force (NYOCETF) (the Task Force), provides oversight for plans and policy related to:

1. Changes to separation minima.
2. Issues relating to traffic management.
3. Airspace/ATS Routes.
4. Standardization of ATC and Operator procedures.
5. Contingency procedures.
6. Communication issues.
7. Status of oceanic ATC automation.

The NYOCETF is the body that is developing WATRS RVSM implementation plans. The New York Air Route Traffic Control Center (ARTCC) Plans and Procedures Manager chairs the Task Force. The Task Force is using the policy and criteria developed in International Civil Aviation Organization (ICAO) forums to build the RVSM program for the WATRS airspace.

*History of RVSM*

Rising traffic volume and fuel costs, which made flight at fuel-efficient altitudes a priority for operators, sparked an interest in the early 1970s 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. Data showing that RVSM implementation is technically and economically feasible has been published 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 advocated initial introduction of RVSM in oceanic airspace where special navigation performance standards were already required. 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.

On March 27, 1997, RVSM was implemented in one such special navigation area of operation established in the ICAO NAT Region, the NAT Minimum Navigation Performance Specification (MNPS) airspace. In designated NAT MNPS airspace, tracks are spaced 60 nautical miles (NM) apart. Between FLS 310 and 390 (inclusive), aircraft are separated vertically by 1000 feet. All aircraft operating in this airspace must be appropriately equipped and capable of meeting required lateral navigation performance standards of 14 CFR 91.705 and the vertical navigation performance standards of 91.706. Operators must follow procedures that ensure that the navigation standards are met. Flight crews must also be trained on RVSM policy and procedures. Each operator, aircraft, and navigation system combination must receive and maintain authorization to operate in the NAT MNPS. The North Atlantic Systems Planning Group (NATSPG) Central Monitoring Agency (CMA) monitors NAT aircraft fleet performance to ensure that a safe operating environment is maintained.

In addition, Pacific RVSM was implemented on February 24, 2000. The Asia/Pacific Approval Registry and Monitoring Agency performs the function of the CMA in the Pacific.

#### *Current Aircraft Capabilities*

FAA data indicate that the altitude-keeping performance of most aircraft flying in oceanic airspace meet the standards for RVSM operations. The FAA and ICAO research to determine

the feasibility of implementing RVSM 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)*. This committee is an industry organization in Washington, DC, that addresses aviation technical requirements and concepts, and procedures, 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 (RGCSPP)*. In 1987, the FAA concentrated its resources for the development of RVSM programs in the ICAO RGCSPP. The U.S. delegation to the ICAO RGCSPP 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. The 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 supporting documents, to approve aircraft and operators for conducting 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 that ICAO has distributed to civil aviation authorities and NAT users. Also, 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 Air Traffic Control (ATC) procedures for RVSM, conducting simulation studies to assess the effect of RVSM on ATC, and developing documents to address ATC issues.

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

### Discussion of Traffic Alert and Collision Avoidance System (TCAS) II, Version 7.0 for RVSM Operations

Traffic Alert and Collision Avoidance System (TCAS) is a general term for equipment that warns pilots of nearby aircraft and provides collision avoidance protection. It is designed to serve as a safety back-up to the air traffic control system.

TCAS I warns pilots of the potential for collision by providing traffic advisories (TAs). These TAs show where another aircraft is relative to the TCAS-equipped aircraft. TAs generally include the range, altitude, and bearing of the intruding aircraft.

TCAS II provides both TAs and recommended vertical escape maneuvers, known as resolution advisories (RAs). Resolution advisories provide pilots with information to change a flight path or prevent a maneuver that could cause insufficient separation between airplanes. TCAS II also coordinates RAs between two TCAS-equipped airplanes (i.e., each pilot would receive an RA that would not conflict with the other RA).

The regulations require under 14 CFR sections 121.356, 125.224, and 135.180, that certain aircraft must be operated with TCAS II, or an equivalent, and the appropriate class of Mode S transponder. Certain other aircraft may be operated with TCAS I or its equivalent. Airworthiness Directives issued to the avionics manufacturers in 1994 require that those aircraft that are required to be TCAS II equipped be equipped with TCAS II, Version 6.04 Enhanced. Approximately 90% of the flights now conducted in RVSM airspace are equipped with TCAS II, version 6.04 Enhanced.

This rule will require that aircraft operated in RVSM airspace and equipped with TCAS II, must be modified to incorporate collision avoidance system logic software Version 7.0, or a later version. Version 7.0 is necessary because only Version 7.0 and later versions incorporate revised alert thresholds for traffic alerts (TA) and resolution advisories (RA) for flight levels (FL) 300 through FL 420 that are compatible with RVSM operations. The alert thresholds in Version 6.04 Enhanced are not totally compatible with RVSM operations. The logic for these alert thresholds does not consider the reduced separation in RVSM airspace and occasionally causes false alerts.

This rule will not require aircraft in RVSM airspace to be equipped with TCAS II. Other rules regulate which aircraft are required to be equipped with

TCAS II. The rule will, however, require any aircraft that is equipped with TCAS II to use Version 7.0 to be approved to fly in RVSM airspace.

#### Status of TCAS I

TCAS I is compatible with RVSM operations and no modifications are necessary.

#### Background of TCAS II Operation in RVSM Airspace

RVSM was implemented in North Atlantic (NAT) Minimum Navigation Specifications Airspace (NAT MNPSA) in March 1997. In preparation for RVSM implementation, the North Atlantic System Planning Group (NATSPG) Operations/Airworthiness (Ops/Air) group reviewed the effect that RVSM would have on the operation of TCAS II, Version 6.04 Enhanced in NAT oceanic airspace. The group recognized that TCAS II, Version 6.04 Enhanced was designed with a TA alert threshold of 1,200 feet for FL 300 through FL 420 and would produce inappropriate TA's for aircraft that were separated in RVSM airspace by 1,000 feet vertically, especially in certain situations. For example, the group recognized that in situations where two aircraft were separated by 1,000 feet vertically and one nautical mile or less longitudinally, on the same track and proceeding in the same direction at approximately the same speed, TA's could be received in the cockpit repeatedly over an extended period of time. The group observed, however, that the traffic levels in oceanic airspace are low relative to continental operations and operations are relatively stable (i.e., aircraft generally climb or descend infrequently). For this reason, it concluded that TCAS II, Version 6.04 Enhanced was acceptable during the early stages of RVSM operations in oceanic airspace provided pilots were informed on the operating characteristics of TCAS II, Version 6.04 Enhanced operations in RVSM airspace. To inform pilots of the potential problem with Version 6.04, the group developed and distributed a document to educate pilots on these characteristics. The document also recommended that pilots limit their vertical speed to 1,000 feet per minute when close to other aircraft to reduce the number of unnecessary alerts.

RVSM has been implemented for over three years in North Atlantic airspace and since February 2000 in the Pacific oceanic Flight Information Regions. In that time, TCAS II, Version 6.04 Enhanced has proven generally acceptable for RVSM operations in oceanic airspace. Multiple TA events

have, however, been found to occur in situations where aircraft are on the same track, speed and direction with one nautical mile or less longitudinal spacing.

#### How Unnecessary TA's May Affect Safety

TCAS provides an aural TA in the form of the announcement "Traffic, Traffic" in the cockpit. The "Traffic, Traffic" announcement repeated over a period of time distracts the pilot from the execution of his or her duties and produces the potential to cause a pilot error. As an example, during the flight, pilots program navigation computers with a series of numbers representing positions on the route of flight. A distraction while programming the navigation computer can cause the pilot to make an error that results in the aircraft straying from its assigned route and posing a hazard to itself and other aircraft.

#### Increase in RVSM Operations

As air traffic increases in areas where RVSM is currently implemented and as RVSM is implemented in new areas, there will be more aircraft conducting RVSM flights and increased exposure to distracting TA's. Air traffic in NAT and Pacific oceanic airspace where RVSM has already been implemented is projected to increase 4–6% each year. New RVSM implementations are planned in the near future in airspace over the Western and South Atlantic, the western Pacific, and the Caribbean. The number of RVSM flights will continue to increase and therefore, the probability of aircraft experiencing distracting multiple TA's will also increase.

#### TCAS II, Version 7.0 Compatibility With RVSM Operations

To avoid the potential for an increase in distracting TA's that can lead to pilot errors, those aircraft that are used in RVSM operations that are equipped with TCAS II systems must be modified to incorporate a version of TCAS that is compatible with RVSM operations. TCAS II, Version 7.0 was designed to be compatible with RVSM operations and mitigates the occurrence of unnecessary TA's in RVSM operations. In TCAS II, Version 7.0, the TA alert threshold between flight levels 300 and 420 is reduced from 1,200 feet to 850 feet. This revision will eliminate unwarranted TA's between aircraft that are correctly separated by 1,000 feet vertically in RVSM airspace.

### *ICAO and Foreign Standards*

ICAO Annexes and civil aviation authorities in foreign countries have already established standards and requirements for specified aircraft to be equipped with TCAS II, Version 7.0. ACAS II is the ICAO term that describes aircraft collision avoidance systems and related equipment. To comply with ICAO ACAS II Standards, Version 7.0 must be incorporated in TCAS II. The aircraft covered and compliance dates for ACAS II (TCAS II, Version 7.0) are discussed in the paragraph below.

#### *Part 91, Section 91.703 Requirements Applicable to U.S. Operations*

Various countries throughout the world have adopted the ICAO Annex 6 requirements discussed below for ACAS II equipage in their airspace. In some major areas, countries and regions have adopted accelerated equipage compliance dates. Because 14 CFR 91.703 requires United States operators to comply with the regulations of the countries in which they are operating, the ACAS II equipage requirements of foreign countries have already required United States operators to plan to equip with Version 7.0.

Section 91.703 is entitled "Operations of civil aircraft of U.S. registry outside of the United States". Paragraph 91.703(a)(2) states that each person operating a civil aircraft of U.S. registry outside the United States shall "when within a foreign country, comply with the regulations relating to the flight and maneuver of aircraft there in force".

#### *ICAO Annex 6 Standards for ACAS II Equipage.*

ICAO Annex 6 (Operation of Aircraft), part 1 (International Commercial Air Transport—Aeroplanes), paragraph 6.18 contains standards calling for TCAS II, Version 7.0 (ACAS II) equipage for specified aircraft by January 1, 2003. Specifically, it states that all turbine-engined aircraft with a maximum certified take-off mass (gross weight) that exceeds 15,000 kg (33,000 pounds) or authorized to carry more than 30 passengers shall be equipped with ACAS II by January 1, 2003. Annex 6 also calls for all aircraft to be equipped with a pressure altitude reporting transponder that operates in accordance with the relevant provisions of ICAO Annex 10.

#### *Asia/Pacific Regional Standards for ACAS II*

The ICAO Regional Supplements for the Middle East/Asia and the Pacific are published in the ICAO document entitled "Regional Supplementary Procedures" (ICAO Doc 7030). Those

regional Supplements call for TCAS II, Version 7.0 equipage for the aircraft specified in Annex 6 by January 1, 2000. Since Version 7.0 was not widely available from avionics manufacturers, most aircraft were not able to meet that date. In response, the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APAN/PIRG) has adopted a regional policy that calls for the specified aircraft to be equipped by January 1, 2002.

#### *North Atlantic Regional Standards for ACAS II*

The ICAO Doc 7030 Regional Supplement for the NAT Regional calls for TCAS II, Version 7.0 equipage for the aircraft specified in Annex 6 by March 31, 2001. (The ICAO NAT Region encompasses most of WATRS airspace).

#### *European Country Requirements for ACAS II*

The requirements for ACAS II equipage in European countries have been published in the European Regional Supplements contained in ICAO DOC 7030. European Supplement paragraph 16.1 (Carriage and operation of ACAS II) calls for the aircraft specified in Annex 6, Part 1 to be ACAS II equipped by January 1, 2000. In response to the lack of availability of Version 7.0, the European Civil Aviation Conference (ECAC) member States have granted exemptions to allow aircraft to continue to operate until March 31, 2001 with TCAS, Version 6.04 Enhanced.

#### *Requirements for TCAS II, Version 7.0 in Countries in the Pacific and Asian Regions*

The ICAO Bangkok office has conducted a survey of countries in Asia and the Pacific to determine those countries that have established or plan to establish requirements for ACAS II equipage in their airspace. To date, 28 countries have established or are developing requirements for operators to equip by the ICAO Annex 6 compliance date of January 1, 2003 or sooner. This list includes: Australia, China, Japan, Korea, New Zealand and Singapore.

#### *Effect of Linking TCAS, II, Version 7.0 Equipage to RVSM Operations*

The rule requires aircraft that are used in RVSM operations and equipped with TCAS II to be equipped with Version 7.0 because it is compatible with RVSM operations. Because other countries and ICAO Regions are already requiring ACAS II (Version 7.0), however, the economic and aircraft engineering

impact directly related to this rule will be minimal.

RVSM is currently applied only in certain major oceanic airspace outside the U.S.—the NAT and Pacific. As detailed above, requirements for TCAS II, Version 7.0 have already been established for operators and aircraft operating outside the US to destinations in Europe, Asia and the Pacific. Since operators will already be required to equip with TCAS II, Version 7.0 to operate in the airspace of most countries in the Pacific and European regions, the effect of requiring TCAS II, Version 7.0 for RVSM operations after March 31, 2002 will be minimal.

#### *Compliance Date for Version 7.0*

This amendment requires operators to incorporate Version 7.0 software into TCAS II equipped airplanes used in RVSM operations by March 31, 2002. The following are factors considered in this decision.

First, there have not been adequate numbers of Version 7.0 units and upgrade kits available to operators. TCAS II, Version 7.0 requirement for European airspace was delayed to March 31, 2001 for this reason. To allow time for adequate numbers of Version 7.0 units and upgrade kits to be made available following the European compliance date, the FAA is delaying its TCAS II Version 7.0 requirement for RVSM operations to March 31, 2002. This will allow 12 months after the initial demand for Version 7.0 to meet the European requirement.

Second, incorporation of Version 7.0 in TCAS II unites is not a major aircraft engineering effort. Incorporation of Version 7.0 is a software change. Existing equipment is removed from the aircraft and the Version 7.0 modification is accomplished by an authorized service facility. Considering these factors, the FAA believes establishing a requirement for incorporation of Version 7.0 for operations after March 31, 2002 will provide adequate time for aircraft not affected by the European requirements to comply.

#### **Discussion of Comments**

The FAA received comments on the proposed rule from the following 6 organizations:

- (1) The Air Traffic Control Association (ATCA).
- (2) Aircraft Owners and Pilots Association (AOPA).
- (3) Cessna Aircraft Company.
- (4) General Aviation Manufacturers Association (GAMA).
- (5) The Department of Defense (DOD).
- (6) The Coalition of Airlines Pilots Association (CAPA).

1. *ATCA Comments.* ATCA states that it concurs with the proposed rule to implement RVSM in WATRS airspace and also concurs with the requirement that aircraft equipped with TCAS incorporate a version of TCAS that is compatible with RVSM operations. ATCA also states that the rule offers the prospect of greater availability of the most time and efficient tracks and routes as well as increased capacity in the North Atlantic Route System.

#### *FAA Response*

ATCA comments support publication of the final rule. No FAA response required.

2. *AOPA Comments.* AOPA states that procedures such as WATRS RVSM will likely have minimal short-term repercussions. AOPA is concerned that the introduction of exclusionary RVSM airspace brings the potential to improve service to participating users at the expense of non-RVSM operators. AOPA's greater concern is that RVSM procedures, and with them new equipment mandates and certification processes, will reduce access afforded to some operators if implemented domestically within the United States.

#### *FAA Response*

This rule only affects WATRS airspace, not domestic airspace. The FAA will give careful consideration to AOPA's concern in any future rulemaking.

3. *Cessna Aircraft Company Comments.* Cessna states that it will not have an adequate number of modification kits to be able to meet WATRS RVSM requirements by the compliance dates proposed in the NPRM.

#### *FAA Response*

First, aircraft that are not RVSM compliant retain the option to operate above and/or below RVSM airspace. The option for unapproved aircraft to climb through RVSM flight levels to operate above RVSM airspace has been used successfully in both North Atlantic and Pacific operations, and it will be available to WATRS operators. Aircraft that are not RVSM compliant may also operate below WATRS RVSM airspace. Maximum leg lengths across WATRS RVSM airspace are approximately two hours. Fuel consumption at lower altitudes for two hours or less should not provide unacceptable operational limitations.

Second, the FAA provided industry with over 3 years of notice of its intent to implement WATRS RVSM. The FAA announced its intention to implement RVSM in the New York FIR portion of

WATRS airspace at the New York Oceanic Capacity Enhancement Task Force on August 28, 1998. The FAA believes it has given the aircraft manufacturers and operator community adequate time to prepare for WATRS RVSM implementation and has made extensive efforts to keep them informed on the progress of implementation plans. RVSM has been implemented for over four years in the North Atlantic and for a year and a half in the PAC. Operators and aircraft manufacturers have been well informed of the planned expansion of RVSM to other airspace.

4. *General Aviation Manufacturers Association (GAMA).* GAMA states that its member companies support the planned implementation of RVSM where airspace is congested. However, it is concerned that the proposed rule to implement RVSM in WATRS on November 1, 2001 may not allow enough time for the fleet to be properly equipped.

#### *FAA Response*

The FAA responses to the Cessna comments also apply to the GAMA comments.

Additionally, by November 1, 2001, a significant majority of flights are projected to be conducted by RVSM compliant aircraft. As of May 2001 (six months prior to the planned implementation date), 75 percent of all flights operating at and above FL 290 in WATRS airspace had already been approved for RVSM operations. The FAA has observed a steady increase in the number of RVSM approved aircraft and projects that by November 1 RVSM compliant aircraft will conduct a significant majority of WATRS flights. In addition, business aviation aircraft conduct approximately 7.5 per cent of the flights in WATRS airspace. As of May, 51% of business jets operating above FL 290 in WATRS airspace had already been RVSM approved. The FAA anticipates that this percentage will continue to increase as implementation approaches. The FAA estimates that the percentage of WATRS flights projected to be conducted by unapproved business jets will be 3% or less.

5. *DOD Comments.* DOD is concerned that it would have to separately notify each sector/center in the route of flight when an aircraft is not RVSM approved. DOD requests that the FAA adopt the following guidance: "For operational purposes, it is the desire of the Department of Defense that filing of a routine flight plan will suffice for advance notification of non-RVSM equipped aircraft and request that the first oceanic center make all subsequent coordination."

#### *FAA Response*

The FAA accepts the DOD's recommendation. Specifically, filing a flight plan for non-RVSM equipped aircraft is adequate advance notice to ATC and no additional notice is required.

6. *CAPA Comments.* CAPA does not object in principle to the concept of reducing vertical separation, as long as safety is not compromised. CAPA states, however, that reducing vertical separation minima without requiring TCAS for all aircraft will jeopardize safety.

#### *FAA Response*

The FAA does not agree that reducing separation without requiring TCAS equipage will create a safety problem. The FAA does recognize, however, the significant enhancements to operational safety provided by TCAS. In its comments on this issue below, the FAA discusses the FAA and ICAO initiatives that should lead to increased TCAS equipage in oceanic operations. The FAA does not agree with the CAPA position for the following reasons:

First, 1,000-foot vertical separation has been applied below flight level 290 since the early 1960's (over 40 years) without special aircraft equipage or performance requirements, including TCAS. ICAO Annex 2 (Rules of the Air), Appendix 3 (Table of Cruising Levels) provides for 1,000 ft vertical separation to be applied globally below FL 290.

Second, standardized aircraft altitude-keeping performance and pilot/controller contingency procedures maintain safe RVSM operations. Section 91.706 and Appendix G require that for an aircraft to be approved for RVSM operations, the aircraft altimetry systems, automatic altitude-keeping devices and altitude alerters must meet stringent performance requirements.<sup>1</sup> In addition, pilot and controller procedures in contingencies and emergencies were developed and revised prior to RVSM implementation. Pilot and controller actions in events such as aircraft system malfunctions, turbulence encounters and wake turbulence encounters have proven to be effective over the past four and one half years of RVSM operations.

Third, RVSM has been applied successfully without a TCAS requirement since March 1997 in North Atlantic oceanic airspace and since

<sup>1</sup> Aircraft equipage and performance were developed in the ICAO Review of the General Concept of Separation Panel (RGCSF) and published in ICAO Document 9574 in 1992. Section 91.706 and Appendix G reflect the ICAO requirements.

February 2000 in Pacific airspace. Over that period of time, approximately 1.7 million flights have been conducted in RVSM airspace and approximately 7.2 million hours of RVSM successful flight experience have been accumulated. NAT airspace has the highest traffic density of any oceanic airspace in the world. Between 900 to 1100 flights are conducted each day in the RVSM airspace of the North Atlantic. The busiest route system in the Pacific is the North Pacific Route System (NOPAC) where approximately 175 flights are conducted each day and in the entire Pacific, approximately 440 flights operate per day.

Fourth, monitoring of system safety has shown that the probability of collision in RVSM operations is extremely low when measured against the agreed Target Level of Safety (TLS). The ICAO recommended Target Level of Safety applied in the vertical dimension is five fatal accidents in one billion hours of flight time. Both NAT and Pac RVSM airspace have been assessed against this TLS. When considering the major components of Collision Risk Modeling (CRM), RVSM operations have been shown to meet the TLS.<sup>2</sup>

#### *Applicability of CAPA Comments to TCAS Rulemaking*

The FAA believes that the CAPA comments relate more specifically to the benefits of TCAS as a safety net in general operations. We do not believe that the CAPA recommendation for TCAS equipage is relevant to the expansion of 1,000-foot vertical separation above FL 290. The FAA has reviewed incidents where TCAS could have or did contribute to the prevention of an accident. None of these incidents occurred in airspace where RVSM is applied and many of them occurred below FL 290.

#### *Current Rule Projects Related to TCAS Equipage.*

There are efforts under way in the United States to revise the regulations related to TCAS equipage. Also, ICAO has published Standards and Recommended Practices (SARPS) that address TCAS equipage. The status of these efforts is as follows:

#### *Revision of Regulations Related to TCAS Equipage.*

In response to an Independent Pilot Association (IPA) petition for rulemaking, the FAA is developing an NPRM. We believe that the CAPA

comments are more applicable to this effort than to RVSM rulemaking.

#### *ICAO Annex 6 (Operation of Aircraft).*

In November 1998, Annex 6 Part 1 (International Commercial Transport Airplanes) was amended to require TCAS equipage by January 1, 2003 for aircraft in excess of 15,000 kg (33,000 pounds) takeoff weight or authorized to carry more than 30 passengers. By January 1, 2005, aircraft in excess of 5,700 kg (12,500 pounds) take off weight or authorized to carry more than 19 passengers will be required to be TCAS equipped. In addition, Annex 6 Part II (International General Aviation Airplanes) has been amended to require IGA aircraft equipage with a pressure altitude reporting transponder by January 1, 2003. This amendment was made to enhance the effectiveness of TCAS operations.

#### **Paperwork Reduction Act**

The reporting and recording keeping requirements associated with this rule remain the same as under current rules and have previously been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), and have been assigned OMB Control Number 2120-0026. There are no new requirements for information collection associated with this amendment.

#### **International Compatibility**

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

#### **Regulatory Evaluation Summary**

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or 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, OMB directs agencies to assess the effect of regulatory changes on international trade. And fourth, the Unfunded

Mandates Reform Act of 1995 (Pub. L. 104-4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by private sector, of \$100 million or more annually (adjusted for inflation).

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 not significant as defined in the 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 amends 14 CFR 91, Appendix G, Section 8 (Airspace Designation) by adding the New York FIR portion of the WATRS airspace to the list of airspace where RVSM would be implemented. It also amends section 2 (Aircraft Approval) by adding a new paragraph that requires any aircraft that are equipped with TCAS II to use Version 7.0, which is RVSM compatible.

This rule will provide operators the following benefits: (1) Permit more operations at fuel/time efficient tracks and altitudes, thereby providing fuel savings, (2) increase the number of available flight levels, and (3) enhance airspace capacity.

In addition to operator fuel savings, many non-quantifiable or value-added benefits will result from the implementation of RVSM in WATRS. Input from air traffic managers, controllers, and operators has identified numerous additional benefits.

- These benefits include:
- Enhanced capacity.
  - Reduced airspace complexity.
  - Decreased operational errors in these regions.
    - Reduction of user-requested off course climbs for, altitude changes.
    - Improved flexibility for peak traffic demands.
    - More options in deviating aircraft during periods of adverse weather.
- The operational benefits realized in the NAT and PAC regions are anticipated in WATRS as well.
- Specific benefits cited by aircraft operators are:
- Decreased flight delays.
  - Improved access to desired flight levels.
    - Reduced average flight times.
    - Increased availability of step climbs.

<sup>2</sup> The major CRM components are: Traffic density, aircraft altitude-keeping performance and the frequency of large errors attributed to human and aircraft system errors.

- Increased likelihood of receiving a clearance for weather deviations.
- Seamless, transparent, and harmonious operations between the NAT and WATRS regions.
- Consistent procedural environment throughout the entire flight.
- Reduced impact of adverse weather by permitting aircraft deviations to other airways without any efficiency loss.

Implementing RVSM in WATRS should increase user satisfaction. The benefits described in this section are compelling in number and operational impact. These benefits are also significant in that both air traffic service providers and aircraft operators will enjoy them.

Most of the costs of this rule will be incurred by those operators who choose to participate in WATRS RVSM and, therefore, must upgrade various equipment and altimetry systems to meet requirements. The quantifiable benefits of the rule result from fuel savings to participating operators who may operate at more fuel-efficient altitudes. Significant non-quantifiable benefits are also associated with the rule as previously discussed.

The FAA assumed for the purpose of this analysis that all existing operators in the area would become WATRS RVSM participants. Based on that assumption, the agency's final quantified estimates of the costs and benefits are nearly equal. For the period 2001–2015, estimated undiscounted benefits in fuel savings are \$34.2 million, while undiscounted costs are \$26.2 million. Discounted benefits, however, are \$18.4 million while discounted costs equal \$23.4 million. Discounted benefits fall below discounted estimated costs because costs are incurred early in the 15-year analysis period and benefits are distributed more evenly throughout the period.

Although the FAA's quantified estimates of costs and benefits are nearly equal, there are substantial non-quantifiable benefits. Each operator will be free, under this rule, to decide for itself if the benefits to that operator justify the costs to that operator. As stated previously, participating in WATRS RVSM is entirely voluntary. Operators who choose not to participate will still be able to fly above or beneath WATRS RVSM airspace.

The FAA believes that many operators will decide that benefits justify costs and participate in WATRS RVSM. This belief is strengthened by the widespread acceptance of similar RVSM programs recently implemented in the North Atlantic and Pacific regions, and further reinforced by the fact that no comments

on the NPRM opposed the rule on economic grounds.

TCAS II Version 7.0 is mandated for any operator who uses TCAS II. There is no economic impact to operators upgrading to TCAS II Version 7.0 due to their upgrading for other international requirements.

#### **Final Regulatory Flexibility Determination**

The Regulatory Flexibility Act of 1980 establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulations." To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have significant economic impact on a substantial number of small entities. If the determination is that it will, then the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

Operators that met the Small Business Administration (SBA) small entity criteria were extracted from the 44-day traffic sample of ETMS data. These operators were cross-referenced with the Central Monitoring Agency (CMA) and the Asia Pacific Approvals and Monitoring Organization (APARMO) databases to determine if they operated any RVSM-approved aircraft. The small entity operators with RVSM-approved aircraft were not considered further in this impact determination.

The list of potential small entity operators, taken from the traffic sample, was used to identify six operators currently reporting financial data to the FAA Bureau of Transportation Statistics. Revenue information for these small entities for year 1999 was obtained from the *Air Carrier Financial Statistics Quarterly*. The operators were

then ranked with respect to their total operating revenue.

The annualized cost of compliance is less than one-half of one percent of annual operating revenues for all but one small entity operator. The FAA does not consider one operator being significantly impacted by this rule to be a substantial number of small operators being significantly impacted. Moreover, the FAA does not mandate these costs. Only operators who choose to participate in the RVSM program and WATRS will incur costs. The FAA therefore certifies that this rule does not have a significant impact on a substantial number of small entities.

#### **International Trade Impact Statement**

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards.

In accordance with the above statute, the FAA has assessed the potential effect of this rule and has determined that it will impose the same costs on domestic and international entities and thus has a neutral trade impact.

#### **Federalism Implications**

The regulations proposed herein will not have a substantial direct effect 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 rule will not have sufficient federalism implications to warrant the preparation of a federalism assessment.

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

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), codified as 2 U.S.C. 1501 1571, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of \$100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by

electd officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a Federal agency regulation that would impose an enforceable duty upon state, local, and tribal governments, in the aggregate, of \$100 million or more (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

This rule does not contain a Federal intergovernmental and private sector mandate that exceeds \$100 million a year, therefore, the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply.

#### Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental assessment or environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rule qualifies for a categorical exclusion.

#### Energy Impact

The energy impact of the notice has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) and P. L. 94-163, as amended

(42 U.S.C. 6362) and FAA Order 1053.1. It has been determined that the final rule is not a major regulatory action under the provisions of the EPCA.

#### Immediate Adoption

Expansion of RVSM into WATRS is part of an internationally coordinated plan to expand RVSM in the ICAO North Atlantic Region. Operators have already committed financial and engineering resources and obtained RVSM approval. Because of the efficiencies that RVSM will bring to operations in this area, good cause exists for making this rule effective on publication.

#### 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 Code of Federal Regulations 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. In Appendix G, amend section 2 by revising paragraph (g), and adding a new paragraph (h), and in section 8 add a new paragraph (c) to read as follows:

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

\* \* \* \* \*

#### Section 2. Aircraft Approval

\* \* \* \* \*

(g) Traffic Alert and Collision Avoidance System (TCAS) Compatibility With RVSM Operations: All aircraft. After March 31, 2002, unless otherwise authorized by the Administrator, if you operate an aircraft that is equipped with TCAS II in RVSM airspace, it must be a TCAS II that meets TSO C-119b (Version 7.0), or a later version.

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

\* \* \* \* \*

#### Section 8. Airspace Designation

\* \* \* \* \*

(c) *RVSM in the West Atlantic Route System (WATRS)*. RVSM may be applied in the New York FIR portion of the West Atlantic Route System (WATRS). The area is defined as beginning at a point 38°30' N/60°00' W direct to 38°30' N/69°15' W direct to 38°20' N/69°57' W direct to 37°31' N/71°41' W direct to 37°13' N/72°40' W direct to 35°05' N/72°40' W direct to 34°54' N/72°57' W direct to 34°29' N/73°34' W direct to 34°33' N/73°41' W direct to 34°19' N/74°02' W direct to 34°14' N/73°57' W direct to 32°12' N/76°49' W direct to 32°20' N/77°00' W direct to 28°08' N/77°00' W direct to 27°50' N/76°32' W direct to 27°50' N/74°50' W direct to 25°00' N/73°21' W direct to 25°00'05" N/69°13'06" W direct to 25°00' N/69°07' W direct to 23°30' N/68°40' W direct to 23°30' N/60°00' W to the point of beginning.

Issued in Washington, DC on December 4, 2001.

**Jane F. Garvey,**  
Administrator.

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