EUROCONTROL Navigation Domain

Home

EUR RVSM

The Official Website for the European Reduced Vertical Separation Minimum Programme

[Top]

Aircraft Operators

Benefits for Airlines

The RVSM Programme offers multiple benefits to airspace users, and especially to airline companies. The addition of six flight levels at the most fuel efficient (and thus most popular) cruising levels means traffic flows can be more flexible and will reduce congestion in Europe's airspace by up to 20%. Since the additional levels let more aircraft use their preferred routes at their most efficient flight levels, the programme generates substantial reductions in fuel costs and in-flight delays.

Nothing irritates passengers as much as delays do. Reducing them is thus crucial for an airline's success. By relieving key constraints on air traffic controllers, RVSM allows a smoother flow of air traffic, directly leading to a reduction in in-flight delays. One third of delays are caused in the en-route phase of flight. Research has shown that prior to RVSM, the average in-flight delay of a flight in Europe's airspace was 4 minutes, adding up to a total of over 2,000 years of passenger time lost per year. RVSM will save a substantial proportion of that time. Furthermore, fewer delays increase the likelihood that passengers can make their connecting flights, saving additional time.

Research also points to significant fuel efficiency gains. Based on conservative estimates, an average of 80 Kg of fuel is saved during each flight in RVSM airspace. Considering that there are about 10,000 RVSM flights every day in Europe and a significant number of these had to fly at sub-optimal flight levels, this represents 290,000 tons of fuel per year. At current prices, that alone represents a saving of 60 million Euro per annum.

Taking all these factors into account, it is estimated that the RVSM Programme will save the airlines close to 4 billion Euros annually. A cost benefit analysis undertaken by PA Consulting, on behalf of the RVSM Programme, has indicated a 14:1 benefit to cost ratio.

The RVSM Programme was a crucial innovation by which European air traffic adapts to the industry's future needs. By opening a new era for European air traffic control, RVSM helps the air transport industry prosper.

Height Monitoring

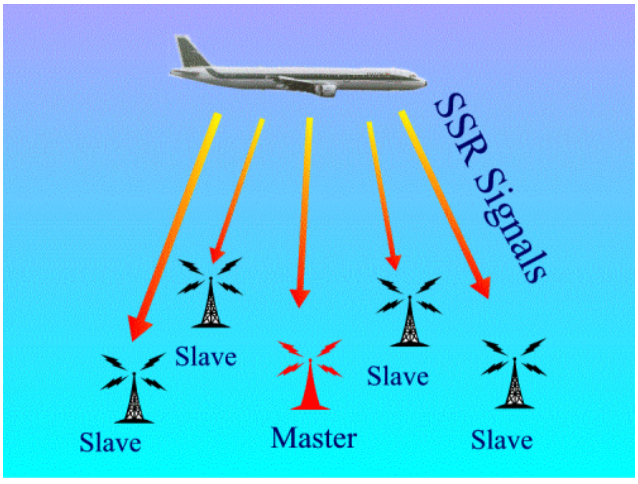
The ICAO requirement for monitoring was derived from the need to confirm that operations in RVSM can be shown to be safe when assessed against pre-determined safety standards. The European RVSM Programme is the first application of RVSM in a dense continental airspace environment and so has had to implement a height monitoring system to confirm that aircraft height keeping performance requirements are being met.

The monitoring programme commenced 25 May 2000 with the first operational HMU at Linz, together with GMUs. The Nattenheim and Geneva HMUs became operational from 9 November 2000.

Operators wishing to operate in European RVSM airspace are required to participate in the RVSM Height Monitoring Programme, except for aircraft for which satisfactory monitoring results are available from RVSM height monitoring programmes of other Regions. Height monitoring will be achieved by overflying either a ground based HMU or by the on-board carriage of a GMU.

HMU

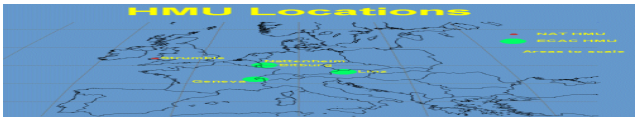
The HMU is a passive ground based system that measures aircraft height keeping within its area of cover. Each system consists of a set of ground stations arranged as a central site with four additional receivers arranged in a square. Each site receives aircraft SSR replies (Modes A, C and S) from which the 3D position of the aircraft is derived. Using meteorological information and the Mode C/S height data it is possible to calculate the altimetry system error.

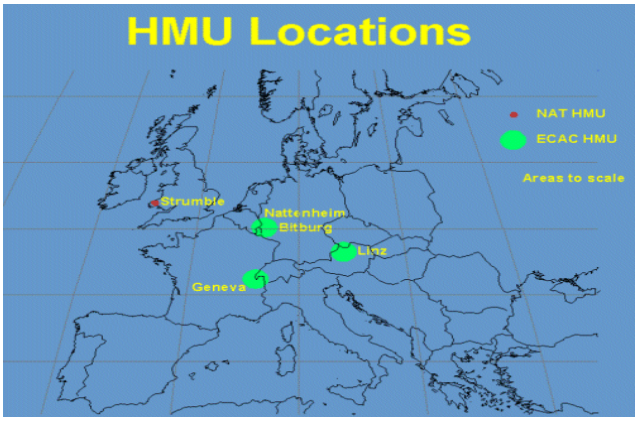


The HMUs locations are:

- Linz in Austria [centre 48°12'N, 014°18'E]
- Nattenheim in Germany [centre 49°57'N, 006°28'E]
- Geneva in Switzerland [centre 46°22'N, 005°56'E]

Operators making special arrangements for a flight over an HMU for RVSM monitoring purposes must confirm the serviceability of the HMU on the date and time of intended flight by contacting the User Support Cell.





Note: The HMUs developed and implemented in the context of NAT RVSM (such as the HMU near Strumble, Wales) may also be used for monitoring.

GMU

A GMU is portable, contained in a 12x29x26cm sized case containing 2 independent GPS receivers with 2 separate antennas and a device for storing the GPS three dimensional positioning data. The GMU is positioned on the relevant aircraft and functions independently of the aircraft's systems. Following the flight, the recorded data is sent to a central site where, using differential post processing, the aircraft altimetry system error is determined.

The characteristics of the GMU are:

- Portable device for easy installation
- Independent from all aircraft systems
- Reception of GPS signals by 2 GPS antennae attached to windows on either side of aircraft
- Reception and processing of mode A/C, mode S transponder signals with integrated antenna
- Onboard recording of GPS and transponder data during flight on disk

GMU monitoring is intended for those operators which have aircraft for which it is impractical to overfly an HMU.

Approval Requirements

Since the introduction of RVSM in European airspace on 24 January 2002, non-approved civil aircraft cannot operate on flight levels FL290 – FL410 inclusive.

To obtain RVSM approval, aircraft operators must satisfy the requirements set out in:

> Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL) No. 6, Revision 1: "Guidance material on the approval of aircraft and operators for flight in airspace above flight level 290 where a 300 m (1,000 ft) vertical separation minimum is applied" JAA TGL No.6 Rev1 is downloadable from the Library.

If you intend to apply for RVSM approval, ensure that your State Approval Authority is fully aware of the EUR RVSM Programme, requirements. If the Authority requires further information, please inform them about this web site and the EUROCONTROL User Support Cell.

In line with the official ICAO publications, a State Approval Authority will grant an aircraft operator RVSM approval when the operator has satisfied the State Authority:

a. that aircraft for which RVSM approval is sought have the vertical navigation performance capability required for RVSM operations through compliance with the criteria of the RVSM Minimum Aircraft Systems Performance Specification (MASPS), and

b. that the operators have instituted procedures for continued airworthiness (maintenance and repair) practices, and

c. that Operators have instituted flight crew procedures for operations in the EUR RVSM airspace.

The RVSM MASPS include the following aircraft system requirements (for more complete and detailed requirements see TGL6, Rev1):

- Two independent, cross-coupled altitude measurement systems
- One automatic altitude control system (±65')
- One altitude alert system (±300'/±50')
- One SSR altitude reporting transponder
- RVSM compliant avionics configuration

The material that may be required by the State Approval Authority for granting RVSM approval is described comprehensively in JAA TGL No.6 Rev1. Confirm these requirements with your State Authority.

A successfully monitored airframe DOES NOT in itself constitute RVSM approval. RVSM approval can only be granted by the appropriate State Authority, based on satisfying all three elements a), b) and c) indicated in the boxed area above.

Information on Flight Crew Training and associated RVSM operational considerations, can be download from the Library.

General Height Monitoring Procedures

Note: Whenever monitoring is mentioned in the following text, it refers to height keeping performance monitoring.

This section describes the different steps required to fulfil the EUR RVSM monitoring requirements. The procedures have been developed with the objective to make the height keeping performance monitoring as transparent as possible to aircraft operators. These procedures are different from the pre-implementation height keeping performance monitoring procedures.

1. For aircraft and operators that are already RVSM approved and operating in EUR RVSM airspace, the RMA will receive the full aircraft details from the State Authority. The RMA will establish the monitoring requirement based on this information and on existing height monitoring data.

2. For new aircraft and operator RVSM approvals, the operator will need to follow the approval procedure established on the basis of the State requirements for RVSM approval, which in itself is based on JAA TGL6 Rev1, or equivalent. After RVSM approval is issued, the State Authority will provide the relevant information to the RMA, to which it is attached. Aircraft RVSM approval information is exchanged between the different RMAs.

3. Operators are to inform the State Authority of any aircraft they intend to remove from their fleet of RVSM approved aircraft. The State Authority will pass this information to the RMA.

4. Operators that regularly operate aircraft within the coverage of the HMUs , are expected to fulfil the monitoring requirements for those aircraft during the course of their day-to-day operations.

    - For those operators that intend to undertake a special flight over the HMU's to fulfil the monitoring requirement or those aircraft for which have no Mode S transponder installed should complete HMU Monitoring Proforma after the flight and forward it to the User Support Cell (USC).

5. Based on of the aircraft and operator information held by the EUR RMA, the EUR RMA will:

    - identify the need for monitoring of airframes to meet the European monitoring requirements, taking into account available monitoring data for these airframes, including the age of that data;
    - establish whether the required data will be obtained through HMU monitoring without the need for a notification to the operator, or whether the operator should be contacted to ensure monitoring takes place;
    - if required, contact the operator to establish if there is a need for specific action to enable the monitoring to take place. The RMA will consult the operator for possibilities to overfly an HMU during check flights, during transiting to/from the operator's maintenance facility or through making a practicable deviation from any intended flight.

6. For a successful measurement by an HMU, it is required that the aircraft is in level flight for approximately 5 minutes, between FL290 and FL410 (inclusive) within the coverage of the HMU.

7. Where the aircraft is not expected to overfly one of the HMUs, the RMA will ask the operator to co-operate for a GMU monitoring flight. Based on the agreement, arrangements will be made for the GMU operator to install and operate the system on a suitable flight in the European airspace. The GMU operator, on behalf of the RMA, will contact the operator to agree GMU flight details. The GMU operator will be responsible for installation of the GMU on the flight deck. Whether the GMU operator will stay with the GMU during the measurements, is subject to the agreement with the aircraft operator. **A charge will be payable to the GMU operator for this service.**

    To arrange GMU flight contact:

CONTACT NAME	CONTACT INFORMATION
Enid Otun	+44-1293-763315 +44-1293-763212 (Fax) E-mail: eotun@arinc.com

    http://www.arinc.com/products/rvsm/index.html

8. If the EUR GMU is to be used for monitoring, the flight must be undertaken in the ECAC Area due to the availability of accurate meteorological data. If the GMU of the North Atlantic and Asia Pacific RMA are to be used, the operator should contact those RMAs for specific information on the areas in which these GMUs can operate.

    Note: The preferred method for monitoring is considered to be overflying an HMU, given the advantages of this method of monitoring compared to GMU monitoring in terms of, amongst others, operator involvement and turn-around time. For GMU monitoring, results are expected to take at least one week from the execution of the monitoring flight

9. Operators may consult the Monitoring Results Page or the contact RMA to ascertain that the information stored about the aircraft is correct and to identify whether the aircraft have been monitored and acceptable performance has been demonstrated.

10. If aberrant or anomalous height keeping performance on an individual airframe is measured which is deemed to require follow-up, the RMA will contact the operator to address the issue. This may require further follow up through the appropriate State Authority.

11. It is important for each RMA to have an accurate record of points of contact for aircraft operators, in order to exchange information on monitoring requirements, and for follow-up in case of anomalous height keeping performance. Operators are therefore requested to include a completed USC Form 2 with their first reply to the EUR RMA. Thereafter there is no

further requirement for information unless there has been a change to the details requested on the form.

Minimum Monitoring Requirements

All operators that operate in the airspace where RVSM is applied are required to participate in the ongoing monitoring programme. The table below shows the minimum monitoring requirements that have been established. Operators are requested to ensure that the required number of aircraft are monitored to comply with the minimum monitoring requirements over a 2 years period. New operators, or operators with new aircraft types, are to comply with the minimum monitoring requirements as soon as possible but no later that 6 months after the issue of RVSM approval

Applicability of Data form Other Regions

Monitoring data obtained in conjunction with other RMA monitoring programs can be used to meet the European Monitoring requirements.

Note. For the purpose of monitoring aircraft types with in parenthesis [ ] can be considered as belonging to the same fleet.

Post RVSM Implementation Monitoring requirements

Type	Classification	Aircraft Group	Initial Monitoring Requirement
1	Aircraft for which there is sufficient data/confidence available	The following aircraft from a manufacturer with a demonstrable track record of production of MASPS compliant aircraft: A300, [A319,A320,A321], A330, A340, A346, [B733, B734, B735], [B736,B737, B738,B739], B744(10" probe), B752, B764, CRJ7, F100, GLF5, LJ31, LJ60, MD11, [MD81, MD82, MD83, MD87, MD88], T154	10% or 2 of the aircraft from each operators fleet to be monitored
2	Aircraft for which there is sufficient data and a reduced confidence available	The following aircraft from a manufacturer with a demonstrable track record of production of MASPS compliant aircraft: A306, A310(GE), A310(PW), B712, B753, [B762, B763], B772, B773, BE40, C56X, [CRJ1, CRJ2], CL60(601/602), CL60(604), DC10, GLF4, MD90, [RJ1H, RJ70, RJ85]	30% or 2 of the aircraft from each operators fleet to be monitored
3	Aircraft for which there is sufficient data and insufficient confidence available	New aircraft from a manufacturer with a demonstrable track record of production of MASPS compliant aircraft or: A318, A345, A3ST, AN72, ASTR, ASTR(SPX), [B721, B722], B732, B737(Cargo), B744(5" probe), [B741, B742, B743], B74S, [BE20, BE30,B350], C500, C25A, C525, C550(552 Citation II), C550(Bravo), [C550,C551], C560, C650, C750, CRJ9, CL30, GL5T, [DC86, DC87], DC93, DC95,	60% of the aircraft from each operators fleet to be monitored

		[E135, E145], E170, F2TH, F70, F900, FA20, FA50, GALX, GLEX, GLF2, GLF2(B), GLF3, H25B(700), H25B(800), H25C, IL96, J328, L101, L29B, [LJ35, LJ36], LJ40, LJ45, LJ55, MD10, P180, PRM1, T134, [T204, T224, T234], TBM7, WW24	
4	Aircraft for which there is insufficient data available.	Other group aircraft other than those listed above including: A124, D328, IL76, IL86, YK42	100% of the aircraft from each operators fleet to be monitored. Plus all new aircraft added to the fleet
5	Non Group	Non Group approved aircraft: A225, B701, B703, B720, B731, DC85, DC91, DC92, DC94, FA10, H25A, IL62, L29A, LJ23, LJ24, LJ,25, MU30, SBR1, SBR2	100% of the aircraft from each operators fleet to be monitored as soon as possible post RVSM approval

Height Monitoring Results

Results of Height Monitoring are available here on a continually updated basis.

A successfully monitored airframe DOES NOT in itself constitute RVSM approval (see Approval Requirements). Aircraft data & monitoring results shown below are normally updated every 2 weeks.

Monitoring results below consist of confirmed measurements only, so there may be a delay between the monitoring of the aircraft and the release of the results. For more detailed information on other Regions' monitoring results, please contact the appropriate Monitoring Agency. Please refer to the Monitoring Procedures for the monitoring by an HMU or GMU.

Monitoring results database – Last update 17 December 2004		
Operators A to D	**Operators E to N**	**Operators O to Z**

Please refer any Height Monitoring issues to the RVSM team - go to Contact Us page.

Wake Vortices

Background

The experience gained from the implementation of RVSM in the North Atlantic Region (NAT) indicated that the turbulence created by the wake vortex of aircraft at adjacent or same flight levels could present operating difficulties. As a result, the EUR RVSM Programme commissioned independent research provide an analysis of wake vortices as part of the overall assurance of the continued safety of flight within the European RVSM environment.

Results of First Wake Vortex Report

This first study was largely based on wake vortex encounters over the North Atlantic region. The results of this first study were included in the Pre-Implementation Safety Case (PISC) developed by EUROCONTROL RVSM Safety sub-programme.

As a result of a recommendation from the first independent Study Report (March 1999), EUROCONTROL has been collecting wake turbulence data above FL245 from aircraft operators since 1 August 2000. The conclusions of the report are that the presence of mountain ranges, the wider mix of aircraft, the greater number of aircraft and the intersection of airways are not expected to increase the probability of encountering hazardous wake vortices within the European RVSM airspace.

Results of Second Wake Vortex Report

A further report was released in August 2001 mainly based on the new European encounters in order to validate the recommendations of the initial study prior to the submission of the PISC to EUROCONTROL Safety Regulation Commission (SRC).

Twenty-four wake vortex encounters within the EUR RVSM airspace were subject to further independent analysis which confirmed the

findings of the first Study Report. Most of the reported wake vortex encounters occurred when one of the aircraft was climbing or descending. The study also considers that increasing air traffic density can only increase the number of these significant encounters.

However, this study confirmed that the introduction of RVSM was not expected to increase the probability of a hazardous encounter with wake vortices, but that pilots and controllers needed to be informed that nuisance encounters would increase.

RVSM Post- Implementation Review of Wake Vortex Encounters

A further independent review of 10 pilot encounters since the introduction of RVSM (Period April –October 2002) concluded that the above statement about hazards and nuisance encounters is supported by pilot reports. However, pilots still express concern about significant wake vortex encounters with the wake of climbing or descending aircraft.

Wake Vortex Data Collection

Any pilot who encounters a wake turbulence incident when flying within the lateral limits of European RVSM airspace above FL 245 should report the incidents using the detailed report provided with Wake Vortex Report Form.

RVSM Implementation commenced on 24th January 2002. The RVSM Programme must now compare the assumptions that were taken in the PISC with today's environment. Pilots are encouraged, therefore, to submit wake vortex reports to the USER Support Cell.

Wake Vortex and Phraseology

In the context of turbulence and mountain wave effects it is important to note that there is specific phraseology provided in the Flight Crew Information Notice for pilots to indicate severe turbulence or other weather related phenomena and an inability to maintain RVSM operations. There is also guidance within the ATC manual on the procedures applicable for individual aircraft reporting severe turbulence, as well as procedures for multiple aircraft in adverse weather-related conditions.

Related documentation, including the required report forms, is available for download from the LIBRARY page