RVSM/TF/2
WP/06
08/07/02

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ATM COMMITTEE OF THE GREPECAS ATM/CNS/ SUBGROUP

SECOND MEETING OF THE RVSM TASK FORCE
(San Jose dos Campos, Sao Paulo Brazil, 8 to 12 July 2002)

(Presented by Roberto Arca, RVSM/TF Rapporteur)

Agenda Item 4: Study and develop the necessary procedures to accomplish the system performance monitoring.

Summary

This working paper **is presented to the Meeting in order to analyze the options for the implementation of a Height-monitoring programme and take appropriate action on this matter.**

References: - Third Meeting/workshop of Air Traffic Management Authorities and Planners, Lima, Peru. 20-24 May 2002.

1. BACKGROUND

1.1. The AP/ATM/3 meeting noted that the monitoring of altimetry system errors was a pre-requisite for maintaining flight safety in an RVSM environment. Currently, there are two known methods for monitoring errors, the HMU and the GMU systems, which have enabled RVSM implementation in many ICAO Regions. Both systems have their advantages and disadvantages.

1.2. The AP/ATM/3 meeting recognised that the RVSM Task Force would need to examine this matter and suggest to the next AP/ATM meeting a methodology to be used in the region, taking into account operational safety and the cost involved in ASE monitoring.

1.3. Monitoring requirements differ between regions and States:

a) The Asia/Pacific Region requires monitoring of two or three airframes per type per operator, depending on previous RVSM experience (**see Appendix A**),

b) The Russian SCAA requires monitoring for each airframe for which RVSM approval is sought,

c) The European Region (EUROCONTROL) does not directly link monitoring of airframes to RVSM approval. However, there are requirements regarding

monitoring of a certain percentage (10%, 30%, 60% and 100%, depending on confidence level) of a fleet prior to RVSM implementation.

2. ANALYSIS

2.1 The Height-monitoring unit (HMU) is a set of ground stations (one master station and four slaves) arranged to receive aircraft SSR replies (Modes A, C and S) from which the geometric height and latitude/longitude of the aircraft are derived.

2.2 The HMU measures the geometric height of aircraft which pass within about 35 to 45 NM of the master station site yielding a large volume of data suitable for determining height-keeping characteristics of individual airframes.

2.3 Height-monitoring will normally be conducted without requiring any co-operation or involvement of aircraft operators, provided the aircraft remain in level flight for approximately 5 minutes within the coverage of the HMU.

2.4 However, it may be necessary to request some aircraft operators to make minor diversions from their normal routes in order to fly in the vicinity of a HMU.

2.5 The HMU works with a Total Vertical Error Measurement Unit (TMU) which calculates the geometric height of the assigned Flight Level using meteorological data and subtracts time dependant information from the aircraft measurements, enabling the components errors to be obtained.

2.6 The disadvantages of HMUs are the high cost (approximately USD $ 8 Million for three units in Europe), a suitably located Mode S radar is required and only aircraft within 45 NM of the units can be monitored.

2.7 A GPS Monitoring Unit (GMU) is a portable self-contained unit, the size of a small suitcase weighing 5 Kgs. It contains a GPS receiver, a small computer and antenna. They are portable carry-on monitoring and recording units. They are produced to meet aircraft equipment standards.

2.8 With the cooperation of the aircraft operators, GMUs will be taken on board of certain flights to collect height keeping performance data for post-flight processing. Specific aircraft can be targeted for monitoring with the data collected on their normal routes.

2.9 The installation procedure for the GMU does not interfere with the crew or the operation of the aircraft. The installation takes approximately 15 minutes and utilizes light antennae which are attached to the rear flight-deck windows.

2.10 The GMUs measure GPS data, which, with ground station differential corrections, provide an accurate 3D position of the aircraft. The units are accompanied by the appropriate documentation to allow on-board carriage and use.

2.11 Furthermore, GMUs are relatively inexpensive (approximately USD $ 10.000 each) albeit other costs such as operating staff and backup units have to be considered.

2.12 The disadvantage of GMUs is that they give a much smaller volume of data.

2.13 It should be recognized that monitoring data from other regions is valid for use in CAR/SAM assessments of height keeping performance and system safety.

3. CONCLUSION

3.1 The meeting is invited to:

a) consider this information as guidance material,

b) consider the minimum requirements for monitoring in the CAR/SAM regions,

c) discuss the options for implementation of a height monitoring programme,

d) consider the organization and funding issues with the following principal options:

i) a hybrid monitoring system (HMUs and GMUs),
ii) only GMU monitoring,

e) in case of preferring GMUs for sole height monitoring in the CAR/SAM regions, the meeting analyze the following principal options (**see Note below**):

i) approve one or more suitably qualified companies to carry out the task on a direct contractor-client basis with individual operators needing a monitoring service.

ii) offer a height keeping monitoring service through IATA who will engage a suitable qualified company to provide the service.

Note: Provided that the measuring methodology and results for both options are accepted by another regional monitoring agency such as APARMO or EUROCONTROL and, the service is available on equal terms to all users of CAR/SAM Regions.

ASIA-PACIFIC RVSM MINIMUM MONITORING REQUIREMENTS:

AS OF: 24 JANUARY 2002

1. INITIAL MONITORING. All Asia-Pacific operators that operate or intend to operate in airspace where RVSM is applied are required to participate in the RVSM monitoring program. The attached chart of monitoring requirements establishes requirements for initial monitoring associated with the RVSM approval process. In their application to the appropriate State authority for RVSM approval, operators must show a plan for meeting the applicable initial monitoring requirements.

2. AIRCRAFT STATUS FOR MONITORING. Aircraft engineering work that is required for the aircraft to receive RVSM airworthiness approval must be completed prior to the aircraft being monitored. Any exception to this rule will be coordinated with the State authority.

3. FOLLOW-ON MONITORING. Monitoring is an on-going program that will continue after the RVSM approval process. A follow-on sampling program for additional operator aircraft will be coordinated by the Asia-Pacific RVSM Implementation Task Force.

4. MONITORING OF AIRFRAMES THAT ARE RVSM COMPLIANT ON DELIVERY. If an operator adds new RVSM compliant airframes of a type for which it already has RVSM operational approval and has completed monitoring requirements for the type in accordance with the attached chart, the new airframes are not required to be monitored - except as targeted at a later date in the follow-on monitoring program. If an operator adds new RVSM compliant airframes of an aircraft type for which it has NOT previously received RVSM operational approval, then the operator should complete monitoring in accordance with the attached chart.

5. APPLICABILITY OF MONITORING FROM OTHER REGIONS. Monitoring data obtained in conjunction with RVSM monitoring programs from other regions can be used to meet Asia-Pacific monitoring requirements. The Asia-Pacific Approvals Registry and Monitoring Organization (APARMO), which is responsible for administering the Asia-Pacific monitoring program, has access to monitoring data from other regions and will coordinate with States and operators to inform them on the status of individual operator monitoring requirements.

6. UPDATE OF MONITORING REQUIREMENTS CHART AND WEBSITE. As significant data is obtained, monitoring requirements for specific aircraft types may change. When the chart is updated, a letter will be distributed to States and operators. The updated chart will be posted on the APARMO website being maintained by the Federal Aviation Administration (FAA) on behalf of the International Civil Aviation Organization (ICAO) Asia-Pacific regional planning group. The website address is:

http://www.tc.faa.gov/act-500/niaab/rvsm/aparmo_intro.html

7. PRIOR RVSM EXPERIENCE. When a new-entrant-RVSM operator completes the regional monitoring requirements for State approval for all of its Pacific aircraft types or North Atlantic aircraft types, the operator is considered by APARMO to have "Prior RVSM Experience."

For most aircraft types, monitoring is not required to be completed PRIOR to operational approval being granted, however participation in monitoring IS REQUIRED in accordance with the attached chart.

ASIA-PACIFIC APPROVALS REGISTRY AND MONITORING ORGANISATION
EFFECTIVE AS OF: 24 JANUARY 2002

MONITORING NOT REQUIRED **PRIOR** TO THE GRANT OF RVSM APPROVAL, HOWEVER PARTICIPATION IN MONITORING **IS REQUIRED** IN ACCORDANCE WITH THIS CHART			
CATEGORY		**AIRCRAFT TYPE**	**MINIMUM OPERATOR MONITORING FOR EACH AIRCRAFT GROUP**
1	OPERATORS PLANNING TO CONDUCT OPERATIONS IN PACIFIC AIRSPACE AND OPERATORS WITH PRIOR RVSM EXPERIENCE PLANNING TO OPERATE IN THE WESTERN PACIFIC/SOUTH CHINA SEA AREA	New aircraft types from a manufacturer with a demonstrable track record of the production of MASPS compliant airframes **or** [A30B, A306], A310 (GE), A310 (PW), [A319, A320, A321], A330, A340, B712, [B721, B722] [B733, B734, B735] [B736, B737/BBJ, B738, B739] [B741, B742, B743, B74S] B744, [B752, B753], [B762, B763], B764 [B772, B773], DC10, MD10, MD11, MD80, L101 CL60, GLEX, GLF3, GLF4, GLF5 [F900, F900EX] FA50, FA50EX, F2TH, LJ45 LJ60, H25B	Two airframes of each type* to be monitored as soon as possible but not later then 6 months after the issue of RVSM operational approval. ** Note. For the purposes of the minimum monitoring requirement, aircraft within parenthesis [ ] may be considered as the same type.*
Category 2 below has been adopted in preparation for RVSM implementation in the Western Pacific/South China Sea Area on 21 Feb 2002			
2	OPERATORS WITHOUT PRIOR RVSM EXPERIENCE WHOSE OPERATIONS ARE PRIMARILY IN THE WESTERN PACIFIC/SOUTH CHINA SEA AREA	Same types as above in section 1.	At least 3 airframes of each type unless operator has only 1 or 2 of a type, then all operator airframes of that type should be monitored. Monitoring to be completed as soon as possible but **not later then 3 months** after the issue of RVSM operational approval or not later then 3 months after the start of Western Pacific/South China Sea RVSM operations, whichever occurs later.

MONITORING REQUIRED PRIOR TO THE GRANT OF RVSM APPROVAL			
3	OPERATORS OF AIRCRAFT TYPES SHOWN IN THE BLOCK TO THE RIGHT	Other group or non –group aircraft other than those listed above including: A124, ASTR, B707, B731, B732, C525, C560, C650, C750, DC8, DC9, E145, FA10, FA20, F100, GLF2, GALX, H25A, H25C, IL62, LJ31, LJ35, LJ55, MD90 or new aircraft types from a manufacturer **without** a demonstrable track record of the production of MASPS compliant airframes.	60% of target number of airworthiness approved, same type, airframes of each operator to be monitored **or** individual monitoring of airworthiness approved airframes of a given operator.