APPENDIX D - Assessment for Compliance with the MASPS

1. The assessment of ASE to confirm compliance with the MASPS requires five basic evaluations – two for individual aircraft, two for aircraft groups, and one for the number of individual aircraft ASE samples. All ASE performance assessments described within this section will be made on MASPS approved aircraft. Specifically, it is necessary to determine that:

a) an individual aircraft's sample ASE mean indicates that the true ASE mean for the airframe meets airworthiness requirements;

b) the ASE mean and standard deviation from operators of similar aircraft groups are consistent;

c) an aircraft group's sample ASE mean and standard deviation indicate that the aircraft group's true ASE mean and standard deviation meet airworthiness requirements;

d) the ASE mean for individual aircraft is stable over time; and

e) the number of samples from an aircraft group needed to assure that the remaining non-sampled aircraft in the group, by themselves would not cause the system to exceed the TLS.

2. To confirm that the ASE of an individual aircraft is within an acceptable range of values and meets the airworthiness requirements necessitates a statistical evaluation. It is designed to aid in making decisions under the uncertainty created by normal performance variation and measurement errors. In RVSM, the maximum acceptable magnitude for the mean ASE of individual aircraft, which is from an aircraft group that meets the MASPS group requirement, is 245 ft. Two critical values (target levels) were established and are compared to the measured ASE. One target level is set at 300 ft and is larger than the maximum acceptable ASE mean. It guards against a compliant aircraft being scrutinized for deficiencies due to the uncertainty of measurement error. If individual aircraft measured ASE is above this target level, ASE performance is judged to be non-compliant. If individual aircraft ASE is below this target value, ASE performance is judged to be in compliance. However, this leaves a possibility that a marginally non-compliant aircraft is judged to be compliant. Therefore, a second target level is set (160 ft) and is smaller than the maximum acceptable ASE mean. It guards against a marginally non-compliant aircraft being accepted as compliant. If individual aircraft measured ASE is above this target level and below the first target level, ASE; performance is judged to be aberrant. If individual aircraft ASE is below this target value, ASE performance is judged to be normal.

3. Unfortunately, even with the above precautions, the possibility of incorrect decisions cannot be eliminated since only a sample (and not the true value) of an individual aircraft's ASE is available from the monitoring program.

4. The assessment of ASE for an individual operator of an aircraft group (usually aircraft of the same type or series with similar altimetry systems) will be made by comparing the ASE performance of the individual operator being assessed to other individual operators of the same aircraft group which have exhibited consistent ASE performance.

5. The assessment of ASE for an aircraft group begins by creating a chart of sample aircraft group means and standard deviations against a template defining the permissible region of airworthiness requirements. The purpose of the assessment is to confirm that the aircraft's true ASE

mean and standard deviation meet the MASPS airworthiness requirements for an aircraft group. The testing concept is similar to the assessment of individual aircraft, however, due to the simultaneous testing of both the ASE mean and standard deviation, the test is inherently more complex. Instead of comparing the measured values to a target level, it is necessary to simultaneously compare them to a two-dimensional region.

6. In addition, underlying the development of the MASPS is the assumption that the distribution of ASE for each aircraft type follows a Gaussian distribution. It is critical to confirm this assumption in order to use the chart show in Figure 1 and be assured that the resulting risk due to ASE is negligible.

7. ASE for an individual aircraft is considered to be stable if the statistical distribution of ASE is the same for all times t. That is, the distribution of ASE for an individual aircraft at some initiating time, t_0, is the same as the distribution of ASE at some later final time, t_f. Since it is assumed that individual aircraft ASE can be described by a Gaussian distribution, which is completely characterized by a mean and variance, the stability of ASE for an individual aircraft can be evaluated by comparing estimates of ASE means and standard deviations at different and widely spaced times, t_0 and t_f. It is assumed that the ASE mean values of several individual aircraft will be measured repeatedly during the Verification and Trial Phases of the monitoring effort.

8. The monitoring targets for the Verification Phase have been designed to provide a monitoring sample that is representative of all the different aircraft types, operators and altimetry system fits. A single aircraft with a large non-compliant ASE can break the system TLS within a very short period of time. Any sampling procedure that does not require a complete census of Caribbean and South American airframes permits a finite possibility that a non-compliant aircraft will remain undetected. However during the first RVSM implementation, it was felt by the NAT SPG that to perform a complete census during the Verification Phase was neither a realistic nor a practical goal. Nevertheless, the ultimate objective is still a complete census. It is to be achieved as soon as possible into the RVSM trial and prior to the RVSM Operational Phase.

9. Assessment of FTE for compliance with MASPS

9.1 FTE is gathered through pilot and ATC reports of large height deviations and Mode C data. These data are compared to an exponentially decreasing function that describes the maximum acceptable frequency of FTE of different magnitudes. If the measured FTEs are below the functional values, aircraft performance is considered to be compliant.