



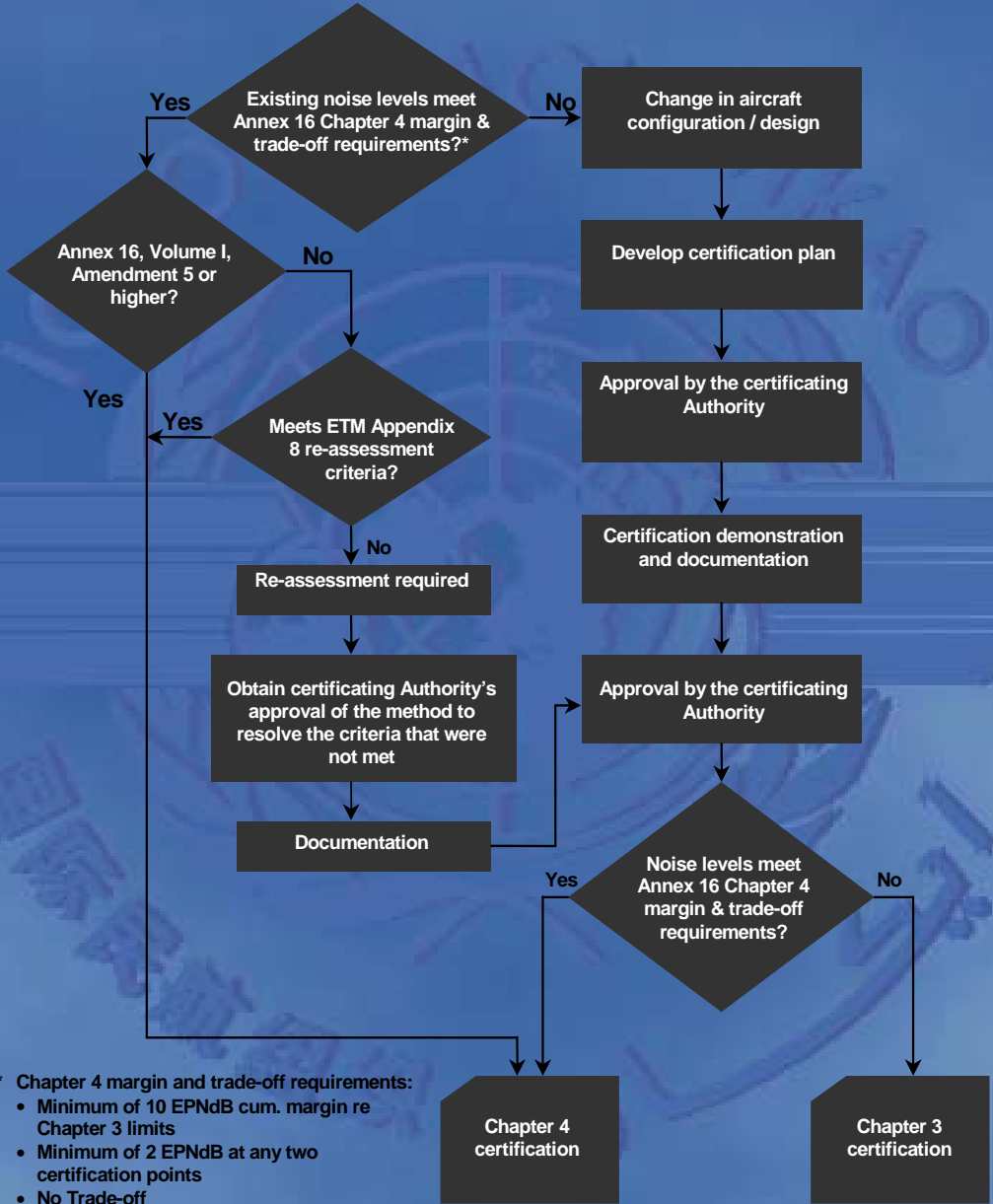
Noise Certification Workshop

Session 3: Aircraft Noise Re-certification ***Worked example of applying assessment*** ***criteria***

Alain DEPITRE DGAC - France

Re-certification “Roadmap”

- ✿ Appendix 8 of the ETM contains a “roadmap” describing the process for the re-certification of sub-sonic jet aeroplanes from Chapter 3 to Chapter 4



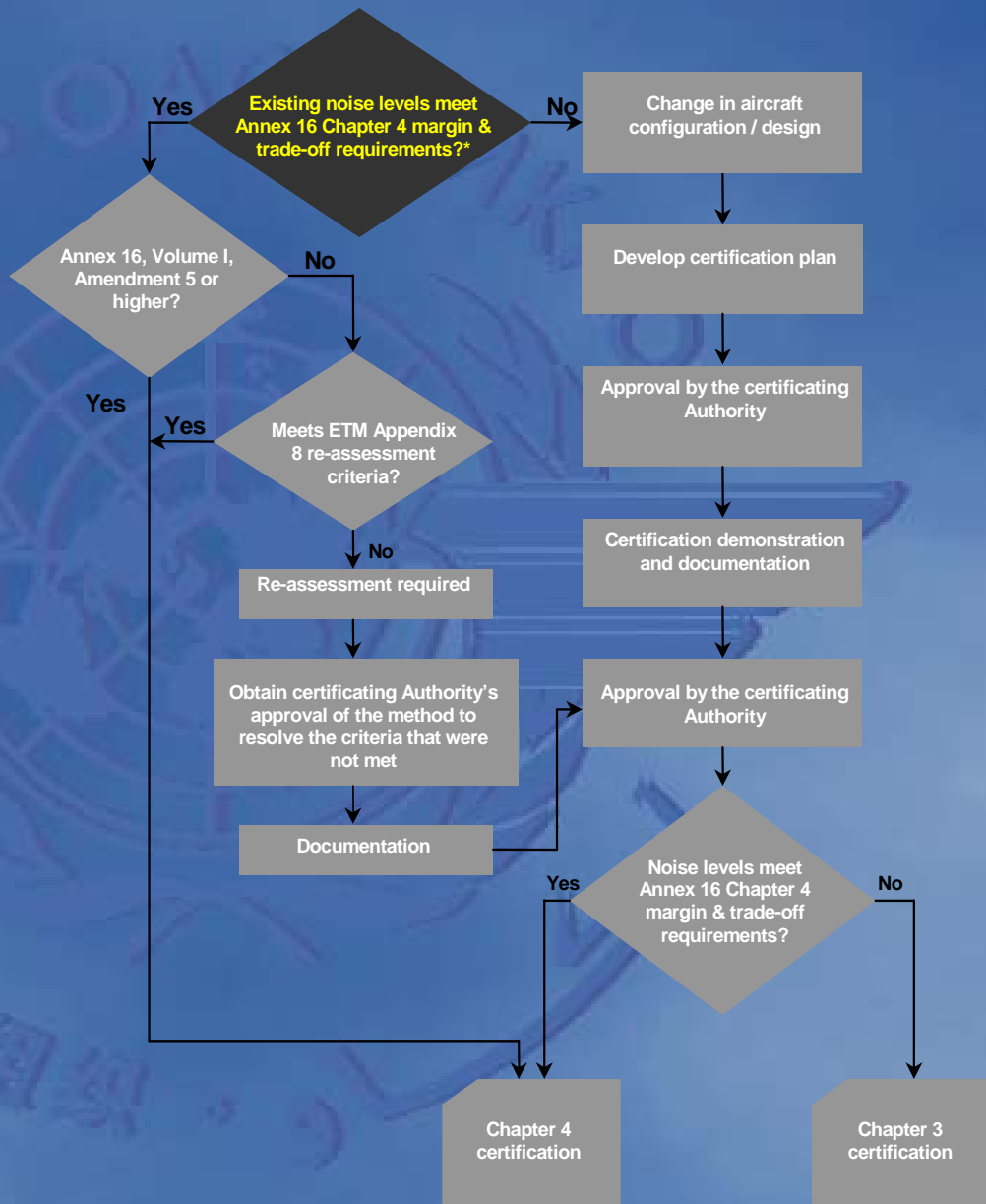
* Chapter 4 margin and trade-off requirements:

- Minimum of 10 EPNdB cum. margin re Chapter 3 limits
- Minimum of 2 EPNdB at any two certification points
- No Trade-off

Aircraft "A"

Do the existing (Chapter 3) noise levels meet Annex 16 Chapter 4 margin & trade-off requirements?

- Minimum of 10 EPNdB cumulative margin re Chapter 3 limits
- Minimum of 2 EPNdB at any two certification points
- No trade-off



Aircraft “A”

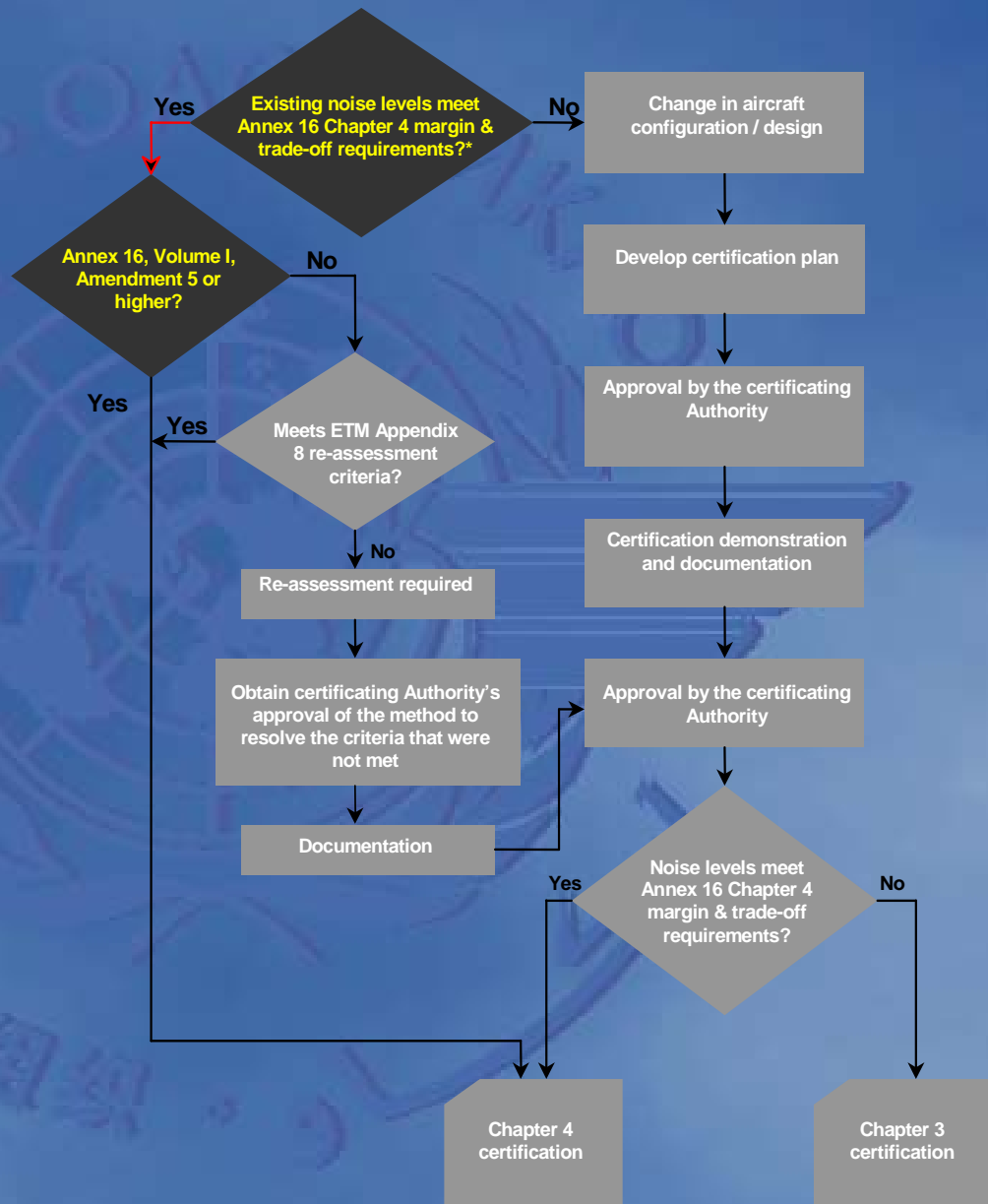
Compliance with Chapter 4 Noise Criteria?

| AIRCRAFT “A” | | | |
|-------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------|--------------------------------|
| POSITION | CHAPTER 3 NOISE LIMIT (EPNdB) | CERTIFICATION NOISE LEVEL (EPNdB) | CHAPTER 3 MARGIN (EPNdB) |
| Lateral | 94.8 | 88.9 | 5.9 |
| Flyover | 93.4 | 86.0 | 7.4 |
| Approach | 98.7 | 95.2 | 3.5 |
| Chapter 4, 4.4.1 No Chapter 3 exceedances | | | Compliant |
| Chapter 4, 4.4.1.1 Cumulative Margin not less than 10EPNdB | | | 16.8 Compliant |
| Chapter 4, 4.4.1.2 Sum of the differences at any two points not less than 2 EPNdB (least value shown) | | | 9.4 Compliant |

Aircraft "A"

Is the original certification basis Annex 16, Volume I, Amendment 5 or higher?

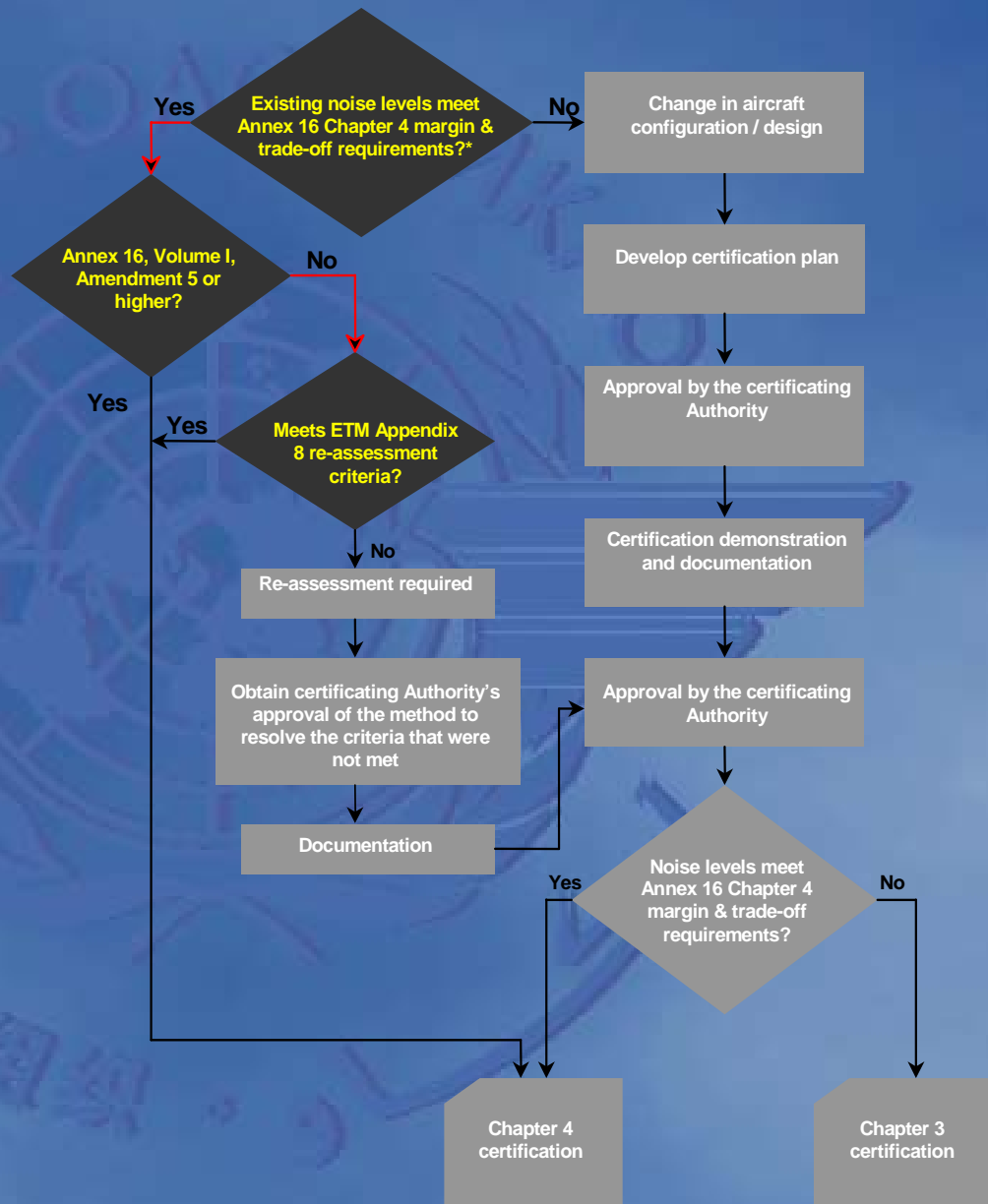
- For aeroplanes which were approved in accordance with Amendment 5 or higher of Annex 16, Volume I, a re-assessment is not required.



Aircraft "A"

Aircraft "A" was approved against Amendment 3 of Annex 16, Volume I

- For aeroplanes which were approved in accordance with Amendment 4 or lower of Annex 16, Volume I...the applicant should be required to show that the existing approved Chapter 3 (or Chapter 5) noise levels are equivalent to those approved to Amendment 5 by answering the re-assessment questions.



Aircraft "A"

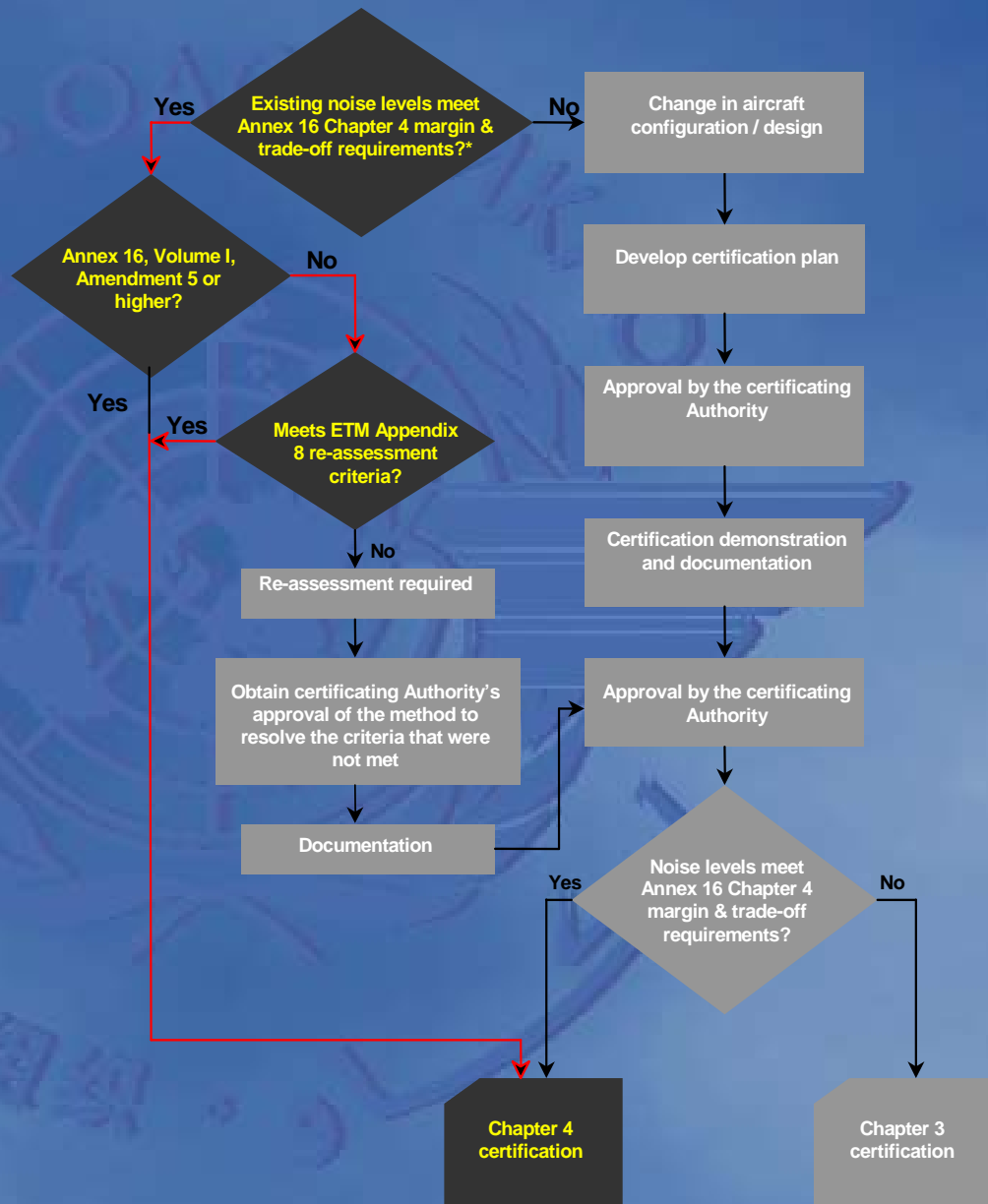
Compliance with Appendix 8 Re-assessment Criteria

| App. 8 2.2.2 | RE-CERTIFICATION CRITERIA | COMPLIANCE STATEMENT |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a | Was full take-off power used throughout the reference flight path in the determination of the lateral noise level? | COMPLIANT Full t/o power was used throughout the ref. flt path to determine the lateral noise levels as specified in Reference 6, Volume 1, Section 3.3.1(a) |
| b | Was the "average engine" rather than the "minimum engine" thrust or power used in the calculation of the take-off reference flight path? | COMPLIANT Thrust is controlled by the Thrust Management System to always give the required AFM standard thrust which is consistent with the standard used in the derivation of the reference profiles |
| etc. | etc. | etc. |

Aircraft "A"

- Meets Chapter 4 margin and trade-off requirements
- Certification basis is Annex 16, Volume I, Amendment 3
- Meets all relevant re-assessment criteria

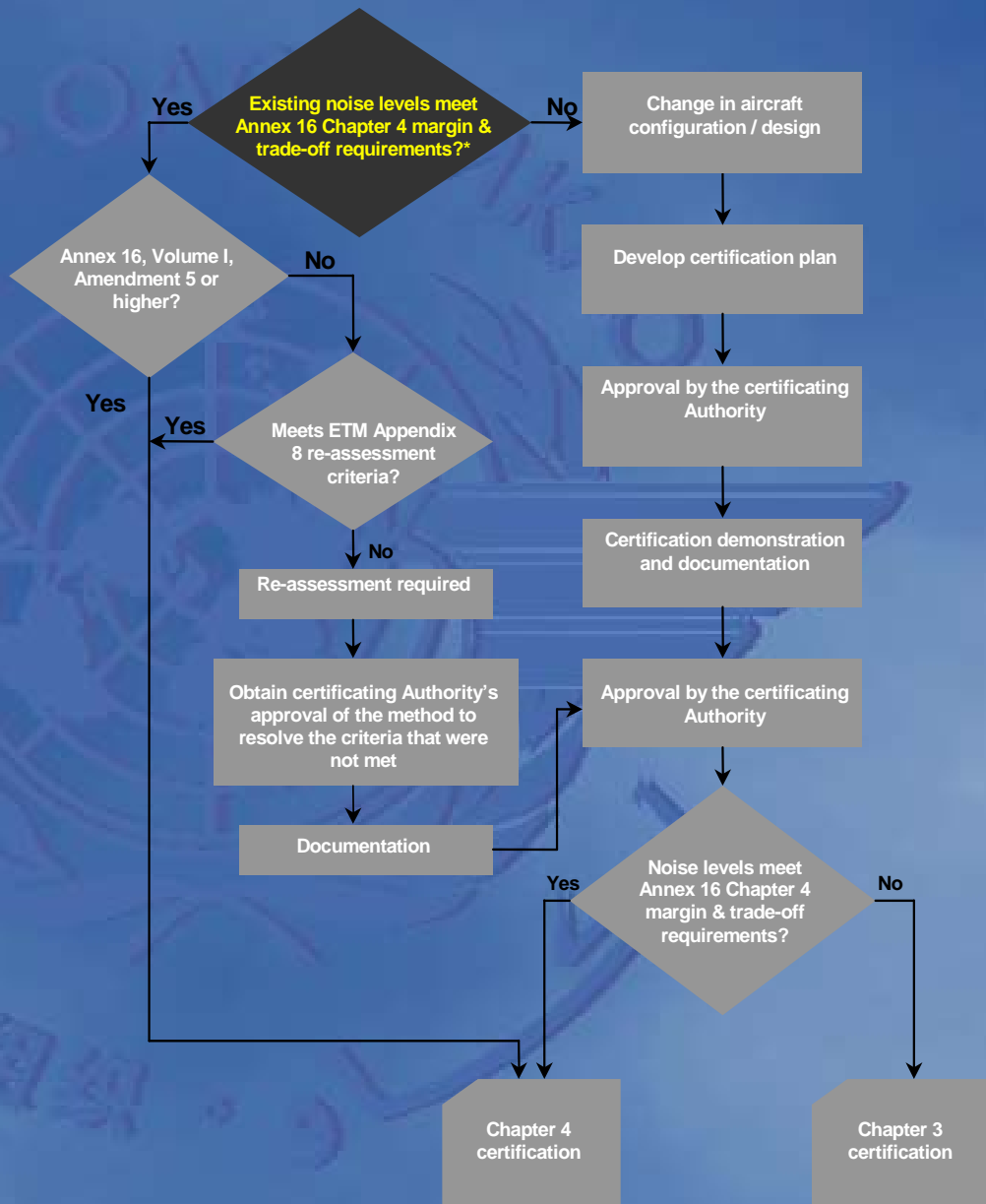
Aircraft "A" is therefore approved to be compliant with Chapter 4



Aircraft "B"

Do the existing (Chapter 3) noise levels meet Annex 16 Chapter 4 margin & trade-off requirements?

- Minimum of 10 EPNdB cumulative margin re Chapter 3 limits
- Minimum of 2 EPNdB at any two certification points
- No trade-off



Aircraft “B”

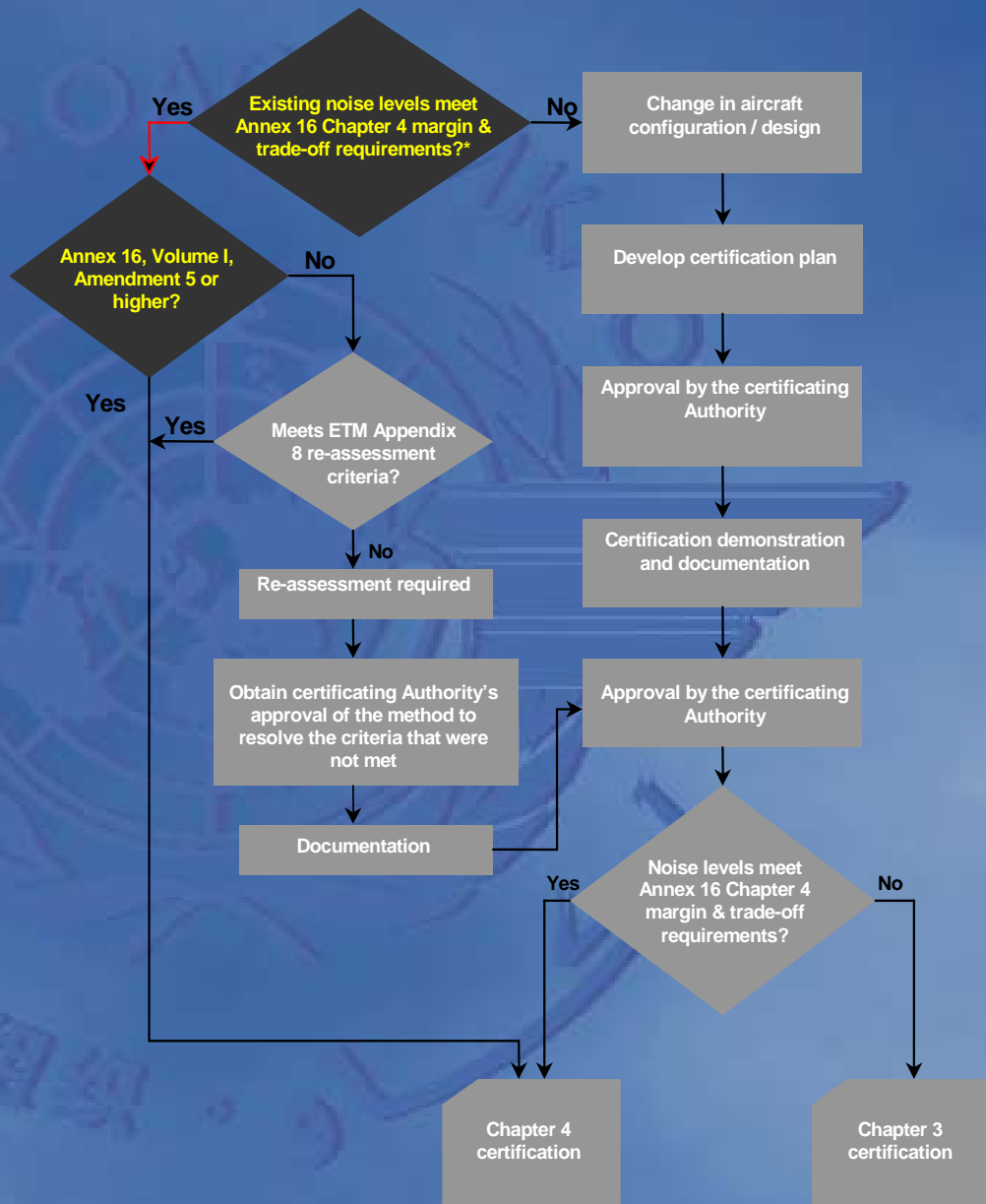
Compliance with Chapter 4 Noise Criteria?

| AIRCRAFT “B” | | | |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------|-----------------------------------------|
| POSITION | CHAPTER 3 NOISE LIMIT (EPNdB) | CERTIFICATION NOISE LEVEL (EPNdB) | CHAPTER 3 MARGIN (EPNdB) |
| Lateral | 94.0 | 89.1 | 4.9 |
| Flyover | 92.1 | 87.1 | 5.0 |
| Approach | 98.0 | 97.4 | 0.6 |
| Chapter 4, 4.4.1 No Chapter 3 exceedances | | | Compliant |
| Chapter 4, 4.4.1.1 Cumulative Margin not less than 10EPNdB | | | 10.5 Compliant |
| Chapter 4, 4.4.1.2 Sum of the differences at any two points not less than 2 EPNdB (least value shown) | | | 5.5 Compliant |

Aircraft "B"

Is the original certification basis Annex 16, Volume I Amendment 5 or higher?

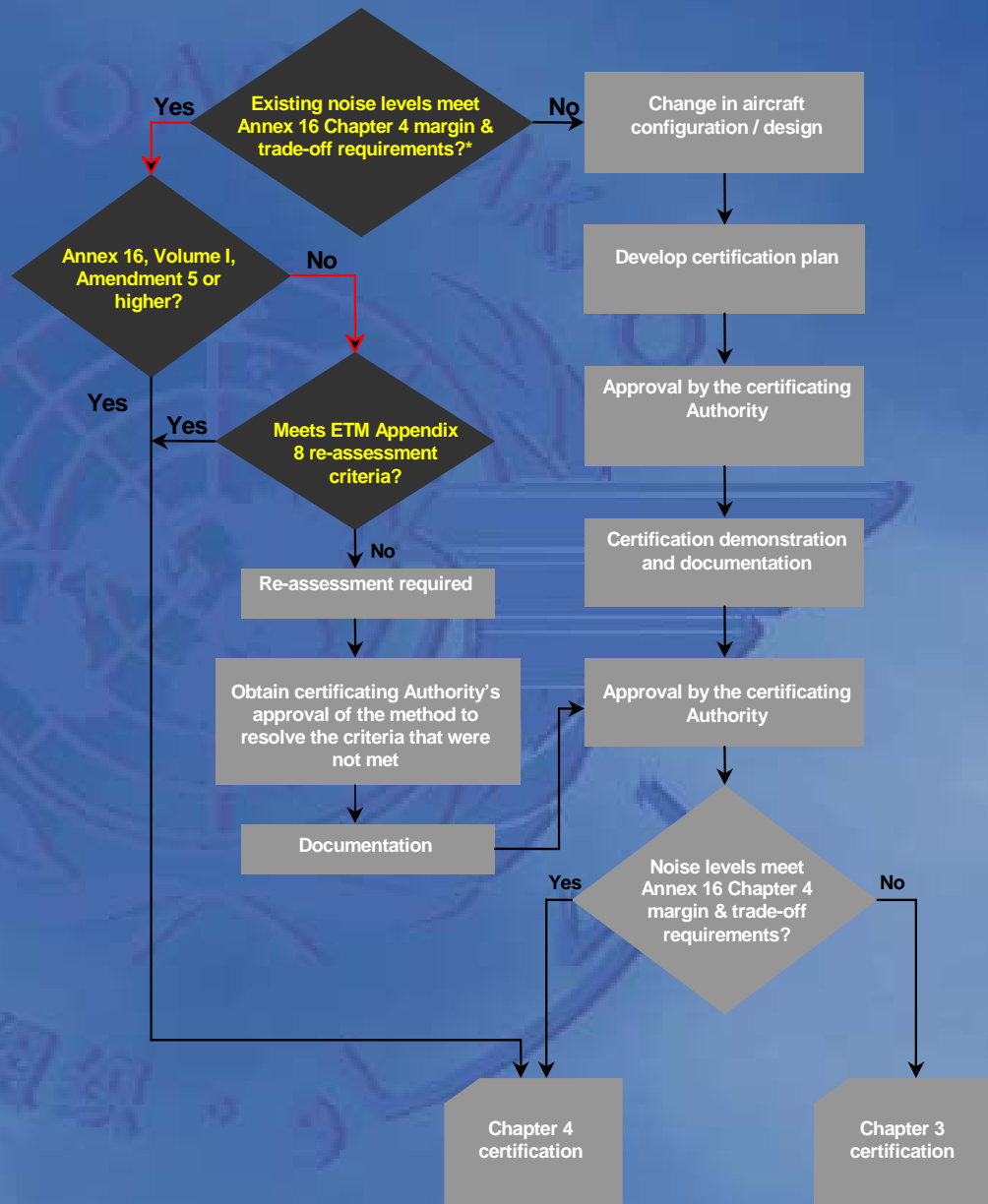
- For aeroplanes which were approved in accordance with Amendment 5 or higher of Annex 16, Volume I, a re-assessment is not required.



Aircraft "B"

Aircraft "B" was approved against Annex 16, 1st Edition, Amendment 5.

- For aeroplanes which were approved in accordance with Amendment 4 or lower of Annex 16, Volume I...the applicant should be required to show that the existing approved Chapter 3 (or Chapter 5) noise levels are equivalent to those approved to Amendment 5 by answering the re-assessment questions.



Aircraft “B”

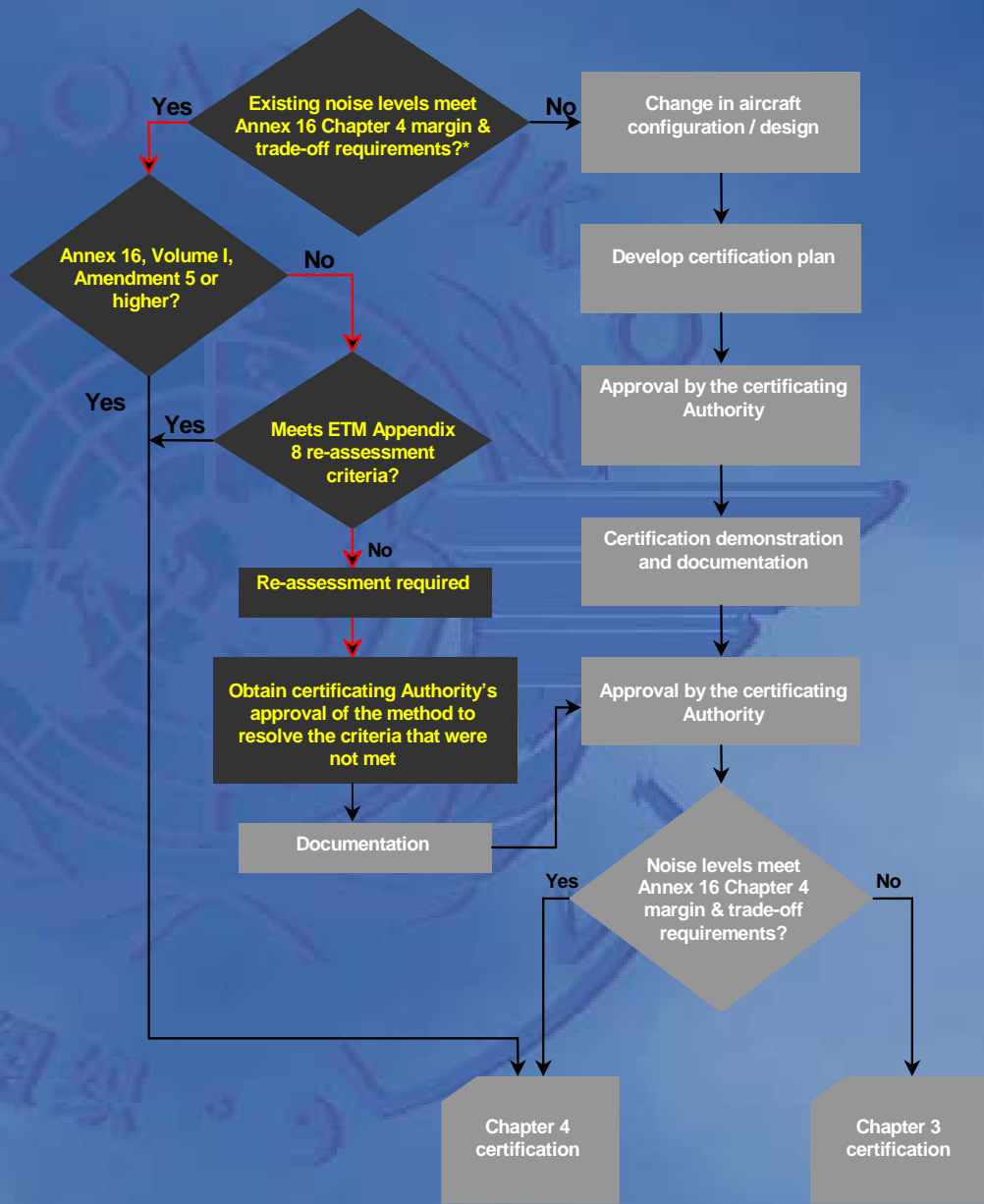
Compliance with Appendix 8 Re-assessment Criteria

| App. 8 2.2.2 | RE-CERTIFICATION CRITERIA | COMPLIANCE STATEMENT |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a | Was full take-off power used throughout the reference flight path in the determination of the lateral noise level? | COMPLIANT Full t/o power was used throughout the ref. flt path to determine the lateral noise levels as specified in Reference 6, Volume 1, Section 3.3.1(a) |
| b | Was the “average engine” rather than the “minimum engine” thrust or power used in the calculation of the take-off reference flight path? | COMPLIANT Thrust is controlled by the Thrust Management System to always give the required AFM standard thrust which is consistent with the standard used in the derivation of the reference profiles |
| C | Was the “simplified” method of adjustment defined in Appendix 2 of the Annex used and, if so, was –7.5 used as the factor for the calculation of the noise propagation path duration correction term? | NON-COMPLIANT The “simplified” method was used. However a –10 instead of a –7.5 factor was used. |
| etc | etc | etc |

Aircraft "B"

Aircraft "B" does not meet re-assessment criterion 2.2.2c.

Applicant proposes to the certifying Authority the following method to resolve the criterion that is not met....



Annex 16, Volume I, Appendix 2 at Amendment 5 specifies that the adjustment for the duration correction shall be determined according to:

$$\Delta 2 = -7.5 \log (QK/QrKr) \quad \text{Equation 1}$$

The “Chapter 3” noise levels of Aircraft “B” were derived using the following expression for duration correction:

$$\Delta 2 = -10 \log (QK/QrKr) \quad \text{Equation 2}$$

It is proposed to derive the Chapter 4 noise levels by adjusting each of the Aircraft “B” certification events using Equation 1.

Aircraft “B”

The “Chapter 4” noise levels after re-calculation

| AIRCRAFT “B” | | | |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------|-----------------------------------------|
| POSITION | CHAPTER 3 NOISE LIMIT (EPNdB) | CERTIFICATION NOISE LEVEL (EPNdB) | CHAPTER 3 MARGIN (EPNdB) |
| Lateral | 94.0 | 89.1 | 4.9 |
| Flyover | 92.1 | 87.7 | 4.4 |
| Approach | 98.0 | 97.3 | 0.7 |
| Chapter 4, 4.4.1 No Chapter 3 exceedances | | | Compliant |
| Chapter 4, 4.4.1.1 Cumulative Margin not less than 10EPNdB | | | 10.0 Compliant |
| Chapter 4, 4.4.1.2 Sum of the differences at any two points not less than 2 EPNdB (least value shown) | | | 5.1 Compliant |

Aircraft "B"

- All non-compliant re-assessment criteria are resolved and "Chapter 4" noise levels re-computed
- Meets Chapter 4 margin and trade-off requirements

Aircraft "B" is therefore approved to be compliant with Chapter 4

