

Noise and Emissions Examples to support implementation of the

Technical Implementation Procedures

For

Airworthiness and Environmental Certification

Between the

Federal Aviation Administration of the United States of America

and the

European Union Aviation Safety Agency

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Section 1 Examples of Noise (acoustical) Basic/Non-Basic Classification

The below tables show examples of noise substantiation methods to illustrate the application of the §3.5.3.2(e) Basic and Non-Basic classification criteria of the TIP for the acoustic part of validation projects. The ‘basic/non-basic’ classification refers to the method chosen by the applicant to substantiate the aircraft noise levels and is independent from the ‘acoustical change’ classifications.

Following are examples of projects that maybe classified as Basic.

Example number	Classification	Description	Jet Powered and Propeller-Driven Aircraft with MTOM greater than 8,618 kg	Propeller-Driven Aircraft with MTOM less than 8,618 kg	Rotorcraft
1	Basic (accepted or streamlined)	Analyzed mass/weight variant: a weight variant for which noise analysis was already provided and approved by the VA.	Basic	n/a	n/a
2	Basic (accepted or streamlined) <i>[Non-basic: Outside the approved certified weight range]</i>	New mass/weight variant: within existing noise database adjusted by CA and VA approved methodology - Substantiation of the noise levels of a <u>new weight variant</u> within the range of already approved weight variants using the <u>initial noise certified flight test database</u> and the adjustment software version used for the previous weight variant calculations performed by the same organization (equipment, procedures and qualified staff).	Basic	n/a	n/a

Example number	Classification	Description	Jet Powered and Propeller-Driven Aircraft with MTOM greater than 8,618 kg	Propeller-Driven Aircraft with MTOM less than 8,618 kg	Rotorcraft
3	Basic (accepted or streamlined) <i>[Non-Basic: new intermix methods proposed.]</i>	Engine Intermix: based on CA and VA approved methods - Substantiation of the noise levels of <u>engine intermix</u> of engines configurations which were already calculated in a demonstration document accepted in a previous project.	Basic	n/a	n/a
4	Basic (accepted or streamlined)	EPNL-vs-weight Interpolation Method: Based on CA and VA approved methods. Substantiation of the noise levels of a new weight variant between already certified weight variants.	Basic	n/a	n/a
5	Basic (accepted or streamlined)	For jet powered aircraft only, Re-certification from Chapter 3/Stage 3 to Chapter 4 or 14 (Stage 4 or 5): Re-certification to Chapter 4/Stage 4 or Chapter 14/Stage 5 when noise margins are appropriate and certification noise levels are not re-assessed and based on already demonstrated results.	Basic	n/a	n/a

Example number	Classification	Description	Jet Powered and Propeller-Driven Aircraft with MTOM greater than 8,618 kg	Propeller-Driven Aircraft with MTOM less than 8,618 kg	Rotorcraft
6	Basic (accepted or streamlined)	<p>New Propeller and/or Engines for certified airplane based on certification testing: Based on CA and VA approved methods.</p> <p>When applicable to only one model of a light propeller aircraft type. Substantiation of noise levels resulting from noise flight test measurements for a propeller and/or engine change performed by an organization (noise measuring and processing equipment, noise procedures and qualified Noise staff) with which the Certifying Authority is fully familiar.</p>	n/a	Basic	n/a

Any project not identified as Basic above is classified as Non-Basic. Following are some, but not all, examples of specific Non-Basic projects.

1	Non-Basic	<p>Jet Engine and Nacelle Treatment Change:</p> <p>Non-acoustical change (NAC) substantiation for changes in the acoustic treatment.</p>
2	Non-Basic	<p>Reference Speed Change:</p> <p>Substantiation of new noise levels resulting from a <u>changed reference speed</u></p>
3	Non-Basic	<p>New Propeller for certified airplane based on equivalency:</p> <p>On one model of a propeller aircraft type, substantiation of noise levels resulting from a change with a demonstration based on an acoustical <u>equivalency</u> (for the FAA) or an <u>alternative means of compliance</u> (for EASA).</p>

4	Non-Basic	New methodology and/or software use: Using unfamiliar, non-approved NAA methodology and/or software - Substantiation of noise levels using new methodology and/or software which has not yet been validated by the validation authority.
5	Non-Basic	Re-certification involving data reanalysis- Re-certification to Chapter 4 or Chapter 14, when the certification noise standards are <u>re-assessed</u> to identify what data reanalysis is necessary for showing compliance.
6	Non-Basic	Applying equivalency (for the FAA) or alternative means of compliance (for EASA): Substantiation, as alternative to a standard noise flight test, of noise levels calculated through the use of the noise flight test data of a parent aircraft for which the <u>equivalency</u> (for the FAA) or alternative means of compliance (for EASA) is proposed for the derived model.
7	Non-Basic	Family Plan: Substantiation, as alternative to a standard noise flight test, of noise levels calculated through the use of engines static noise data and static to flight projection calculations (" <u>family plan</u> ").

Section 2 Examples of Engine Emissions Basic/ Non-Basic Classification

EMISSIONS CERTIFICATION: List of examples for BASIC -vs- Non-Basic classification

Whenever the certified emissions levels are changed, at a minimum, the new emissions levels need to be transmitted to the VA together with the approval by the CA, irrespective of the classification.

#	Classification	Example Scenario	Remarks / Action from CA & VA including "Acceptance" "Streamlined" or "Technical"
1	BASIC	<p><i>NO-Emissions change:</i></p> <p>Changes to a type certified engine with existing metric values that have a margin of more than 5% for gaseous and 20% for nvPM to the regulatory limits, and where these changes:</p> <ul style="list-style-type: none"> could potentially affect the emissions levels within the allowable ranges below (ETMvII), and have been assessed (analytically or by testing), and are within the threshold of a no-emissions change, which reflects instrumentation and measurement system uncertainty, as per Environmental Technical Manual, Vol. II (ICAO Doc. 9501): <ul style="list-style-type: none"> LTO NO_x: ± 3 g/kN LTO HC: ± 1 g/kN LTO CO: ± 5 g/kN Maximum Smoke Number: ± 2 SN nvPM Mass Concentration: $\pm 20\%$ for values greater than or equal to $1000 \mu\text{g}/\text{m}^3$. If the maximum nvPM mass concentration level is less than $1000 \mu\text{g}/\text{m}^3$, then the change in nvPM mass concentration is within $\pm 200 \mu\text{g}/\text{m}^3$. LTO nvPM Mass: $\pm 20\%$ for values greater than or equal to 400mg/kN. If the values are less than 400mg/kN, then the change in nvPM LTO values is within $\pm 80\text{mg}/\text{kN}$. LTO nvPM Number: $\pm 20\%$ for values greater than or equal to 2×10^{15} particles/kN. If the values are less than 2×10^{15} particles/kN, the change in nvPM LTO values is within $\pm 4 \times 10^{14}$ particles/kN. 	<p>"Acceptance" = No-emissions changes requires that the CA is completely in agreement with the applicant's technical justification. No action on behalf of the CA to notify the VA. No documentation changes, and no proposed changes to the EEDb.</p> <p>"Streamlined" = Minimum non-technical documentation changes are made (i.e., TCDS editorial changes, etc.). No VA involvement.</p> <p>"Technical" = Else, if the applicant fails to fully satisfy the CA's engineering judgement of a no-emissions change, then further substantiation is required and some involvement by the VA may be warranted. In this case the change shall be classified Non-Basic.</p>

#	Classification	Example Scenario	Remarks / Action from CA & VA including "Acceptance" "Streamlined" or "Technical"
2	BASIC	<p><i>Additional unchanged-engine testing:</i></p> <p>Establishment of revised emissions levels by additional engine testing of an unchanged engine whereby the test was conducted in the same test setup configuration for this model and in accordance with a previously approved test plan by CA and VA. Emissions results from previous tests will be analyzed together with the new results and a new statistical coefficient for multi-engine compliance will be applied, which usually results in more margin to the limit.</p>	<p>"Streamlined" =</p> <p>The CA shall Update TCDS. Report emissions levels. Make compliance determination. Inform the VA about the results of the test(s) and updated documentation.</p> <p>The VA shall accept the findings of the CA without any detailed review. Issue updated documentation.</p> <p>"Technical" = N/A.</p>
3	BASIC	<p><i>Small design change(s):</i></p> <p>Small change(s) to an already certificated and validated engine model involving further engine emissions testing that was conducted in accordance with an approved test plan by CA and VA (e.g. additional engine testing to cover for small improvements that had been introduced over time).</p> <p>Changed engine gets tested (3 times). Data from previous unchanged engine is not used to calculate regulatory emission values.</p>	<p>"Streamlined" =</p> <p>The CA shall Update TCDS. Report emissions levels. Make compliance determination. Inform the VA about the results of the test(s) and updated documentation.</p> <p>The VA shall accept the findings of the CA without any detailed review. Issue updated documentation.</p> <p>"Technical" =</p> <p>The VA may request from the CA further details if information is not clear. If the CA does not have or cannot provide additional clarifying information, then the change shall be reclassified Non-Basic. The applicant will need to apply for validation with the VA. [see TIP 1.9.2]</p>

#	Classification	Example Scenario	Remarks / Action from CA & VA including “Acceptance” “Streamlined” or “Technical”
4	BASIC Streamlined	<p><i>New model based on existing approved emissions test data:</i></p> <p>If an engine manufacturer introduces a new intermediate thrust engine model (e.g. for a new aircraft weight variant) of an existing engine family, they do not necessarily need to perform another emissions test if this model is covered by existing emissions test results and if this new model does not incorporate design changes that would be relevant for emissions performance. In such a case they would establish the new emissions level from an existing approved emissions report for the highest thrust engine in the family. This may be acceptable if the existing results cover for the maximum thrust, however extrapolation beyond the maximum tested thrust is not acceptable, would require a new emissions test, and therefore considered Non-Basic.</p>	<p>The CA shall inform the VA about the new representative emissions levels based on the existing highest thrust engine in the family, which includes the necessary data for updating the TCDS.</p> <p>The VA would accept the findings of the CA without any detailed review.</p> <p>The VA can ask for further details if required. In this case the change shall be reclassified as Non-Basic.</p>

The following are some examples of Non-Basic projects. Addedly, projects not specifically shown as Basic/Basic Streamlined above are also Non-Basic and which may not necessarily appear below.

5	Non-Basic	<p><i>New model of a family with increased thrust:</i></p> <p>If a new engine model with increased thrust is introduced and proposed to be amended to a TC, and if additional engine emissions testing is required, then this example is clearly Non-basic.</p>	<p>This example shall be classified Non-Basic.</p> <p>The VA needs to be informed and involved.</p>
6	Non-Basic	<p><i>Improvement packages to an existing engine family:</i></p> <p>An engine family is proposed to be “upgraded” such that the design changes would introduce new improved emissions levels.</p>	<p>This example shall be classified Non-Basic.</p> <p>The VA needs to be informed and involved.</p>
7	Non-Basic	<p><i>Novel equivalent procedures:</i></p>	<p>This example shall be classified Non-Basic.</p> <p>The VA needs to be informed and involved.</p>

		The manufacturer proposes novel equivalent procedures which had not been accepted in previous projects of the manufacturer, or those which are not (yet) included in the ICAO ETM.	
8	Non-Basic	<i>Deviations from the fuel specifications:</i> Any projects where the test fuel is out of the fuel specifications of ICAO Annex 16, Appendix 4, and subsequently fuel corrections, which had not been accepted in previous projects for the manufacturer, were applied.	This example shall be classified Non-Basic. The VA needs to be informed and involved.
9	Non-Basic	<i>New standard or new stringency:</i> Finding of compliance with a new standard or new stringency is a legally sensitive act where the VA needs to formally find compliance.	This example shall be classified Non-Basic. The VA needs to be informed and involved.
10	Non-Basic	<i>Design changes that would or could potentially be considered "out of family":</i> Where a design change to an engine or engine family is introduced and where this new design would change the emissions behavior of one or more regulated pollutants and where the CA would conclude that this modification should not be analyzed together with previous emissions results prior to the proposed design change. Examples are changes in the shape of the nvPM curves for both mass and number, as well as gaseous pollutants.	This example shall be classified Non-Basic. The VA needs to be informed and involved.
11	Non-Basic	<i>Compliance demonstration for emissions of a new series of an engine family:</i> If a new series of engines is introduced as part of an existing TC. [example: the CFM56 family.]	This example shall be classified Non-Basic. The VA needs to be informed and involved.
12	Non-Basic	<i>Compliance demonstration for emissions of a new engine family:</i> If a new engine family is introduced that requires a new TC.	This example shall be classified Non-Basic. The VA needs to be informed and involved.