# Commission Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC of the European Parliament and of the Council (Text with EEA relevance)

# ANNEX

Appendix B

**Flight performance calculations**

B10 DESCENT AND DECELERATION

Approach flight normally requires the aeroplane to descend and decelerate in preparation for the final approach segment where the aeroplane is configured with approach flap and gear down. The flight mechanics are unchanged from the departure case; the main difference is that the height and speed profile is generally known, and it is the engine thrust levels that must be estimated for each segment. The basic force balance equation is:

| | |
|---|---|
| $F_n / \delta = W \times \frac{R \times \cos\gamma + \sin\gamma + a/g}{N \times \delta}$ | (B-20) |

Equation B-20 may be used in two distinct ways. First the aeroplane speeds at the start and end of a segment may be defined, along with a descent angle (or level segment distance) and initial and final segment altitudes. In this case the deceleration may be calculated using:

| | |
|---|---|
| $a = \frac{(V_2/\cos\gamma)^2 - (V_1/\cos\gamma)^2}{(2 \times \Delta_S/\cos\gamma)}$ | (B-21) |

where $\Delta s$ is the ground distance covered and $V_1$ and $V_2$ and are the initial and final groundspeeds calculated using

| | |
|---|---|
| $V = \frac{V_C \times \cos\gamma}{\sqrt{\sigma}} - w$ | (B-22) |

Equations B-20, B-21 and B-22 confirm that whilst decelerating over a specified distance at a constant rate of descent, a stronger headwind will result in more thrust being required to maintain the same deceleration, whilst a tailwind will require less thrust to maintain the same deceleration.

In practice most, if not all decelerations during approach flight are performed at idle thrust. Thus for the second application of equation B-20, thrust is defined at an idle setting and the equation is solved iteratively to determine (1) the deceleration and (2) the height at the end of the deceleration segment — in a similar manner to the departure acceleration segments. In this case, deceleration distance can be very different with head and tail winds and it is sometimes necessary to reduce the descent angle in order to obtain reasonable results.

For most aeroplanes, idle thrust is not zero and, for many, it is also a function of flight speed. Thus, equation B-20 is solved for the deceleration by inputting an idle thrust; the idle thrust is calculated using an equation of the form:

| | |
|---|---|
| $(F_n/\delta)_{idle} = E_{idle} + F_{idle} \cdot V_C + G_{A,idle} \cdot h + G_{B,idle} \cdot h^2 + H_{idle} \cdot T$ | (B-23) |

where ($E_{idle}$, $F_{idle}$, $G_{A,idle}$, $G_{B,idle}$ and $H_{idle}$) are idle thrust engine coefficients available in the ANP database.