

Analytical Balanced Field Length Calculation

Task for a *Master Thesis*

Background

Calculation of the Balanced Field Length (BFL) traditionally involves a numerical calculation, where the various forces are evaluated as a function of speed, using a step-wise integration and an estimate for V_1 . The process is iterated with different values for the engine failure speed until the accelerate-stop and accelerate-go distances are equal. Dennis Lucht wrote a thesis: [Numerical and Analytical Takeoff Field Length Calculations for Jet Aircraft](#). He performs a numeric integration with MATLAB (Chapter 5.2.4) to obtain the BFL. The equations are also listed in the [MATLAB m-files](#). Instead of using MATLAB with the function "ode45", now BFL is calculated with an equation obtained from solving the integral of the equation of motion. This is explained in Chapter 5.2.3. As such, all equations from Lucht can be inserted into Excel.

Task

A spread sheet with a friendly Graphical User Interface (GUI) should be produced to allow easy and accurate BFL calculation. These points should be observed in the work:

- Instead of using the Oswald factor (span efficiency factor) from Howe (Chapter 2.4, Equation 2.38), a new equation should be included into Excel. The equation is presented [here](#) in Chapter 3.2.2, 3.2.3, Eq. (6.4), Table 7.1.
- Instead of iterating for V_1 , a direct algebraic solution should be found.
- Apply your Excel-Table to the Airbus A320 and A340 and compare your results with those from Lucht.
- A comparison with Take-Off Filed Length (TOFL) values from selected passenger aircraft (Airbus, Boeing, ...) should also be included.
- A recent paper (2025) "[Development of Improved Empirical Take-Off Equation](#)" should be considered.
- Goudreault wrote an important [SAE paper](#) in 2013. Now, the author shared his industry experience in several e-mails. This input should be used to write about the practical industrial implications of BFL calculations.

The report has to be written in English based on German or international standards on report writing.