

3.3 Empty Weight Estimation

Raymer (along with many other textbooks on aircraft sizing) shows the empty weight fraction (W_e/W_0) as an exponential function of W_0 . This relationship can be expressed more simply as a linear relationship without a significant loss of accuracy. In this most simple form, there are some parts of W_e that are proportional to W_0 and some that aren't, or

$$W_e = K + GW_0$$

where K represents weight that is not proportional to W_0 (such as the cockpit or flight deck and avionics), and GW_0 represents everything else. We can compare these two methods using a spreadsheet. Take the equation in Table 3.1 and convert it to the form

$$W_e = AW_0^{(C+1)}K_{vs}$$

where the constants are defined in the textbook. If you plot these in a spreadsheet you will get a pair of curves looking something like Fig. 3.3.1 for jet transports.

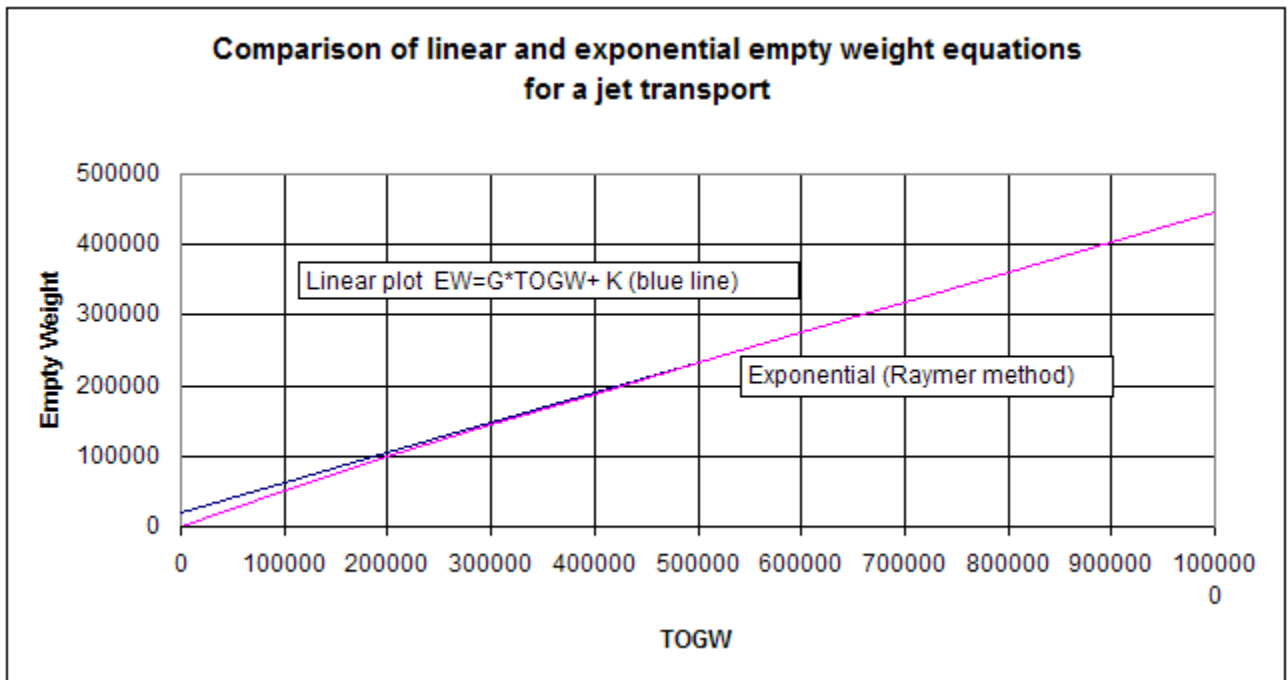


Fig 3.3.1 Comparison of Linear and Exponential Empty Weight Equations

For the straight line plot, $K = 20,000$ lb and $G = 0.425$. This seems reasonable that for aircraft above about 200,000 lbs the flight deck and avionics weigh about 20,000 lbs and everything else is proportional to W_0 . You can repeat the exercise for other classes of aircraft, as illustrated in the spreadsheet 'Empty wt vs TOGW' located on the ADAC website under Support > Sample Spreadsheets.