

# Project 4 – Cruise performance

v1.3 – CC by-sa Olivier Cleynen – aircraft.ariadacapo.net

## 4.1 Context and objectives

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The aim of this project is to begin exploring the implications of aircraft cruise performance on airline economics.

Your employer is a large, international aircraft manufacturer, which wishes to maintain the market value of an existing airplane. It is proposed to improve on the 25-year old design with a new set of winglets.

Based on calculations as well as your best judgment,

- Show qualitatively how the modifications would modify the weight-range and payload-range diagrams of the aircraft (you may exaggerate tendencies to increase clarity);
- Evaluate the maximum price at which the winglet installation may be proposed to the customers.

Your mark will be based on clarity of your work, and the validity of your calculations. You may use any tool you wish (e.g. software, books), but you are required to quote all of your sources.

Groups handing in written reports must hand in one single printed or PDF (A4-size) document, no longer than 8 pages.

Groups making an oral presentation must aim for less than 15 minutes (all members participating), and then answer questions from the class. Please hand in your slides as a print-out or PDF file.

## 4.2 Winglet specifications

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The aerodynamics team has put forward a proposal for a winglet design whose effect on aircraft performance would:

- Incur a 6% reduction in lift-dependent drag;
- Incur a 1% increase in friction drag;
- Require a wing structure modification adding 200 kg per aircraft.

## 4.3 Aircraft specifications

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The aircraft is a well-selling, fly-by-wire, narrow-body jetliner with a capacity for 150 passengers. More than 5000 models have been built to-date, and the list price is approximately \$80 million.

|                      |                           |
|----------------------|---------------------------|
| OWE                  | 43 t                      |
| MTOW                 | 78 t                      |
| Fuel capacity        | 24 000 l                  |
| Drag characteristics | $C_D = 0.02 + 0.063C_L^2$ |

Table 4.1: Specifications of the considered aircraft.

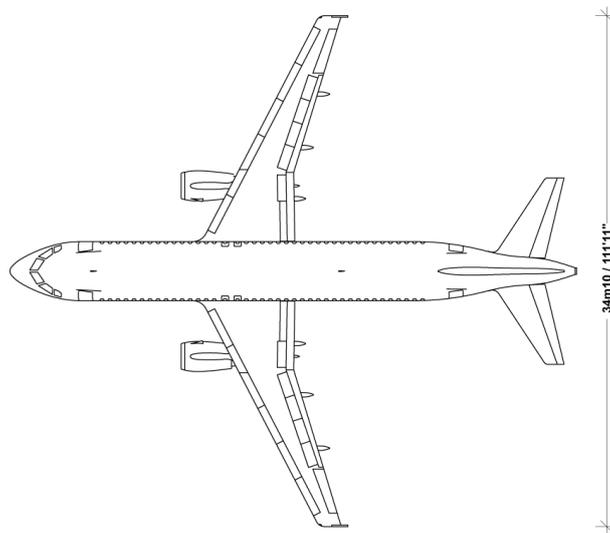


Figure 4.1: Top view of the considered aircraft. *Drawing CC by-sa drawing by Julien Scavini*