

# Project 8 – Static longitudinal stability

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## 8.1 Context and objectives

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The objective of this project is to explore the constraints brought by stability requirements on aircraft design.

You are working for the manufacturer of a modest, well-recognized regional turboprop-powered aircraft. Your employer wishes to modify the design of the airplane, by removing the tail and installing canards. S/He motivates his/her decision quoting “the improvement in the eco-efficiency as well as the dramatic appearance brought by canards”.

Do you approve of the proposal to change the aircraft layout to a canard type?

You should focus on ensuring that the aircraft is safe to fly in all conditions. You might consider other factors, such as constraints on the aircraft layout, operational restrictions, constraints on the canard geometry, or possible benefits in fuel efficiency.

Your mark will be based on the 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.

## 8.2 Aircraft characteristics

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The aircraft is shown in figure 8.1 and is a 66-passenger twin-turboprop airliner with the following weights:

- OWE: 12,9 t
- MTOW/MLW: 22,8 t

The main data related to aerodynamics and stability are:

- Wing top-view surface (unchanged with flaps deployment): 61 m<sup>2</sup>
- Horizontal tailplane surface: 11,7 m<sup>2</sup>
- Wing mean aerodynamic chord: 2,26 m
- Wing aerodynamic moment coefficient: -0,11 (cruise);  
-0,18 (landing).
- Aircraft lift coefficient at landing: 2
- Maximum safe tail lift coefficient (absolute value): 1,1
- Aircraft lift coefficient slope: 0,103 °<sup>-1</sup>
- Tailplane lift coefficient slope: 0,07 °<sup>-1</sup>
- Maximum allowable pitch stiffness value: -0,01 °<sup>-1</sup>

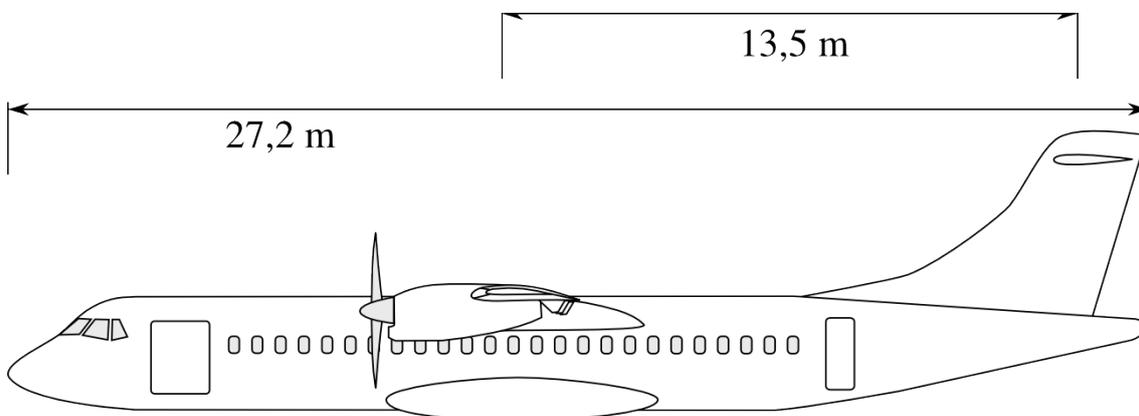


Figure 8.1: Side view of the existing aircraft, with relevant dimensions shown.