HAW HAMBURG

DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

The Cubic Wing Loading Parameter in Passenger Aircraft Preliminary Sizing

Task for a *Master Thesis*

Background

Wing Loading, m/S is the mass of the aircraft divided by the wing surface area. Cubic Wing Loading is $m/S^{3/2}$. Here, the surface area is taken to the power of 3/2. As such the unit of the denominator is converted from m² to m³ and Cubic Wing Loading (CWL) has the unit of kg/m³, which is the unit of density. We know from statistics that Wing Loading (WL) unfortunately depends of aircraft size. Wing loading increases with aircraft size. We would like to investigate if CWL is rather a constant value for passenger aircraft of comparable design. CWL has been discussed in a study by S. Durmus in 2020 (https://perma.cc/923V-EU8T). This research can serve as a starting point for this thesis. CWL is also used for Radio Controlled (RC) aircraft. A related webpage is e.g. https://perma.cc/6UM8-L7GZ. RC plane designers claim that CWL is related to aircraft performance, handling, fuel efficiency, and structural characteristics. For this reason, it is widely and successfully used in RC aircraft design. It is however problematic that traditional WL-based equations for preliminary passenger aircraft sizing must be rewritten.

Task

Task of this project is to show potential advantages of using Cubic Wing Loading as a fundamental airplane parameter in aircraft performance, handling, and design of passenger jet aircraft. Following subtasks have to be considered:

- Literature review related to CWL.
- Fundamental description of CWL and related basic equations.
- Rewriting preliminary sizing equations after the introduction of the CWL parameter, including a "T/W versus CWL matching chart".
- Collecting aircraft data.
- Investigating statistical correlations based on the CWL parameter.

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