

Business Jet Conceptual Design: A Cost-Driven Approach

Riccardo Falsetti, Gabriele Sirtori, Lorenzo Trainelli, Carlo E. D. Riboldi

Department of Aerospace Science and Technology, Politecnico di Milano, Milano, Italy

Corresponding author: gabriele.sirtori@polimi.it, tel. +39 02 2399 8387

Business aircraft can be classified looking at propulsion (piston engines, turboprop, jet) or the applicable certification category, or the design mission, characterized by its range and payload. Particularly, a classification for business jet (BJ) aircraft that is often used refers to six different classes, ranging from Very Light Jets certified under CS23, with up to eight passengers and up to 1 200 NM long missions, to Long Range Jets certified under CS25, with up to 19 passengers and up to 6 500 NM long missions. A further class is represented by Executive Airlines, *i.e.* airliners converted to business aircraft.

The present work illustrates a cost-driven approach to the conceptual design and preliminary sizing of a BJ that allows a reduction of operating costs when compared to existing aircraft, while enabling an extended operational usage that goes beyond the traditional classification mentioned above. This is applied to a range of missions of interest from mid-range (4 000 NM) to long-range (6 500 NM). Based on direct contacts with BJ operators and a thorough review of publicly available data, it can be argued that the average amount of passengers carried over long-range flights is equal to 4-5 people, making a 10-to-19-seat aircraft much too large. Therefore, a new BJ concept is developed, with maximum payload of ten passengers and a design mission consisting in a range of over 5 500 NM with six passengers.

The preliminary aircraft sizing has been carried out using HYPERION, a general, extensively validated preliminary aircraft sizing methodology developed at Politecnico di Milano. Some technical innovations, reflecting the aerodynamic and propulsive improvements that have already been introduced on the latest commercial jets, have been considered. The result is the preliminary sizing of the New Business Jet (NBJ) concept. Figure 1 shows a comparison in economic performance between the NBJ and two reference designs, the Medium Range Business Jet (MRBJ) and Long Range Business Jet (LRBJ), both sized with HYPERION to represent suitable competitors. As apparent, the NRJ can perform long-range missions with sensibly lower costs than the LRBJ, while keeping slightly cheaper than the MRBJ on mid-range missions.

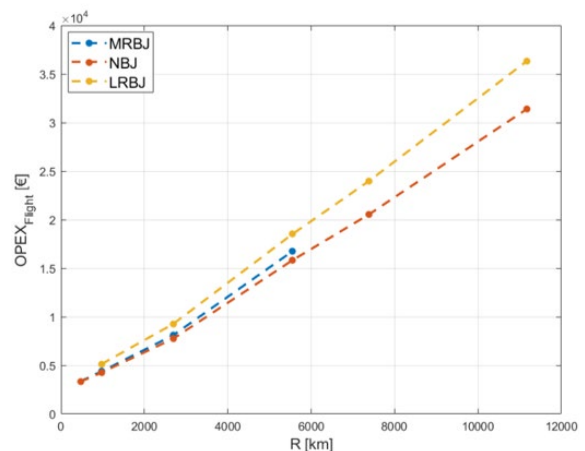


Figure 1: Comparison of OPEX as a function of flight distance between the proposed design (NBJ) and two reference designs