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CONCEPTUAL DESIGN OF CARGO AIRCRAFT

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Nowadays, there is a trend towards an increase in air transportation, both passenger and freight [1], [2]. This relates to several factors that significantly affect the development of transport aviation, such as the factor of globalization and the factor of urbanization. Design begins with the development of the concept of aircraft application, since it will depend on further solutions during the design. In the project, an aircraft was designed considering the following initial data: payload equal to 30000 kg and flight range 5000 km. The entire design process is based on the methodology and recommendations outlined in [3].

On the first stage of design work, the analysis of modern market of aviation was carried out to determine the need of a new heavy long rage transport aircraft. For analogs, it is most expedient to take as new aircraft as possible, since in this case they reflect modern statistics. The following prototype aircraft are selected: Boeing KC-135, An-70, Ilyushin Il-76, McDonnell Douglas YC-15, Airbus A400M, Kawasaki XC-2. Based on the study of statistical material and the study of the development of military transport aircraft, the trends in the development of aircraft of this type are determined.

Based on the statistics data and forecasts, the tactical and technical requirements for the projected aircraft are formulated. All requirements for the aircraft are divided into several groups. As one of the main functional requirements, the possibility of airborne assault is put forward, as this will allow expanding the aircraft modification series. After the list of requirements to the projected aircraft is formulated, the main parameters of aircraft are calculated such as specific wing load and thrust to weight ratio, which are 589 daN/m2 and 0.32.

The aircraft projected with "normal" aerodynamic scheme, high-lying wing and T-shape tails. Geometric parameters of the fuselage (length 36.7 m and diameter 5 m) are chosen with the ability to content payload of standard aviation containers. T-shape tail was chosen according to the ability to get stabilizer out of stream. Necessary of airdrop was also considered. External shape of projected aircraft was build on the basis of previously defined main geometric parameters.

Take off mass of first and second approximation was calculated with use of equation of existing of aircraft, statistic data and weight formulas. Masses of first and second approximation were 124354 and 125489 kg. A small discrepancy of the values (about 0.1%) means accuracy of calculations.

Using masses of each aggregates and the geometric parameters the centering of the aircraft was calculated. All of 9 options of centering are located in small diapason (23-25)% of mean aerodynamic chord, which means good result.

As a result of the work, a heavy military transport aircraft was designed with the possibility of airdrop assault. The applied design methodology gives a complete understanding of each design stage separately, as well as their interrelations.

References

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