The aviation sector is facing its greatest crisis ever yet. With the ongoing Covid-19 crisis, the upcoming economic crises, the European Green Deal and the ever greater sustainable demand for reducing the number of flights, a solution is vital for the survival of the sector. The aviation sector therefore needs to switch from fossil fuels to sustainable carbon-neutral energy sources. The resources to achieve this, however, lack investment to scale up production due to the absence of aircraft using these carbon-neutral resources. On the other hand, airliners are cautious to replace their fleet with carbon-neutral aircraft due to the absence of large scale production of carbon-neutral resources. On top of that, due to the current crisis in the aviation sector, airliners are facing bankruptcy on a large scale. This prohibits the airliners from investing in the expensive innovative solutions presented by companies and universities. The solution? A Carbon Neutral Ready Airliner.

**Mission Objective**

The mission objective is to design an Airbus A320neo replacement aircraft that initially uses kerosene, but can be converted to be carbon neutral within one month. The Carbon Neutral Airliner (CNA) should carry 194 passengers in a high density lay-out, have a payload capability of 20 tons and a maximum range of 3400nm with a cruise Mach number of 0.78. Apart from the carbon-neutral conversion, it excels in sustainability by having a minimum of 75% of the primary structure by mass to be recyclable and by reducing the emissions per passenger kilometre with respect to state-of-the-art competitors by 10%. This very ambitious CNA is to have an entry into service in 2030 for a list price of no more than 110 M$.

**System Design**

As a carbon-neutral energy source, the CNA will enable the use of synthetic kerosene. The use of synthetic kerosene allows for a realistic yet completely sustainable and efficient design. The CNA has furthermore three major novel systems to fulfil the mission objective. The first novel system design is that the aircraft has a high aspect ratio high wing to increase the L/D in order to have an extensive reduction in fuel consumption. To support this high aspect ratio wing, a strut structure was designed making the CNA have a strut-braced wing optimised to avoid flutter. As the span of the wing is high, a folding mechanism was designed to fold approximately 7m of the wing tips whilst on the ground to fit in standard gates. The second novel system design is a boundary layer ingestion (BLI) ducted fan in the aft of the fuselage. This ducted BLI fan can reduce the power needed during cruise with up to 10%. In combination with two ultra high bypass engines, this effectively reduces the drag and thus fuel consumption. The third novel system design is the landing gear. Due to the high wing configuration, the landing gear cannot be stored in the wings. However, fairings are not an option as that interferes with the boundary layer being injected into the ducted BLI fan. A slim tricycle design was therefore adopted, with two spring-load controlled supporting landing gears in the strut. The result is the Albatross Embracer, a Carbon Neutral Ready Airliner 17.2% more efficient than the A320neo with reduced NOx emissions and noise.

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