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Life cycle carbon emissions assessment using an Eco-Demonstrator aircraft: The case of an ecological wing design

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Abstract

Airplane production is at record levels, and thus, vast quantities of new aircraft of every class will be produced in the near future. Concerns regarding local and global environmental conditions are being raised in the developed and developing worlds. Consequently, new aircraft with greater dependence on environmentally friendly materials are needed. Life cycle carbon emissions assessment (LCCEA) uses traditional and innovative materials for wing construction to improve the ecological appeal of aeronautical structures. For each part of the wing, there are preferred materials, and in this study, additional improvement scenarios were analyzed. Carbon fiber composites performed better than the industry standards of aluminum and balsa, consistent with industry claims that these composites not only reduce aircraft weight but are also more eco-friendly. These results also indicate that research on structural applications of innovative biosourced materials could provide long-term advantages for mitigating global warming even if substantial technological challenges remain.

Keywords: Eco-demonstrator aircraft; Life cycle assessment; Composites; Green material; Unmanned aircraft vehicle.

1. Introduction

The first impact analysis of aircraft materials was performed in 1968. The smoke produced during the exposure of 141 aircraft interior materials to flaming or smoldering was measured (Gross et al., 1968). At this time, air travel was expensive, and environmental awareness did not exist. Additionally, petroleum was a relatively cheap resource until the petroleum crisis of 1972, which spurred efforts in the aviation industry

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