595° Solutions

GHG Emission Analysis

Deliverable Deck

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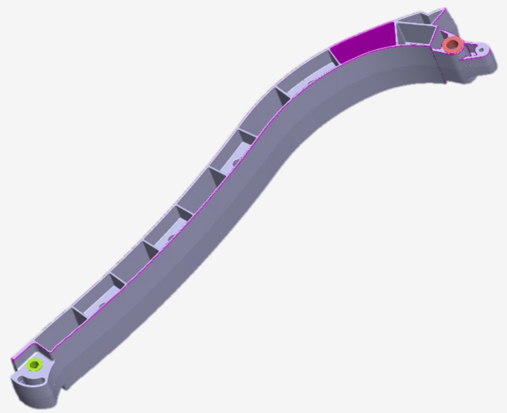
Proposal number: 0011811410

Executive Summary

Accenture conducted an **analysis of the weight saving potential of introducing a new Magnesium Alloy** (MgCarbonit[91]) in the aviation industry, using a simulation approach to evaluate Greenhouse Gas (GHG) emissions during the use phase of an aircraft. The analysis utilized scientific data and industry-specific data and involved modeling two variants of a tablearm, one made from an Aluminum Alloy and the other from the new Magnesium Alloy MgCarbonit.



Tablearm by Zim Aircraft Seating GmbH (www.zim.aero)

This assessment was made according to common approaches in Life Cycle Assessment methodology. The primary objective of the analysis was to assess the environmental impact of the new Magnesium Alloy by quantifying GHG emissions, specifically CO2-equivalent emissions, over the use phase.

The findings indicate a significant **reduction of 32%** in GHG emissions compared to conventional materials, demonstrating the potential of the Magnesium Alloy in mitigating environmental impacts.

Furthermore, the analysis revealed that the **results are sensitive to various parameters** that impact flight efficiency. This sensitivity analysis underscores the importance of considering factors such as fuel consumption and operational conditions, as they can **significantly influence the overall environmental performance of the Magnesium Alloy**.

A Systematic Approach to Ensure Data Validity Across the Use Phase

Five steps to derive total GHG emissions

The **step-by-step** process enables **qualitative rigor** throughout the analysis.

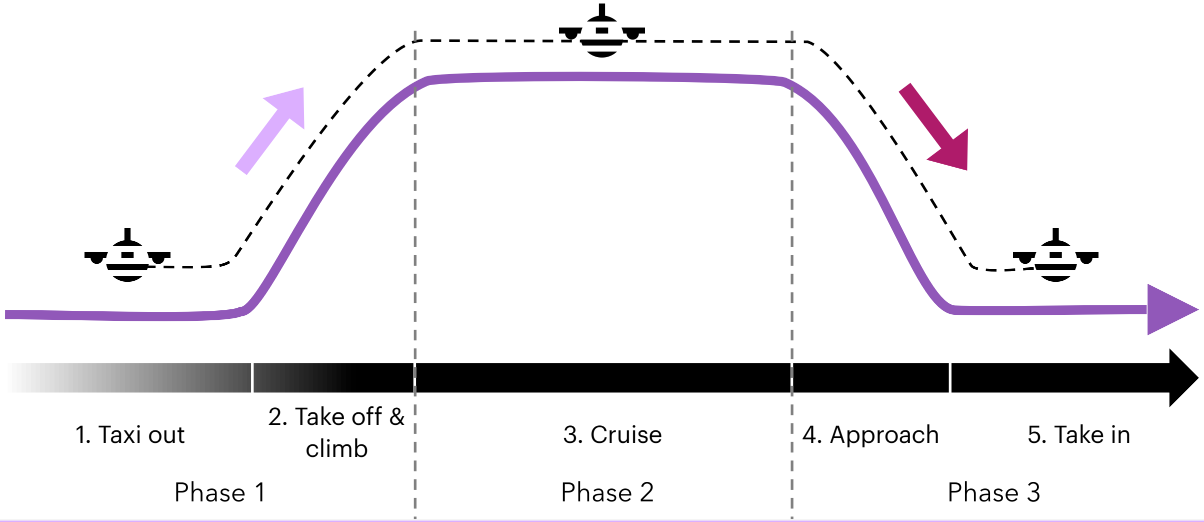
1 Aircraft
- A320 CEO: 180 seats
- A320 NEO: 194 seats

2 Data collection
- Fuel burn rates
- Gross weights: 63.000 kg
- Flight cycles: 48.0000
- Short range definition: 1.500 km

3 Weight allocation
- Aluminum alloy weight per part: **0.4688 kg**
- Magnesium Alloy weight per part: **0.3181 kg**

4 Weight allocation Magnesium Alloy
- Magnesium Alloy: **61.71 kg**
- Aluminum: **90.95 kg**

5 Calculation
- Calculation of GHG emissions



Phase 1	A320 NEO	A320	Phase 2	A320 NEO	A320	Phase 3	A320 NEO	A320
Taxi Out	0.151	0.292	Cruise	3.595	3.991	Appr-oach	0.114	0.149
Take Off	0.07	0.09				Take In	0.049	0.086
Climb	0.182	0.232						
Total burn rate	**0.403**	**0.614**		**3.595**	**3.991**		**0.163**	**0.235**
% share of total	**9.68**	**12.68**		**86.4**	**82.46**		**3.92**	**4.86**

Estimated burn rates kerosine per stage in tons; LHR – MAD A320 (1243 km); LHR – LIS A320neo (1564 km)

Sources: Airbus 2023; OAG 2023; UTTA 2019

32% GHG Reduction During the Use Phase

The Current – Al Silafont 36

Per flight	Per year	Per use phase
0,094 kg CO2eq	29.035 kg CO2eq	871.069 kg CO2eq

A320 neo

The Future – MgCarbonit91

Per flight	Per year	Per use phase
0,063 kg CO2eq	19.702 kg CO2eq	591.056 kg CO2eq

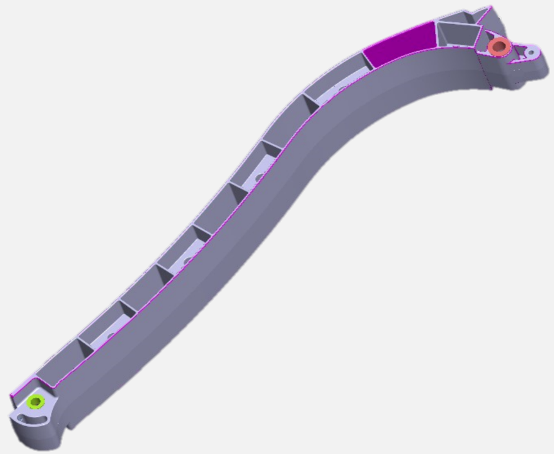
A320 neo

Savings
32% reduction equals
280.013 kg CO2eq

Sources: Accenture Analysis

Deployment of Magnesium Alloy has Significant Cost Saving Effects Over the Use Phase

MgCarbonit enables fuel **cost savings** of up to **32.15%**



Material saving **one seat 150,7 grams**

Material savings for **194 seats 29,24 kg**

569 €
Fuel savings one seat

3.776 €
Savings per kg of MgCarbonit

110.000 €
Total fuel savings

Estimated savings over the use phase in an A320neo

Price estimation per liter kerosine (excl. tax and VAT) 1,47 € A1 jet fuel

Sensitivity Analysis: Assessing Potential Savings and Impact Factors

Key impact areas for flight efficiency

There are **five** district **parameters** during the **use phase** the **impact flight efficiency.**

1 **Routing**
- Predetermined flight plan
- Taxi on the airport

2 **Altitude**
- Optimum flight level feasibility
- Cruise flight adjustments

3 **Weather**
- Weather and outside conditions

4 **Weight**
- Payload
- Weight balance distribution

5 **Distance**
- Distance to destination
- Flight hours / cycles needed

Parameters	Weight Gross Weight 70.000 kg	Burn rate 20% higher burn rate	Flight cycles 60.000 cycles
Aircraft	**Saving potential (kg CO2 eq)**		
A320 NEO **280.013**	**252.012** -10% emissions	**336.016** +20% emissions	**350.016** +25% emissions
A320 CEO **380.244**	**342.220** -10% emissions	**456.293** +20% emissions	**475.305** +25% emissions

GHG emissions in kg CO_2eq

Sources: Airbus 2021; Accenture Analysis