HSLU Lucerne University of Applied Sciences and Arts

Engineering and Architecture
B.Sc.. Energy and Environmental Systems Engineering
Bachelor-Thesis

Optimising Aluminium Resource Utilisation in Aircraft Part Production

Student: Tristan, Grüter

1. Introduction, Goals and Research Questions

At Pilatus Aircraft Ltd., aluminium aircraft parts are produced by milling solid aluminium plates. This process creates finished aircraft components, aluminium shavings, and reusable solid cut-outs known as recursive raw material, or REK. Instead of being recycled, REKs are intended to stay within the production system and be reused as raw material for smaller components.

However, REKs are not always reused as efficiently as intended. In some cases, reusable aviation-grade aluminium remains in storage while new raw material is ordered. This increases inventory costs, reduces material efficiency, and increases environmental impact.

The aim of this thesis is to analyse the current REK system and identify practical opportunities to improve resource efficiency, reduce excess inventory, and increase the reuse of aviation-grade aluminium.

Research questions:
- How does the current REK system operate at Pilatus Aircraft?
- What factors limit efficient REK utilisation?
- How can REK management be improved to increase resource efficiency?

2. Method Overview and Materials

1) Analysing the REK Status Quo

- Reviewed literature on material efficiency, REK reuse, and standardisation.
- Mapped the REK process through site visits, meetings, and flow diagrams.
- Analysed REK data, inventory, costs, and milling blueprints.

2) Identifying Problems and Creating Solutions

- Compared process maps, REK data, and expert input.
- Identified causes of inefficient REK use and excess inventory.
- Developed three concepts: standardisation, alternative milling templates, and No-REK usage.

3) Solution Evaluation and Recommendations

- Assessed each concept for feasibility, impact, complexity, cost, and implementation effort.
- Selected the most feasible improvement direction.
- Developed short- and long-term recommendations.

3. Results and Discussion

Problems Identified: REKs are generated in one production stage but reused later in another. When generation, storage, and demand are not aligned, reusable aluminium accumulates in inventory.

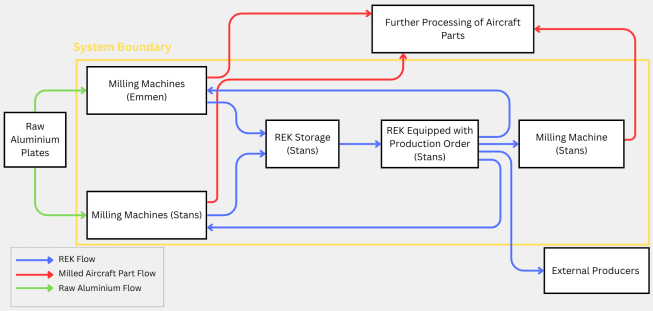

Figure: Overview of the REK process (Grüter, 2026).

Solution Concept: Similar or duplicate REK sizes can be consolidated into fewer standard variants. This Standardisation of REK would simplify inventory management and increase reuse flexibility, as one standard REK could be used for several suitable receiver parts instead of being linked to only one specific part.

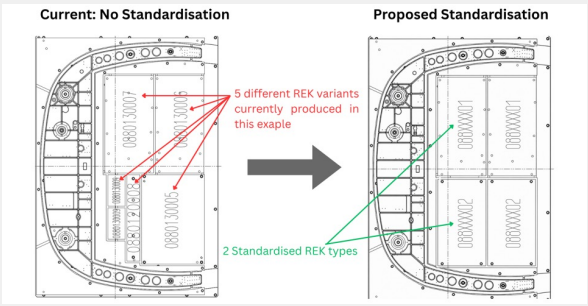

Figure: Proposed REK standardisation concept, comparing the current milling blueprint with a standardised version (Grüter, 2026).

4. Conclusion and Recommendations

The REK problem is a system-level issue caused by limited standardisation, timing mismatches, storage constraints, and manual coordination. In the short term, it is recommended to validate the proposed standard sizes, improve process documentation, strengthen training, and increase coordination between departments. While in the long term, efforts should be made to develop a digital REK management system to better align REK stock, generation, and demand, which will enable further innovative solutions.

References

Mula, J. et al. (2006). Models for production planning under uncertainty: A review. *International Journal of Production Economics, 103*(1), 271–285. https://doi.org/10.1016/j.ijpe.2005.09.001

Industry Partner: PILATUS

Supervisor: Prof. Dr. Claas, Wagner
Expert: Dr. William, Gizzi
Semester: Spring Semester, 2026