Summary

Currently, the general aviation sector is shifting from conventional fuel aircrafts to electric propulsion aircrafts. The goal of this shift is among others to reduce the CO_2 and other greenhouse gas emissions of this sector. Besides that, this shift could potentially reduce the noise of aircrafts too. The Dutch Electric Aviation Centre (DEAC) is researching the possibility of this shift, by retrofitting a conventional Cessna 337F Skymaster with an electric propulsion system. The results from this 'Flying Testbed' may in the future foster the shift to electric aviation for commercial aircrafts as well. This report aims to improve the maintainability of the propulsion system of this testbed. To accomplish this, the following main question is composed:

In what way(s) does the propulsion system of an electric general aviation aircraft (in specific the test aircraft of DEAC) need to be adapted to improve its maintainability?

To get a general understanding of the workings, benefits, and difficulties of an electric propulsion system, a literature study has been conducted at first. This focuses mainly on the different configurations of electric propulsion systems that exist. Also, the specific parts used in these configurations is described. Besides that, information about DEAC's testbed is gathered as well. Most information was gathered during a literature study. Besides that, two semi-structured interviews were conducted. In these interviews, the founder of Falcon Electric Aviation and maintenance technicians from DEAC were interviewed. These both gave insights that added significantly to this report.

Since it was decided to focus mainly on maintainability, the definition of this term was defined as follows:

"Maintainability is the degree to which a product allows safe, quick and easy replacement of its component parts." - (Taylor, 2016)

Design for maintainability guidelines were found, that should be followed in order to improve the maintainability of a design. Besides that, ergonomics was found to be a contributing part of maintainability.

With this knowledge, aspects that influence the maintainability of parts of the electric propulsion system were explored. Based on these aspects, it was decided that the energy storage system (ESS), being batteries and/or hydrogen tanks, requires the most maintenance and has the most issues regarding maintainability. Therefore, it was decided to focus on solutions that improve the maintainability of this specific part.

Multiple solutions were found that potentially improve the maintainability of the propulsion system in general. The advantages of using a 3D model, as well as forms of Extended Reality (ER), have been described. Besides that, the benefits of designing modular systems are indicated. When focussing more on the ESS, it was found that the use of a belly pod could potentially improve the maintainability of this part. Therefore, the focus from this point onwards was on a belly pod for DEAC, in combination with the use of a 3D model and modularity.

A design for a belly pod for DEAC's testbed was, at the moment of conducting this research, made by Hiddink (2021). This design did not focus on maintainability of the belly pod itself and also the purpose of the pod was kept undecided. A review of this initial belly pod design was conducted, based on the design for maintenance guidelines mentioned previously. From this review, it became clear that a redesign could potentially improve the maintainability of the belly pod, as well as the configuration of the components inside it.

Therefore, a redesign of this belly pod with a focus on maintainability was proposed. Also, a configuration for batteries or hydrogen tanks inside this redesign was proposed. This redesign is validated using requirements that are based on the findings of the literature study. By improving the doors of the initial design, larger components can be placed in the pod. This redesign also improves the accessibility and removability of these parts.

Ariën Hoekstra S1967002 a.hoekstra@student.utwente.nl