SUMMARY

The primary objective of this thesis was to provide a comprehensive understanding of the tools, processes, and stages involved in the evolution of satellite designs for the TalTech Space Centre. The study explores the use of rapid prototyping, computer-aided design (CAD), and simulation tools in the design process. It also examines the iterative nature of design, where each stage builds upon the previous one, incorporating modifications and refinements based on feedback from testing and simulations.

The thesis introduces nine satellite models, with each iteration building upon the previous version and incorporating necessary identical parts. The final results of the design process are Mod 7 (appendix 1), a mock-up used for marketing purposes, and Mod 9 (appendix 2), a functional deployable model used for deployment tests.

Part of the study focus on the antenna design, specifically the use of metal tape to accommodate long antennas within limited spaces. Common measuring tape is found suitable for this purpose due to its conductivity, lightweight, and elastic bending properties. The tape also exhibited the desired strength and bending radius, serving as hinges to facilitate the opening of the wings substituting the rigid hinges. Challenges were faced in securing the tape to the main body and wings while ensuring adequate length for elastic bending. Subsequent model revisions addressed these challenges and incorporated refinements and improvements.

In the successful Mod 7 mock-up model, marketing aspects were considered, resulting in a visually appealing design with blinking LEDs and solar panel lookalike stickers. The Mod 7 model was displayed at the TalTech U01 and Mektory buildings to showcase the achievements of the satellite program. It featured double-panelled wings to minimize shading and maximize solar panel exposure. The antennas were sleeker, secured with glue, and equipped with white LEDs for enhanced visibility.

The second successful mock-up model, Mod 9, was specifically designed for the stratospheric test. It incorporated improvements such as increased rigidity through the addition of two hinges per side, repositioning of antennas to the bottom plate, and the removal of LEDs for a streamlined design. The stratospheric test aimed to evaluate the satellite's performance and functionality under near-space conditions, assessing the capabilities of all subsystems.

Prior to and during the stratospheric test, deployment tests were conducted. These tests involved manual cutting of the nylon string or using a heated resistor for controlled and accurate deployment. The satellite prototype successfully deployed during the manually

triggered test, but the triggering by the resistor burning through the string during the stratospheric test partially failed.

In conclusion, the thesis demonstrates the evolution of satellite designs through iterative improvements based on practical considerations and test results. It provides insights into the tools, processes, and stages involved in satellite design and highlights the importance of testing and simulation in enhancing the deployables functionalities and performances.