CUSTOMER STORY

REIMAGINING HEAVY EQUIPMENT DESIGN

ETTEPLAN USES ALTAIR® INSPIRE™ FOR TREE HARVESTER COMPONENT

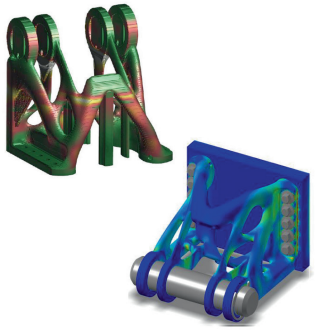
About the Customer

Etteplan Oyj is a worldwide technology service company specializing in software, embedded systems, engineering solutions, and technical communication. With extensive experience of successful additive manufacturing (AM) projects, Etteplan's AM experts embrace virtual design validation, enabling them to explore and optimize part geometry, performance, manufacturability, and process development.

> "With Etteplan's experience of real-world engineering with additive manufacturing (AM), we are genuinely impressed by how Altair's simulation-driven design tools streamline the entire process. The intuitive modeling features, extensive implicit toolbox, simulation and optimization capabilities, and seamless workflow automation with Altair Inspire Python API have equipped us with everything we need to tackle challenging AM design cases.
>
> Erin Komi – Additive Manufacturing Specialist – Etteplan Oyj

Cast option – final design

AM option – final design
(Photo: Teemu Leinonen – LUT)



AM option – **TOP:** Process simulation **BOTTOM:** FEM validation

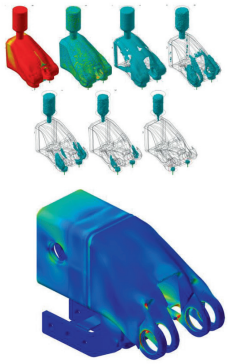
Their Challenge

Tasked by one of its clients, a renowned manufacturer of agricultural plants and equipment looking to enhance its products and improve the harvesting process, Etteplan revisited the design of a cast steel extension boom-end of a tree harvester. This large, heavy part is designed to resist both static and dynamic forces throughout its arduous working environment.

Working with its customer, Etteplan specialists chose Altair's simulation-driven design for manufacturing (DfM) tools to initially demonstrate the design-development, manufacturing, and physical testing of the optimized AM part's durability. Then, the company re-examined the design so it could be manufactured via casting – a more affordable mass production process.

Our Solution

Altair software tools were successfully applied in almost every step of the design-development process from design optimization work to design finalization. This workflow included a combination of implicit modeling and polyNURBS for innovative geometry creation, producing organic shapes supported by lattice cores. Altair® Inspire™ and Altair® OptiStruct® were used for finite element method (FEM) validation, while Oqton's Amphyon, via the Altair Partner Alliance (APA), was applied for the print process simulation.



Cast option – **TOP:** Quick manufacturability check (casting solidification) **BOTTOM:** Final FEM and fatigue analysis

For the cast version, Etteplan reused the optimization runs but changed the manufacturing constraints used for the topology optimization. Leveraging Inspire's Python API scripting capability, the team developed a script that combined implicit modeling and polyNURBS generation to import optimization results and resolve challenging geometry, enhancing the part's castability. A quick solidification analysis using Altair® Inspire Cast™ was then performed to identify and correct potential issues such as areas of high porosity, ensuring the overall manufacturability of the final design.

66% ▼

WEIGHT REDUCTION BY ADDITIVE MANUFACTURING

53% ▼

WEIGHT REDUCTION BY CASTING

Results

With confidence in the simulations from Altair's tools, Etteplan successfully presented to its customer how the original part could be redesigned and redeveloped for both additive manufacturing and casting.

The AM option was a technology demonstrator for a customer new to the process. While an expensive option for serial manufacturing, it clearly showed the power of AM to reduce weight by 66%, coupled with an exceptional fatigue performance (failing at six times original peak loads, after 3.5 million cycles). Such exceptional durability achieved by the organic part geometry was due to a lack of any stress raisers acting as crack initiation points.

While the optimized cast design revealed features known to be challenging during casting, such as wall thickness variations and corners, Altair's tools enabled engineers to easily resolve these problems early by adding material or making local adjustments as needed, long before patterns or molds were created. Even with adjustments made for manufacturability, the design achieved a weight reduction of 53%, demonstrating how tailoring the design optimization workflow to the chosen manufacturing method, enabled by Altair's solutions, delivers both efficiency and performance.

Learn more at altair.com/manufacturing-applications.