

Projektsammanfattningen ska kunna spridas och publiceras fritt och får således inte innehålla konfidentiella eller på annat sätt känsliga uppgifter. Den ska skickas in till programkontoret för Lättviktsdesign: info@lighterarena.se.

Projektsammanfattning

(max 1 sida exklusive nedanstående tabell, publik)

Projekttitlet på svenska (max 80 tecken) Varmformning av lättviktsdetalj med variabel plåttjocklek för bi-metallisk struktur	
Projekttitlet på engelska (max 80 tecken) Hot forming of lightweight tailored components for bi-metallic structures in superalloys	
Akronym (max 10 tecken) LIGHTform	
Erbjudande <input type="checkbox"/> FoI-projekt	Projektet bygger vidare på resultat från ett tidigare projekt <input type="checkbox"/> ja, med stöd från Vinnova (Projekts diarienummer: 2017-04849)
Finns uppgifter om affärs- och driftsförhållanden som skulle kunna leda till skada om de offentliggörs Nej	
<p>Sammanfattning (max 1500 tecken) – Denna ska skrivas så att en extern bedömare ska kunna förstå syftet och innehållet i projektet.</p> <p>Lättviktsdesign ligger alltmer i fokus hos tillverkningsindustrin. Globala miljöutmaningar, mål och lagstiftning medför att lättare och hållbara produkter är nödvändigt för att förbli konkurrenskraftig. Det strategiska lättviktsarbetet för flygmotorindustrin innebär stort fokus på de unika möjligheter som tillverkningsmetoden fabricering medför, där kompletta motorstrukturer byggs genom att plåtformade detaljer svetsas samman med smiden och gjutgods vilka förstärks och interface skapas genom AM. Fabricering innebär att olika legeringar, godstjocklekar och materialtillstånd kan kombineras på ett optimalt sätt i syfte att uppnå minimal vikt, excellens i prestanda och samtidigt effektivisera tillverkningen. Detta post-doc projekt tar sikte på att effektivt utveckla en unik varmformningsprocess för bi-metalliska lättviktskomponenter med variabel tjocklek där två olika legeringar formas och sammanfogas. Arbetet är branschgeneriskt och bygger vidare på tidigare forskningsarbete där virtuella metoder som inkluderar tillverkningskedjor med kopplade FE-analyser utvecklats i syfte att träffsäkert korta utvecklingstiderna av innovativa varmformningsprocesser. Projektet samlar kompetens från flygmotorindustrin i Sverige, erkänt institut inom tillverkningsprocesser, FE-modellering samt SMF med erfarenheter från plåtformning. Projektets mål är:</p> <ul style="list-style-type: none"> Tillämpning av generisk metodik för kopplade FEA av tillverkningskedja för bi-metallisk komponent med variabel tjocklek. Simuleringsdriven utveckling av unik varmformningsprocess som säkerställer geometri och egenskaper i framställd komponent <p>SMF tillverkar och utvärderar av GKN efterfrågad viktoptimerad varmformad komponent i superlegeringar</p>	
<p>Sammanfattning på engelska (max 1500 tecken)</p> <p>Lightweight design is increasingly in focus to the manufacturing industry. Global environmental challenges, targets and legislations imply that lighter and more sustainable products are necessary to remain competitive. One strategic lightweight technology area for the aero engine industry focus on the unique possibilities that comes with fabrication, in which engine structures are built from sheet metal parts, forgings and castings that are welded together and heat treated to complete structures. The components also include reinforcements and interfaces created using AM. Fabrication imply that different alloys, thicknesses and material states can be combined in an optimal way to reach minimal weight, performance excellency and makes the production more effective. Based on previous research work, this post-doc project aims at developing an innovative hot forming procedure for bi-metallic</p>	

lightweight components with varying sheet thickness. The work is generic for different industry segments and involves virtual methods which includes coupled FE-analyses of the tailored blank, hot forming and welding to secure and shorten the tool and die development time. The project gathers competence from the aero engine industry in Sweden, acknowledged institute within manufacturing processes, FE-modelling and SME with experiences in sheet metal forming. The project goals are:

- To further develop and apply the generic methodology with coupled FE-analyses of the bi-metallic component with various thicknesses in superalloys. Simulation driven development of the innovative hot forming procedure that secures the resulting geometry and properties.

The SME manufactures and evaluates the tailored hot formed geometry desired by GKN

Startdatum 20190901	Slutdatum 20210830
Totalt sökt stöd (SEK) 2 225 000	Total medfinansiering (SEK) 2 225 000

1. Projektets idé

This post-doc project will develop a unique hot forming process of a tailored bi-metallic component for GKN. Research activities are required within coupled FE-analyses of a manufacturing process chain consisting of tailored blank, hot forming and welding to compensate for accumulated shape distortions. With previous research at RISE IVF and LTU as a base, the tailored blank is added to the manufacturing process chain. By building a new hot forming tool at the SME Ryd-Verken, the numerical and experimental results, of the hot forming procedure performed at 950°C, can accurately be compared. SMEs MagComp contribute with knowledge on inductive heating of the forming tooling and LaserTool assist with geometry assurance according to the aerospace requirements. GKN will implement the virtual compensation methodology to minimize costly compensation loops of fabricated engine structures and seek to receive hot formed components from the Swedish aerospace approved sub-supplier Ryd-Verken, within five years. Ryd-Verken will take new technology steps during the project and study the business case of hot forming to quote production after the project end. Studies of e.g. low cycle fatigue properties and defects in fabricated lightweight bi-metallic components can be incorporated in a future research application.

2. Projektets bidrag till programmålen

The results obtained from the project will, after implementation in five years at GKN and SME, reach $\geq 20\%$ shorter development time and reduce weight by $\geq 20\%$ by combining different material states and alloys while improving product properties through innovative hot forming procedures for tailored lightweight parts. Starting from TRL 4 this project will take the technology to TRL 6 by exploring the possibilities for hot forming of lightweight materials by means of CAE-tools. A hot forming tool is built, and demonstrator parts are manufactured in which the need for manual compensations are minimized, straightening the way to industry implementation. The project results can benefit other industry segments such as the marine (e.g. ship impellers) and land-based turbine industry, automotive, energy and nuclear industry. A general hot forming tool will be built that also are made available to the industry in Sweden through the test bed facilities within “LIGHTest” at RISE and results will be incorporated in a LIGHTer PhD course. It is very likely that Rydverken and MagComp will increase and apply their expertise for lightweight design in other areas over the next five years.

3. Projektets aktörskonstellation

The project gathers all necessary competence needed to perform the project and successfully achieve the results with minor risks. The project consortium involves the aero engine industry in Sweden, acknowledged institute within manufacturing processes, FE-modelling and SMEs with experiences in sheet metal forming, geometry scanning and inductive heating methods. The project partners are **GKN Aerospace Sweden** with demands and needs for developing tailored lightweight components for their future aero-engine components, SMEs **Ryd-Verken AB**, **LaserTool in Blekinge AB**, and **MagComp AB** possess invaluable competence and resources within tool manufacturing, forming, geometry assurance and inductive heating all necessary to the project and **RISE IVF AB** in Olofström which has a long experience within research and development of thermo-mechanical material characterization, validation hot forming tests and FE-modelling of thermo-mechanical manufacturing processes, also through cross border activities with Luleå University of Technology. A close collaboration will take place between the participants in the work packages through commonly performed projectactivities, hands-on manufacturing and complemented with both physical and virtual meetings.