2022

# Lightweighting for sustainability and resource efficiency.

The Lightweight Agenda leads the way



#### Lightweight researchers build networks

In LIGHTer Academy, researchers and businesses make new contacts who have an interest in radical lightweight solutions and co-publishing.

page 4–5



#### **Bolder ideas**

Groups that have a wide range of skills tend to achieve greater results. Feasibility studies make it possible to take greater risks in research.

page 6-7

#### Bio-based kayaks and composites

Bio-based materials and composites were used to make strong yet lightweight kayaks 20 % lighter. These two projects were awarded funding through LIGHTer SME. **page 9** 

#### PhD students meet industry experts

2023 kicks off a new round of LIGHTer PhD Network courses for PhD students on the topic of lightweighting. This is where researchers and industry representatives interact and build networks. **page 10–11** 

#### Sweden hosts ELN

In the spring of 2023, Sweden will host the European Lightweighting Network meeting – an opportunity to highlight lightweighting in the green transition. page 12

## **LIGHTer**

## The Lightweight Agenda leads the way

e're equipped for the future. Through an extensive external analysis and lively discussions, we have updated our research and innovation agenda, the Lightweight Agenda. We update the agenda every three years. It is the most important, the most difficult and the most fun thing we do. Thanks to all of you who contributed! You make a difference.

As we look to the future, we have also undergone a nine-year evaluation. It is with humility that we accept the evaluators' high praise for our results. The evaluators at Sweco had this to say: "LIGHTer is a well-organised, well-managed programme that has created opportunities for representatives from industry and research to interact across traditional silos."

We can all feel proud of what we have accomplished together.

#### Innovation for the next generation

We have packaged our strategic conclusions into input for the next generation of strategic innovation programmes, Impact Innovation. In partnership with the sister programmes RE:Source, Innovair and SIO Grafen, as well as the Wallenberg Initiative Material Science for Sustainability (WISE), we have drafted an application for a preparatory project. We are positioned to offer our experience, expertise and partner networks as we take radically new approaches in the transition to a sustainable world.

#### International lightweight host

Around the world, we are steadfastly building networks on both a strategic and a technical level. Among other efforts, we are hosting the third meeting of the European Lightweighting Network in Stockholm on 8–9 June 2023 during Sweden's presidency in the European Council. We are also developing bilateral partnerships with Germany, Austria and Switzerland.

In Sweden, we are more closely involved in new sectors like the forestry industry and infrastructure sector. One way we get involved is through our national lightweight conference, LIGHTer Summit, on 28–29 March. Finally, as an example of our efforts, I'd like to mention the winning entry in our innovation competition InfraLIGHTer Awards - a lightweight bridge in wood that brings us closer to the vast majority of the UN's 17 sustainable development goals. So, let yourself be inspired!

#### **Cecilia Ramberg** Director SIP LIGHTer



#### This is SIP LIGHTer

We are currently in the final phase of stage three and will soon enter stage four, which extends to 2025. Our roadmap is available in the Lightweight Agenda with a 2040 Perspective. Read more at lighteragenda.nu/en

In this annual report for 2022, we wish to show how SIP LIGHTer has evolved as we look to the future. We highlight a number of successful cases and meet some of the people who are driving lightweight technology forward. We start with the seven innovation mechanisms in our common Lightweight Agenda.

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# **Drief**

international conferences in 2022 TOTAL OF **CO-ORGANISER OF** THE INNOVATION **R&I PROJECTS** CADEMIC COMPETITION FUNDED SEMINARS INFRALIGHTer AWARDS ORGANISATIONS IN OUR NETWORKS SME projects funded PhD students, 61 of whom are alumni SOMF ORGANISATIONS HAVE RECEIVED PROJECT UNDING VIA LIGHTE Verified product use TRL9 TRL9 workshops Product and TRI 8 process development **TRL 7-8** TRL7 Technical verification and demonstration TRI 6 **TRL 5–6** Exchanges Skills with small iternation & large TRL5 comp Applied research TRL4 Industry-driver **TRL 3-4** TRL3 Academic research **TRI 2** TRL 1-2 TRL1 Technology readiness level staircase SEVEN INNOVATION MECHANISMS The seven innovation mechanisms of the Lightweight Agenda can be connected to the Technology Readiness Level (TRL) ladder. It illustrates the need for collaboration on all levels. SIP LIGHTer's operational function extends to TRL 6 with a focus on creating an effective structure for developing technologies, test environments, materials and people. In this annual report, we follow up on some of the concrete

results we have already achieved.

#### **LIGHTer ACADEMY**

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# Where lightweight researchers come together

LIGHTer Academy is a network for lightweight researchers in Sweden where we interact and gain new insights, from each other and together with each other.

At our lunch-to-lunch workshops, the latest research results from academia and industry are presented. And at the coffee breaks, which are just as rewarding, lightweighting is discussed and new contacts are made.

"LIGHTer Academy opens up opportunities for collaboration with academia in lightweight research for us at DYNAmore Nordic. Our goal is to improve and increase the use of simulation and of our products for developing lightweight sustainable materials and structures"

#### In-person meetings

This year we returned to in-person meetings, including a visit to Max IV in Lund, where we were inspired by the potential of synchronous technology. In December we also visited Luleå, where we learned about new research initiatives in the wake of green technology.

#### Online lunch seminars

Together with the LIGHTer PhD Network, we arrange a series of monthly online lunch seminars. They are open to anyone who is interested and are announced on LIGHTer's website.

#### For researchers with a lightweight profile

In 2023, we kicked off a new season of the LIGHTer Academy for researchers who are studying lightweighting. If you are an industrial researcher with a lightweight profile and are eager to make new connections, contact the LIGHTer Academy steering committee.



Mats Landervik, Head of Research at DYNAmore Nordic

MANAGEMENT TEAM

LIGHTer Academy's 12 part-time funded researchers

Malin Åkermo oval Institute of Technology





Anna-Lena Ljung Fluid mechanics and ntal mechanic Luleå University of Technology

Leif Asp

Material and

al mechanic

Andreas Borg, GKN Aerospace Engine Systems, also part of the management team

Please contact one of our academic researchers if you have an idea or want to talk about technology and the future:

lighter.nu/la

Fang Liu

**Martin Fisk** 

Materials science &

applied mathematics

Malmö University



Materials and solid me Luleå University of Technology

Martin Fagerström

Lars-Erik Lindgren

of A-SMC.

Induction heating of ferromagnetic materials is highly energy efficient, and industries stand to gain major savings. Simulating the induction heating process is not entirely simple, mainly because there is significant non-linearity as the temperature increases. Traditionally, the mathematical description for simulating induction heating has been based on magnetic linear materials. For most ferromagnetic materials, a linearization has been required. A new numerical methodology for simulating induction heating has therefore been developed by LIGHTer Academy researchers Martin Fisk and Lars-Erik Lindgren together with Andreas Hultkratz from SKF and Matti Ristinmaa from Lund University. The new methodology allows for a better match with experimental data.

#### One challenge is describing the behaviour of composite materials in structures under complex loads. This requires an effective material model that necessitates extensive material characteri-

Virtual testing provides

faster characterisation

Composite materials with three-dimensional fibre

reinforcement show great lightweight potential.

**Five** 

results

from new research within LIGHTer Academy

sation. Physical characterisation can be cost prohibitive and time consuming. That's why researchers at Chalmers and the Bristol Composites Institute (BCI) have developed a method that characterises the macroscopic properties of the material through a combination of physical and simulated experiments. The simulated experiments take place using a detailed model of the material's

architecture. This method allows for a more affordable and time-efficient characterisation. The project has been run by Carolyn Oddy, a PhD student in the LIGHTer PhD Network, in

partnership with Chalmers colleagues Martin Fagerström (LIGHTer Academy) and Magnus Ekh as well as Stephen Hallett, Bassam El Said and Ioannis Topalidis from BCI.

#### **Computational models** predict properties

Advanced sheet molding compounds, or A-SMCs, are a class of composite materials that show great promise to ramp up the use of lightweight components in the automotive industry. One challenge is their high fibre content, which requires advanced computational models to make numerical predictions of mechanical properties and manufacturability.

In this study, flow results from general CFD code were combined with Python code for fibre orientation calculations. The study was done by Gustaf Alnersson, industrial PhD student from Gestamp Hardtech, and Anna-Lena Ljung and Staffan Lundström from the Luleå University of Technology. The results were then verified by

BROAD EXPERTISE in metals, composites, modelling, simulation, manufacturing processes, multimaterial solutions, additive manufacturing, multifunctional materials and advanced characterisation methods is represented. This creates an effective transfer of knowledge to industry and promotes lifelong learning.

12 RESEARCHERS from five Swedish universities receive part-time funding from SIP LIGHTer, and 23 active researchers from research institutes and the industry interact with LIGHTer Academy. The aim is to jointly formulate the right research questions in order to meet the future needs of companies. This strengthens Swedish industry through both incremental development and radical innovative solutions within lightweighting.



Yvonne Aitomäki from RISE using specialised composite computational programmes. By clarifying the possibilities and limitations of different types of flow models, further steps can be taken towards qualitative and credible sheet molding compound calculations. The research is part of the PROSICOMP II project funded by Vinnova. At the 20th European Conference on Composite Materials (ECCM20) in Lausanne, Switzerland, the project presented a contribution for 3D modelling

#### A new numerical method simulates induction heating

#### Microstructure control during additive manufacturing

Additive manufacturing (AM) with laser-powder bed fusion (LPBF) makes it possible to create complex geometries and lighter components. One challenge with the manufacturing method is that grain growth occurs primarily in one direction. This results in columnar grains and anisotropic material properties that produce different properties depending on the direction of the load, making component design complicated. By grafting the powder with particles during printing, we can form

more equiaxed grains. The particles then act as nucleation sites for the equiaxed grains.

The DEMA project has developed computa tional models and powder metallurgic alloying methods that can be used for material design in additive manufacturing using grafting. Project funding was provided by Vinnova, the Swedish Energy Agency and Formas through Metalliska Material. LIGHTer Academy researchers Greta Lindwall from KTH and Lars Nyborg from Chalmers, together with Swerim and industrial partners (Kanthal, Höganäs, Alleima, Quintus Technologies, Jernkontoret), participated in the project.

#### Optimised use of powder in additive manufacturing

Metal powder is the most common raw material in metal additive manufacturing (AM). The production method determines the properties and suitability of the powder for various AM technologies. In addition, during the additive manufacturing process the metal powder is subjected to process conditions that differ significantly from one AM technology to the next. This causes the properties to change during the manufacturing cycle and influences the properties of the final components.

LIGHTer Academy researchers Eduard Hryha and Lars Nyborg from Chalmers, together with about 30 research and industry partners, have developed models describing the change in powder properties depending on alloy and AM technology. The project was conducted at the Centre for Additive Manufacturing - Metal (CAM2) funded by Vinnova.

The models help optimise powder reuse and improve the durability of powder-based metal AM. Together with Swedish industry, the project has also developed new materials for additive manufacturing, such as a brand-new aluminum alloy family that has high strength combined with high temperature properties. This will pave the way for new lightweight solutions based on additive manufacturing.



Lars Nyborg Chalmers University of Technolog

**Greta Lindwall** Materials Science Royal Institute of Technolog



**Eduard Hryha** Chalmers University of Technolog

Håkan Hallberg Solid Mechanics Lund University

#### Industry-oriented development projects

Through innovation projects with implementation within five years and more visionary projects at lower technology readiness levels, we are strengthening several industries and supplier levels at the same time.

#### LIGHTer INDUSTRIAL PROJECTS

### Existing paints provide approved fire protection for composites

The LightSURF project demonstrated that many of the market's fire-retardant paints provide good fire protection for composites. In factory-built bathrooms, a protective plasterboard could be completely removed since the composite in the ceiling coated with fire-retardant paint successfully met fire safety requirements.

The LightSURF project studied how fire-retardant paint could be used to protect composites from fire.

Composites have many fantastic properties and can often replace heavier materials, but one challenge is that they are combustible, says project manager Anna Sandinge at RISE. We wanted to see if the fire-retardant paint could help them meet the tough fire protection standards in shipping, aviation and construction, in terms of both fire protection properties and adhesion,

a company producing ready-made, factory-built bathrooms for on-site assembly, took part in the project. The ceilings are made of a composite with plasterboard as fire protection. By applying fire-retardant paint right on the composite, they were able to completely remove the plasterboard.

The ceiling became lighter, the handling was easier and, not least, the ceiling was easier to transport to the construction sites, Sandinge says.

#### **Creates new partnerships**

LIGHTer gives us the chance to link these kinds of constellations with a variety of experts who were involved in the project. It's not a constellation that would otherwise naturally interact. The composition of the project team also enables us to find new application areas for the material design that was developed in the project.

#### Maintenance-free thanks to lightweight stainless steel beams

Significantly lighter beams with zero maintenance, a longer service life and less material extraction. Corrugated web beams in lightweight stainless steel have many advantages as a replacement for conventional beams in bridges and other structures.

"Before the end of the project,

Podcomp had implemented this

new solution in its products"

Anna Sandinge

RISE, project manager for LightSUR

so that they could both protect and

In construction, highly satisfactory

results were achieved. Podcomp,

adhere to composites.

Already in production

If you create a structure with corrugated web beams and make them in stainless steel, you get a strong, lightweight structure that can replace traditional beams in composite bridges - made in both steel and concrete - and is nearly maintenance-free. This is what the SunLIGHT project investigated.

#### Lower life cycle cost

You have to apply rust protection to ordinary steel every 15-20 years, says Pia Borg at Swerim, project manager for SunLIGHT. If it's a bridge, you have to close off traffic, and people have to queue up or take other roads, resulting in a cost to society. But with stainless steel, you don't have to. For a bridge, the life cycle cost is reduced by 20-40 percent.

The corrugated web beams tested in the project will be both easier and cheaper to produce than previous beams. High-strength stainless steel for the beams further reduces weight while providing lower maintenance costs. Although stainless steel is more expensive to buy than conventional steel, it drives lower costs over time because less steel is needed and less material is consumed when lightweighting. Both the supply chain and the construction phase also benefit from lower weight structures.

#### Sustainability - a natural component

In the project, four-metre-long beams and samples from the beams were tested. The measurements turned out to be highly consistent with the simulations that were performed. The results demonstrate that it is possible to add data for beams like these in

an appendix to the Eurocode regulations. This would mean that the regulations approve the use of corrugated stainless steel beams.

I like that the discussions around environmental sustainability have become a natural part of product development, Borg says. It's not something you add on at the end, but it informs the entire project. And this is true not only for LIGHTer projects, but

has spilled over into other calls for proposals.

The project was funded by LIGHTer via Vinnova, and was carried out in collaboration with Chalmers, Swerim, the Swedish Transport Administration, Outokumpu, Esab, AFRY, COWI, WSP, Stål och Rörmontage (SRM-AB) and the Swedish Institute of Steel Construction (SBI).

**R&D PROJECTS & FEASIBILITY STUDIES** 

## Funding that delivers bolder ideas

By funding feasibility studies and research projects, LIGHTer makes it possible to take greater risks in research. Testing radical ideas increases the chances of achieving greater results in the long term. LIGHTer's network serves as a hub for turning ideas into industrial value.

Here are six examples of projects that show how collective ownership of risks and the creation process paves the way for the industrial lightweight solutions of the future. All of our projects are available in a project database at lighter.nu

#### **METTHRAM** / Additive manufacturing

#### Welding-based additive manufacturing resulted in a weight reduction of nearly 25% over the original product. Off-road vehicles and extruded profiles are some examples of applications.

This study showed great potential for welding-based additive manufacturing concerning weight reduction and improved business models for several products. The project results were part of Sweden's single biggest project in welding-based additive manufacturing. It is being run by DEDICATE at University West, with funding from the Knowledge Foundation and ten industrial partners. The project, which began in the summer of 2022, will run for more than eight years. The study was conducted in a consortium whose members included University West, SWERIM, BAE Systems Hägglunds and Hydro Extruded Solutions.

#### **TIGER** / Natural fibre

#### This project developed a mechanical testing platform for single natural fibres, specifically jute and wood fibres, for applications like paper straws. It provides faster, more efficient and affordable feedback on the properties of the fibre.

Natural fibres are paving the way for durable, lightweight, inexpensive and high-performance products in the future. However, there is a lack of good experimental methods for studying the tiny fibres in detail and gaining an understanding of how the complex fibre structure affects material properties. The project therefore developed a method for identifying the mechanical properties of single natural fibres. One possible use would be to test chemically modified wood fibres, such as in the paper straws that replace single-use plastic straws following the implementation of the EU directive. The developed method provides quick feedback on chemical modifications without expensive and time-consuming tests, and can also provide key input for modelling. The project was run by Juteborg Sweden and Tetra Pak.

#### Virtual corrosion testing / Bimetallic corrosion

#### Accelerated virtual corrosion testing using models created in this project delivered substantial time savings, from 6 weeks to 3-6 hours, compared with experimental corrosion testing

The project developed virtual simulation tools for corrosion testing, in parallel with experimental methods for testing the bimetallic corrosion of aluminum. The result can help drive the use of more aluminum-based lightweight components in vehicles, which will save fuel. Use of the model can also help to extend the service life of aluminum components and corrosion testing equipment, and to reduce material use in corrosion testing. The project was carried out by RISE Research Institutes of Sweden, Volvo Cars, Scania CV and Gestamp HardTech.

"For a bridge, you can reduce

the life cycle cost by 20-40 percent using lightweight stainless steel beams with corrugated web beams."

#### **Pia Borg**

Swerim, project manager for SunLIGHT

#### ALVA2 / Tribology in hot aluminium forming In hot forming of aluminium, several challenges in tribology remain before the technology can be commercialised.

The project produced tools and methods to make the two hot forming processes that were evaluated for aluminium more robust and predictable Choosing well-functioning tribological systems that were included in guidelines made the processes more robust. Higher predictability was achieved through a friction model and the selection of a suitable material model for simulating hot forming of aluminium sheet. The project was carried out by RISE Research Institutes of Sweden, Gestamp HardTech, Hydro Extruded Solutions, Ionbond Sweden, Luleå University of Technology, Quaker Houghton Production Sweden, Uddeholms and Volvo Cars,

#### **ThermLight** / Induction for heating sheet metal

Induction heating can slash energy consumption by at least 50% for heat-forming processes while reducing footprint area and investment costs.

This feasibility study explored whether a new induction technology could be used for heating sheet metal in industrial production. This is something that would give more companies access to heat-forming processes and make it cheaper to manufacture lightweight, high-strength products. The outcome as a whole was very positive for the induction technology that was evaluated. The study was conducted by RISE Research Institutes of Sweden, AP&T Sweden, PR Development and TC TECH Sweden. The results served as the basis for an application for a full-scale project that has received extended funding.

#### Stronger fibres with plasma / Plasma treatment Plasma treatment of high-strength synthetic fibres doubled the shear strength of epoxy composites.

In a broad screening, this project demonstrated how plasma treatment can affect fibre strength, wettability and surface structure. The project also looked at the effect of plasma treatment on wound and injected composite laminates. The study included biofibres, synthetic fibres and carbon fibres. Bio-based epoxy and PET were used as a matrix. The study showed that plasma treatment of high-strength synthetic fibres doubled the shear strength of epoxy composites. In addition, increased plasma wetting resulted in an improved interface between fibre and matrix, and more time-efficient impregnation. The study was conducted by Agaria, Bandindustri, Backpackinglight, Comfil, Juteborg, Melker of Sweden, Oxeon and RISE Research Institutes of Sweden.

#### INNOVATION MECHANISM #3 Test and demo activities We must continue to increase availability, minimise business risks and create synergies along the entire value chain and across industries.

#### TALENT ATTRACTION

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## **Global users of Swedish lightweight** testbeds

In the Talent Attraction project, the regions of Västra Götaland, Blekinge and Norrbotten are investing in increasing the worldwide use of test beds in the forming and additive manufacturing of lightweight products.



Swedish delegation at Arcelor Mittal, with host Gilles Brun head of the forming team, pictured in

The project was carried out in 2022 to promote contacts with innovative global SMEs. Its long-term goal is to establish international players in Region Norrbotten, Region Blekinge and Region Västra Götaland. The project started off with a gap analysis to determine the current situation and the desired skillsets needed in the three regions. Descriptions of services aimed at global players were a key component.

Business Sweden contacted companies in France and Germany, and arranged 41 online meetings with stakeholders who were specifically interested in certain testbeds.

- The collaboration with Business Sweden was very effective and accelerated internationalisation of the testbeds, says Boel Wadman, project manager. This type of collaborative project is a great idea from Vinnova, and I'm happy to have taken part in one of the first pilot projects.

testhed

#### Visits to Germany and France

Online meetings with testbed representatives were followed by in-person meetings, including at trade fairs such as IAA in Hanover and FormNext in Frankfurt. In November, a delegation trip to France took place which was arranged by Business Sweden's office in France. Representatives from several testbeds joined, including the application centre for additive manufacturing, stamping center in Olofström and the testbed for sustainable composite manufacturing. The trip included visits to Imerys in Toulouse, Arcelor Mittal in Montataire, ICMP in Paris and Materiaupôle's cluster companies. In addition, new research contacts were made at a reception at the Swedish Embassy in Paris. These contacts have led to several direct inquiries, and visits to Sweden are planned for 2023.

#### CONTACT TALENT ATTRACTION

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Digi Demo Day is a collaboration among seven strategic innovation programmes. For the sixth consecutive year, we hosted an inspiration day in September dedicated to testbeds where we showcased digitised production processes focusing on aviation. This year's theme was how to take the next step in product development and production using a



#### LIGHTer SME

## Lower weight and higher performance with bio-based composite materials

project

Thanks to the BioLIGHT project, two kayaks serve as proof that you can build both strong and light products with bio-based materials.

We reduced the weight by several kilos and increased rigidity by creating a microsandwich material with a thin core of cork surrounded by flax fibre laminate, says RISE's Jocke Pettersson, who was the project manager for BioLIGHT.

Kayak manufacturer Melker of Sweden wanted to transition from fibreglass to bio-based laminates to make their kayaks. They already use some bio-based material to manufacture their fibreglass kayaks. Now they wanted to see if a kayak could be made entirely from bio-based materials.

#### High performance – low weight

In the project, a completely biobased laminate was created with woven flax as a reinforcement, and bio-based epoxy as a matrix to bind the fibres together. The high performance and low weight were achieved through a microsandwich solution, with a thin core of cork covered on both sides by the flax fibre laminate.

We made two kayaks, one of which was weight-optimised, Pettersson says. Then we looked at the performance, and we're thrilled with the result. We want to show that bio-based materials in the laminate can be an alternative to ones based



## **Composites reduced weight by 20 percent**

When composites were introduced as a lightweight material in a demonstrator for airport infrastructure, a study showed that weight can be reduced by 20 percent.

With the demonstrator, the LINOP project wanted to showcase a lightweight solution that can help bio-based fibre composites in Sweden increase their technological readiness level. In a feasibility study, an aircraft docking system was identified as a suitable structure for demonstrating the new material solution. It was also a way to demonstrate how weight reductions can produce positive knock-on effects in terms of regards costs, the environment and energy consumption.

The lightweight material in the demonstrator helped to reduce environmental impact by reducing the need for surface-treated steel sheeting. In addition, the reduced weight is expected to pave the way for further reductions in power out-

Exchanges with small & large companies We need to find the optimal interaction between small tech-oriented companies and Sweden's major global manufacturing industries.

on fossil fuels. Plus, the cork has fantastic sustainability data. The outer bark of a cork oak can be harvested about twenty times over a tree's lifetime, and the trees live an average of 200 years. And cork doesn't absorb any water, it doesn't rot and it doesn't burn.

#### Product lifespan in a new

The project was funded through LIGHTer SME, enabling it to get up and running quickly in the spring of 2022. Also, with funding through

gramme, a follow-on project is now underway that will investigate the laminate's lifespan.

The rapid administration of funding from LIGHTer has meant a lot to the project, and now we get the chance to study the lifespan in a new project, Pettersson says. We'll look at how the material can withstand degradation in simulated outdoor climates that present a combination of UV light, moisture and temperature fluctuations. We'll also test different ways to increase the service life. The fact that the product lasts for many years is essential from a sustainability perspective.

The project was carried out by RISE, Melker of Sweden, PodComp and Midnight Composites.

> the project wich materi consisting of flax fibre bio-based epoxy and a thin cork cor

put for hydraulic control of a bridge. The project was carried out by RISE and FMT Sweden, and it lay the groundwork for a new LIGHTer application that was recently approved called the LINOP II project.



CONTACT LIGHTer SME

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Skills development By continuing to develop forums for skills exchange and training with a multidisciplinary mindset, we compl the industries' own training

#### LIGHTer PHD NETWORK

## PhD students meet industry experts

The LIGHTer PhD Network is a network of PhD students, senior researchers and industry representatives who share an interest in lightweight technologies.

The network runs a unique PhD course each year, with lectures, industry seminars and study visits

over the course of ten days at five different companies. The network offers PhD students studying lightweighting a broad perspective on both research and the industrial use of lightweight technologies.

The companies also discuss their sustainability efforts in detail. This provides a broad overview of lightweighting and

theoretical foundations from a broad perspective. The PhD students also gain an understanding of

the challenges and possibilities around lightweight solutions in Swedish industry. The LIGHTer PhD

"This course is unique. It has given University of Technology (LUT). me the tools to look at my research The school develops the activiin a broader, more applicationoriented perspective – a strong motivation for doing research"

Matilda Johansson University of Borås

Network is hosted by the Luleå ties for the PhD student network together with the Stockholm Royal Institute of Technology (KTH), Chalmers University of

Technology and RISE. It has been fantastic to be part of the PhD students' work spanning different disciplines,

says Jörgen Kajberg, recently appointed project manager at LUT. Despite their differences, they're

MANAGEMENT TEAM LIGHTer PHD NETWORK

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KTH Royal Institute of Technology

united through the fruitful discussions about each other's research.

#### Sustainability and open seminars

New for the year 2022 was a sharper focus on sustainability and international activities. Open online seminars are now given each month, with several international speakers. These take place in collaboration among PhD students, alumni and researchers at LIGHTer Academy. The seminars are a popular way to stay updated on lightweighting research, both within and outside Sweden. One of our speakers was alumnus Ross Harnden of CorPower Ocean, who talked about his new job after he received his PhD.

#### **Multidisciplinary research**

KTH, Saab

i Linköping

The network aims to facilitate and promote multidisciplinary collaborative research. This in turn opens doors to radical new lightweight solutions and co-publications, while strengthening the interaction between academia and industry.

For small and medium-sized businesses, it's both important and exciting to meet the PhD students,

#### LIGHTer PhD Networks unika doktorandkurs omfattar tio dagar fördelade på fem utbildningstillfällen, där akademi och industri samverkar:

1. Material selection Chalmers, AB Volvo Group in Gothenburg 2. Composite materials 3. Cellular materials and sandwich constructions KTH, DIAB i Laholm

#### LIGHTer PRODUCT OPTIMIZATION Smarter working methods

Product optimisation is yet another example of how SIP LIGHTer cultivates networks where industry, academia and research institutes together develop new, smarter approaches to lightweight design.

It's about developing employees so that they can use the new methods, says Harald Hasselblad, analysis engineer at Volvo Car Group and member of LIGHTer's management team. He runs the LIGHTer Product Optimization network together with Mikael Thellner, technical expert at Scania.

In the automotive industry, as in others, it can traditionally be a time-consuming process for designers and computation managers to produce relevant results. A more optimisation-driven development minimises time-to-market. Here, there

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**Mikael Thellner** mikael.thellner@scania.com 08-553 517 30

is scope for more ambitious efforts to work in parallel as well as new virtual tools that focus on weight reduction. Product optimisation has

taken a maior step into the ightweight Agenda, Thellner savs.

A good entry point is the online course LIGHTer Product Optimization, available at lighter.nu.

It presents new ways of thinking and new approaches needed to transition to more sustainable indus-

LIGHTer Product Optimization is run by a manage-KTH. Learn more about LIGHTer Product Optimization at lighter.nu.



The workshop in Mölndal in Vovember vas a great opportunity to exchange xperience and make new contacts

#### LIGHTer NODE, VÄSTRA GÖTALAND Lightweight takes on the challenges of electrification

In the third phase of the LIGHTer node Västra Götaland, efforts are focused on the component, material and manufacturing challenges of electrification. This is especially relevant for transport and the transformation that awaits manufacturing companies.

The node maintains a regional research and innovation network that is globally competitive within lightweighting. Their focus is on the automotive, shipping and aviation industries, which dominate in the Västra Götaland region, though they also consider other sectors that show an interest in lightweight technology. The third stage has been in operation for a year, with activities aimed at SMEs that are willing and able to grow, with the support of large companies.

#### Fire lab in Borås

In September, the RISE test and demo facility in Borås opened its doors to more than 20 people who wanted to learn more about lightweighting and electrification. The attendees especially appreciated the fire lab and the new Swedish Electric Transport Laboratory (SEEL) which is under construction there.

#### Lively discussions

A few breakfast seminars were held at PTC in Trollhättan, including one on electric motors and their production challenges, and another on opportunities and challenges during the production and recycling of

tries

During the autumn, an on-site seminar was arranged with 50 participants from industry, software suppliers, academia and research institutes. ment team with representatives from Volvo Cars, Scania, Combitec, Saab, Örebro University and

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says Fredrik Olofsson, R&D Manager and Quality & Environmental Manager at Brogren Industries in Älvängen. In return, we offer them insights into how today's engineering industry can function when we demonstrate how new technology and digitalisation are connected to process challenges in metal cutting and welding, in a real-world setting.



At the end of 2022, 123 PhD students were part of the LIGHTer PhD Network. 61 have now defended their thesis and are part of the alumni network. This year's international workshop was held at SINTEF and NTNU in Norway.

#### 4. Metalliska material LTU, RISE, GKN, Brogren

Industries i Trollhättan

5. Manufacturing of metal structures LTU, Gestamp Hardtech i Luleå

batteries for electric vehicles. Each seminar attracted about 30 participants, who got the opportunity to establish new contacts. The lively discussions revealed the presence of impressive collective expertise at these events.

#### Megacasting

The node has also supported several project applications in electrification and lightweighting. One project application addressed how to join the huge cast parts produced through megacasting. That project was awarded SEK 8.3 million from Vinnova (FFI Circularity) to determine the process limitations and optimisations for joining cast aluminum using self-piercing riveting and flow-drill fastening - something Volvo Cars often

uses today. The project supports Volvo Cars and their suppliers as they introduce designs that use megacastings, which can lead to lighter and more sustainable electric cars in the future.



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#### INNOVATION MECHANISM #6

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**Cross-cutting collaboration** 

The interaction among regional, national and global stakeholders is a key success factor, and we are always seeking regular collaboration with public-sector funders, industry organisations and other strategic innovation programmes.

#### LIGHTer INTERNATIONAL

## **High-level** meeting in Sweden set for 2023

In the spring of 2023, Sweden will host the European Lightweighting Network (ELN) meeting. The meeting will take place during the Swedish Presidency of the European Council, and we will get the chance to influence how Europe can use lightweighting for the green transition. We see strong interest in working LIGHTer – with a cross-sectoral, interdisciplinary approach.

#### INTERNATIONAL COLLABORATION

#### INDUSTRIAL DELEGATION **TO AND FROM GERMANY**

In May 2022, a Swedish industry delegation was funded by the German government. The visits proved to be a success. In 2023, LIGHTer is arranging a trip for Swedish parties to visit Germany.

#### **INDUSTRIAL DELEGATION TO AND FROM AUSTRIA**

An industry delegation from Austria visited Sweden in April 2022, and many different collaborations were developed following the visit. Among other plans, discussions are ongoing about global cooperation within the framework of the LIGHTer PhD Network.

#### EUREKA CALL FOR LIGHTWEIGHT

Sweden is participating in a Eureka call for lightweighting projects for 2023. LIGHTer has been involved in providing input to the call text.

#### **ELCA AND ELA MERGE**

The European Lightweight Cluster Alliance (ELCA) and European Lightweight Association (ELA) merged in 2022. LIGHTer takes a positive view of this collaboration and continues to be actively involved in the network. Swedish stakeholders can find suitable partners for their EU applications.

#### NATIONAL COLLABORATION

Since its inception in 2013, LIGHTer has arranged 63 workshops and seminars throughout Sweden, 28 of which were arranged with others. Over the years, LIGHTer has collaborated with eight other strategic innovation programmes.

#### **REGIONAL COLLABORATION**

LIGHTer has three regional nodes: NODE Blekinge, NODE Småland and NODE Västra Götaland.

## STATEMENT OF THE CHAIRMAN OF THE BOARD We need a lighter, more resource-efficient world

Backed by a nine-year evaluation result of "approved with distinction", we look ahead to tackling the last three-year phase in SIP LIGHTer's history. We thus present our latest Lightweight Agenda 2022, which you can read at lighter.nu.

In the new agenda we talk a lot about circularity, a key trend that will drive lightweighting across a wide variety of industries.

Much to our delight, in 2022 we were again able to meet each other in person. So in April, we welcomed roughly 100 participants from no less than nine countries to the LIGHTer International Conference.

Access to clean energy and other resources is perhaps the most crucial factor for creating the future sustainable world we all want - the world we want to pass on to those who come after us. And as we face a major war in Europe, we have been reminded that access to energy and resources cannot be taken for

granted. It has raised awareness

among you all and me, as well as our national and international political bodies, companies and other organisations, that the supply of energy and resources is not free. And it places a new focus on the urgency of not only a lighter world, but a more resource-efficient one.



#### "Energy and resources cannot be taken for granted. We need a lighter world"

Bengt A.G. Nilsson Chairman of LIGHTer's Board of Directors

## European lightweight agenda for a green transition

For many industries, lightweight technology makes it possible to reduce the consumption of materials as well as energy. It therefore has a major role to play in the transition to sustainable growth in Europe. Lightweighting is needed for many reasons, including emissions-free transport and the transition to renewable energy. Ahead of the third meeting of the European Lightweighting Network set to take place in Sweden, we are writing the first draft of a European research agenda for lightweighting. Together with other European countries, we intend to step up the pace of the transition.

Marie Jonsson Linköping Universit MANAGEM Lars Nyborg Chalmers University of Technology ß ЪЪ Jörgen Kajberg Luleå University of Tech



RISE



Eva-Lis Odenberger

#### INNOVATION MECHANISM #7

#### Management and coordination

The ability to coordinate financial resources and the roles of cross-industry partners is an important prerequisite for creating long-term viability and a clear direction in a large portfolio of research and development projects.

Harald Hasselblad Volvo Car Group

Marie Fredriksson



2022

BOARD

LIGHT

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**Eric Falkgrim** Scanie



Henrik Blycker



Magdalena Sandström



Anna-Karin Jönbrink AFRY

Tomas Ireman

Pernilla Walkenström RISE

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"Creating the European Lightweighting Network is a constructive

way to strengthen European cooperation for sustainability on both

a political and industrial level. We look forward to our next net-

work meeting in Sweden in June 2023, where we will enforce

and clarify the contribution of lightweight solutions to the

Green Deal and to a sustainable growth in Europe."

"We like LIGHTer. We use them as a

Henrik Blycker

VD Oxeon

network and a way to test our innovation.

Through various funding calls, we can finance

the stages from idea to finished product."

Werner Loscheider.

Federal Ministry for Economic Affairs

and Climate Action, Germany

## Lightwe MEMBER PROGRAMM

## **Cutting-edge expertise** in a unique network

The Lightweight Member Programme offers its 60-plus member organisations a unique network of companies, universities and research institutes, all of which pursue technologies for weight reduction. In 2022, the programme arranged the LIGHTer International Conference together with SIP LIGHTer.

#### In the Lightweight Member Programme, personal contacts are established and Sweden's leading experts in lightweighting come together. When your organisation becomes a member, it can make a difference by being part of a wider network responsible for developing world-class lightweight technology in Sweden. Our members represent major export companies, SMEs, industry associations, research clusters, higher education institutions and research institutes.

As a member you get access to networking opportunities, the latest news in lightweighting, strategic investments, international contacts, business intelligence and professional development. The programme offers exciting discussions about future projects, study visits to industry colleagues, and technology group meetings with plenty of opportunities to build strong personal networks.

#### initiatives In 2022, the member pro-

As a member, you also get platforms and numerous website at lighter.nu/mpl

the Lightweight Member Programme later become the Lightweight Agenda.

#### 2022

• 4th LIGHTer International Conference InfraLIGHTer Awards - IAA Hannover Trade Fair

#### 2021

 LIGHTer Summit 2nd European Lightweighting Network - SWII conference in Switzerland

#### 2020

 1st European Lightweighting Network Paying member of ELCA Name change from SIP Lightweight to SIP LIGHTer

#### 2019

Lightweight

The Lightweight Member

Programme is independent of SIP \_IGHTer and is run by its own board.

owever, the member programme and

SIP LIGHTer share the management team

· Lightweight Agenda updated 3rd LIGHTer International Conference Six-year evaluation of SIP LIGHTer • Trade Mission with Switzerland

#### 2018

 LIGHTer International News launched Feasibility studies launched Collaboration with construction and infrastructure industries

#### 2017

 LIGHTer News created LIGHTer Product Optimisation launched LIGHTer SME launched LIGHTest launched 2nd LIGHTer International Conference Study trip to Germany

#### 2016

· Lightweight Agenda updated • The first three years evaluated

#### 2015

 1st LIGHTer International Conference Collaboration with other SIPs kicked off

#### 2014

 LIGHTer Academy launched LIGHTer PhD Network launched LIGHTer Regional Nodes launched

#### 2013

 The first Lightweight Agenda written SIP LIGHTer created R&I projects commenced

#### Key strategic events over the years

STRATEGIC INNOVATION PROGRAMME **SIP LIGHTer** 

"The LIGHTer programme has launched a series of initiatives that have consistently pursued defined impact goals (Sustainability, Growth and Efficiency) and have helped to develop lightweighting through projects and educational initiatives that are fundamental for sustainable development."

> Torbjörn Fängström Sweco



LIGHTer

#### Experts and strategic

gramme funded several strategic initiatives. These include an investigation of the potential of CT scanners in non-destructive testing techniques and discussions on biomaterials, both of which have attracted substantial interest. Members gain access to all of these strategic ventures. discounts on external courses in the field of lightweighting as well as access to global lightweight experts. You can read more about us on our Any organisation that has a Swedish company registration number can apply for membership. The Lightweight Member Programme is independent of SIP LIGHTer and is run by its own board. However, the two share business management. Many discussions in suggestions for updates to

#### Quick facts 2013-2022

MEMBER

COMPANIES



MEMBER PROJECTS

STRATEGIC INITIATIVES

#### Happenings in the Lightweight Member Program in 2023

- Network meeting during LIGHTer Summit
- Delegation trip to Germany
- Several results from our strategic initiatives
- Technology group meetings



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See more at lighter.nu/mpl

#### **PLEASE GET IN TOUCH!**

## **LIGHTer Management Team**

Want to get involved in strengthening Sweden's competitiveness in lightweighting by developing new skills and testing new initiatives and ideas? SIP LIGHTer has a lot to offer thanks to its cross-industry approach. We on the management team are always eager to explore new initiatives. We look forward to hearing from you!



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Strategic