

We help Sweden's lightweight technologies take off.

Together, we sum up the first six intensive years with SIP LIGHTer



Anchored in strategic research

LIGHTer Academy is creating new formats for strategic research. The foundation is 12 part-time funded senior university researchers who collaborate with employees from research institutes and industry.

pages 4–5



Industry-oriented development projects bring a leap in technology and radical lightweighting

Over 80 LIGHTer Industry projects have been funded in which academia and industry together drive forward developments in lightweighting for use in industry. The new form of funding, "Feasibility studies", is spawning even more leaps in technology.

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Value chains strengthen as more companies interact

Increased accessibility resulting from the LIGHTer Test and LIGHTer SME initiatives strengthens collaboration between small and large companies, which together explore new lightweight concepts.

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Skills development offered at all levels

The LIGHTer PhD Network brings together more than 100 PhD students. Interest in LIGHTer Industry's online training and the LIGHTer Product Optimisation network continues to grow.

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Cross-cutting collaboration is key

Lightweighting initiatives have both intensified and gone global. The LIGHTer International Conference is unique, and the national and regional workshop initiatives build a strong network.

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We dare to think outside the box. Together.

The eagerness to collaborate that my colleagues and I witness in the SIP LIGHTer projects simply amazes me. I would, in fact, say that it's our greatest common success factor. Together, we achieve our goals thanks to the network members' willingness to bring together their experts. When researchers, engineers, research managers, entrepreneurs and PhD students all work across industry silos to develop lightweight technologies, we create industrial competitiveness – and a sustainable future.

The funding organisations' six-year evaluation of our entire operations to date inspires confidence and pride in us: "SIP LIGHTer is a well-managed and well-functioning programme that has succeeded in creating a cross-industry lightweight arena for Sweden. Our evaluation reveals that the programme has created what is needed to achieve its impact targets. The programme should therefore receive increased funding."

It is with great humility, much joy and growing curiosity that we now approach our seventh year of operations. We are now set to take an even bigger leap forward to achieve radically lower weight, through things like multifunctional structures. At the same time, we are increasing the pace of industrial change thanks to national partnerships for testing and demo operations. We are also intensifying our global partnerships and strengthening value chains to build the Swedish supplier chains of the future. And last but not least: We are developing solutions that meet all of the UN's 17 sustainable development goals. Read more about this in the third edition of the Lightweight Agenda, published in 2019.

Filled with inspiration and full of energy, we move on.

Cecilia Ramberg

Director
 SIP LIGHTer



Learn more about SIP LIGHTer and all our ongoing projects at lighter.nu

This is SIP LIGHTer

SIP LIGHTer was granted funding in autumn 2013 by Vinnova, the Swedish Energy Agency and Formas. We were one of the first five strategic innovation programmes (SIP). In total, 17 programmes have been awarded funding. The rationale of our programme is that lightweight technology is one of the strengths of Swedish industry.

The third of four stages runs from 2020 to 2022 and the roadmap, indicated in the Lightweight Agenda, aims for 2039. For more information, see lighter.nu/lva

In this annual report for 2019, we also want to show how SIP LIGHTer has evolved since its inception in 2013 as we take a look at the future. We do this by showcasing some good examples and talking with some of the people who are in some way driving lightweight technology forward based on the seven innovation mechanisms from our shared Lightweight Agenda.

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Strategic research

Creating new structures for strategic Swedish research strengthens industry, academia and cross-cutting research collaboration.

LIGHTer ACADEMY

Research network with a focus on lightweighting

LIGHTer Academy is a unique academic network launched in 2014 that has funding for at least twelve years. The foundation is 12 part-time funded senior university researchers, who spend about 20 percent of their time conducting interdisciplinary research with a focus on lightweighting.

The researchers come from different disciplines and universities. The idea is to take a holistic perspective to lightweighting, and to inspire and benefit from each other's expertise to make greater leaps in technology. LIGHTer Academy has already created new structures for strategic research. Researchers can invite international researchers to Sweden or initiate their own international exchanges.

"We intend to be a sustainable nationwide cluster of excellence that performs interdisciplinary research relevant to industry. At the same time, we intend to be a world leader in the development of models and tools for material solutions for innovative lightweight products," says Malin Åkermo from LIGHTer Academy's management team.

Since its inception, LIGHTer Academy has stepped up national research collaboration, industrial collaboration and a focus on future sustainable solutions in lightweight technology.

Andreas Borg, in charge of technical design at GKN Aerospace Engine Systems and one of

many lightweight industry researchers, sees great advantages in the close interaction with LIGHTer Academy, where he is also part of the management team.



Andreas Borg of GKN Aerospace Engine Systems is also a member of LIGHTer Academy's management team.

"The interaction with LIGHTer Academy successfully translates the results of academic research into methods and solutions"

"This is a vital part of GKN's efforts to find composite and metal solutions and new multifunctional solutions for lightweighting in tomorrow's propulsion systems."

In order for GKN to meet the tough sustainability goals for European aviation (ACARE 2050), new breakthroughs are needed in lightweight aircraft components.

"The interaction with LIGHTer Academy successfully translates the results of academic research into methods and solutions within the company," Borg notes.

MANAGEMENT TEAM

LIGHTer Academy's 12 part-time funded researchers



Malin Åkermo
Lightweight constructions
Royal Institute of Technology



Leif Asp
Material and computational mechanics
Chalmers University of Technology



Dan Zenkert
Lightweight constructions
Royal Institute of Technology



Anna-Lena Ljung
Fluid mechanics and experimental mechanics
Luleå University of Technology

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

Please contact one of the academic researchers if you have ideas or want to talk about technology and the future: lighter.nu/la



Fang Liu
Materials and manufacture
Chalmers University of Technology



Lars-Erik Lindgren
Material and solid mechanics
Luleå University of Technology



Martin Fisk
Material science & applied mathematics
Malmö University



Martin Fagerström
Material and computational mechanics
Chalmers University of Technology



Lars Nyborg
Industrial and materials science
Chalmers University of Technology



Greta Lindwall
Materials science
Royal Institute of Technology



Eduard Hryha
Materials and manufacture
Chalmers University of Technology



Håkan Hallberg
Solid mechanics
Lund University of Technology

Janis Varna and Andrejs Pupurs from LTU have also been involved in LIGHTer Academy during part of the first six years.

Five results from new research within LIGHTer Academy

Carbon fibre multifunctionality

LIGHTer Academy excellence researcher Fang Liu and senior researchers Leif Asp and Dan Zenkert published a study on how carbon fibre's microstructure affects its ability to function as an anode in structural batteries; simultaneously co-ordinating Li atoms in the carbon structure and carrying mechanical loads. As part of the study, Fang developed a method for studying the atomic structure of carbon fibre in a high-resolution transmission electron microscope (TEM). The study was recognised by the journal Physics World as one of the ten biggest breakthroughs in the field of physics during 2018.

With an understanding of the multifunctional properties of carbon fibres, we can expect competitive structural batteries to be implemented in new, extremely energy-efficient electric cars within 10-12 years.

Simulating the induction hardening of steel

LIGHTer Academy excellence researcher Martin Fisk and senior researcher Lars-Erik Lindgren, with external researchers Walter Datchary and Vinayak Deshmukh from SKF, published a numerical calculation method for analysing steel induction hardening. Comparisons with experiments showed that the calculation method can predict the hardness and microstructure of steel with an accuracy that allows it to be used for further development of the induction hardening process.

The numerical tool can be used for new process parameters, but also for developing more efficient processes that replace existing induction hardening processes. This can lead to reduced energy consumption.

Increased accuracy in simulations of metal microstructures

LIGHTer Academy excellence researcher Håkan Hallberg and Vasily V. Bulatov from Lawrence Livermore National Laboratory in the United States reveal a method that makes it possible to take into account the anisotropic variation of grain boundary energy in numerical simulations of metal microstructures. This anisotropy is usually greatly simplified, or completely neglected. It turns out to have a major impact on the microstructure changes predicted by the numerical models.

These types of models can be used in industry to do things such as predict material properties in metallic materials and prescribe treatments that provide the desired material properties for a particular application.

SMC modelling - a review

Externally employed PhD student Gustaf Alnersson from Gestamp Hardtech, together with LIGHTer Academy's excellence researcher Anna-Lena Ljung, Waseem Tahir and Staffan Lundström, published a review on the challenges and potential of numerical simulations of SMC moulding. Modelling is essential for predicting material properties, and the review discusses models for viscosity and fibre orientation, for example. The review shows a clear need for further research, especially on fibre orientation at a high fibre content.

The development of models contributes to the prediction of material properties and optimisation of the manufacturing process, which is of great importance in increasing the proportion of lightweight components in the automotive industry and other areas.

Calculation method for designing gradient alloys

LIGHTer Academy excellence researcher Greta Lindwall, together with Rice University in the United States, has published a study on how thermodynamic computational tools can be used to design gradient alloys made using additive manufacturing (AM). Nowadays, AM techniques make it possible to fabricate components with a compositional gradient.

One challenge of AM-fabricated gradient alloys is that they fracture, because unwanted phases are formed when the composition changes. This study shows how thermodynamic solidification calculations can be used to study which phases are formed along a particular compositional gradient. This calculation method allows the design of compositional gradients that avoid areas where unwanted brittle phases are formed.

Enables industry to completely control how mechanical and physical properties vary in one component.

12 RESEARCHERS from five Swedish universities receive part-time funding from SIP LIGHTer, and about 15 active researchers from research institutes and industry interact with LIGHTer Academy. The aim is to formulate the right research questions together in order to meet the future needs of companies. This strengthens Swedish industry through both incremental development and radical innovative solutions within lightweighting.

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.

Industry-oriented development projects

Through innovation projects with a five-year implementation horizon and more visionary projects with lower technology readiness levels, we simultaneously reinforce multiple industries as well as suppliers.

LIGHTer INDUSTRY PROJECTS

84 projects since inception

Through LIGHTer Industry projects, 84 research projects have been launched since 2013. Cross-cutting initiatives give rise to new forms of collaboration which, in parallel with concrete results, strengthen the value chains between different technology readiness levels.

MULTIGRAPH and HPMM2 are just two of many examples that serve as proof. Read more at lighter.nu/li

PROJECT: MULTIGRAPH

The Multigraph project has investigated a completely new type of lightning protection for aircraft, combined with a lighter structural material. In the long run, this can lead to fewer process steps and lower energy consumption – all because the planes weigh less.

“The project is about adding graphene in carbon fibre composite to improve strength, but also to introduce other functionalities such as electrical and thermal conductivity. Simply put, multifunctional materials that provide lighter structures,” explains Linnea Selegård, materials engineer at Saab AB,

which drives development in collaboration with Chalmers and Brazilian university UFABC.

The results are likely to radically simplify the construction and production of lightning protection in the long term. Swedish companies Blackwing, 2DFab and Saab are now all boosting their global competitiveness thanks to this industrial lightweight solution. The project shows that it is possible to gain high conductivity with just a small amount of graphene. The next step is to increase the mixture in various forms to increase the conductivity properties and replace today’s technology, which is built on large copper networks and heavy connection cabling. MULTIGRAPH has therefore garnered huge interest.

In a 20-year perspective, the results are expected to become enablers for new platforms and new technologies for system integration and new materials for the aircraft of the future. Conductive composites are also interesting for industries like automotive and wind power.

“We believe we’ll be able to cut 20–25% off the weight of the components”

In addition to the positive technical results, materials engineer Linnea Selegård from Saab believes that Multigraph has provided new insights into creating a successful project setup. “Using both simulations and experimental attempts shortens lead times and allow you to more quickly arrive at the interesting attempts.”

PROJECT: HPMM2

Project HPMM2 has led to the development and implementation of an advanced material model. It captures the specific properties that allow forming simulations of sandwich materials with metal surfaces and an open core.

HPMM2 stands for High-Precision Material Model for High Performance Multilayer Materials.

The prediction using a simulation is performed with such precision that it is suitable to use both for developing new products and for new material configurations in other applications. This type of sandwich material allows you to reduce the weight by more than 50 percent.

“Product development can be streamlined through efficient simulation, slashing the need for tests and prototype series. Besides the fact that reliable simulations are needed for industrial use of this type of lightweight material, they contribute significantly to both shorter time-to-market and reduced costs,” says Bengt Nilsson, CEO of Lamera AB, which has developed its own sandwich material.

The project results are demonstrated with a deep-drawn housing with a 40-percent lower weight for battery pack covers for electric vehicles (EV BPC) and with bent panels, with both lower weight and better quality, for the construction industry.

Both mechanical testing at Lamera and KTH as well as the co-development of algorithms with IMPETUS based on the test results and simulations have been used to produce the results.

Physical tools have been developed and used at TechROi and Viskadalens Produktion to verify the results with physical demonstrators. The goal is to continue the development process to achieve broad industrial use.



MULTIGRAPH

Blackwing, 2DFab, UFABC, Saab AB

HPMM2

Lamera AB, KTH, IMPETUS Afea AB, Viskadalens Produktion AB, TechROi Engineering AB

FEASIBILITY STUDIES

Technology advances for radically lighter weight

The new form of funding for feasibility studies makes it possible to increase risk-taking in research based on the requirements of industry.

Because more radical ideas are being tested in teams across a wide range of skill sets, the chances of obtaining greater long-term results increases. LIGHTer’s network lies at the core of transforming ideas into industrial results.

Here are five examples of projects showing how collective ownership of risks and the creation process are paving the way for future industrial lightweight solutions.

	Stiff tape Chalmers, KTH, Oxeon, Volvo Car Group, GKN Aerospace	Graded LMD University West, Swerim, Kanthal, Sandvik Heating Technologies, GKN Aerospace	LIBERCO KTH, Chalmers, Biteam AB, Volvo Car Group	LISTTEX Saab Barracuda, Engtex	ADMIRE Chalmers, Eindhoven University of Technology, GKN Aerospace, Volvo Car Group, Siemens Industry Software, BETA CAE Nordic
STARTING POINT	Taking the structure of mother-of-pearl as a starting point, this project investigates the potential to develop a completely new type of carbon fibre composite possessing previously unmatched mechanical properties.	Multifunctional materials can provide radically lower weight. One way to achieve several properties in the same material is to grade the material properties when the material is manufactured.	To investigate whether previously observed ductile fracture behaviours of composite materials having 3D woven fibre reinforcement have the potential to improve the energy-absorbing properties of safety solutions in vehicle structures.	To test fibres with extreme weight-to-strength properties in protective clothing and camouflage fabrics that can make the products both lighter and stronger.	To further develop a calculation method that can quickly and accurately analyse delamination in composite laminates. It is ideal for thin-walled structures.
COLLABORATION	It has worked very well to address industry challenges with research at a low technology readiness level. The project has succeeded in developing products with technicians from the Borås company Oxeon, and the products have been verified with Volvo Car Group and GKN Aerospace.	Together, the project team has attempted to make materials in high-temperature alloys with graduated properties through additive manufacturing via laser metal deposition (LMD).	This turned out to be a highly effective way to blend expertise from several different research organisations. Innovative forms of collaboration, agility and trust within the network have enabled everyone to make progress on their respective research questions.	Saab Barracuda, north of Västermik, manufactures camouflage nets and chainsaw protective clothing, while rapidly growing Engtex in Ulricehamn manufactures technical textiles for industry and is a world leader in chainsaw protective clothing. The two companies were already familiar with each other.	The link between visionary research ideas and industry requirements has rapidly borne fruit.
RESULTS	Ultra-rigid and strong composites for structures with complex geometries can be manufactured on an industrial scale. The principle works: thin discontinuous tapes can be used to realise composites with superior mechanical properties. And it is possible to analyse them.	This is a hot field of research, and many of the results are confidential. Innovation height means that it is highly possible that the project’s companies will continue the research on their own to maintain secrecy.	Test results from similar objects in different projects have been collected and compared in order to build up knowledge about how more efficient low-weight collision structures can be developed and analysed.	Several prototypes were manufactured, for both camouflage nets and chainsaw protective clothing, using new textiles that are both stronger and lighter. Two brand-new product groups were created.	BETA CAE is interested in continued collaboration and wants to commercialise the results. Chalmers thus increased the opportunities to generate models for its research code and proceed with a PhD student. GKN Aerospace, Siemens and Volvo Car Group want to use the results in bundled commercial software.
POTENTIAL	Oxeon sees opportunities for applications, and its next step is volume production. Its long-term goal is to become a material supplier that can participate throughout the chain, and together with a tools supplier provide Swedish companies with composite components of the highest quality.	Interest expressed from several companies in various metallic materials. Developing demonstrators to show a concept and encourage others to move forward with multifunctional materials and graduated properties has great value. The potential of different applications is realised when the technology is tested on a product.	Their vision is to manufacture lighter and better crash protection using energy-absorbing 3D-reinforced composite materials.	Saab Barracuda is aiming to launch a lightweight product shortly, and in 2021 Engtex will launch light and strong textiles for protective products such as for tree felling.	The interest from industry is proof of the value of the project results. BETA CAE is a major software supplier to the automotive industry and offers the leading pre-processor.

Test and demo activities

We must continue to increase availability, minimise business risks and create synergies along the entire value chain and across industries.

LIGHTest

A test bed for the materials of the future

LIGHTest provides a live test and demonstration facility for products and systems in new materials. The focus is holistic and involves a sustainable life cycle.

LIGHTest offers a test environment that is independent of traditional supply chains, where quality-assured testing can take place confidentially. This aims to help industry players test material properties for products and system solutions. Test beds provide expertise and infrastructure in advanced materials, manufacturing methods and recycling techniques. Small and large companies can also collaborate on pre-development and verification projects.

The test beds, whose construction is funded by Vinnova through the government's strategic collaboration programme "Connected industry and new materials", focus on strengthening the ties between material research and industrial users of new materials while developing collaborative initiatives between large and small companies.

Several actors are connected virtually from two nodes:

- The RISE facility in Olofström, which offers metal forming and the joining of separate materials into a composite structure.
- The RISE facility in Piteå, for the high-speed manufacture of fibre composites and multimaterial solutions.

LIGHTest brings together a broad project group with a mix of individuals from both academia and industry. The steering committee includes programme managers of the strategic innovation programmes from Metalliska Material, SIP LIGHTer, SIO Grafen and Innovair and the test bed manager for Produktion2030, together with Lamera, SSAB and Scania.



Thomas Bru, RISE Mölndal, trims process parameters for a new variant of syntactic epoxy.

A total of 13 LIGHTest pilot projects have been launched, six of which were launched in 2019. Five more projects, with a special focus on SMEs, have been implemented. We present two of them that delivered outstanding value through rapid time-to-market:

Swedfoam Development

Material development via manufacturing method in lightweight materials

Agile processing in the test bed allowed Swedfoam to respond swiftly to a customer request. Together with experts from LIGHTest, a resource-efficient moulding of foam materials was developed.

Nils Malmgren AB

Syntactic epoxy for battery applications

Swedfoam also took part in this project, which developed new material variants and sparked the interest of several potential customers. The work continues, with a large-scale prototype in a project funded by Region Västra Götaland.

Digi Demo Day For the third year in a row, we held an Inspiration Day in June 2019 around test beds that illustrated industrial digitalisation. This year's theme was test beds for industrial additive manufacturing as an enabler for flexible industrial production.



Digi Demo Day

Digitised test beds for industry
Collaboration among SIP LIGHTer, Produktion2030, Metalliska Material, Innovair and SIO Grafen

CONTACT
LIGHTest

Boel Wadman
boel.wadman@ri.se
+46-10-228 48 42



Exchanges with small & large companies

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

LIGHTer SME

How new value chains are built

LIGHTer SME is a series of calls for proposals to develop Swedish small and medium-sized enterprises (SMEs). Since autumn 2017, two calls for proposals have been issued every year. An extra-high number of projects were awarded funding in 2019, and 16 small businesses got the chance to develop their lightweight concepts. Two of them are described here.



There is a global demand for lightweight modular solutions. Eventhotell envisions a bright future.

EVENTHOTELL, KUNGÄLV

"Thanks to LIGHTer SME, we dared to go through with our proof-of-concept, bringing us a giant step closer to large-scale production," says Tommy Carlson, project manager at Eventhotell.

Eventhotell produces accommodation structures that significantly reduce environmental impact, lower transport costs and fulfil a unique societal function during events such as crises. In addition, the cost is significantly lower compared with existing products.

The LIGHTer SME project enabled Eventhotell to test and evaluate their construction technology and, perhaps most importantly, the strength of their modules. The

design proved to be so robust that the cost of materials was reduced by roughly 40 percent. The test also identified bottlenecks in construction technology. This led to a newly developed method that maintains production speed but requires fewer people.

In a next step, the company intends to solve a design question using flexible wall elements, which will allow the modules to be used differently for different purposes, such as in healthcare. In an age of more climate crises and pandemics, this solution can bring great benefits and Eventhotell is now seeking additional support from investors or partners.

EXMET, KISTA

Can magnesium be used to build new lightweight components using additive manufacturing? Exmet is searching for the answer.

Magnesium alloys are already being used in several lightweight applications in the automotive and aerospace industries.

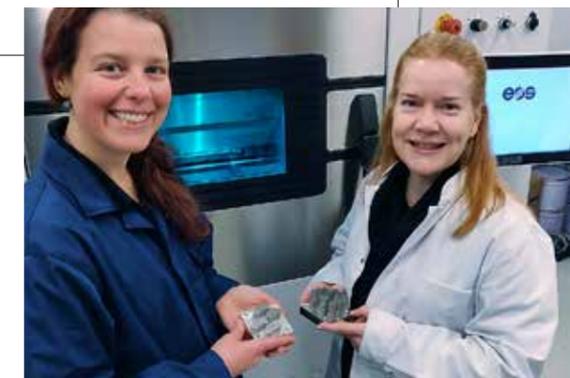
They are important in medical technology, too, and the alloys are found in implants and other applications. The metal degrades and dissolves, and the bone can grow back in its place. Exmet conducts research and development within additive manufacturing of amorphous metals, meaning metals with a disordered atomic structure. They are ten times more elastic and can achieve a very high strength.

"We have used a laser-based technology to produce samples and smaller components," says Exmet's project manager and co-founder, Lena Thorsson.

Through LIGHTer SME, Exmet got the opportunity to collaborate with future industrial customers and the research institute Swerim.

"Together, we have built up knowledge that provides a foundation for the realistic planning of future projects," Thorsson says.

The project's technical objectives – to show that the processed alloy becomes homogeneous, porosity-free and reaches acceptable properties – has been achieved. The results can be used to create a commercial process.



Hanna Nilsson Åhman (left) from Swerim and Exmet's project manager Lena Thorsson continue to test magnesium as a lightweight material. Their long-term goal is to print lightweight components in magnesium-based amorphous alloys.

CONTACT
LIGHTer SME

Carolina Pettersson
carolina.pettersson@ri.se
+46-10-228 47 37



Skills development

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

LIGHTer PHD NETWORK

100 PhD students collaborating with industry

The long-term goal of the LIGHTer PhD Network is to create a sustainable network for PhD students, senior researchers at higher education institutes, and actors in lightweight technology industries.

The LIGHTer PhD Network is run by the Luleå University of Technology, together with the Royal Institute of Technology and Chalmers University of Technology.

Through a unique annual PhD course including lectures, five industry presentations and five study visits over a total of ten days, PhD students in the field of lightweighting are offered a broader perspective on both research and industrial use of the technologies.

The aim is, of course, to help train PhD researchers by providing a broader understanding of challenges and potential lightweight solutions in Swedish industry. The examination takes place in conjunction with a SIP LIGHTer event.

"PhD students gain access to a unique mix of research disciplines that provide a broad understanding in the field of lightweighting, while they build up a wide network that also includes international researchers," says Eva-Lis Odenberger,

"The LIGHTer PhD Network's course for PhD students is one of the most valuable courses I've taken."

Sravan Tatipala
Blekinge Institute of Technology

contact person for the LIGHTer PhD Network at RISE.

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

Martin Jonsson, Head of R&D at Gestamp Hardtech Luleå, confirms this outcome:

"Our participation, especially through conducting a session of the course 'Lightweight Materials & Design', has given us unique opportunities to make contacts and gain insight into current research projects within lightweighting," he says.



At the end of 2019, 100 PhD students were part of the LIGHTer PhD Network, of which 34 defended their thesis and are now in the alumni network. In addition to the popular courses for PhD students, which combine theory with study visits, two workshops with different themes are arranged each year. These students build a good foundation for multidisciplinary research in the future.

CONTACTS LIGHTer PHD NETWORK



Pär Jonsén
Luleå University of Technology
par.jonsen@ltu.se
+46-920-493 460



Fang Liu
Chalmers University of Technology
fang.liu@chalmers.se
+46-31-772 67 86



Eva-Lis Odenberger
RISE
eva-lis.odenberg@ri.se
+46-10-228 48 24



Dan Zenkert
Royal Institute of Technology
danz@kth.se
+46-8-790 64 35

LIGHTer PhD Network's unique PhD course runs for ten days with five training sessions and offers academia-industry collaboration:

- | | | | | |
|---|---|--|---|---|
| 1. Material selection
Chalmers, Volvo Car Group in Göteborg | 2. Composite materials
KTH, Saab in Linköping | 3. Cellular materials and sandwich constructions
KTH, DIAB in Laholm | 4. Metallic materials
LTU, GKN, Brogren Industries in Trollhättan | 5. Manufacturing of metal structures
LTU, Gestamp Hardtech in Luleå |
|---|---|--|---|---|

LIGHTer INDUSTRY TRAINING

Lifelong skills development

LIGHTer Industry training upgrades skill sets in industry. The focus on online courses is attracting more and more operators, technicians and engineers and is becoming a springboard for new solutions.

Knowledge, networking and an increased awareness of how industry uses different materials, design solutions and manufacturing methods.

"That's the core of LIGHTer Industry training," says Patrik Svanängen, training director at RISE's department for manufacturing processes and member of SIP LIGHTer's management team.

Together with RISE communicator Sofia Öggesjö, he runs the production of the much-appreciated online courses. Their combined experience in educational management, journalism, and sound and film produc-

tion results in courses that provide participants with solid knowledge in a streamlined, convenient way.

"Many people can't travel to a course that lasts several days, so this is a great option that we have focused on since 2018. In cooperation with the Lightweight Member Programme, we strive to spark interest in industrial processes and methods with a focus on lightweighting. The basic idea is that after offering the online course we'll offer in-depth courses via different partners to anyone who wants to continue," Svanängen says.

In 2020, the online courses Product Optimisation and Introduction to Composite Materials will be launched.

300
unique impressions for the online courses in casting and joining techniques.

CONTACT LIGHTer INDUSTRY TRAINING

Patrik Svanängen
patrik.svanangen@ri.se
+46-10-228 49 16



LIGHTer PRODUCT OPTIMISATION

Smart approaches drive tech advances

Within the LIGHTer Product Optimisation network, smarter work methods are being developed for more streamlined product development.

The initiative is yet another example of how SIP LIGHTer builds networks that enable industry, academia and research institutes to co-develop new work methods for lightweight structures.

"But it's also about developing the employees so that they can use these new methods," says Harald Hasselblad, analytical engineer at Volvo Car Group and member of SIP LIGHTer's management team. He runs the LIGHTer Product Optimisation network together with Mikael Thellner, technical expert at Scania. In the automotive industry, among others, it can traditionally be a time-consuming process for designers and calculation

managers to produce relevant results. A more optimisation-driven development that aims to have more parallel workflows, together with new virtual tools that focus on weight reduction, can minimise development time.

"In industry, we want to develop lighter and better products in less time. With LIGHTer Product Optimisation, we're developing new methods to achieve this," Thellner says. Product optimisation has also taken a step into the Lightweight Agenda.

"We're now designing an online course to reach even more people," Hasselblad says.

Activities in LIGHTer Product Optimisation

- Seminars
- Initiation and coordination of degree projects and applications of research projects
- Industry-oriented development projects



CONTACT LIGHTer PRODUCT OPTIMISATION
Harald Hasselblad
harald.hasselblad@volvocars.com
+46-72-885 20 07



Mikael Thellner
mikael.thellner@scania.com
+46-8-553 517 30

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

Swedish lightweight claims a position in Europe

Lightweighting initiatives have both intensified and gone global in recent years. SIP LIGHTer establishes strategic international partnerships as part of its ongoing efforts in various innovation mechanisms.

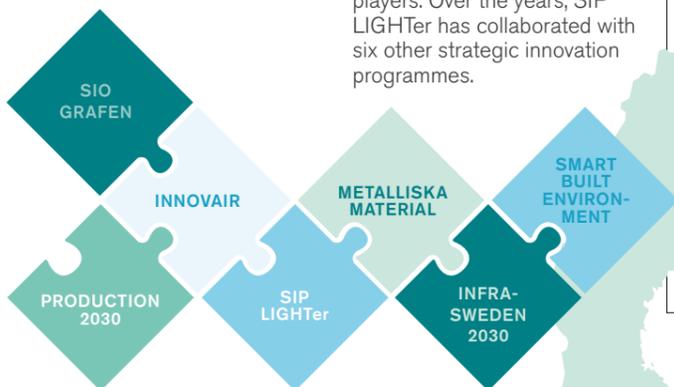
The LIGHTer International Conference is one such joint initiative. It brings together researchers in academia and industry mainly from Europe but also the rest of the world. Evaluations of the 2019 conference contained consistently excellent reviews from the participants. One of them was Ahmet Muderris, managing director of Composites Busch, Switzerland:

"If you're in the lightweighting field, it makes a lot of sense to participate in the LIGHTer International Conference," he emphasises. Sofia Teixeira de Freitas, assistant professor at the Delft University of Technology in the Netherlands, agrees:

"The LIGHTer International Conference is a very convenient way to network around lightweight structures," she points out.

NATIONAL COLLABORATION

Since its inception in 2013, SIP LIGHTer has arranged 39 workshops and seminars around Sweden, 18 of which were arranged with other players. Over the years, SIP LIGHTer has collaborated with six other strategic innovation programmes.



INTERNATIONAL COLLABORATION

LIGHTer INTERNATIONAL CONFERENCE 2019

The LIGHTer International Conference is held every two years, and has established itself in earnest among Europe's industries and researchers. It features leading speakers in the field of lightweighting along with seminars based on the Lightweight Agenda.

HANNOVER TRADE FAIR INVITATION

SIP LIGHTer has been invited to give a lecture at the Lightweight Summit at the Hannover trade fair, the world's largest and most important meeting place in the field of industrial conversion.

GO GLOBAL WITH LIGHTWEIGHT

In 2019, Produktionslyftet together with SIP LIGHTer initiated Go Global with Lightweight. It is a start-up programme for internationalisation aimed at SMEs.

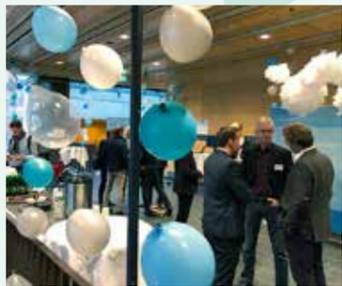
TRADE MISSION 2019

In 2019, SIP LIGHTer, together with Carbon Composites Switzerland, arranged a "trade mission". A trade delegation from Switzerland visited Scania, Saab Aeronautics, Ruag Space and Volvo Group Trucks Technology.

ELCA 2019

In 2019, SIP LIGHTer continued its cooperation with the European Lightweight Cluster Alliance (ELCA), which brings together major lightweight initiatives across Europe.

"We need to get better at finding customers and partners outside Sweden. And that's something we need help with."



On 20-21 November 2019, SIP LIGHTer's international conference was held at Chalmers in Gothenburg and welcomed participants from 10 different countries.

Anders Hallåker
Project manager, Svero Lifting AB
Svero Lifting AB is one of the participants in Go Global with Lightweight.

REGIONAL COLLABORATION

Several regions have taken the initiative to create SIP LIGHTer Nodes with different orientations:

NODE Blekinge
Waterjet cutting and sheet metal stamping

NODE Småland
Strategies for meeting customer requirements

NODE Västra Götaland
SME collaboration

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.

BOARD AND MANAGEMENT TEAM

Experience and different skill sets provide long-term viability

For several years now, SIP LIGHTer has built up confidence in its role as a hub for lightweight development in Sweden. This is where research and companies with a long track record meet. And everyone shares experiences.

2019 saw intensive efforts around the third Lightweight Agenda, which was completed in conjunction with LIGHTer's annual general meeting and November's international conference.

"I think that the commitment of the working group that has driven the work of the agenda symbolizes much of the soul of SIP LIGHTer. There is a strong will to really take responsibility for boosting Sweden's global competitiveness, and I'd like to thank everyone who contributes their skills in different ways," says Cecilia Ramberg, director of SIP LIGHTer.

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

in its six-year evaluation conducted in 2019.

The former chairman of SIP LIGHTer's board, Kaj Fredin from Volvo Car Group, sees the cross-industry innovation programme constantly breaking new ground.

"The biggest challenge is still to move from innovation as an idea to research where we can test the idea, on to development, and then through to industry-relevant application development. That's why SIP LIGHTer is needed more than ever," says Kaj Fredin.

His successor Bengt Nilsson, CEO of Lamera, assumed his position in 2019. He highlights in particular the Lightweight Agenda's recent sharp focus on sustainability from a holistic perspective.

"It means a great deal that we have now put sustainability in an even broader context," Nilsson says.

"There is a strong will to really take responsibility for boosting Sweden's global competitiveness"



In connection with the annual general meeting and the international conference in Gothenburg on 20 November 2019, Bengt Nilsson of Lamera (right) succeeded Kaj Fredin of Volvo Car Group as chairman of the SIP LIGHTer board.

SIP LIGHTer 2020 BOARD



Bengt Nilsson
Lamera
Chairman



Kaj Fredin
Volvo Car Group
Vice-Chair



Malin Åkermo
Royal Institute of Technology



Ingegerd Annergren
Scania



Erik Sandahl
Volvo Group Trucks Technology



Mats Landervik
DYNAmore Nordic



Henrik Blycker
Oxeon



Magdalena Sandström
Diab



Tomas Ireman
Saab



Pernilla Walkenström
RISE

SIP LIGHTer 2020 MANAGEMENT TEAM



Anders Andersson
GKN Aerospace Engine Systems



Harald Hasselblad
Volvo Car Group



Lars Nyborg
Chalmers University of Technology



Eva-Lis Odenberger
RISE



Pär Jonsén
Luleå University of Technology



Patrik Svanängen
RISE

SIP LIGHTER 2013–2019

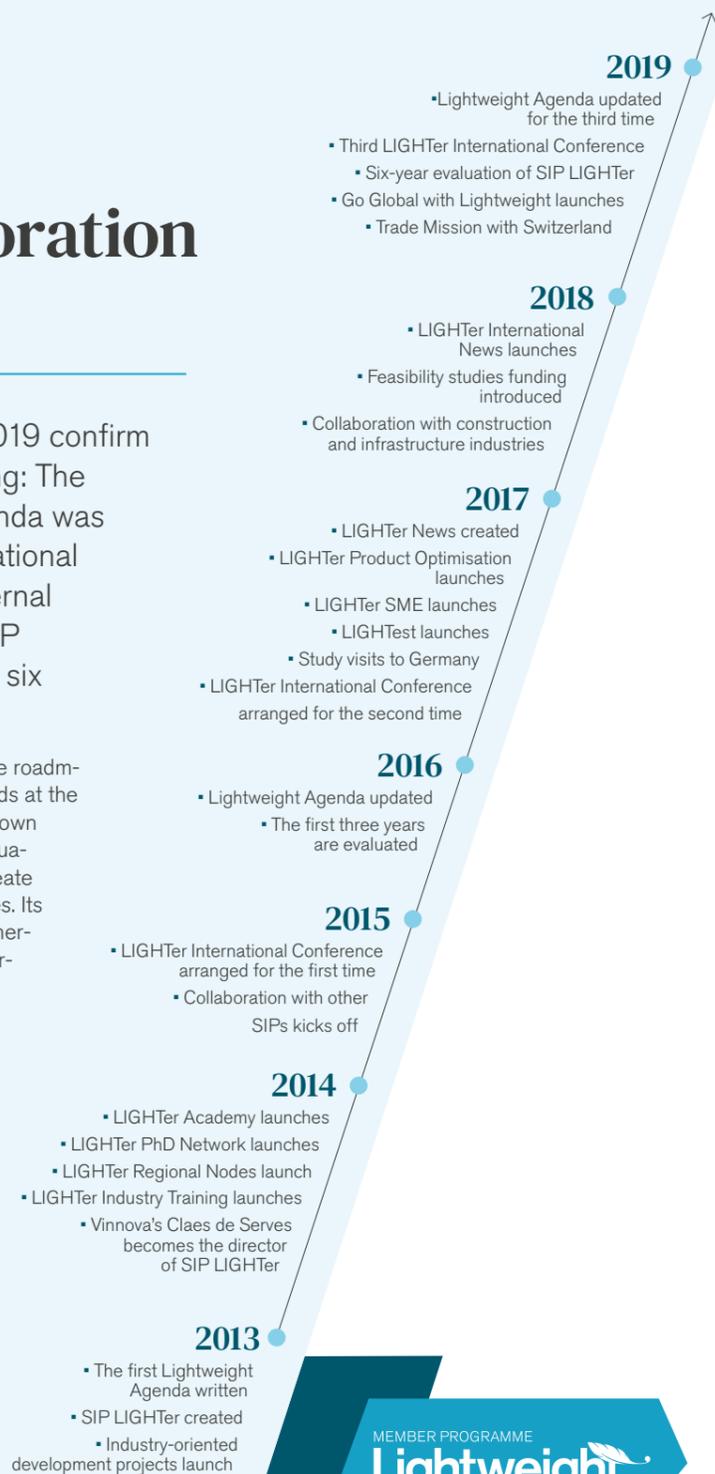
The road to strategic collaboration with industry

Three more milestones passed in 2019 confirm that the LIGHTer brand stands strong: The third edition of the Lightweight Agenda was developed, the third LIGHTer International Conference was organised and external experts evaluated everything that SIP LIGHTer has achieved over the past six years. The results are inspiring.

The updated Lightweight Agenda, which sets out the roadmap, describes the necessary renewal and future needs at the half-way mark of SIP LIGHTer's 12-year initiative known as a strategic innovation programme (SIP). The evaluation shows that SIP LIGHTer has the potential to create systemic changes that can address global challenges. Its activities continue to grow, develop and evolve. Partnerships are bearing fruit, providing synergies and inspiring fresh approaches all the time, and SIP LIGHTer has truly gained a firm foothold.

LIGHTER as a brand was born nearly ten years ago from a budding lightweight collaboration among industrial companies, academia and research institutes. Today LIGHTer embraces a much larger, cross-cutting collaboration around lightweighting in Sweden – and is expanding internationally.

To be even clearer in our communications, we have updated our terminology. As of 1 June 2020, the strategic innovation programme is called SIP LIGHTer and the member program is called Lightweight Member Programme. The name alignment facilitates external communication. RISE Research Institute hosts both initiatives.



The Lightweight Member Programme is independent of SIP LIGHTer and is run by its own board. However, the member programme and SIP LIGHTer share the management team.

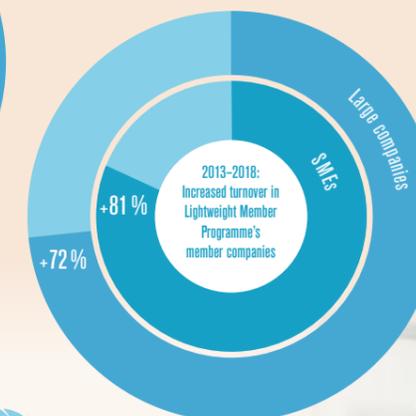
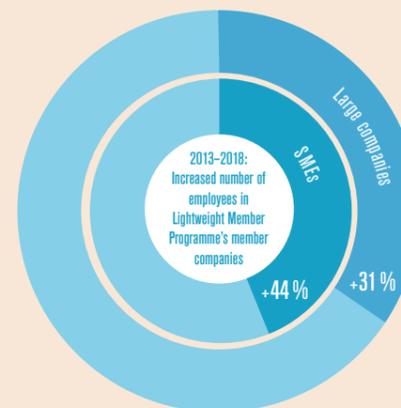
Key strategic events over the years

LIGHTer

STRATEGIC INNOVATION PROGRAMME
SIP LIGHTer

+100% 8 companies
+200% 3 companies
+300% 1 company

Several small and medium-sized enterprises (SMEs) in the Lightweight Member Programme increased their turnover by 100-300% in 2013-2018.



MEMBER PROGRAMME Lightweight

The Lightweight Member Programme is independent of SIP LIGHTer and is run by its own board. However, the member programme and SIP LIGHTer share the management team.

As a member, you gain access to a unique cross-industry network of companies and organisations operating in the field of lightweight technology. You'll receive the latest news about lightweighting, strategic investments, market intelligence and skills development, and you can get involved in taking on a nationwide responsibility for developing lightweight technology in Sweden.

We also offer thought-provoking discussions about future projects and study visits to industry colleagues. Smaller member

companies can apply for member cheques to develop their lightweight technology business. You can visit lighter.nu/mpl to discover all our member benefits and view a list of the 70 or so member organisations. Members represent large export companies, SMEs, industry associations, research clusters, higher education institutions and research institutes.

Any organisation that has a Swedish company registration number can apply for membership.

"For me, the Lightweight Member Programme has been an interesting forum where our get-togethers and online courses expand the view of the wide range of lightweight activities in Sweden. Not least in small and medium-sized enterprises. It's stimulating and offers new ideas about lightweight solutions and partnerships."



Anders Sjunnesson, GKN Aerospace
Heads the Technology Group in the Lightweight Member Programme



CONTACT
LIGHTWEIGHT MEMBER PROGRAMME
Christian Olsson
christian.olsson@ri.se
+46-10-228 49 34

Quick facts, 2013-2019

- 74 MEMBER COMPANIES
- 12 MEMBER CHEQUES
- 11 MEMBER PROJECTS
- 4 STRATEGIC INITIATIVES

Read more at lighter.nu/mpl

CONTACT US!

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 a cross-industry approach. We on the management team are always eager to explore new initiatives. We look forward to hearing from you!



Cecilia Ramberg

Director

+46-10-228 47 05
cecilia.ramberg@ri.se



Christian Olsson

Deputy Director

+46-10-228 49 34
christian.olsson@ri.se



Katinka Ernstsson

Programme Administrator

+46-10-228 47 43
katinka.ernstsson@ri.se

We would like to warmly thank everyone who has been involved in driving developments through their roles in management since the start of SIP LIGHTer in 2013.



Fredrik Stig

*Deputy Director
March 2017–Apr 2020*



Ann-Charlotte Weiblad

*Acting Programme
Administrator
Sep 2019–Aug 2020*



Stefan Gustafsson Ledell

*Director
2013–Feb 2017*



Jenny Kierkemann

*Project Assistant
2014–2016*



LIGHTer
lighter.nu
info@lighter.nu

Med stöd från



Strategiska
innovations-
program