



Development trends in Finnish metal industry

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Ruukki in brief

Net sales in 2008 €3.9 billion

Operating profit in 2008 €568 million

Personnel 13,300 in 26 countries

- Metal-based solutions for
 - construction and
 - engineering customers
- Standard and special steel products
- Strong presence in Nordic countries
- Growth in CEE, Russia and Ukraine

- Processing
- Sales and service
- Steel production



Ruukki's broad customer base



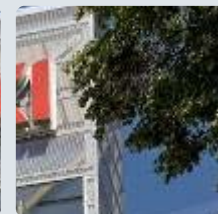
Lifting,
handling &
trans-
portation
industry



Equipment
manu-
facturers
in energy
industry



Commercial
and
industrial
construction



Infra-
structure
construction



Energy efficiency from special steel products

Design new and improved end-products



Reach higher, extend useful life



Improved productivity and payloads



Optimise processing and lead times



High-strength, wear-resistant and coated steels

High-strength steels

Wear-resistant and high-strength steels

Parts processing, prefabrication

Systems and components to the engineering industry



Cabins for mobile machines



Common base frames

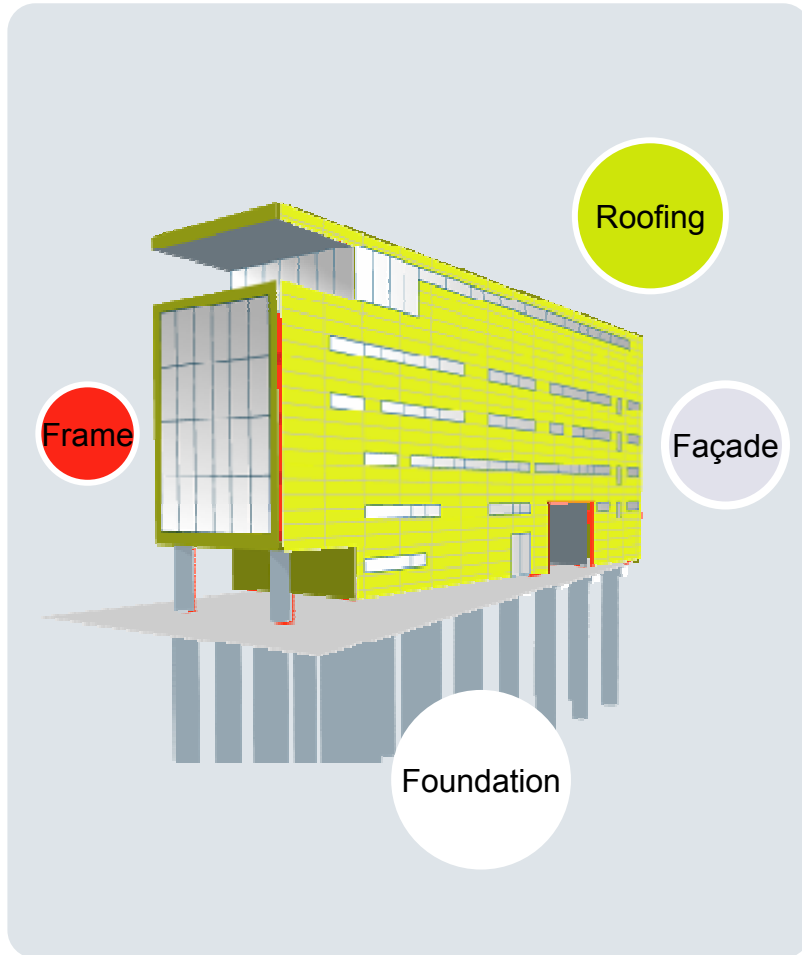
Ready-to-install booms

Suction anchors



Plates, flanges, gear box frames for wind power plants

Speed and quality for construction customers



- **Shorten** construction and design time
- **Reduce** numbers of workers and site managers at site
- **Improve** working safety at site
- **Remove** risk related to interfaces between different work phases and parties
- **Industrialise** – move work from site to controlled climate

Content

- 1. Lightweight solutions**
- 2. Demanding applications**
- 3. Laser processing**

Fimecc programs

FIMECC Ltd. is a new innovation company in Finland which has a broad industrial participation in metals and engineering industries. Finnish Metals and Engineering Competence Cluster, works to boost strategic research in metals and engineering industries.

The aim of FIMECC Ltd. is to increase and deepen the cooperation between companies, universities and research institutes in the area of top quality research. FIMECC Ltd. manages research in the area of five strategic research themes through research programs that address specific issues and research questions mentioned in the Strategic Research Agenda. Research programs consist of variety of research projects and are expected to start in 2009.

Finnish Metals and Engineering Competence Cluster strategic research themes are:

- **Service Business**
- **User Experience**
- **Global Networks**
- **Intelligent Solutions**
- **Breakthrough Materials.**

http://www.fimecc.com/en/index.php/Main_Page

1. Lightweight solutions



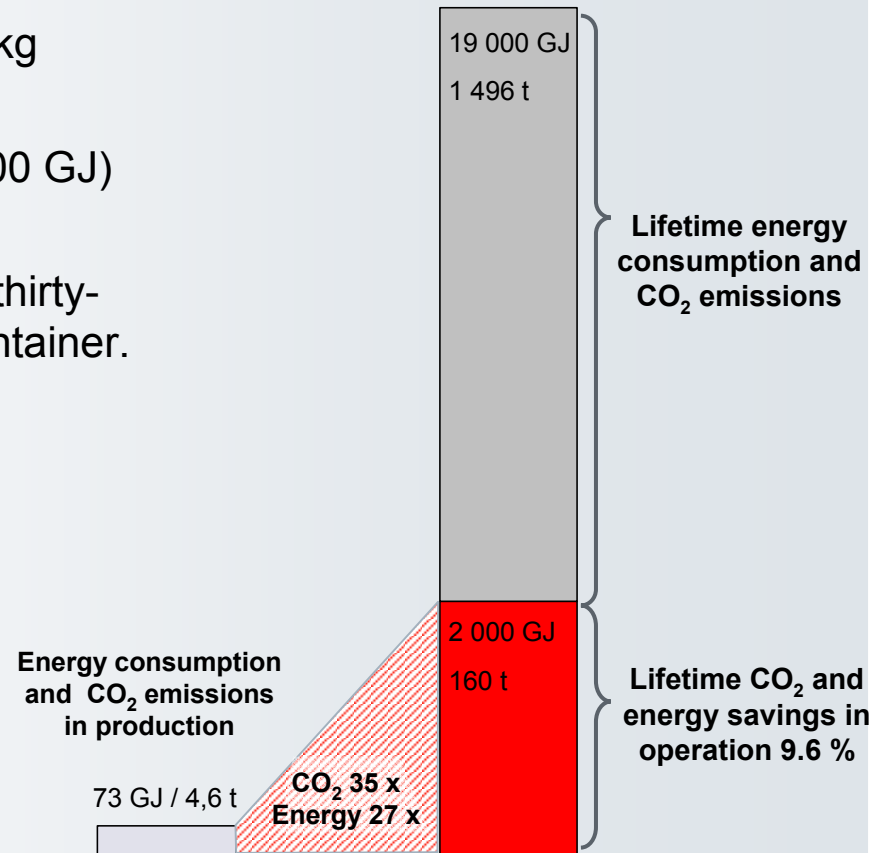
FIMECC LIGHT program 2009-2014

Case 1: Lifetime savings of container

- Use of light-weight high-strength steel reduces weight of a container by 800 kg
- Savings for end user*:
 - energy: 60 000 litres of fuel (2 000 GJ)
 - CO₂ reduction: 160 t
- Lifetime CO₂ and energy savings are thirty-fold compared to production of the container.



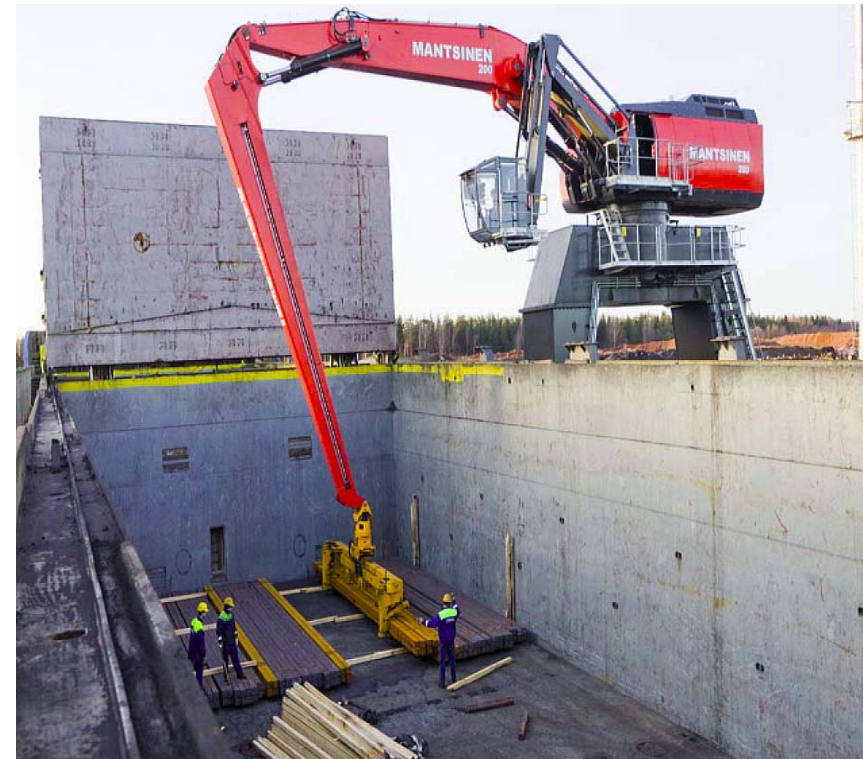
* Tandem trailer, 150,000 km/a, lifetime 10 a



Case 2: Material handling machine boom

Mantsinen 200 R HybriLift

- Energy saving hydraulic hybrid crane
- Harbour machine handling steel billets, weight up to 16 t
- Maximum reach 34 m with 14 m long boom designed in high strength steel S690
- Low boom weight enables precise operation, high swing speeds and quick working cycles
- Computational weight saving > 20 %
- New design with improved fatigue strength



LIGHT Program summary

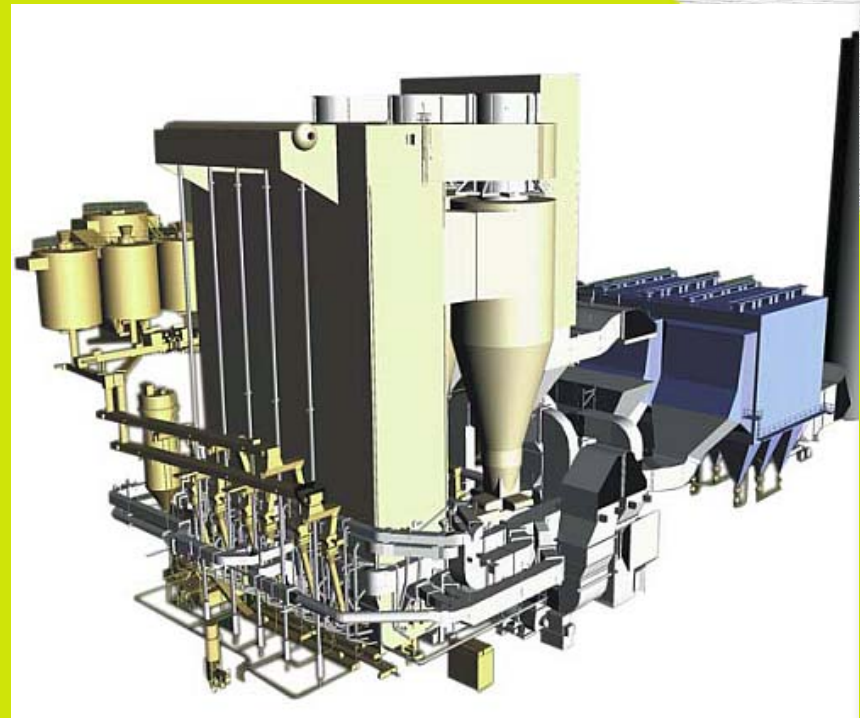
The aim of the research program is to develop new materials and solutions for light weight products. Potential benefits to end users can be summarized as follows:

- Reduced operation and life cycle costs
- Improved safety
- Improved payload-to-weight ratio
- Decreased environmental impact
- Lower energy consumption in production and transportation
- Improved performance, e.g., increased boom extension or vehicle maneuverability

The research programme will include five projects in focus areas:

1. Production and properties of breakthrough materials
2. Novel manufacturing technologies
3. Innovative design solutions
4. Environmental footprint
5. Low density material solutions (to be started in 2010)

2. Demanding Applications



FIMECC DEMAPP program 2009-2014

DEMAPP Background

Future challenges in materials performance in demanding applications result from increasingly more demanding operation and service conditions. The identified development needs in material performance are related to:

- Wear conditions
- Corrosive conditions
- Service in extreme conditions
- Friction and energy
- Production technologies for high performance materials

DEMAPP program is focused on these identified topics.

DEMAPP goals

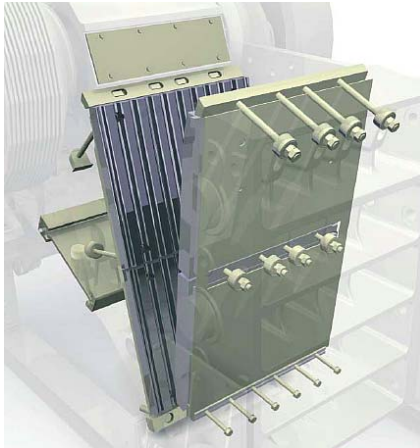
The aim of the research program is to develop new material solutions for demanding applications. Potential benefits to end users can be summarized :

- Deeper understanding of material behavior in demanding applications which gives a strong background for further selection and tailoring of materials for specific process conditions
- Development of next generation materials designed for demanding applications (wear, corrosion, extreme conditions regarding e.g. high operational temperature, loading or friction)
- Cost-efficient volume production of breakthrough materials

The research program will include five projects in following focus areas:

1. Wear resistant materials and solutions
2. New corrosion resistant materials and solutions
3. Extreme service conditions
4. Friction and energy (to be started in 2010)
5. Production technologies for demanding applications (to be started in 2010)

Wear resistant materials & solutions



Rock and mineral crushing



Construction and mining equipment



Metal recycling



Solid waste recycling

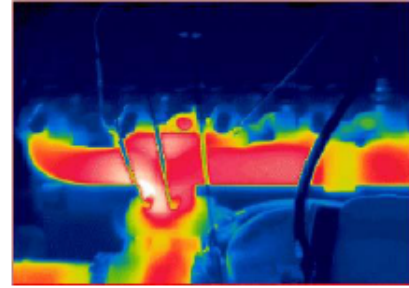
Corrosion resistant materials & solutions

NGF — New generation ferritic stainless steels with enhanced corrosion resistance

Driving force:
Global trends in material development and heavy fluctuations in raw material prices.



FABRICS — Fabrication and service performance of advanced stainless steels for demanding exhaust systems



Driving force: New demands for energy production to find clean and cost effective solutions.

NEW CORROSION RESISTANT MATERIALS AND SOLUTIONS

Driving force: Comparable data of welded structures in demanding applications is missing.



X-WELD — New methods to optimize the performance of welds in corrosive industrial environments



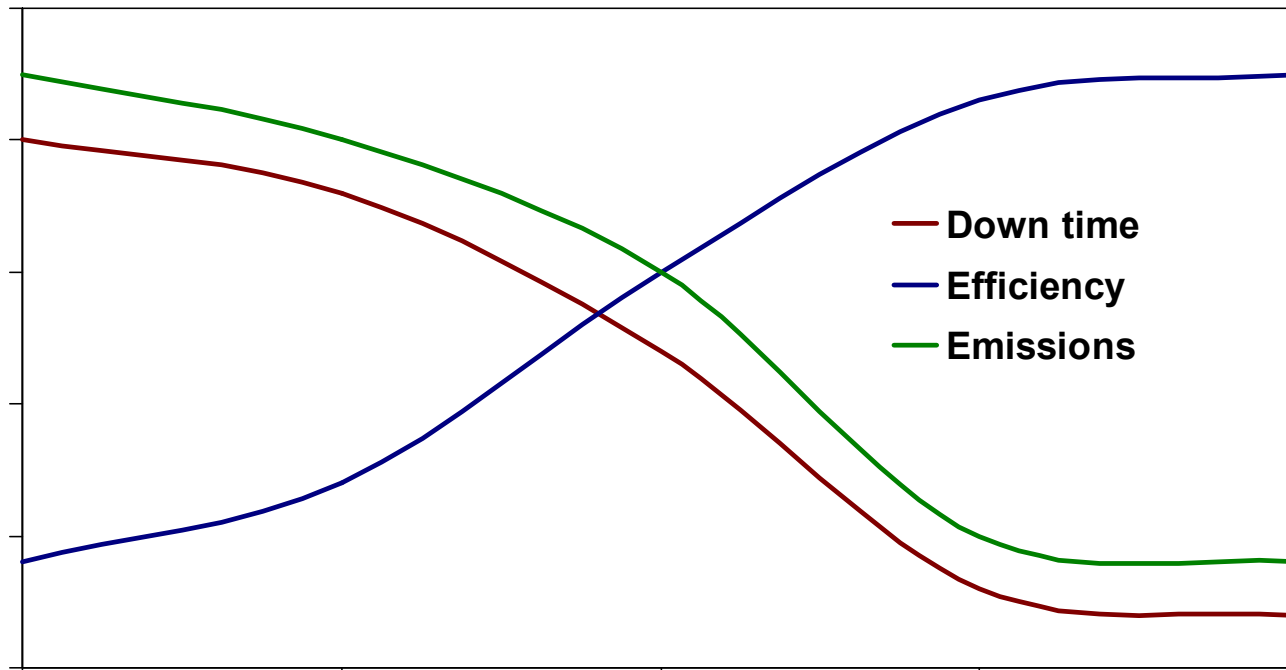
Driving force: Effective use of new materials in pulp & paper industry and in energy production.

Mn-Steels — Development of manganese and nitrogen alloyed stainless steels for alkaline environments

Extreme service conditions

In power production the recognition and control of extreme conditions enables an efficiency increase .

The control of extreme conditions will reduce the amount of unwanted service breaks.
=> Decrease in emissions and down time



3. Laser processing

Cutting

**Surface
treatment**

Machining

Welding

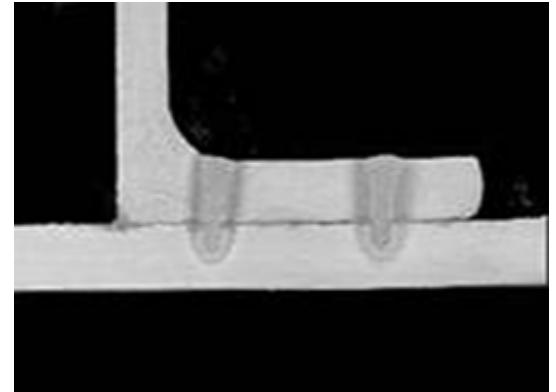
Marking

Measuring

Ruukki Laser 2007-2011- Laser development program

Ruukki Laser - Goals

- Innovate and develop new business opportunities and product generation by using laser technology.
- Increase understanding in laser technology.
- Build up networks of laser competence for future projects.



Laser cutting

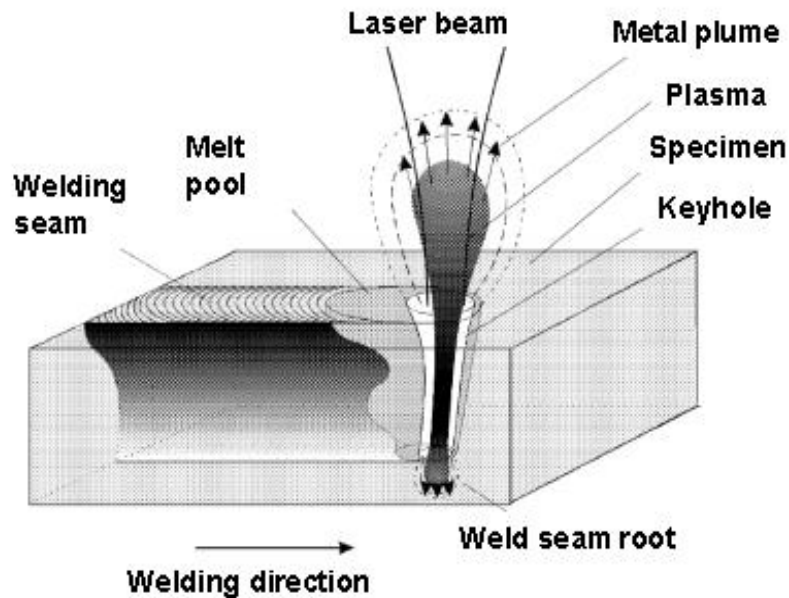
- Tube cutting
- Oxygen assisted cutting of thick plates (LASOX)
- Laser bevel cutting
- Laser cutting of sandwich panels



Welding development

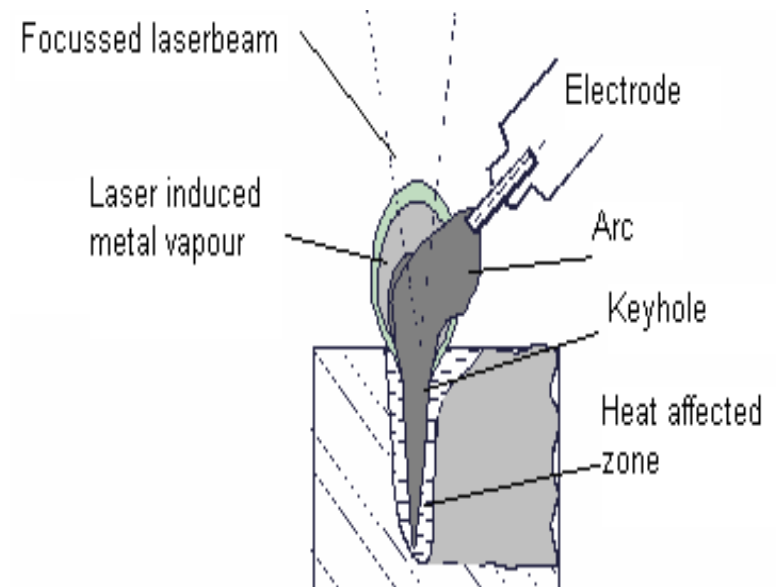
Laser welding:

- conduction limited
- keyhole weld (traditional applications)
- pulsed



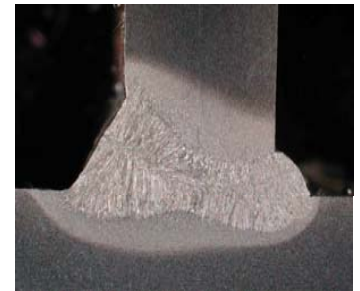
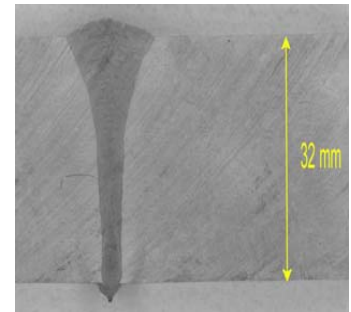
Laser hybrid welding:

- laser & arc welding combined
- => Benefits of both processes



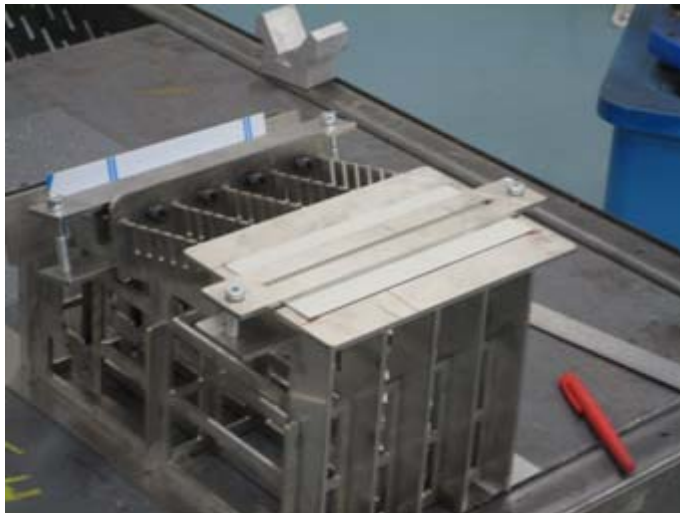
Why laser/laser hybrid welding

- **High welding speed & deep penetration**
 - Welding speed 2-3 times higher
 - Penetration >30 mm with 1 pass possible
- **Reduced edge preparation & consumables**
 - Reduced groove volume -> less preparation time, consumable cost savings ~50 %
- **Lower heat input**
 - Reduced weld distortions, reduced post-welding work
 - Suitable for high strength steels
- **High quality**
 - Mechanised welding leads to homogeneous quality
- **Versatile tool**
 - Same laser used for cutting, hardening, surfacing etc.



Laser welding and brazing of coated steel

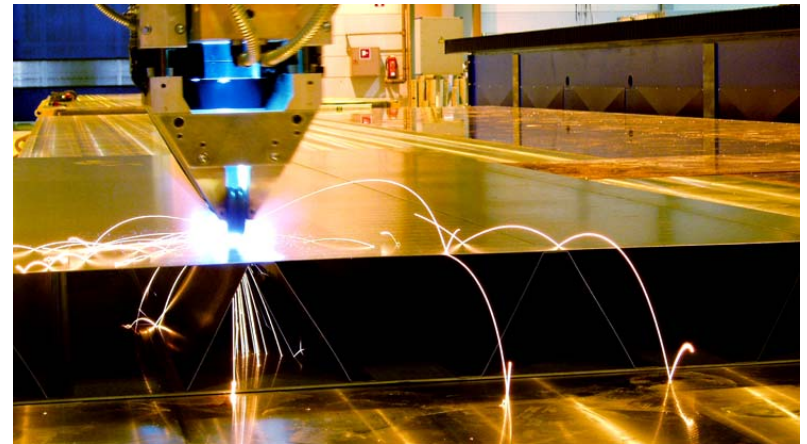
- Laser welding of zinc coated and organically coated steels 1.0 – 1.5 mm
 - Controlled heat input with pulsed Trumpf HLD 4002 disc laser
 - Welding from back side, damage free top coat



Laser welding of metal sandwich panels

(Ruukki Uusikaupunki)

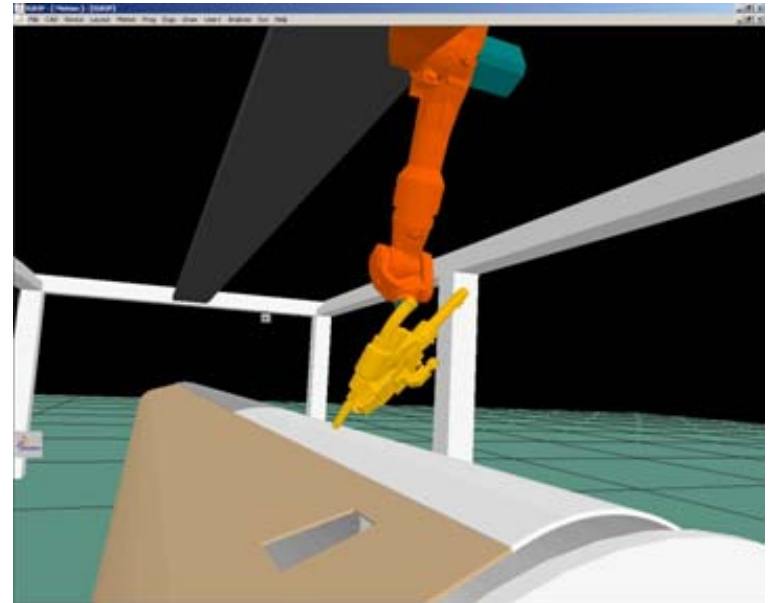
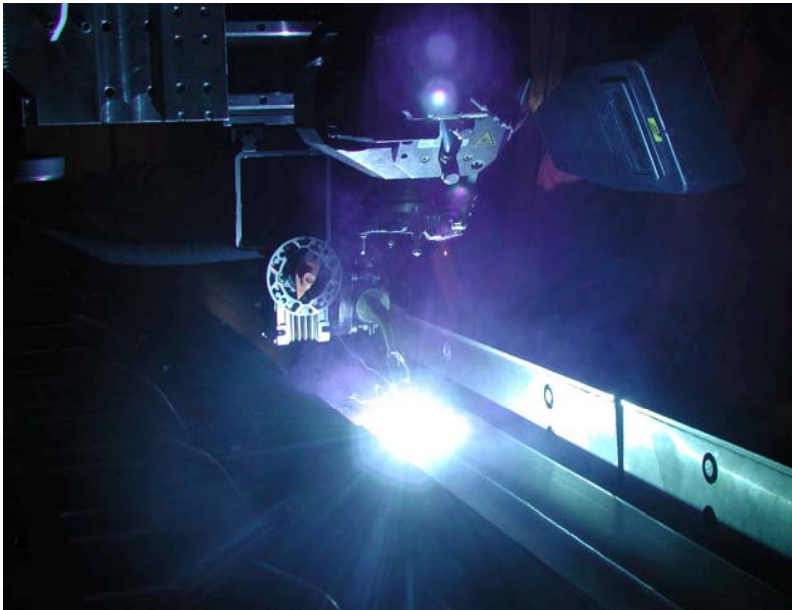
- Two Rofin-Sinar CO₂ lasers, power 8 kW
- Working area: 18 000 x 4 500 x 600 mm.
- Two large transfer tables for both work stations
- Air gap is minimised with press roll
- Single sided welding
- Applications in transportation and construction industries



Welding simulation

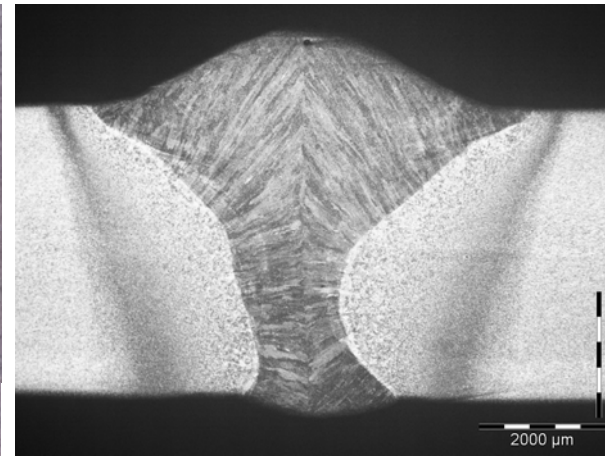
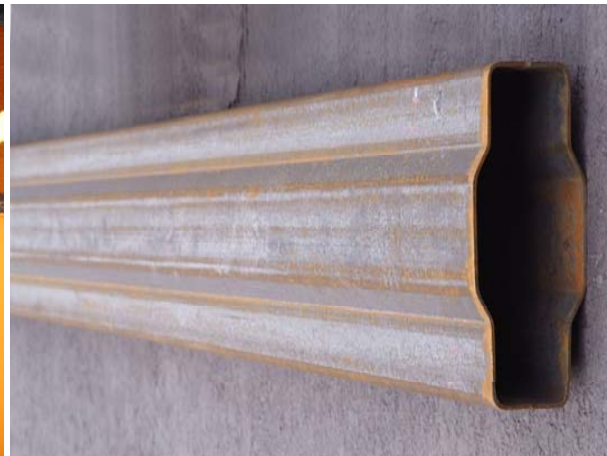
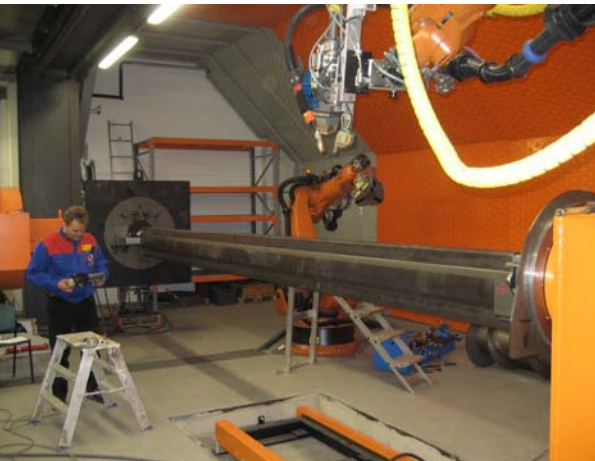
Simulation of hybrid welding with IGRIP software

- Developing the welding station
- Calculation the lead time for the product
- Optimizing the welding time with two robots



Hybrid welding of boom products

- Hybrid welding of UHSS, 900 N/mm²
 - Roll formed profiles with mechanically cut edges
 - 4 kW Nd-YAG laser + MAG
 - Welding speed 1.5 – 2.1 m/min
 - Good weld quality, further development needed for seam tracking



Laser-hybrid welded wide plates

Wear resistant Raex 400 steel and combination of Raex 400 with Optim 650

- Thickness 4-6 mm
- Applications tipper bodies, transport wagons, containers...





RUUKKI

more with metals