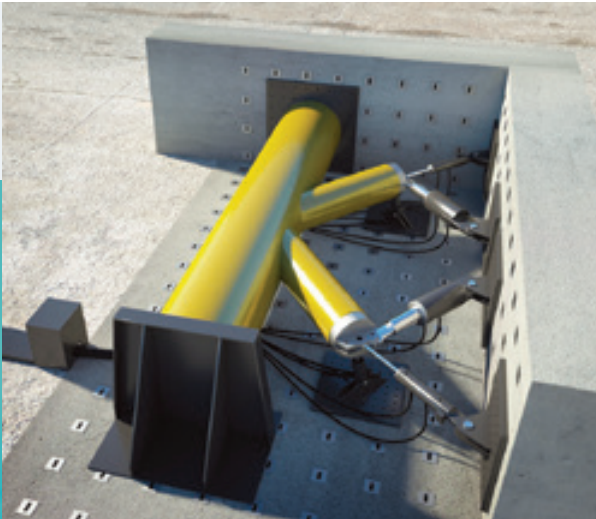


# Annual Report 2015



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## > MANAGEMENT'S REVIEW

# Positive result despite significant changes in market conditions



### DEVELOPMENT IN TURNOVER AND PROFIT

The group turnover in 2015 was MDKK 1,191 against MDKK 1,225 in 2014, representing an overall decrease of 2.8%. 0.7% of the decrease is due to a stronger Danish krone compared to the two other currencies, SEK and NOK. Therefore the Group's actual turnover decreased with 2.1%.

The FORCE group did not obtain the expected activity in 2015, as the energy prices declined with approximately 50% in December 2014/January 2015. This caused an instant decrease in demand and a very high pricing pressure. Especially Norway and Denmark noticed this development. As in 2013 and 2014 there are significant geographical and sectorial differences in the markets – some markets/industries are growing and others are declining. These facts are the primary reasons why the consolidated revenue decreased by 2.8% compared to 2014.

The level of investments is still high and the products, which were introduced to the market within the second half of 2014 and the first half of 2015, have started to generate revenue and contribute to the profit. The information and communication activity is maintained at a high level, and this will continue in 2016.

### DENMARK HAS CONTINUOUSLY HIGH DEVELOPMENT AND INNOVATION EFFORTS WITH A WEAK TURNOVER PERFORMANCE AND A DECLINING PROFIT PERFORMANCE

FORCE Technology Denmark has in 2015 achieved a turnover of MDKK 791 – an increase of 2.2% compared to 2014. The low growth is primarily caused by the situation in the oil- and gas sector. We have managed to increase our market share but with price pressure.



The result of the operating profit in 2015 was MDKK 11.4, which is 50% less than in 2014. During the first half of 2015 the organization was adapted to the new market situation, and during the second half of 2015 we have generated a normal profit. The result is considered satisfactory/acceptable due to the given circumstances.

2016 is expected to be a normal year assuming that the market situation does not deteriorate further.

### SWEDEN IS IN PROGRESS - IN GROWTH AS WELL AS IN REVENUE

The turnover for FORCE Technology Sweden AB was MDKK 195 against MDKK 175 in 2014. The increase is primarily due to a higher demand in both the energy and the manufacturing sector. Note that Sweden is only slightly dependent on the price development in the oil and gas market. The result from operating activities is MDKK

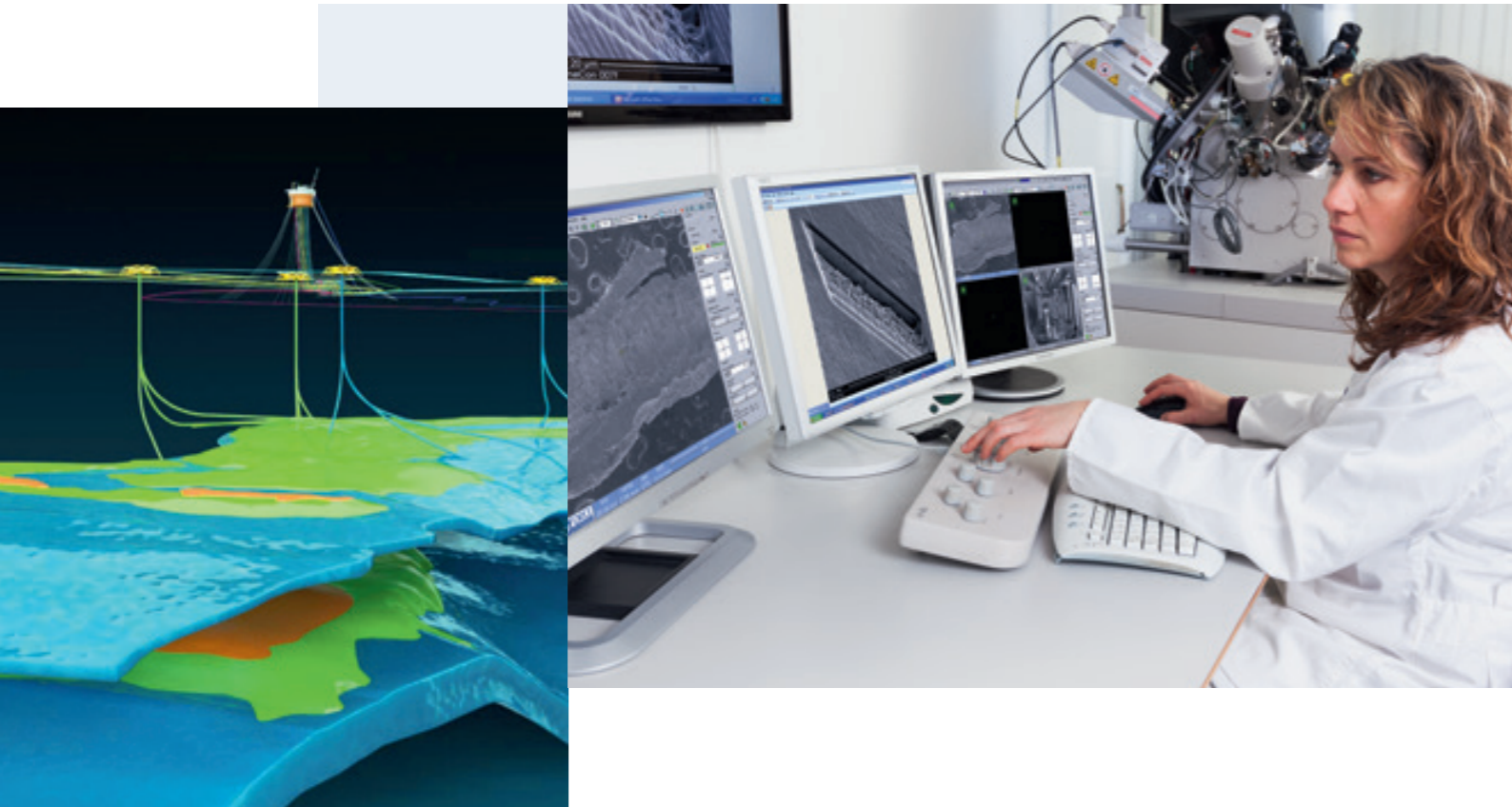
2.7 against MDKK 1.5 in 2014. The result is considered satisfactory. We expect a moderate increase in both revenue and profit in 2016.

### NORWAY HIT BY SIGNIFICANT FALL IN OIL AND GAS PRICES

The turnover in FORCE Technology Norway AS amounts to MDKK 236 against MDKK 296 in 2014 – representing a decrease of 25%. The reason is primarily the large dependence on the oil/gas sector and secondarily the currency exchange rate between NOK and DKK. The result from operating activities is MDKK -3.4 against MDKK 6.8 in 2014. The capacity is adjusted to the new market situation, and the second half of 2015 has generated a normal profit.

The result is considered not satisfactory. 2016 is expected to be a normal year on the financial part assuming that the market situation does not deteriorate.

## > MANAGEMENT'S REVIEW



### STRATEGY FOR SIGNIFICANT EUROPEAN KNOWLEDGE CENTRE - WITH SCANDINAVIAN ORIGIN - SEEN IN THE LIGHT OF BIG CHANGES IN THE GLOBAL MARKET

Since 2000 the Group has stuck to pursuing its growth strategy as regards activities – the turnover in 2000 was just under MDKK 400 and MDKK 1,191 in 2015 – as well as regarding applications. The strategy has proven sustainable, also in times of crisis. This way we fulfil our tasks for society, enabling us to keep servicing our customers with optimum technological services.

In 2015 we expanded our infrastructure in Denmark and we are ready to seize growth where it arises.

The above is done while maintaining a responsible financial development, and keeping the Group fit for the future regarding knowledge and financing. This is especially important in a time where macro factors come quickly and with great effects. FORCE Technology is financially solid and can, – even in times of crisis – raise the necessary capital for both promising innovative applications as well as its own growth.

The price pressure in the oil and gas sectors, in conjunction with the previously mentioned capacity adjustments in Norway and Denmark, means that we expect a moderate increase of growth in 2016 and will continue to focus on organic growth, at the top as well as on the bottom lines.

The globalisation and various crises create a high degree of consolidation and proactively we look for opportunities of relevant acquisition.

The objective is hereby to strengthen and streamline the organisation to take advantage of the current opportunities in a globalised world of rapid change and continual temporary crisis.

On the short term, FORCE Technology works on a number of special initiatives aimed at strengthening and enhancing efficiency in the total organisation regarding competences, resources, efficient cost management and infrastructure. At the moment FORCE Technology employs 36 different nationalities. Furthermore, we are working on maintaining and developing already existing customers and exploiting the possibilities of a – due to the after effects of the financial crisis and the intensely decrease in oil prices – continuously fragile market, which we expect will slowly improve.

FORCE Technology participates regularly in the special initiatives of the Danish Agency

for Science Technology and Innovation – for supporting innovation in Denmark.

FORCE Technology still participates actively in the initiatives around “Production in Denmark” and “Material Technology”. These are both large investments made to contribute to create many jobs in the production industry in Denmark and through increased competitiveness.

In addition to this FORCE Technology will continue to focus on strengthening internal competences – also in commercial terms – to be able to continue to meet the demands from the market.

FORCE Technology is working on a new corporate strategy, which takes the opportunities and risks that the globalized world offers into consideration.

All together the adjusted strategy will help ensure that FORCE Technology is able to position itself more clearly and with more significance and greater effect among the five most influential knowledge and technology centres in Europe in the pri-

oritised competency and business areas. Further, the strategy will in focused manner direct to future global growth areas.

At group level FORCE Technology expects a stabile growth in profits in 2016 – with moderate revenue growth. This by focusing on sale of wider ranges of services. We also expect growth in sales and profit due to the earlier mentioned new product launches.

As a result of the performed actions, focused on strengthening the organisation, the productivity, the competences and the profitability in the Group, FORCE Technology expects a 2015 with a stabilised profit development

The total effort will ensure continued technological and commercial development and success – for the customers, the employees and the Group.

*Brøndby, 11. March 2016*

Erik Søndergaard  
*Chairman of the Board*

Ernst Tiedemann  
*Chief Executive Officer*



Erik Søndergaard  
*Chairman of the Board*

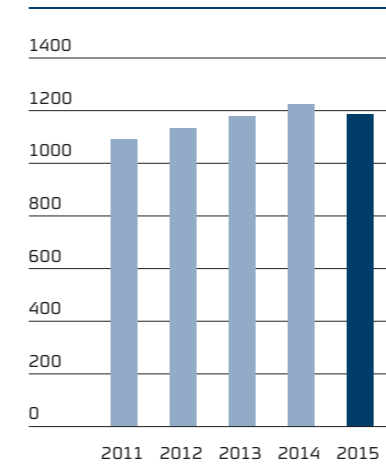


Ernst Tiedemann  
*Chief Executive Officer*

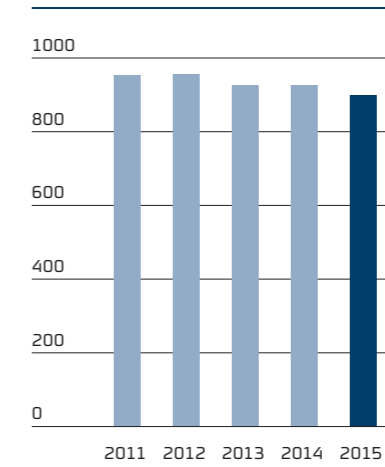
> KEY FIGURES



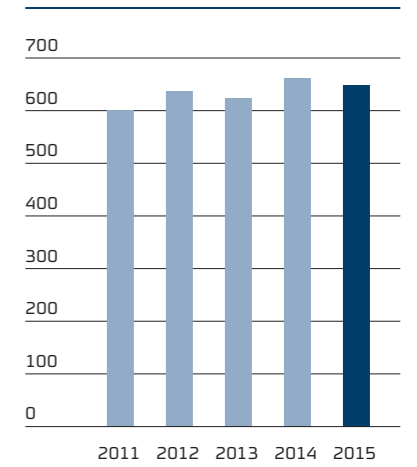
**TURNOVER**  
MDKK



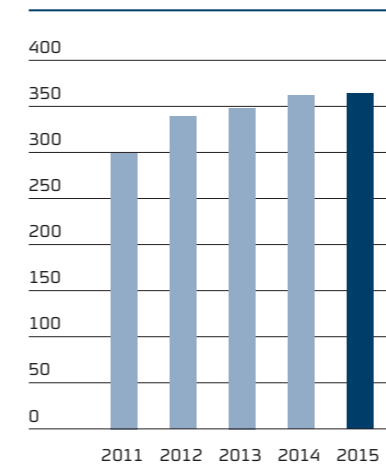
**TURNOVER PER EMPLOYEE**  
TDKK



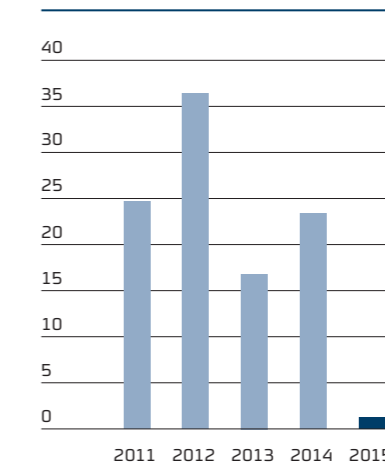
**TURNOVER, ABROAD**  
MDKK



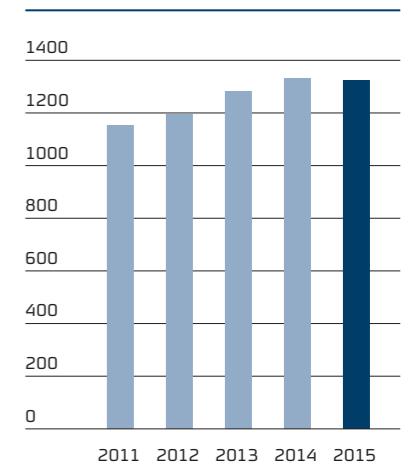
**CAPITAL AND RESERVES**  
MDKK



**PROFIT FOR THE YEAR**  
MDKK



**NUMBER OF EMPLOYEES**  
AVERAGE NUMBER



## > ABOUT FORCE TECHNOLOGY



FORCE Technology is a leading independent technology consultant that help our customers to improve their products and processes, thereby increasing their competitive edge. We convert highly specialised engineering know-how into cost-effective solutions for a wide range of companies working within the field of energy, oil and gas, maritime, infrastructure, service and manufacturing – from one-man companies to international corporations.

Our consulting, technologies and products are all based on customer and sector specific insights gained throughout more than 75 years. Our more than 1,300 employees are located at our headquarters in Brøndby, at branches all over Denmark, and at sub-

sidiaries in Sweden, Norway, the United Arab Emirates, China and Singapore. Every year, we collaborate with more than 7,000 companies in over 70 different countries.

### OUR AREAS OF EXPERTISE

We strive to be amongst the world leaders within our areas of expertise:

- Energy and resource efficiency
- Material technology
- Welding
- Integrity management
- Inspection and testing
- Metrology and chemical analysis
- Sensor innovation
- Management systems and certification
- Education, training and courses

### WORLD-CLASS FACILITIES AND KNOW-HOW

Amongst the key benefits of working with FORCE Technology are our world-class laboratories, equipment and technical facilities which are operated by highly skilled personnel and available to our customers at all times.

Our customers also have access to the latest know-how and technologies within our areas of expertise and to our comprehensive international knowledge network.

### INDEPENDENT R&D DEPARTMENT

When companies work with us on R&D projects, they get access to state-of-the-art facilities and highly skilled staff as well as a research collaboration with knowledge institutions. When developing our R&D projects, we also focus on the terms of the customers as well as the market. They can also benefit from our expertise throughout the entire innovation process: from the initial design phase, through product and process development, to testing and documentation.

This is our contribution to strengthening competitiveness in business and industry – and to generating growth and creating jobs in companies of all sizes.

### GTS INSTITUTE

FORCE Technology is one of eight approved technological service institutions under the auspices of the Danish Ministry of Higher Education and Science. As a GTS institute,

### VISION

We aim to be the preferred partner on projects requiring extensive specialist knowledge – from initial concept to the delivery of a turnkey solution.

we disseminate technology and know-how to Danish companies, thereby boosting their competitiveness. SMEs, in particular, can receive assistance on their manufacturing and process-related challenges.

We participate in international standardisation efforts and help establish the right conditions for competitive production in Denmark. We participate in R&D projects with public-sector co-funding aimed at developing products and processes at the cutting edge of market needs. Our Innovation Agents advise SMEs on new technology and business development. Businesses can also engage with us via innovation networks throughout Denmark.

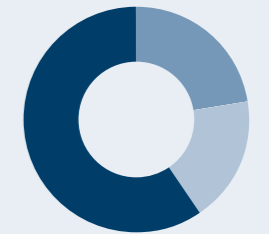
### OUR EMPLOYEES

FORCE Technology is a multi-faceted company in which our talented specialists work together to deliver the right solution for the customer. Our employees are among the most skilled and most respected in the industry. They continuously update their skills and acquire new knowledge through international networks, participating in standardisation efforts, and contributing to national and international R&D projects.

They work closely with different types of companies and possess an in-depth understanding of their needs and the framework conditions that apply to their business areas. At our world-class facilities, they collaborate with customers to achieve the best possible solution. Thereby, we offer solutions on seemingly unsolvable problems.

### MISSION

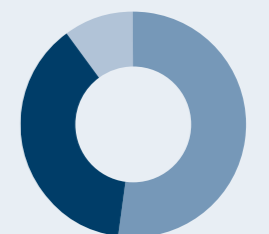
We develop technological solutions and services that improve our customers' competitiveness.



1.369

NUMBER OF EMPLOYEES AT THE BEGINNING OF 2016

- Other technical staff: 814
- Administration: 308
- Academic staff: 247



PERCENTAGE OF REVENUE

- Danish customers: 38%
- International customers: 52%
- R&D: 10%

## > WORKPLACE HEALTH AND SAFETY

# We continually strive to maintain a good working environment and a strong health and safety culture



A good working environment and a strong health and safety culture are high priorities for us. We therefore continually strive to make improvements in both areas.

At FORCE Technology, we want to maintain a strong health and safety culture, and we set health and safety requirements in connection with all our activities. We have high demands of our employees, insisting that they contribute to a culture that promotes safety and that they work towards creating an accident-free environment. Our goal is for all our employees to feel safe and to thrive at work. We want them to return home each day uninjured.

### SMARTPHONE APP FOR RISK ASSESSMENTS

To achieve our goal, we are doing our utmost to make workplace health and safety a natural part of everyday life for everyone. Boosting individual awareness is crucial for our safety efforts, and in this regard the right tools can make a huge difference. We have developed an app that any employee can use to conduct a risk assessment when working in the field.

With a yes/no checklist, the employee can assess whether the working conditions are appropriate. The employee can also attach photos and other relevant documentation. This risk assessment is then automatically added to the customer's file in our case management system. The app also registers near-misses, which are also automatically stored in our QHSE system.

This enables us to collect, and subsequently learn from, all the relevant data. And like rings in water, our high level of safety awareness has a positive influence on our safety-related behaviour.

### HEALTH AND SAFETY AUDITS

In our day-to-day work, we closely monitor safety while working for our customers,



as well as in our own laboratories and workshops. We share our knowledge and experience across the health and safety organisation and across the company.

The health and safety organisation is broadly based, comprising 20 safety groups in Denmark, 15 in Sweden and 9 in Norway, all of which work together to take care of colleagues and the working environment.

Among other things, the safety groups are responsible for conducting periodical audits of FORCE Technology's work at our own and

our clients' facilities. In 2015, 53 audits were carried out in Denmark, 25 in Sweden and 34 in Norway. We learn from the results of these audits, using them to maintain the best health and safety initiatives.

We want to be among the finest in our areas of expertise when it comes to developing high-quality solutions and products for our customers. And with an intensive and responsible effort within health and safety, we aim to build trust in our organisation among staff, customers, suppliers, authorities and the general public.

## > SECTORS

# Our services help one-man companies, large international corporations and everything in between

When it comes to facilities and know-how, we always operate at the cutting edge within our various sectors. Our understanding of the challenges in the individual sectors is vital for solving the customers' problems.

### ENERGY

We are continuing to see an ambitious conversion to more carbon-neutral and energy efficient solutions, which presents new opportunities for us and our customers. Our customers are working on energy production optimisation, with green conversion creating new conditions for choice of materials, structures, fuels etc.

### OIL & GAS

Despite exceptionally low oil prices and declining newbuild activity, we are seeing some exciting developments in the oil and gas sector. Reluctance in the newbuild sector means stricter requirements for safety

and uptime at existing facilities. This shift has led to an increased need for our services within inspection, lifetime extension, metering technology in connection with billing etc.

### MARITIME

The maritime sector, despite low oil prices, is maintaining its focus on energy optimisation in connection with design, loading and onboard systems. Compliance with ever increasing environmental regulation and improved offshore safety are areas where we offer our clients expert consultancy.

### INFRASTRUCTURE

Urbanisation is leaving its mark on Europe and the rest of the world, with infrastructure that is continuously being expanded and optimised. We aid our customers in providing better solutions with special focus on safety, environment, energy optimisation and people.

### SERVICE SECTOR

In both the public and the private sectors, the focus in recent years has been on increasing the user value with fewer resources. This requires sustainable, smart solutions and closer contact with users. Resource optimisation and user-friendliness are our starting point during any customer collaboration.

### MANUFACTURING

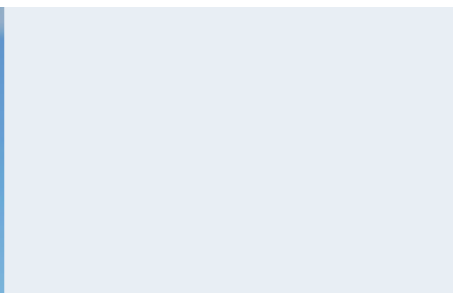
Several companies are experiencing an upswing as a result of the falling energy prices. However, there is always a constant pressure to increase productivity and further develop their processes and products. We have both the know-how and the facilities to help our customers in these areas. We can also assist in documenting that their products comply with national and international standards.





> ENERGY

# The energy sector is continuing its transition to CO<sub>2</sub>-neutral energy types



## A well-trained crew can quickly and safely install offshore wind turbines

Offshore wind turbines are being installed farther and farther away from the coast, where greater water depths and higher waves make conditions for workers difficult. In contrast to the construction of offshore oil rigs, self-propelled liftboats used in the installation of wind turbines have to be moved many times before a wind farm is complete. For this purpose, a special jack-up liftboat is used with legs that can be extended to the sea floor. However, if one of the legs sinks lower than the others, the liftboat will list and has to be stabilised quickly. In addition, strong currents, winds and waves can easily push the liftboat off its course as the legs are being extended and retracted. In either case, the crew must react quickly and effectively.

In our new simulator, crews can undergo training in critical situations involving a lost footing or in extending and retracting the



legs of the self-propelled liftboat. One of the largest offshore service providers in Asia, Teras Offshore Pte Ltd from Singapore, was the first to use our new simulator to train its crews.

Crews can also use the simulator to fine-tune and develop day-to-day routines. Experience shows that a well-trained crew can better handle critical situations and perform tasks quickly and safely, resulting in improved cost-of-energy. In the maritime sector, this means better and safer operation of the equipment.

## “Cleaner air will improve the lives of millions of people”

This is how our China Liaison Manager, Minjie Zeng, explains the importance of helping large power plants and industrial companies in China to remove a range of harmful substances from their exhaust gases.

We use calculation models, CFD simulations and testing on realistic scale models to ensure optimum flow in their exhaust gas scrubbing systems. With China's new five-year plan for 2015-2019, we have had to quickly expand our competences to also meet the needs of Chinese companies for removing sulphur from exhaust gases.

We have therefore developed new CFD models and specially designed new testing facilities with multiphase flow, enabling us to test the desulphurization of exhaust gases. In 2015 one of our first customers was a long-time partner, the high-tech advisor on clean air solutions, Tongfang Environment CO., Ltd.:

“The cooperation with FORCE Technology in designing and testing clean emission technologies is essential in our work on power plants and in reaching the 2020 goals of clean emission in China,” says Ms. Tang Leping, Vice President at Tongfang Environment CO., Ltd.

# 29/9

2015 – on this day, a microphone and camera were recording in our clean air department when representatives of the four largest Chinese business media paid us a visit to report on Danish clean air technologies.



## GASES, ODOURS AND PARTICULATES

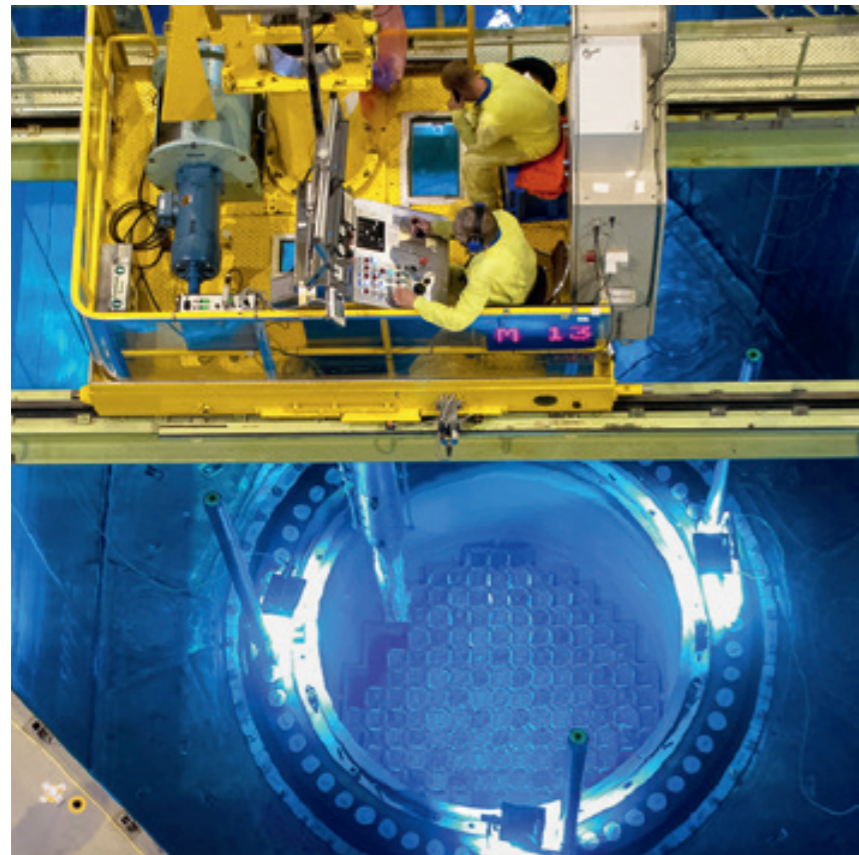
from industry and power plants require precise measurements. As the Danish Environmental Protection Agency's Reference Laboratory for Air Emissions, we have helped ensure high quality in emissions measurements in Denmark since 1997.

# 19

## PYROPROCESSING LINES

at Danish and Swedish waste incineration plants have their fossil CO<sub>2</sub> emissions measured using our accredited carbon-14 technique. In addition to compliance with the CO<sub>2</sub> quota legislation, the plants can also document their production of green electricity.

> ENERGY



**Full audit at Ringhals**

Just south of Gothenburg, Sweden's second-largest city, you will find Ringhals – the largest nuclear power plant in the Nordic region. During the audit shutdown in 2015, every reactor at the facility was checked in accordance with international standards. Ringhals representatives and subcontractors worked closely throughout the process, with Fredrik Hafsten of FORCE Technology Sweden in the key position of installation controller – a vital piece in the quality work puzzle.

“We check the qualifications of the welders, and that the work and documentation are up to scratch. Sometimes we find imperfections that need to be corrected, and there are special procedures for this. The welding companies are not always keen on making repairs, but by showing some cheerfulness and mutual respect, everything goes just fine,” Fredrik Hafsten explains.

**It was an ordinary December day in the megacity of Beijing**

Visibility was only 200 metres in a toxic grey haze of smog that was more than 40 times over the safety limit defined by the World Health Organization.

On this day, however, the Chinese government issued its first-ever 'red alert' in response to massive pressure from the public. For a time, 2,100 companies were forced to shut down and vehicle traffic was halved. Meanwhile, at the COP21 summit in Paris, the Chinese government signed an internationally binding climate agreement.

Requirements were tightened in other areas as well. The Chinese market is driven by five-year plans, which set limits for air pollution, among other things. FORCE Technology has been involved in qualifying the three most recent five-year plans to ensure that power companies can comply with the official environmental requirements.

“Now we've commenced a new five-year plan, 2015-2019, which tightens the regulations even further. In some areas the environmental legislation is even stricter than in Europe. The focus used to be on NOx, but now sulphur and particulates also have to be reduced. This means looking at all the processes for scrubbing exhaust gases,” explains Kristian Lykkemark, head

of the thermal energy and flow mechanics department.

He enthusiastically continues: “Fast adaptation in a large organisation requires a high degree of agility, and this has been possible thanks to the strong connections to our subsidiary in China. The Chinese market is moving at lightning speed at the moment and has huge potential. As a result, Danish cleantech companies are expecting to triple their revenue in China in the future. And with new cost-effective clean air technologies, we're helping to make a mask-free life in China a reality.”

**Green energy for Ireland**

In recent years, many power plants have made the conversion from coal to biomass. This increases the risk of corrosion in the combustion chamber and the boiler, because biofuels release corrosive gases and salts during combustion.

This prompted us to develop new CFD simulation models that take into account:

temperature, materials, fuels and the flow of corrosive gases and particulates that occur at certain combustion temperatures. With these models, we can optimise boiler designs meaning that the concentration of corrosive substances is distributed more evenly. This extends their lifetimes and, if the steam temperature is also increased, enables them to produce more electricity as well. In existing boilers, we can identify any parts that need to be replaced with more wear-resistant materials.

One of the biggest Danish boiler manufacturers, Aalborg Energie Teknik (AET), asked us to carry out corrosion analyses on a new boiler for a power plant in Ireland. We started by simulating various scenarios for current boilers. Alongside this, our materials specialists assessed the lifetimes of the incineration plant's individual parts. Our final recommendations gave AET a solid basis for choosing an optimised boiler design offering the longest possible lifetime.

**First approved method for measuring methane gas**

Methane is one of the most powerful greenhouse gases and a major contributor to the greenhouse effect. It is formed when bacteria break down organic material without sufficient oxygen, such as in dumps and landfills. Until now, it has been difficult to quantify the amount of methane released into the atmosphere. But with a new tracer gas method, FORCE Technology can now offer this service.

the methane into CO<sub>2</sub>, which is 23 times less harmful to the climate. This makes biocovers a cost-effective way to minimise Denmark's greenhouse gas emissions. To quantify the amount of methane emitted by landfills, the Danish Environmental Protection Agency recommends the tracer gas method.

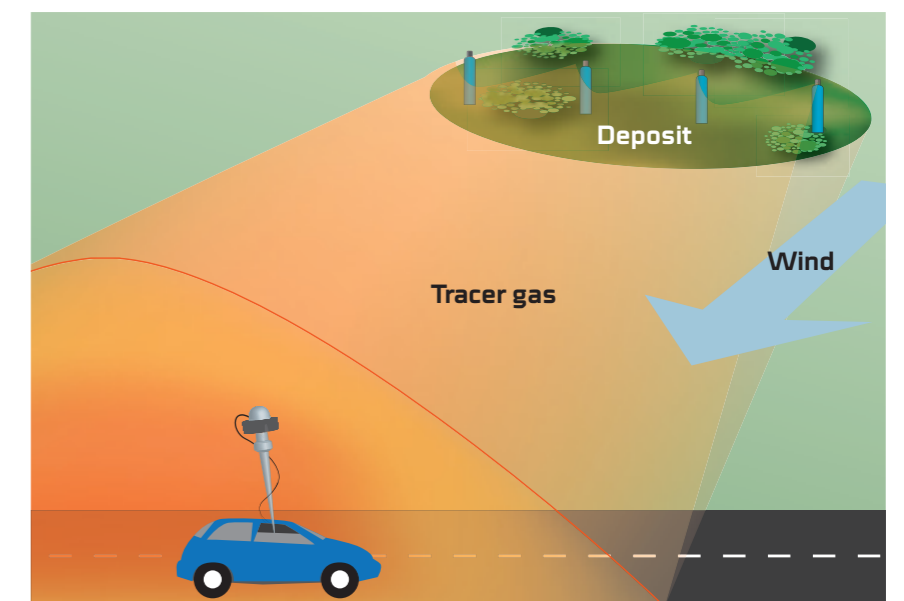
Jacob Mønster, head of project at FORCE Technology, is the driving force behind the development of the tracer gas method and is about to commence an industrial postdoc

on the subject in collaboration with DTU with the aim of, among other things, getting the method accredited.

“It means a lot to me that FORCE Technology is willing to invest in such a crucial business area. There are many other business areas all over the world where we can locate and quantify unwanted emissions, such as increasing biogas production or giant landfills in countries like the UK, which make extensive use of methane for energy,” explains Jacob Mønster.

We have developed a mobile analytical platform which can locate areas with methane emissions and quantify how much is released. The platform consists of a highly sensitive methane analyser and a GPS. By releasing a known quantity of tracer gas, we can measure the dilution rate from the landfill to a distant measuring point. We can then apply this rate to get the methane emission and suggest where and how emissions can be reduced.

In Denmark, a total of DKK 178 million has been earmarked up to 2020 for stopping methane gas emissions from old landfills with the help of biocovers. The basic premise is to cover the waste under a layer of compost. The soil bacteria then convert



> OIL & GAS

## Exciting developments despite low oil prices and reduced activity



### Customised scanners “down under”

—  
FORCE Technology Norway has delivered subsea scanner solutions to the Australian market for 5 years. One of the more recent assignments is a project in which we collaborate with Inpex, a Japanese oil company and the future operator of the Ichthys oil field.

We took part in the detailed planning of the subsea structures in order to create the perfect conditions for trouble-free inspection before designing scanners specifically

for this oil field. What is unusual about this project is that we have mounted guides on the substructures. These guides will act as a placeholder and a point of reference for the scanners, meaning that each inspection result can be compared to previous results.

In short, we have tailored a solution that supplies Inpex with important historical data – and furthermore less costly than a continuous monitoring device. This solution allows Inpex to use the data to make qualified estimates of remaining service life and plan maintenance with great accuracy.

### Gas meters from all over the world pass through Vejen

—  
Giant natural gas meters from all over the world are now sent to FORCE Technology in Vejen, Denmark. There, they are calibrated using the world’s largest closed loop for high-pressure calibration of all types of gas meters up to 65 bar.

The system is the only one of its kind in the world and one of the largest investments in FORCE Technology’s history. It has been designed as a closed calibration loop using natural gas as medium. The complexity of the system assures minimal calibration uncertainty at maximum flow and pressure all year round, regardless of the season.

Today, our staff calibrate meters for some of the largest meter manufacturers in the world. Time differences and urgent jobs are part of daily life in Vejen, where flexibility is key. We therefore calibrate meters at any time of the day or night – all year round. We have also made it possible for the customer to observe the calibration of their meter – either live or via remote access and camera.



In addition to the new high-pressure calibration system, in recent years we have developed a primary system that enables us to generate traceability in accordance with international standards. Furthermore, we are also part of the European Natural Gas Cubic Meter (EUREGA) cooperation, working with metrology bureaus in Germany, France and the Netherlands to maintain the harmonised natural gas cubic meter.

The new plant was officially opened on 13 May 2015, when customers, partners and others from the international gas sector were invited to tour the new facility.

# 1,000

MILLION EURO

is the estimated financial uncertainty for global trade in LNG (liquefied natural gas).

We are participating in a project under the European metrology research program called “Metrology for LNG”, which aims to halve measurement uncertainty so that tanker ships and lorries actually transport what the meter says.

This year, we held the third Metrology for LNG workshop in Brøndby, Denmark. Here, 55 participants from all over the world were presented with the project’s latest findings.



### FORCE TECHNOLOGY NORWAY

has been approved to conduct drone inspections in Norway. The approval was granted by the Civil Aviation Authority and is valid for two years.

## > OIL & GAS

### A project of Biblical proportions

Weighing in at 59,500 tonnes, and with a height of 75 metres and a diameter of 107 metres, Goliat is by far the largest and most complex floating oil production and storage facility ever developed and built. It is designed to withstand a 10,000 year storm and is situated in the Barents Sea.

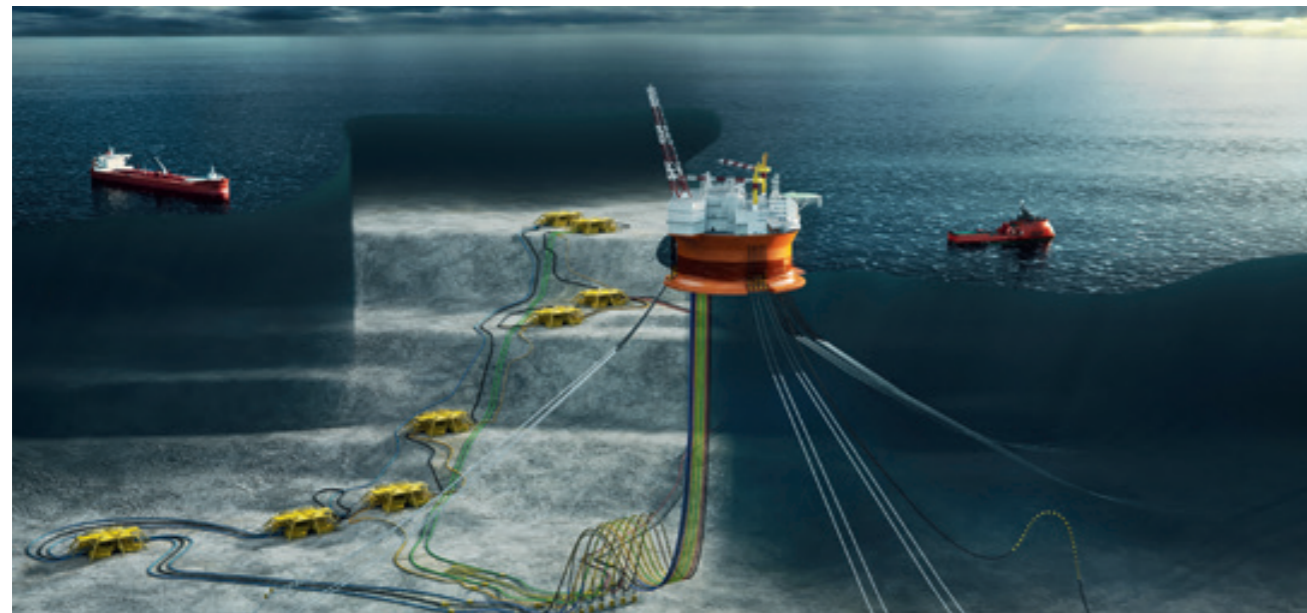
Three subsurface pipelines are connected to Goliat, two of which are equipped with direct electrical heating (DEH) to ensure

optimum oil flow. However, there is a risk with DEH that even the slightest damage to the coating on the pipe could result in aggressive corrosion. So how do you check that Goliat's pipelines are free of coating damage and thus fully operational?

Goliat's operators chose to use a sensor called FiGS (Field Gradient Sensor) developed and manufactured by FORCE Technology Norway. FiGS is up to 100 times more sensitive than other sensors and can therefore also inspect subsurface pipelines. With its high sensitivity, FiGS can detect the slightest damage to the coating simply by

floating over the area. It can also measure the condition of the cathodic protection and register the direction of the anode current, making it possible to locate the damage – even under the seabed – and rectify it before it becomes serious.

Coupled to a remotely operated underwater vehicle (ROV), FiGS has floated over 21 km of Goliat's pipelines, supplying huge volumes of data for our analysts to assess and process. Based on their recommendations, it will be possible to provide qualified consultancy on the condition of Goliat's pipelines and recommend an action plan.



### New oil terminal for DONG Energy's Hejre field

Our independent inspection body, FORCE Certification A/S, has won the contract to approve DONG Energy's new oil refinery in Fredericia, Denmark, to ensure it complies with Danish and European legislation. The

plant is a separate expansion of the existing refinery and will treat the crude oil from the Hejre field in the North Sea.

The inspection contracts have taken FORCE Certification A/S to workshops all over Europe and, through our excellent collaboration, we have been able to conclude a number of new contracts.

The contract is unique in that the entire Hejre project, with a total value of DKK 14.1b, is one of the largest investments in modern Danish oil history. The Hejre field contains approx. 170m tonnes of oil equivalents, approx. 2/3 oil and 1/3 gas.

### Out to sea with Spiderwoman

On a clear and frosty day in February, we found our certified IRATA rope access and NDT inspector, Marte Sletvold, hanging from a rope two metres above the waves of the North Sea. She was inspecting a conductor pipe transporting gas up to the Maersk Halfdan B oil platform. "Working offshore is a complicated jigsaw. It has to be timed precisely with the manning on the rig and Mother Nature needs to turn down the wind and fog," explains Marte Sletvold, and continues: "Rope access inspections are popular with our Danish offshore clients because they get a fully manual NDT inspection of hard-to-reach areas. Even though the rigs are not necessarily built for climbing inspections, we have the experience to get the job done. And, of course, I'm not afraid of heights."



### Drone inspection is gaining ground on land and at sea – especially in a number of key offshore areas



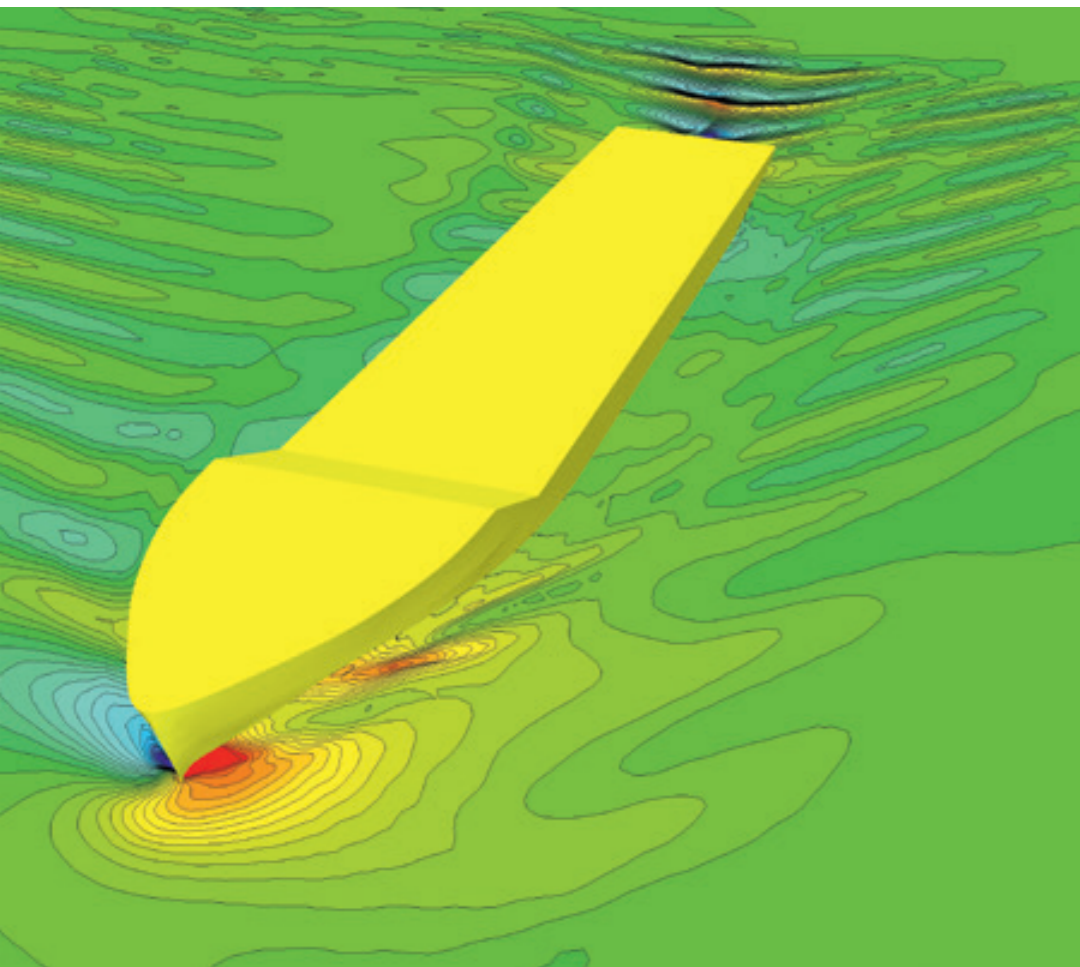
Technological advances have given us drone inspections with better images from harder to reach areas and at significantly lower costs compared to manned helicopter inspections. In 2015, FORCE Technology has conducted a wide range of inspections, including oil platforms for Maersk Oil, by flying drones between the platform and the flare, where the excess gas is burned off, as well as along the bottom of the flare deck. This is a risk-free manoeuvre for the mechanical winged inspector.

Troels Føgh Sørensen, head of maintenance with the Danish business unit of Maersk Oil, is impressed by the drones: "We used to carry out inspections by helicopter. This meant greater distances and, consequently, lower image quality. With drones, we can get close to the flare, even when it is in operation. This gives us better data with which to plan our maintenance work."

Fast status assessments are another advantage of inspections by drone. For instance, if lightning has struck a wind turbine, a drone can fly up and within minutes provide an overview of the damage. In connection with other inspection tasks, the use of drones makes scaffolding unnecessary. Finally, the operator can regularly check the images during the flight and – within minutes of the drone landing – send them to colleagues for analysis.



## This sector is embracing energy efficiency and meeting stricter environmental and safety requirements



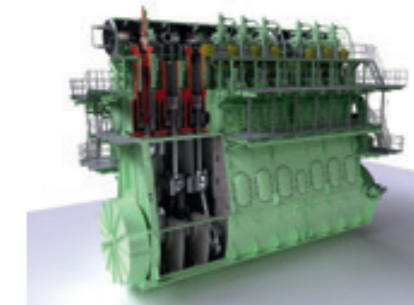
### Ship engines the size of a three-storey building

MAN Diesel & Turbo develops and designs ship engines with 10,000 to 100,000 horsepower. The largest are as high as a three-storey building.

They are generally built at shipyards and engine factories in Japan, Korea and China, which operate under licence from MAN Diesel & Turbo.

FORCE Technology has collaborated with MAN Diesel & Turbo for a number of years, and in 2015 we won the contract to measure air emissions from their engines. Our project manager, Jan Andersen, is one of three employees seconded to the manufacturer in turn for up to a month at a time:

"Usually, we travel out with a group from MAN Diesel & Turbo. We measure the air emissions while they use the measured emissions data to fine-tune the engine in collaboration with the licensees. The emissions data are used in the R&D work to lower air emissions and fuel consumption further without affecting the engine, which must be able to run for approx. 7,000 hours a year," explains Jan Andersen, project manager.



### Tides and targeted dredging leads to large savings at Port of Brisbane

The Port of Brisbane on the east coast of Australia is the fastest-growing container port in the country. To get there from the Pacific Ocean, ships have to sail up a 90-km channel. The Port of Brisbane was keen to attract larger container ships and needed an economic feasibility study to make the channel deeper.

In collaboration with DHI, who are experts in water environments, we calculated and quantified whether it was realistic to make the port accessible to large container ships.

The seabed undulates like the landscape. In high seas, a ship will roll with one side leaning up and the other leaning down towards the seabed. In such conditions, there is a risk of large ships running aground.

DHI calculated the behaviour of the waves and currents in the waters in relation to tide, storms etc. And we calculated the motions of a large container ship in the wave system in question. Together, we found an acceptable safety limit and hence the necessary water depth.

The current channel has a number of bends. The study showed that the Port of Brisbane only needed to dredge the bends. As long as the ship's passage is synchronised with the tide, even very large container ships can easily sail in at high tide. By cooperating with nature, the Port of Brisbane was thus able to achieve large savings compared to dredging the entire channel.

"We enjoyed an excellent collaboration with DHI and profit from combining our competences. The Port of Brisbane project bodes well for a lot more future collaborations with DHI," says Bugge Jensen, senior project manager at FORCE Technology.



**125**  
LPG CARRIERS

had their pressure, temperature and tank levels calibrated via our 24-hour service in 2015. Our travelling technicians met the ships in ports all over the world.

**4,500**  
PASSENGERS

will have a happy holiday. Their 315-metre-long cruise ship has been tested in our wind tunnel to ensure that the swimming pool and open decks are sheltered from the wind and that no smoke from the funnel reaches the decks.



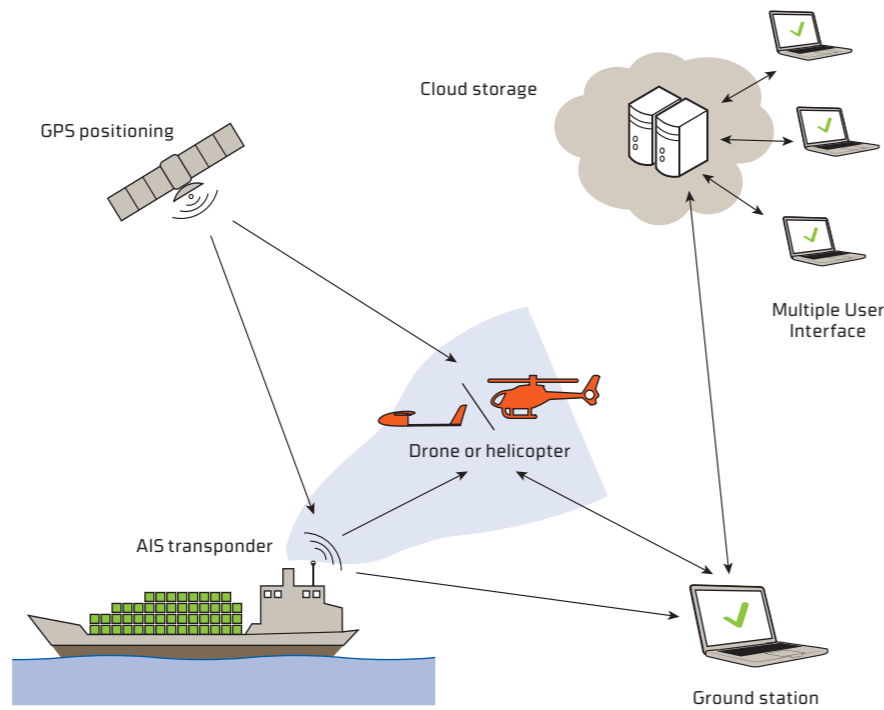
**357**  
MARINERS

from 25 different countries spent 1,558 hours sailing, tugging and docking in our simulators.

## > MARITIME

### Drones catch environmental polluters at open sea

The temptation is huge: Ships can save hundreds of thousands of kroner by not using the environmentally friendly fuel oil required by law, for instance when sailing from St Petersburg to the English Channel. One major reason for this is that the relevant checks are not yet fully in place, so only a few ships are inspected. Danish IT start-up Explicit and FORCE Technology have joined forces to develop a new solution that can quickly and cost-effectively measure the amount of sulphur in a ship's exhaust – even at open sea. Explicit developed the software and hardware, while we selected and tested the sensors for the project. The solution can be used by a drone, which localises sailing ships using AIS positions data, analyses the exhaust and transmits the results to a centralised platform.



### Psychological testing and personalised training to improve safety at large shipping company

A large shipping company from the Middle East came to us for help to change its safety culture. Our experienced psychologists have undertaken similar assignments for other

shipping companies and were quickly able to initiate an ambitious programme. 600 captains, officers and marine engineers are to undergo a series of tests followed by personalised training: "We compiled a number of cognitive tests. A cognitive test measures a person's ability to solve tasks, his ability to maintain concentration or reaction time when decisions have to be made. All employees are also required to take a

personality test. We use personality tests because research has repeatedly shown that certain personality traits increase or reduce the risk of becoming involved in dangerous situations. We then compile an individual safety profile for each employee showing how predisposed the person is to being involved in an accident or putting others in danger. Finally, we submit the results to the shipping company along with our recommendations," explains psychologist Thomas Koester.

In 2015, we tested 144 employees, so we expect the programme to continue for another two years. However, the shipping company has already received positive feedback from its employees. In addition, experience with similar customers shows that insurance premiums can be reduced significantly when a company begins working intensively with its safety culture.

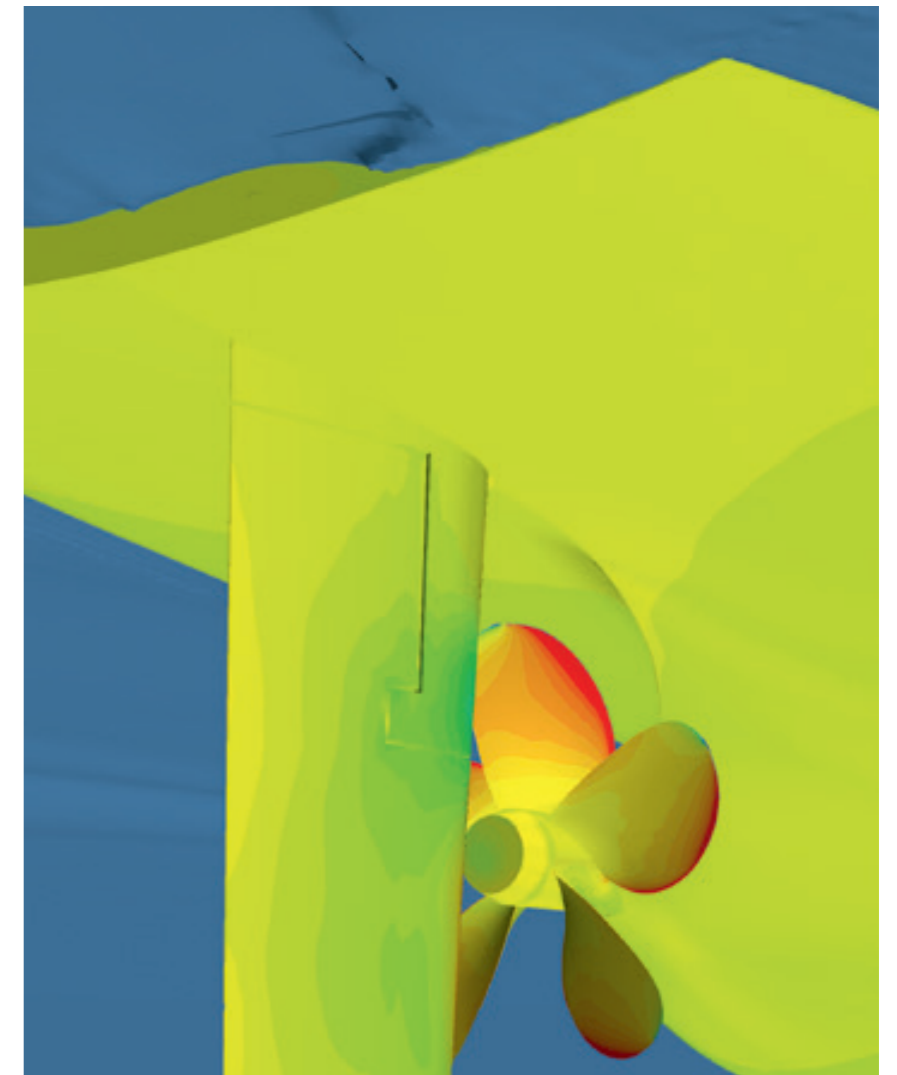


### Optimum ship design from the outset

A ship's manoeuvring characteristics are crucial for whether it can berth properly or negotiate a turning basin, a feature of many modern ports. With our newly developed CFD software, we can test, early in the design stage, a ship's manoeuvring characteristics in both shallow and deep water – as well as during large manoeuvres. Thus providing the shipowner with the necessary information to make the correct adjustments on to the design from the outset.

Our naval architects can pause the tests any time they see something interesting, enlarge the image and examine the hull from all angles. This gives the shipowner a unique opportunity to optimise the details of the hull based on information that cannot be obtained from physical model tests in our towing tank.

And while the ship is being built, the crew can practise manoeuvring the ship, for instance in difficult ports or narrow channels as data from the CFD tests enable us to quickly develop a realistic ship model for simulator training.



### International failure analysis with eight involved parties

On 14 July 2012, the container ship MSC Flaminia caught fire in the middle of the Atlantic. Investigation of the cause of fire is still ongoing three years after and is followed attentively by the involved shipping companies' insurance companies and the owner.

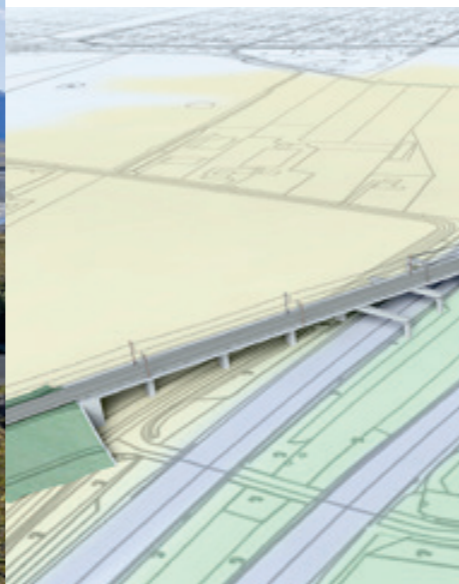
Several times during 2015, FORCE Technology has assisted the team of international fire inspectors in charge of the investigation. We have performed the practical work such as sample taking, measuring and analysing the samples applying advanced metallurgical methods including digital radiography and 3D scanning.

Often we have worked on an ad-hoc basis under personal supervision by the experts

who have visited our laboratories for a total of several weeks. When a ship catches fire at sea, it has great consequences. It has thus been a task of the utmost importance to our failure analysis group, as their results may contribute to clear up the cause of the fire and put an end to this matter.

> INFRASTRUCTURE

## Expanding infrastructure requires both people-friendly and eco-friendly tech solutions



### A second opinion resulted in an extra DKK 60m

Spalling concrete façades on 12 high-rise buildings in Brøndby Strand required action. As a social housing project, the four housing associations could apply for funding for the renovations from the Danish National Building Fund (Landsbyggefonden), an independent fund established for making improvements to social housing buildings. However, the National Building Fund was only able to provide 25% of the funding as the documentation did not qualify the housing associations for more. Therefore they were encouraged to obtain additional documentation to shed light on the full extent of the damage so the funding percentage could be re-evaluated. The firm of consulting architects and engineers,

AI a/s, recommended FORCE Technology for the job.

This is how our concrete specialist Birgitte Leth became involved in providing a second opinion. She planned the studies, took the necessary samples and drew up a detailed status assessment report. The constructive collaboration between AI and FORCE Technology gave the housing associations a positive financial surprise:

"Based on AI and FORCE Technology's great work and thorough documentation, the National Building Fund increased the funding from 25 to 75%! That is at least DKK 5m more per high-rise," declares Project Manager Martin Kjølbjerg from sbs rådgivning a/s, who served as the client advisor for the housing associations.

### 19 shoeboxes will connect Scandinavia to the rest of Europe

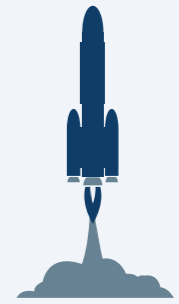
Banedanmark is building Denmark's first rail line for high-speed trains, the Ringsted Line, between Copenhagen and Ringsted. The rail line will disentangle a complex knot of commuter, international passenger and freight transport.

The principal contractor CG Jensen has chosen FORCE Technology to supervise the largest and most complicated railway bridge on the line. The bridge crosses the O4 motorway at Vallensbæk, southwest of Copenhagen, where more than 66,000 vehicles speed by daily. Casting a concrete bridge would cause significant disruptions to traffic. For this reason, Banedanmark has chosen to build a composite bridge using steel and concrete. The bridge is 510 metres long and consists of 19 giant

steel "shoeboxes" of up to 39 metres in length. The sections are welded together on site and supported by six concrete legs. A concrete deck is cast on top of them, making it possible for two trains to pass each other.

The bridge has a guaranteed lifetime of 120 years and contains more than 20 km of weld joints.

"We've been in discussions about materials, weld joints, manufacturing and NDT procedures with the contractor, the structural engineer and the workshop. We've carried out welding inspections during manufacturing in Poland and assisted the contractor throughout the process," explains our consultant Peter Krabbe-Christensen.



## 410 metres OF WELDING

on a 1 metre high nozzle for the Ariane 6 rocket. This is more than the length of Maersk's Triple E. From 2020, Ariane 6 will launch commercial and scientific satellites into Earth's orbit.



## COPENHAGEN AIRPORT

has two monitoring stations where we measure air quality. This enables the airport to document the concentrations of particulates and NO<sub>2</sub> in relation to the European threshold values for air quality.

## > INFRASTRUCTURE

### Behavioural influences to increase traffic safety in Aarhus when the first Danish light rail system opens in 2017



Aarhus, the second-largest city in Denmark, is taking action to reduce rush-hour traffic

on its approach roads and optimise transport in the city centre by building the first light rail system in Denmark. The light rail system is a modern tramway, but operates on a dedicated track, which means it is not disrupted by queuing cars. This is one of the reasons why light rail is the form of mass transit that gets the highest number of people to drop their cars in favour of public transport.

The challenge with the new light rail line, however, is that it has to traverse city squares and other areas where people are used to be able to move about without having to watch out for traffic. This has a significant impact on safety because most people feel safe in areas they know well and therefore tend to concentrate their attention on other things.

Psychologists and behavioural experts from FORCE Technology are advising the Aarhus

Letbane on how to improve safety for all road users in the areas around the new light rail line. In this process, we are utilising our understanding of human perception, behavioural patterns and ability to decode symbolic barriers, for instance by making the area around the light rail track a distinctly different colour from that of the pavement so it automatically catches people's attention.

Basically, we are identifying the areas of the new waterfront in Aarhus where potentially dangerous situations could arise. We will then recommend a series of design solutions that will influence people's behaviour in the right direction, such as utilising coloured paving that is also uncomfortable to walk or cycle on so that people naturally choose a different route. The idea is for the solutions to be multi-sensorial to make the area around the light rail line safe for everybody.

### Reliable refuse weighing

The engineering company Poul Tarp A/S develops and manufactures IT and weighing systems for refuse collection and other vehicles. These systems automatically record the weight of an individual container and send the data directly to the municipality. We use a wide range of tests to verify these mobile weighing systems to ensure that the scales always weigh correctly up to their maximum capacity – e.g. 14 tonnes. When a refuse collection vehicle is standing on a sloping road, the weighing system still needs to be able to weigh correctly. We verify this by hoisting up the vehicle, which can weigh several tonnes, and tilting it up to 15% in all four directions. There is an interesting factor that comes into consideration with vehicles for Norway and Sweden:



Gravity influences the scales differently as you move from south to north. We therefore adjust the weighing system to match the

gravity zone in which the vehicle will be operating.

### Icelandic bridge passed wind test

The Thórsörk Nature Reserve in Iceland is nestled between the Krossá and Markarfljót rivers. Access to the extremely popular hiking area is not easy: either by foot over a mountain pass or by crossing the Krossá river in a special 4x4 vehicle.

With the growing number of tourists, the Icelandic Road and Coastal Administration therefore decided to open a new, safe hiking trail by building a bridge over the Markarfljót river. The bridge had to blend in naturally with the rugged landscape, be comfortable for cyclists, horses and wheelchair users – and be able to bear the weight of a 4x4.

Studio Granda and EFLA Consulting Engineers designed a 158-metre-long bridge that met all the requirements. The 3-metre-wide bridge deck consists of timber beams, which let people look down at the roaring river below. The beams rest on two main cables of high-strength steel which span the entire distance across the river and are anchored in the cliffs on either side. A light and elegant design.

However, if a bridge does not have an aerodynamically optimal structure, wind can cause serious oscillations, resulting in damage to the bridge or, at worst, causing it to collapse. Unfortunately, it is not easy

to ascertain if a design is optimal. The Icelandic Road and Coastal Administration's aerodynamic consultant, Krabbenhøft & Ingolfsson, therefore recommended testing the bridge in our wind tunnels.

We have many years' experience testing bridges for customers all over the world, and we are one of the few companies in Scandinavia with testing facilities. We started by commenting on a drawing of the bridge which led to a few changes. Next, we built a scale model of the revised bridge

from which it was easy to remove individual parts and test adjustments to the design. Krabbenhøft & Ingolfsson were directly involved in the testing process and were able to ensure that the aerodynamic changes harmonised with the function of the bridge.

The final bridge design was able to withstand hurricane-strength winds. The Icelandic Road and Coastal Administration expects the bridge to be ready for the first hikers in 2016.



### When a motorway bridge collapses

Mere seconds after a vehicle had passed, a motorway bridge under construction north of Copenhagen in Denmark collapsed. Luckily, no one was injured. The police quickly contacted us, and early the next morning

our concrete expert, Jens Henriksen, was at the scene. Together with experts from Sweco, Niras and the Technical University of Denmark, he came up with a plan for gathering evidence and photo documentation. The Danish Ministry of Transport and Building appointed Jens Henriksen as head of the commission. The cause of the collapse turned out to be faulty calculations

that resulted in insufficient support during the casting.

"We've been working for almost a year on an incredible amount of data covering many different disciplines. It's been interesting to collaborate across the various organisations and stakeholders," explains Jens Henriksen.



> SERVICE SECTOR

# Both the public and private sectors are aiming for greater customer focus and improved service at a lower cost



## Newly developed, tailored auditor course for the Danish Safety Technology Authority

In 2015, the Danish Safety Technology Authority asked us to develop a course on internal auditing complying with the ISO 9001:2015 standard. An additional requirement was that the course should contain a section on appreciative communication, which was to be taught by an external instructor already chosen by the authority.

The project presented plenty of interesting challenges. First, the new ISO 9001:2015 standard did not exist in Danish at the time the course commenced. Luckily, our Senior Consultant Bent Møller was involved in developing the standard, so we were a step ahead there. Second, integrating appreciative communication in a course on auditing was new for us.

In developing the course programme and materials, Inge Stage, Chief Consultant at the Danish Safety Technology Authority, worked closely with our own Senior

Consultants Bent Møller and Jens Ulrik Hansen, and the external instructor, Thomas Michaelsen, from the consulting firm edsbjerg, who had expertise in, among other things, integrating change in organisations. The result was a tailored four-day course that 15 employees from the Danish Safety Technology Authority successfully completed.

"We're extremely satisfied with the course and impressed by the cooperation between Thomas from edsbjerg and Bent and Jens Ulrik from FORCE Technology. According to the feedback from the participants, the instructors were able to quickly understand our job assignments and working conditions as a public authority," says Inge Stage.



## Re-used is well-used

The Danish company Kamstrup is one of the world's largest manufacturers of intelligent heat, cooling and water meters. They have their meters type tested by FORCE Technology and DELTA, with FORCE Certification A/S taking care of approval and verification. When a new executive order on cooling meters came into effect in Denmark on 11 November 2014, the efficient infrastructure for testing, approval and verification of heat meters was reused. This enabled Kamstrup to launch the first cooling meters approved according to the new regulations as early as 28 January 2015.

Later, mutual recognition of the Danish approvals within the European Union paved the way for sales in Germany, Austria and Switzerland.

"We have benefited greatly from working with FORCE Technology and DELTA. Their collaboration is so close that on a daily basis they function as a single unit. The approvals go through quickly and the shorter time-to-market for our products allows us to start earning from our sales much faster, enabling us to hire more people. So we feel very privileged as manufacturers," says Søren Lang, Product Group Manager at Kamstrup.

**500+**  
TIMES A YEAR,

we classify imported goods, e.g. sweets, shoes and screws, so the Danish tax authority, SKAT, can determine the customs duties. We do this in our capacity as Customs Laboratory using chemical analyses, testing and consulting.

**In 1429**  
ERIK OF POMERANIA

issued a guild charter for goldsmiths requiring, among other things, that they use silver and gold of good quality. Today, the Danish Assay Office at FORCE Technology checks precious metals at suppliers and goldsmiths.

**101**  
YEARS OLD,

625 metres long and a top speed of 58 km/h. The Roller Coaster at Tivoli in Copenhagen is one of the oldest in the world, and since 1987 we have been part of everyday life at the amusement park, providing safety inspections and later consulting and non-destructive testing (NDT) services.

## > SERVICE SECTOR

### Waste is golden in Næstved

The Danish municipality of Næstved has a vision of promoting growth and innovation in the local community through a green industrial cluster with a special focus on upcycling waste into new products. The project, called Resource City, will be a national focal point for a new way of thinking about and utilising waste as a resource.

We have been asked to identify and attract companies to participate in the Resource City project. We will review a company's business concept to assess the potential for resource optimisation, green innovation and industrial symbioses with the other Resource City companies.

Even though the project will not gather speed until 2016, it has already received strong international publicity in countries such as France, China, Belgium, Germany, Russia, Brazil and Canada. Resource City has a single-digit million-euro budget.



### Energy for more

As a result of the European Union's Energy Efficiency Directive, all large enterprises are required to conduct statutory energy audits by March 2016. The individual EU countries have implemented the directive through national laws in which the requirements are specified. In Denmark, the law in question is Statutory Order No. 1212 of 19 November 2014 on obligatory energy audits for large enterprises (BEK 1212).

According to BEK 1212, companies can use an ISO-certified management system as an alternative to an energy audit. If a company already has a management system in place, an energy management system is the obvi-

ous choice. In such cases, we have helped companies to select and design an energy management system that can be certified.

Bestseller, a large Danish clothing manufacturer with 15,000 employees worldwide, has chosen to start with an energy audit:

"We've been working with FORCE Technology to determine how we can comply with BEK 1212. At Bestseller, we realise that energy will be more and more important in the years to come, and with the help of FORCE Technology we are now conducting an energy audit that can be integrated into an energy management system at a later time," explains Mogens Werge, Director of Corporate Sustainability and Communication at Bestseller.

At FORCE Technology, we know that when companies work with energy optimisation, it often competes with other aspects of the business. In collaboration with the company, we therefore focus efforts on the areas with the greatest potential benefit - and we make sure that the results are spotlighted, as this often has a motivational effect on employees.

We have a strong technical support base with specialists in energy metrology and optimisation, process energy, energy consumption in buildings etc. This means our colleagues can always draw on each other's competences, for instance in the area of energy management, where our management consultants provide specialist sparring.

### How do you help people confidently navigate Europe's largest automated car park?

The brand new multipurpose citizens' centre on the waterfront in Aarhus, Denmark's second largest city, is home to the municipal citizen services, the main public library, a café, playgrounds - and the city's

first automated underground car park which also happens to be the largest in Europe with spaces for 1,000 cars. The company Realdania By & Byg owns the car park.

This is no ordinary car park. There are 20 elevator bays where you can leave your car. The elevator then lowers the car below ground and places it on a vacant parking shelf. When you pick up your car, it does not

necessarily come up in the same elevator bay as where you left it.

Many visitors were confused about how to park and pick up their cars. We were therefore asked by Ramboll Denmark, the client consultant on the DOKK1 project, to recommend improvements of the overall car parking experience.



### Where do misleading data in telemedicine come from?

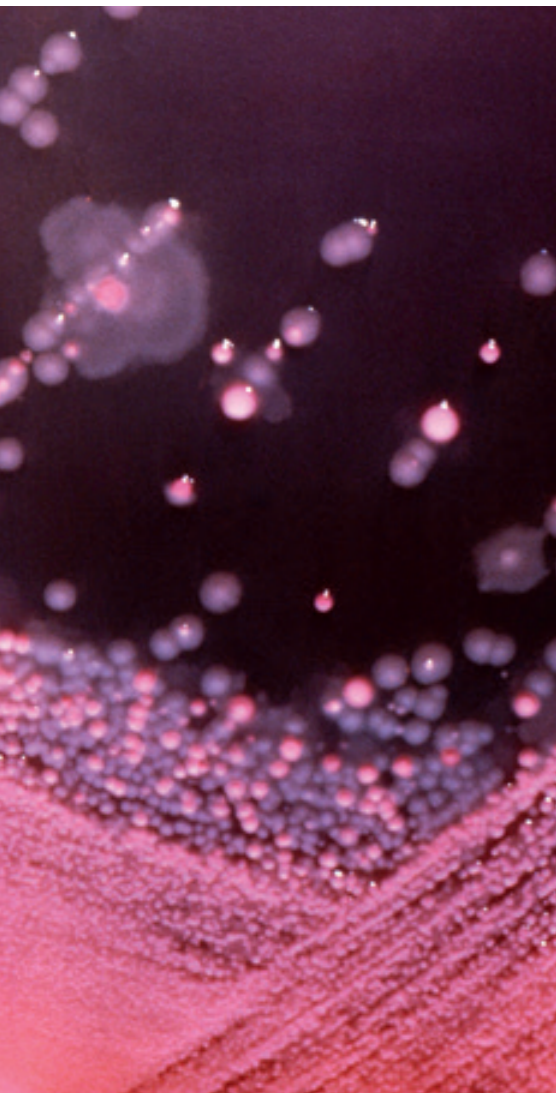
Telemedicine can make it easier to be a patient because self-monitoring means fewer visits to the doctor. In a pilot study, our psychologists investigated whether patients use telemedicine as intended.

One of the four pregnant women involved in the study deliberately chose to take her blood pressure several times and submit the lowest measurement. She understood the procedures and knew that if her blood pressure was too high, she could be hospitalised, and it might be necessary to induce labour. She felt it was best for her child to avoid a premature birth.

Thus, one source of misleading data is patients seeking to elicit or avoid a specific response from the health service. For our customers, we minimise these common sources of error in both new and existing telemedicine techniques, for instance by studying whether the users understand what they have to do, why and in what order. This helps ensure the reliability of the data.

> MANUFACTURING

# Documentation of product quality is increasingly becoming a competitive parameter



## The future of salmon farming is located offshore

Globally, 70% of all salmon consumed is farmed. However, aquaculture, has a negative impact on the environment. Salmon lice are also a serious issue. Each year, they cost the Norwegian aquaculture industry approx. NOK 500 billion in direct and indirect losses. Lice can survive at depths of up to 15 metres and inevitably infest open aquaculture systems. The long-time dream has therefore been to develop an environmentally friendly offshore solution, where there is more room for the growing industry.

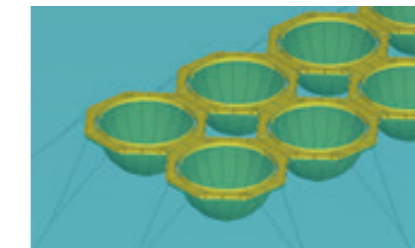
The Norwegian company AkvaDesign develops closed cages and has patented a new closed offshore system. AkvaDesign hired FORCE Technology Norway to complete the design of the closed system. They wanted cages that could be grouped together and could withstand waves of up to 2 metres.

With the help of advanced hydrodynamic modelling, Jorunn Knive Hals, senior engineer,

and Bogdan Iwanowski, principal engineer, took the lead on the final design: a wide floating collar in concrete with an impenetrable polyester skirt underneath. Nothing can get in, and nothing can get out.

Each cage has a diameter of 90 metres and can hold up to 6,000 m<sup>3</sup>. Fresh sea water is pumped up from a depth of 25 metres and the sludge from the bottom of the cages is used on land as fertiliser or biofuel. This results in salmon production with a minimal environmental footprint.

In trials with smaller models of the new design, the salmon stayed completely free of lice and the mortality rate fell to nearly 0%. AkvaDesign expects to begin manufacturing the new system in early 2016.



## 10 years in the desert in 4 months

For more than 300 years, the Danish company, DENEX, in the northern Danish town of Elling, has supplied the Danish military with a range of ammunition and services. All of their products must comply with extremely high standards of quality and must therefore be tested under every condition imaginable. DENEX uses a climate test cabinet to subject products to humidity and temperatures of between -40 °C and 70 °C. For instance, over a period of just four months, the cabinet can simulate 10 years of storage in the desert.

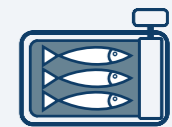
It is essential that the climate test cabinet is calibrated correctly to ensure a high degree of accuracy in the tests. Because our laboratory in Brøndby, west of Copenhagen, is the National Reference Laboratory for Pressure and Temperature, we were able to conduct traceable calibration on site for DENEX.

"We are extremely dependent on the accuracy of our tests. It is also an advantage that our supplier can come to us so we have as little impact on production as possible. This made it the obvious choice to use FORCE Technology, which has facilities in Frederikshavn," explains Bo T. Agger, Project Manager at DENEX.



**17**  
STAKEHOLDERS  
FROM THE DANISH  
TEXTILE INDUSTRY

were involved in the development of a guide to set requirements for avoiding problematic chemicals in textiles. We facilitated and qualified the work of the partnership under the auspices of the Danish Environmental Protection Agency.



**150+**  
MANUFACTURERS  
AND IMPORTERS

of food, packaging, processing equipment and kitchen articles, have received the latest information on food contact materials through our theme days, courses and consulting services, helping them to comply with the regulations and documentation requirements in Denmark, the EU and the rest of the world.

## > MANUFACTURING

### More than 80% reduction of Campylobacter in poultry

Globally, Campylobacter bacteria make more than 7.5 million people sick from food poisoning every year.

One tool for increasing food safety is SonoSteam®, which can kill the dangerous microorganisms in just 1.5 seconds using a combination of steam and ultrasound. One of the largest food manufacturers in the UK, Faccenda, has tested SonoSteam® on

their production line and the results were convincing: Normal operations showed a more than 80% reduction in the number of Campylobacter present on the chicken breast skin, back skin and neck skin, where the highest concentrations of bacteria are generally found. The measurements were conducted at the point where consumers would purchase and prepare the chicken.

Since June 2015, SonoSteam has therefore been permanently installed on the production line at Faccenda's poultry processing plant in Brackley, England.

Faccenda Foods Managing Director Andy Dawkins said: "We are very excited by the results from our in-line trials, which prove that SonoSteam® will work in the real world. There is still a great deal of work for us all to do but, as part of our wider Campylobacter Action Plan, I'm in no doubt that SonoSteam® will help us significantly reduce levels of Campylobacter and improve food safety for consumers."



### Prize for online welding production tool

CE labelling requirements for steel structures entail requirements for certification of the companies' welding methods and quality system. FORCE Technology has developed an electronic quality management tool - eQ1090.

The system was developed for small and medium-sized welding firms and makes working according to EN 1090-1 easier since every aspect of the process is documented.

This simple solution has paid dividends. At Scandinavia's hi technology and industry expo, eQ1090 won two out of a possible three stars as a Danish innovation.

In Sweden, eQ1090 is used by companies including Swans Mekaniska, which employs nine people: "eQ1090 is well set up for and integrated in our quality work. We used to just keep everything in our heads. Now things are structured, profitable and fun," explains owner Tomas Swan.

### New coating paves the way for entering new markets

On the island of Mors in northeastern Denmark, a small company, BUUS Ice, sells 2-3 metres high industrial ice machines to abattoirs, large trawlers and other customers. If the coating on the drum of the ice machine becomes damaged, the extremely heavy drum must be sent off site for repairs, which puts a stop to all production. The company therefore began exploring the market for a different type of coating.

BUUS Ice heard about the 'Production in Denmark' R&D scheme, which aims to strengthen Danish small and medium-sized manufacturing companies in a variety of ways, including by giving them access to laser welding. The project was headed by FORCE Technology and the Danish Technological Institute and co-funded by the Danish Agency for Science, Technology and Innovation.

The company had a number of requirements for the new ice machine. They needed a product that would stand out from the competition by allowing on-site repairs and



giving customers added value in the form of more ice and fewer complaints.

During the R&D process, an analysis of the drum revealed something surprising. On the inside, it was significantly heavier on one side than the other, due to different pipes. As a result, it did not turn smoothly during welding. After a number of attempts, we successfully managed to stabilise the drum. We then used laser welding to apply a new stellite coating, which has the desired durability and can be repaired on site.

BUUS Ice ran field tests of the new coating in 2015. And if everything goes as planned, they expect to start manufacturing ma-

chines with the new coating in early 2016. "A new coating will generate more revenue by distancing us from the competition. Because we use many sub-suppliers, it will also result in more jobs in the local community," explains Frank Olesen, Managing Director of BUUS Ice.

The R&D assistance provided via the 'Production in Denmark' scheme has given BUUS Ice a superior product. And because the new stellite coating has been approved by the American Food and Drug Association (FDA), they have also gained access to brand new markets in the USA and Canada. And this will generate more revenue on Mors.

### Calibration of hydraulic force gauges for aircrafts all over the world

AMETEK Denmark A/S manufactures and sells pressure gauges, hydraulic force gauges and other instruments. The hydraulic force gauges are used in the aviation industry to balance aircraft in connection with cargo loading, final assembly, servicing and repairs. For example, hydraulic force gauges take measurements at selected points to ensure an even distribution of

cargo. And when an aircraft has a new tyre fitted, a hydraulic force gauge is deployed to ensure that the aircraft stays balanced while it is lifted.

In 2015, AMETEK Denmark became solely responsible for the AMETEK Group's sales of Erichsen Wuppertal hydraulic force gauges. For us, this meant a great deal more work for AMETEK Denmark as we were now responsible for recalibrating existing dynamometers after servicing and for calibrating all new hydraulic force gauges sold to customers worldwide. This came to

a grand total of 700 hydraulic force gauges and approx. 200 pressure meters.

During the calibration process, we "exercise" the meter three times by subjecting it to maximum loads of between 40 kg and 160 tonnes, depending on the size of the meter. The third time around, we put the needle at maximum, release the load and check that the needle goes back to 0. And with one final calibration we check that the needle stays within the tolerance levels set by AMETEK as it moves from minimum to maximum.

## > THEMES

# World-class facilities, independent R&D and a technological boost for SMEs

FORCE Technology is an independently owned and operated company that provides technology consultancy to its customers and partners with unique opportunities in three key areas:

### WORLD-CLASS FACILITIES

Our consulting is backed by some of the best laboratories, equipment and testing facilities in the world. This means we can test theories in real life - regardless of whether the goal is testing and documentation or the development of products and processes.

Our staff are more than just experts at using these facilities. With one foot in the world of R&D and the other in the world of business and industry, they are able to communicate with companies on their own terms. And collaborate at all organisational levels.

### INDEPENDENT RESEARCH AND DEVELOPMENT

Every year, we brave the thin ice in various projects in order to develop new methods and technologies that are relevant for Danish and international companies. The financing comes from the companies themselves, public-sector funding, EU projects and our own R&D funding.

This means that companies of all sizes can benefit from our services as an "independent R&D department". It also gives us the opportunity to strengthen our professional insights so we can continue to be the preferred technology service partner for Danish industry as well as an internationally acclaimed business partner.

### TECHNOLOGICAL BOOST FOR SMES

We are an approved technological service

institution (GTS institute) under the auspices of the Danish Ministry of Higher Education and Science. Every three years, we are therefore entitled to apply for funding from the Danish Agency for Science, Technology and Innovation to develop new technology services within the purview of the so-called performance contracts.

As a GTS institute, we have a special obligation to boost the competitiveness of SMEs. To this end, we have a number of Innovation Agents who provide consulting on new technology and business development. SMEs can meet us through innovation networks across Denmark and work with us in a range of R&D projects to test how new technology can promote growth.



## > FACILITIES



**Jesper Busk is the driving force behind the world's largest closed high-pressure facility for natural gas meters. A facility that very few believed possible to build**

“On Monday, 23 September 2013, one of my own personal goals was achieved: FORCE Technology became part of the European Natural Gas Cubic Meter cooperation known as EUREGA – an exclusive club of metrological institutes that provides global traceability. A year and a half later, we were able to open the world's largest closed

high-pressure calibration facility for natural gas.

Few believed a facility of this size was actually possible. In fact, people in the industry warned me against attempting it. And it was an uphill struggle at times. Even though we had experience of building a smaller calibration facility, we were working with extremely powerful forces.

We designed, calculated and built the facility ourselves. Something that was only possible because we had all the necessary competences in-house. That has probably been the most positive experience for me – seeing our knowledge and perseverance combine to

good effect. Getting a team of very different experts to talk to each other and work hard day and night to get the job done.

In my 32 years with FORCE Technology, I have proposed to management a number of new opportunities for strengthening our position. And they have given me the go-ahead. It is extremely motivating to know that they have faith in me and in my employees.”

**Jesper Busk**  
*Head of Department, Gas Flow*

### EXPANDED CALIBRATION OF WATER METERS

We have built a new fully-automated test facility for accredited calibration of water meters at a flow of up to 1,000 m<sup>3</sup>/h – in special circumstances even up to 1,200 m<sup>3</sup>/h, depending on the static pressure.

With an uncertainty of only 0.40%, we can now calibrate six types of meters ranging in diameter from DN 25 up to DN 300: Coriolis, magnetic inductive flow (MAG), ultrasonic, vortex, turbine and differential pressure.

The test facility is one of the largest in northern Europe and covers a flow area that otherwise has very few service providers. This makes us a one-stop-shop for our customers' calibration needs. We calibrate the meters by comparing the measured volume to the volume measured in our 2 MAG reference meters.

### FULL-SCALE TESTING CAN DOCUMENT THE PRODUCT QUALITY

A new component and foundation test centre for advanced full-scale tests is being built at the former Danish shipyard, Lindoe. The facility will offer a wide range of options for the offshore sector as well as for manufacturers of ships, rescue equipment, lorries and tankers.

In both the climatic chamber and the mechanical test bench, companies will be able to commission extremely reliable accelerated lifetime tests. The test results will help in reducing the cost of energy and ensure the manufacturers a competitive design.

The climatic chamber will be 8 x 8 x 14 metres – large enough for a tank. We will also be able to carry out functional testing of e.g. air conditioning systems for wind turbines to ensure secure operations in temperatures ranging from -38 °C to +60 °C, in humid conditions and in sea spray. Siemens will be inaugurating the test bench

in spring 2016 with the testing of a new k-node for a wind turbine foundation as part of a publicly financed project under the Energy Technology Development and Demonstration Programme (EUDP). Each k-node weighs 20 tonnes.

The component and foundation test centre will be operated as a partnership between the Lindoe Offshore Renewables Center (LORC) and FORCE Technology. We will be responsible for daily operation, including test design, results evaluation and consulting regarding improvements of design, materials and processes.

### GET RESULTS 100 TIMES FASTER

With a newly acquired X-ray detector for our electron microscope, we can carry out elemental microanalyses of almost any solid material. This means the results are available 100 times faster and in much more detail than with previous detectors.

The detector is used to reveal the elemental composition of a surface. For instance, as part of the routine maintenance of steel tanks in the pharmaceutical industry, it is used to check for rust staining, known poetically as 'rouge'. The inside of a tank is wiped with a cloth, which is then analysed with the X-ray detector. This will reveal the minutest amounts of rouge on the cloth.

The detector has also been used to analyse fire-damaged materials in a major international accident investigation as well as to reveal faults in aircraft engines simply by analysing the particles collected from the engine's oil system.



## 6 LABORATORIES

in Denmark, Sweden and Norway cover our customers' needs for analysing fuels, microbiological samples, metals, plastics, composites, concrete, toys, jewellery, foods and water.

# 1,500 km

IS THE DISTANCE COVERED BY SHIP MODELS

in our towing tank in 2015. At full scale, this corresponds to sailing once around the Equator.



# 60 KM/H

IS A PROFESSIONAL RACING CYCLIST'S TOP SPEED

Streamlined gear can be decisive in the final sprint, which is why Team Denmark sent their cyclists into our wind tunnel to measure the wind resistance of various helmets. Two days later we found a winner.

## › RESEARCH AND DEVELOPMENT



### Four years of demanding R&D work has resulted in the world's most sensitive underwater sensor: FiGS. And the man behind the technology, Jens Christofer Werenskiold, is continuing his work

"Developing FiGS was particularly demanding because all the components had to be specially designed to work at a depth of 3,000 metres. We're talking material selection down to individual screws. Our success depended on FORCE Technology's specialist knowledge in corrosion protection and other

areas. My boss always believed in the product, as did our partners. Being surrounded by people who believe in you and the project is a powerful driving force.

Now we are a four-person team working to enhance the electronics and tailor FiGS for inspection of all types of underwater structures. The software is also continually being developed and optimised so we can generate faster results for our customers.

At FORCE Technology Norway, I've had a great deal of freedom to work with R&D and the opportunity to be involved in the entire process. I feel a sense of

pride every time my colleagues and I achieve something.

Our most recent breakthrough was in 2015, when FiGS conducted its first inspection of a so-called Christmas tree – in 3D! A Christmas tree, which controls the flow of the oil well, has a very large number of pipes and pipelines connected. So the inspection is extremely demanding. But we have even more R&D projects lined up."

**Jens Christofer Werenskiold**  
*Principal Engineer, Corrosion & Materials Technology*

### NEW REMOTE-CONTROLLED ROBOT STREAMLINES INSPECTIONS

On the Great Belt Bridge, a robot scrambles around inspecting the approx. 63-metre-high anchor blocks. It is a newly developed, remote-controlled robot with caterpillar tracks, a so-called "crawler". It uses a special vacuum concept to attach itself to and move around on non-magnetic surfaces.

The crawler was developed by FORCE Technology under the auspices of the national innovation network RoboCluster, which brings together competences within robot technology research, development and design. The robot is still a prototype, but in 2015 we successfully completed test runs on the Great Belt Bridge in collaboration with A/S Storebælt and on wind turbine blades in collaboration with Siemens Wind Power A/S.

There is huge potential in the remote-controlled crawler, as it can operate in places that are difficult for humans to reach. It will make inspecting bridges, wind turbine blades, building structures etc. safer, faster and cheaper.

The development of sensors for the crawler will continue in 2016 through a three-year R&D project co-financed by the Danish Agency for Science, Technology and Innovation.

### 3D PRINTING OF TOOLS

Thürmer Tools is a Danish company that has been developing and manufacturing a wide range of cutting tools for more than 100 years, including tools for cutting threads in holes for bolts to be fastened.

As part of MADE (the Manufacturing Academy of Denmark), which aims to strengthen manufacturing in Denmark, Thürmer Tools initiated a demonstration project to compare the characteristics of 3D printed tools with those of traditionally manufactured tools.

3D printing presents new opportunities for threading tool design, offering better cooling and higher durability. Furthermore, the customer can have their tool 3D printed on demand so that Thürmer Tools saves inventory space.

We are testing the 3D printed tools with fatigue tests and application trials. The evaluation of the results will be ready in early 2016.

### MORE INFORMATION AND IMPROVED SAFETY WITH NEW UNDERWATER TECHNOLOGY

We are seeing a dramatic increase in the number and complexity of underwater structures, such as pipelines and wind turbine foundations. However, the current technology for documenting the condition of such structures is extremely time consuming, costly and limited. It provides very little information because the equipment must rise to the surface after each exposure. This makes it very difficult to produce a qualified safety assessment with continued operation.

During a three-year R&D project, we have developed a new technique – digital underwater radiography – which can continuously generate and deliver real-time data without the equipment having to rise to the surface. Our technology is designed to be operated at depths of 100 metres and is remote-controlled from the surface using a mini submarine called a Remote Operated Vehicle (ROV).

On 4 November 2015, champagne bottles popped when a demonstration proved that the technology works under water. The Danish Agency for Science, Technology and Innovation co-financed the project and has now granted an extension of the funding for another three-year period, during which we will investigate the possibility of producing 3D visualisations of the data collected.

# 19

## R&D PROJECTS

are included in our new three-year performance contract with the Danish Agency for Science, Technology and Innovation. On 1 January 2016, the work begins on developing new technological services within the following themes:

- Increased productivity
- Advanced materials and product innovation
- Green energy and environmental solutions
- Effective and intelligent quality assurance
- Metrological and maritime infrastructure.

These themes cover areas in which we know that both industry and society face challenges. They are also areas where technological innovation would make a difference.

# 111

## SOLID WASTE SAMPLES WERE ANALYSED

for 5 different physical and chemical parameters to support a PhD project from DTU Environment. The combined dataset is an important basis for future environmental assessment of waste management solutions in Denmark.

> SMEs



**Laser welding may sound like something straight out of the future. In fact, the technology is already available, as was showcased by Peter Tommy Nielsen in an R&D project aimed at Danish SMEs**

“With the ‘Production in Denmark’ R&D project, we wanted to make a difference in the here and now utilising technology that hadn’t been sufficiently implemented in the industrial sector. I was one of six activity managers from FORCE Technology and the Danish Technological Institute who each or-

ganised interdisciplinary events to give companies a professional shot in the arm. SMEs work hard day in and day out to survive international competition. My goal was to enable them to take the right decisions regarding technology. To give them the knowledge they needed to use laser welding in their own production areas. For instance, through some of the subcontractors they met during the course of the project.

For me, it’s about solving problems and achieving results. At FORCE Technology, I’m involved in a variety of tasks, and there is a good spirit of interdisciplinary

cooperation, which enables us to develop the best possible solutions for our customers.

We’ve been on quite a journey with these companies, and many of them will stay in contact with FORCE Technology in the future. They’ve learned that R&D projects make a difference for SMEs and are worth the time.”

**Peter Tommy Nielsen**  
*Project Manager,  
Welding Innovation*

**DYNAMICA ROPES PUTS GOOD MANAGEMENT INTO THEIR WEAVE**

In the past year, Dynamica Ropes, which manufactures extremely strong fibre ropes primarily for the offshore and wind energy industries, has been on quite a journey in close collaboration with our Senior Consultant Jens Ulrik Hansen. It all started with a visit by an Innovation Agent, who recommended the company, headquartered in central Denmark, to boost their business processes with a MADE (Manufacturing Academy of Denmark) demonstration project. MADE aims to strengthen manufacturing in Denmark, focusing especially on SMEs.

First, the company’s processes were mapped. Then, the employees’ ideas and input were translated, in collaboration with management, into new action plans and targets. The crowning achievement was when the company’s management system became so streamlined that Dynamica Ropes was issued an ISO 9001 certificate. This has opened up an entirely new market and allowed the company to invest in new manufacturing and testing equipment.

For Dynamica Ropes, however, the transition has always been about one very simple thing – making their customers happy. And it has worked. At the end of 2015, Dynamica Ropes won the prestigious Gazelle Award as one of the fastest-growing companies in Denmark.

**ONE-STOP-SHOP FOR CONNECTED WIND SERVICES**

What do you do with a broken wind turbine shaft that is simply too big to be worked on? Independent service provider Connected Wind Services was faced with this very challenge. The shaft had a diameter of 630mm with an 1,800mm flange. However, the shaft was too big for their usual partner to handle. Quality Inspector John Christensen therefore contacted us for advice. The solu-

tion came via our powerful network, which we have developed over the years through, among other things, numerous R&D projects in collaboration with SMEs. We were able to refer them to MarineShaft, which specialises in shafts from e.g. supertankers and can handle parts up to 4,000mm in diameter. We then set off for MarineShaft with our mobile equipment and repaired the shaft so that Connected Wind Services could get the wind turbine up and running again.

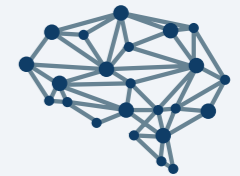
**A CARGO BIKE WITH A BIOCOMPOSITE BOX**

The Danish company Christiania Bikes® has been manufacturing cargo bikes for practical transport since 1984. Over the years, the company has optimised the design, focusing on utilitarian value, sustainability and functionality.

In collaboration with The Industry’s Composite Laboratory, Christiania Bikes® has tested a biocomposite, an environmentally friendly material comprised of natural fibres, as an alternative to the heavier plywood from which their cargo bike boxes are currently made.

We constructed bicomposite panels and mounted them on a cargo bike. Durability tests demonstrated that the box was at least as weather-resistant as the current box. The next step will be to cast the box in a single piece to avoid having to use a supporting frame and brackets. This will open up new design possibilities, make the box even lighter and reduce man-hours in the assembly process.

FORCE Technology, the Technical University of Denmark and Aalborg University joined forces to establish The Industry’s Composite Laboratory to promote the innovative use of composite materials by smaller manufacturing companies. The project receives funding from the Danish Agency for Science, Technology and Innovation.



**2,350**  
DANISH COMPANIES

received new technological insights from one of our 17 R&D projects in the period 2013-2015. The projects were co-financed by the Danish Agency for Science, Technology and Innovation.

**4**  
INNOVATION AGENTS FROM FORCE TECHNOLOGY

helped small and medium-sized enterprises to grow:

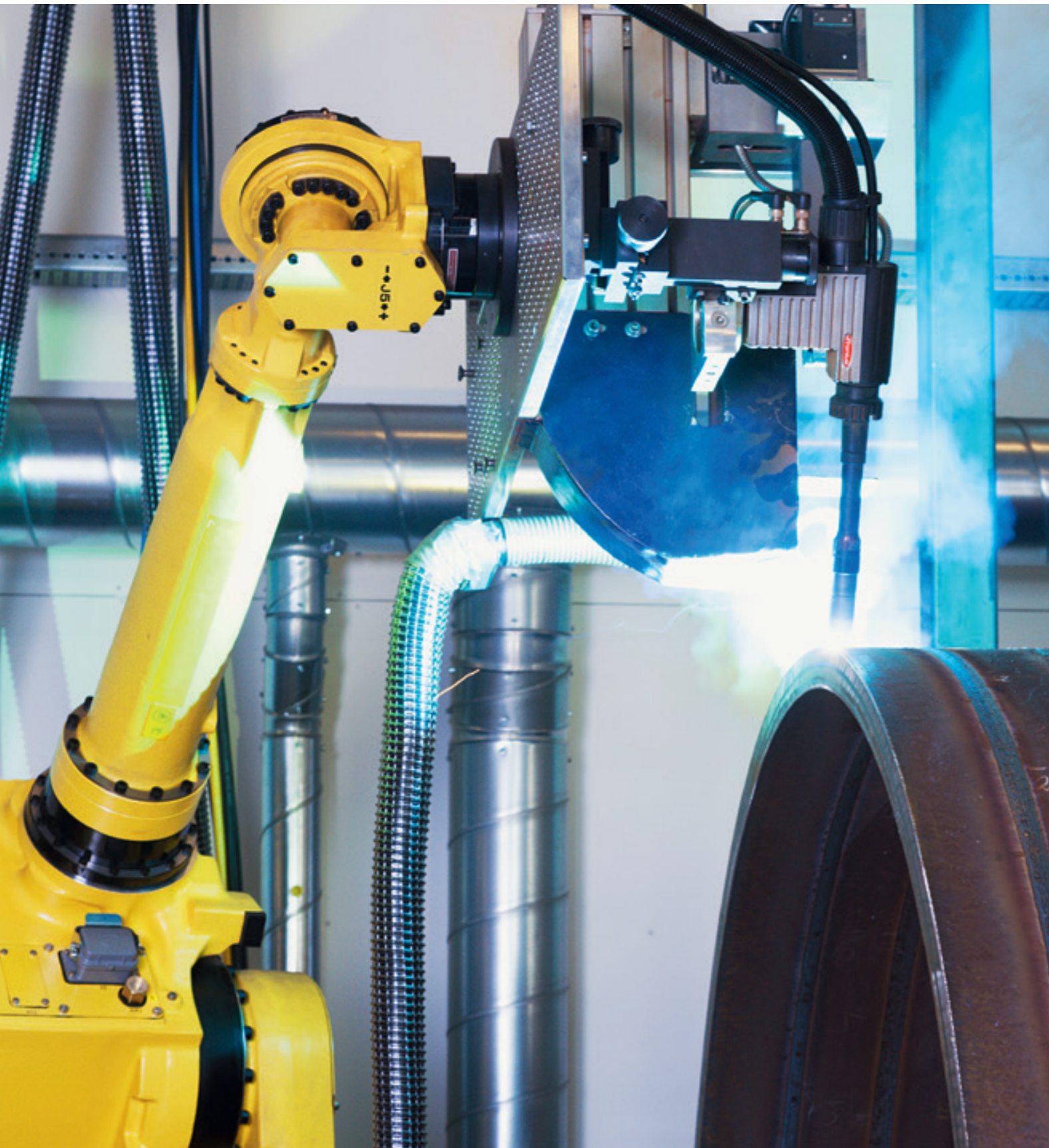
109 SMEs received an innovation check, where private consultants, innovation networks, universities etc. helped with further technological innovation.

43 SMEs were advised about the innovation vouchers and received grants totalling almost DKK 4 m, of which DKK 2,5 m was in the form of product, process or service development from us.

Both schemes were co-financed by the Danish Agency for Science, Technology and Innovation.



> EXTRACT OF THE CONSOLIDATED  
ANNUAL REPORT 2015



**Profit & loss account  
1 January - 31 December**

	CONSOLIDATED COMPANY	
	2015 DKK 1,000	2014 DKK 1,000
<b>CONSOLIDATED TURNOVER</b>	<b>1,190,554</b>	<b>1,224,797</b>
Expenses directly related to projects, outlays	222,131	243,567
Other external expenses	119,654	113,430
Personnel expenses	774,278	781,876
Depreciation and write-downs	66,536	56,890
<b>OPERATING PROFIT</b>	<b>7,955</b>	<b>29,034</b>
Share of profit or loss	-536	-48
<b>PROFIT BEFORE INTEREST, ETC.</b>	<b>7,419</b>	<b>28,986</b>
Financial income and expenses, net	-4,600	-2,533
<b>PROFIT BEFORE TAX</b>	<b>2,819</b>	<b>26,453</b>
Tax	1,536	3,577
<b>PROFIT BEFORE MINORITY INTERESTS</b>	<b>1,283</b>	<b>22,876</b>
Minority interests	-15	565
<b>PROFIT FOR THE YEAR</b>	<b>1,268</b>	<b>23,441</b>

## > EXTRACT OF THE CONSOLIDATED ANNUAL REPORT 2015

### Balance as of 31 December Assets

	CONSOLIDATED COMPANY	
	2015 DKK 1,000	2014 DKK 1,000
<b>ASSETS</b>		
<b>FIXED ASSETS</b>		
Goodwill	24,757	32,621
Development projects under construction	10,087	42,427
<b>TOTAL INTANGIBLE FIXED ASSETS</b>	<b>34,844</b>	<b>75,048</b>
Land and buildings	158,983	98,602
Equipment under construction	10,095	61,343
Furniture and equipment	208,494	146,718
<b>TOTAL TANGIBLE FIXED ASSETS</b>	<b>377,572</b>	<b>306,663</b>
Participating interests	11,071	11,535
Other financial assets	1,865	1,863
<b>OTHER FINANCIAL FIXED ASSETS</b>	<b>12,936</b>	<b>13,398</b>
<b>TOTAL FIXED ASSETS</b>	<b>425,352</b>	<b>395,109</b>
<b>CURRENT ASSETS</b>		
Work in progress and stocks	80,510	76,165
Debtors, work in progress and completed work	223,293	221,450
Other debtors	39,638	42,662
Securities	15	42,196
Cash and bank balances	28,505	62,350
<b>TOTAL CURRENT ASSETS</b>	<b>371,961</b>	<b>444,823</b>
<b>TOTAL ASSETS</b>	<b>797,313</b>	<b>839,932</b>

### Liabilities

	CONSOLIDATED COMPANY	
	2015 DKK 1,000	2014 DKK 1,000
<b>LIABILITIES</b>		
<b>CAPITAL AND RESERVES</b>	<b>361,592</b>	<b>360,176</b>
<b>MINORITY INTERESTS</b>	<b>471</b>	<b>376</b>
Deferred taxes	5,160	6,590
Other provisions	2,000	1,379
<b>TOTAL PROVISIONS</b>	<b>7,160</b>	<b>7,969</b>
Bank debt	19,000	19,000
Prepayments	7,301	7,301
Mortgage debt	116,002	125,433
<b>TOTAL LONG-TERM DEBT</b>	<b>142,303</b>	<b>151,734</b>
Mortgage debt	9,203	6,667
Bank debt	25,432	39,172
Creditors and accrued costs	53,439	60,350
Advance payments and invoicing	19,454	26,587
Other creditors	178,259	186,901
<b>TOTAL SHORT-TERM DEBT</b>	<b>285,787</b>	<b>319,677</b>
<b>TOTAL DEBT</b>	<b>428,090</b>	<b>471,411</b>
<b>TOTAL LIABILITIES</b>	<b>797,313</b>	<b>839,932</b>

## > BOARD OF DIRECTORS & MANAGEMENT

### BOARD OF DIRECTORS

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Executive Officer

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Market & Innovation

**Lars Vesth**  
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Information & Business Processes

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**Annette Ejsing**  
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Managing Director

**FORCE Certification A/S**  
Hans Falster  
Managing Director

**FORCE Technology Singapore II  
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Dynamica Ropes page 39

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