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DIALOGUE

A JOURNAL FROM THE NORWEGIAN OCEAN INDUSTRY AUTHORITY

ARE WE PREPARED?

TOTAL DEFENCE YEAR 2026

Photomontage: ELISABETH KJØRMO

BE PREPARED!

2026 is the Total Defence Year, and the theme of this edition of *Dialogue*.

The total defence concept was originally developed by the Norwegian government-in-exile in London during World War II. Today, it denotes the mutual support and cooperation between the Armed Forces and civil society in peace, crisis, armed conflict and war.

In times of severe crisis or war, the Armed Forces and civil society must work together closely. The goal is to ensure that critical societal functions operate as normally as possible. Activities on the shelf and onshore petroleum facilities are a part of this.

Preparing total defence for crisis and war is a top priority, and a part of our national security strategy.

Norway currently finds itself in the most serious security policy situation since 1945.

The Total Defence Year 2026 calls for a national effort to strengthen our ability to prevent and manage security policy crises and war.

We can no longer take peace for granted.

We must have faith that the unthinkable won´t happen, whilst building the resilience that might be needed.

It means thinking through how we might be affected, as well as planning, practising and ensuring that we are able to handle various situations, also in times of crisis and war.

In short: We must be prepared.

Øyvind Midttun,
editor

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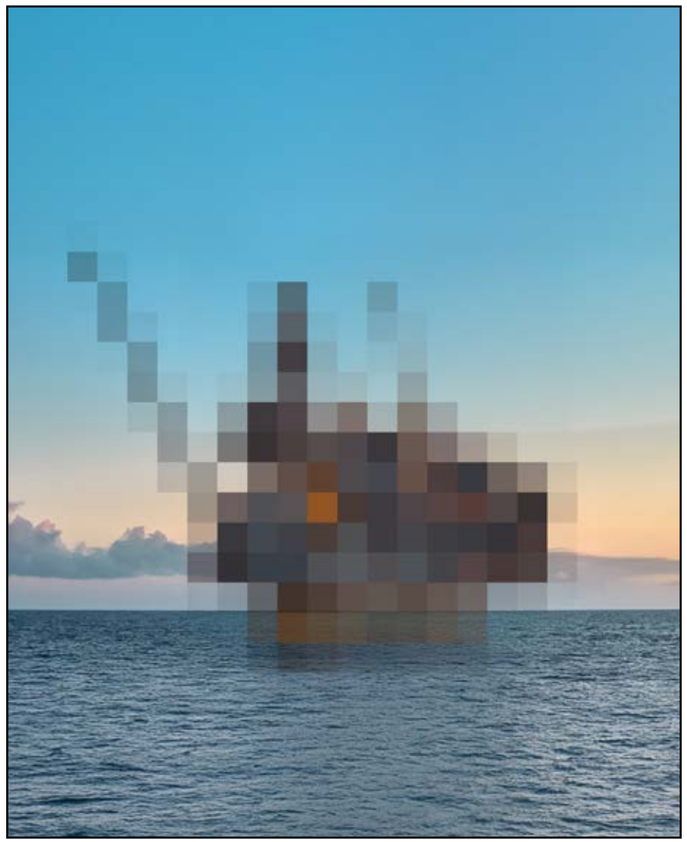


If the unthinkable should happen

Text: ØYVIND MIDTTUN **Photomontage:** ELISABETH KJØRMO

The Total Defence Year 2026 will strengthen Norway's ability to prevent and manage security policy crises and war. "We must be prepared for the worst," says Havtil director Sigve Knudsen.

Norway is facing the most serious security policy situation since World War II. The world is more unpredictable, and the threat landscape is serious.

This is the backdrop for the national strengthening of total defence through the Total Defence Year 2026. Havtil - and the petroleum industry - have an important role to play.

"The message from the top is that Norway must prepare for war. This is a serious, yet necessary message," emphasises Havtil director general Sigve Knudsen.

"We are not currently at war, but nor can say that there is peace. We are somewhere in between.

"When the environment changes so fundamentally, society must also change how we think about security and emergency preparedness. The Total Defence Year is a precise expression of this," says Knudsen.

THE TOTAL DEFENCE YEAR

The overarching goal for the Total Defence Year 2026 is to strengthen Norway's ability to prevent and manage security policy crises and war.

Knudsen points out that building resilience is key.

"Being prepared for war also prepares us for other types of crises. It's about absorbing the seriousness of the situation, about planning, practising and having the ability to handle situations as needed."

SECURITY STRATEGY

The national security strategy and the white paper on total preparedness (Report No. 9 to the Storting (2024–2025) were presented in 2025. Both are of direct relevance to Havtil and the organisations within the agency´s remit, and contain important guidelines for the work on total defence.

The goal of the white paper is to ensure →

TOTAL DEFENCE YEAR 2026

The overarching goal of the Total Defence Year 2026 is to "strengthen Norway's ability to prevent and manage security policy crises and war".

This means strengthening:

- Resilience in critical societal functions
- The ability to protect the civil population
- Civil ability to support military operations
- Ability to provide host country support
- Resilience of the population

(Source: Directorate for Civil Protection and Emergency Planning – DSB)

TOTAL DEFENCE
Total defence is a collective term for the country's military dispositions and civil preparedness.

Total defence includes support and collaboration between the Armed Forces and civil society on prevention, emergency response planning and operational conditions.

Its object is to ensure that society is able, in every type of emergency, to maintain a functioning national crisis management, deal with large numbers of injured people, secure food, water and energy supplies, and maintain communication and transport systems.

HAVTIL'S ROLE IN TOTAL DEFENCE
Havtil has been assigned responsibility for societal safety within its area of authority. This includes assisting the Armed Forces with sector knowledge. Our job is to help ensure that the Armed Forces are equipped with the best knowledge and information regarding our sector. This applies to both incident management and planning work.

that civil society is prepared for crisis and war and to develop a society that supports military efforts and resists complex threats. The national security strategy builds on this foundation and outlines three main strategic priorities for how to strengthen our defence capability, make society more resilient and strengthen economic security.

EXPECTATIONS
"For the petroleum industry, the expectations are very clear in both the national security strategy and the white paper on total preparedness. The documents establish that the business sector owns, operates and develops critical infrastructure, which plays a crucial role in our ability to ensure continuity in critical societal functions and for civil support for military operations," says Knudsen.

"The national security strategy underlines the need to strengthen our ability to protect and repair critical infrastructure on the shelf in close collaboration with our allies.

"For the petroleum industry, this means that the companies must understand the threat and risk landscape, recognise their own vulnerabilities and be able to maintain operations even during more serious incidents. There are clear expectations of self-preparedness, of good plans for recovery and of contributing to total defence through closer collaboration, information sharing and exercise drills with the authorities."

INCREASED AWARENESS
Knudsen encourages the companies to take advantage of the Total Defence Year to strengthen preparedness, collaboration and awareness of the threat landscape.

"Havtil will be a visible stakeholder in the Total Defence Year 2026. We will contribute to an increased understanding of what total defence is, of our role and of what is expected of the businesses within our sector," says Sigve Knudsen.

"Things are connected. Great demands are placed on companies, organisations and agencies, and on safeguarding societal functions. But resilience is also about individual actions. If you practise self-preparedness at home and are self-sustainable, this will in turn benefit your work environment, and thus society's ability to function when it really matters.

"Self-preparedness at an individual level results in less vulnerability, less strain on critical functions and greater room for manoeuvre in a crisis," Knudsen emphasises.

"In war or crisis, maintaining societal functions will be crucial. Schools, postal services, food production and fuel – everything must work. Petroleum activities are a part of this picture, and thus a natural part of total defence." ■

National security strategy

The national security strategy outlines three main strategic priorities for safeguarding our fundamental national interests.

In 2025, the government presented Norway's first national security strategy. This is an overarching and indicative document detailing how Norway should protect its fundamental interests at a time characterised by increased unpredictability and serious security challenges.

The strategy is based on six fundamental national security interests:

- A free and independent Norway
- A strong democracy
- A safe and trusting society
- An open and adaptable economy
- An allied community and unity in Europe
- A world that seeks solutions based on international law

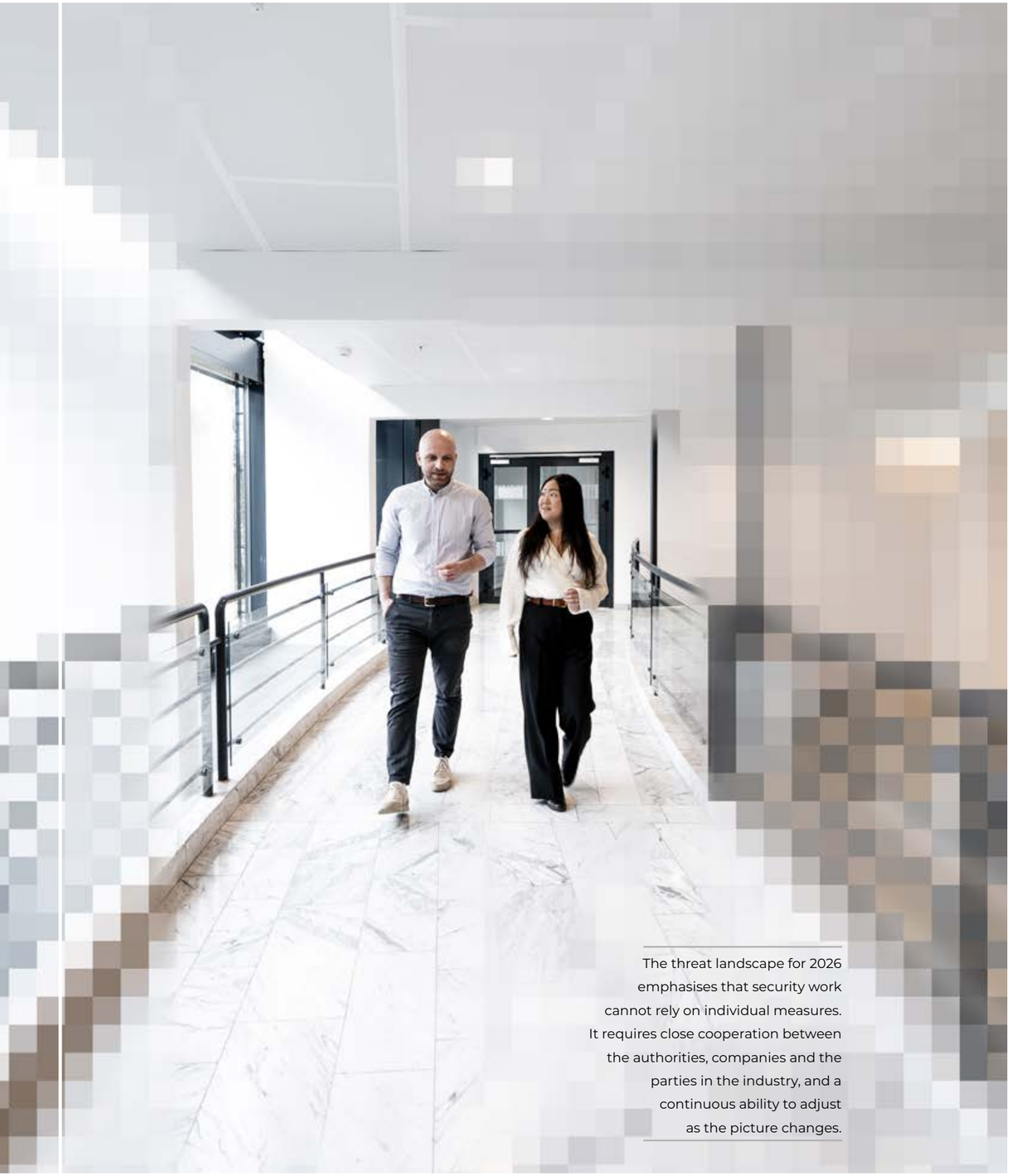
The world has become a more dangerous and unpredictable place. Security policy gravity has increased, and there is deep uncertainty on multiple significant levels. The strategy points not least to Russia's war against Ukraine and its long-term consequences for global and European security. But there are also several other fundamental changes at play of major significance to Norwegian security and to our priorities.

To meet these challenges and safeguard our fundamental national security interests, the strategy outlines three key priorities:

1) Rapidly strengthen defence capability: A more dangerous and unpredictable situation requires that we quickly strengthen defence capability nationally and in collaboration with our allies. We must allocate more resources to security, defence and emergency preparedness.

2) Make society more resilient: We must strengthen our ability to prevent, detect and deal with threats, becoming better equipped to deal with serious incidents.

3) Reinforce economic security: We must strengthen the competitiveness of the Norwegian economy, reduce vulnerabilities vis-à-vis countries with which we do not collaborate on security, and strengthen economic cooperation with our allies and partners. ■



The threat landscape for 2026 emphasises that security work cannot rely on individual measures. It requires close cooperation between the authorities, companies and the parties in the industry, and a continuous ability to adjust as the picture changes.

The threat assessment for Norwegian petroleum activities

Text: EILEEN BRUNDTLAND **Photo:** ELISABETH KJØRMO

The threat and risk assessments for 2026 paint a challenging picture of geopolitical tension, growing cyber threats and sustained interest in Norwegian energy infrastructure. This makes clear demands on the petroleum industry´s work on security and emergency preparedness.

When the Norwegian Intelligence Service, the Norwegian Police Security Service (PST) and the National Security Authority (NSM) published their open threat and risk assessments for 2026 in February, they described a security picture of enduring rivalry and shifting parameters for international cooperation.

The services emphasise resilience work as core to the civilian sector, whilst warning against self-induced fear.

"The threat landscape should not be used as a definitive answer, but as a description of the threats around us and the direction of development. It's about building resilience through systematic and holistic work over time," says Meriton Agushaj, who works in the Security field at Havtil.

GEOPOLITICAL PRESSURE

The Norwegian Intelligence Service places Norway in a security policy landscape affected by geopolitical developments. Russia is described as an actor combining overt, covert and influence-oriented means to shape European decisions. It also indicates the development of capacities aimed at critical underwater infrastructure, relevant for pipelines, cables and other subsea systems in Norwegian waters.

The assessments pinpoint military activity in northern sea areas - some within proximity of Norwegian civilian and commercial activities - and the use of measures potentially affecting navigation and infrastructure. This is seen as part of a broader geostrategic development.

China is depicted in the same landscape, where the country develops its room for →

”Resilience is as much about overview and practice as it is about technology”

Meriton Agushaj works in Havtil’s area of Security.

manoeuvre through economic and industrial means.

DIRECT AND INDIRECT CONSEQUENCES

Norway is a stable supplier of oil and gas to Europe. Infrastructure on the shelf and onshore facilities is therefore of strategic interest to foreign states. PST assumes that activity will increasingly take place covertly. Mapping, influencing and the use of proxies are described as the most likely forms of activity. Sabotage is also seen as a possibility. Russian services are paying close attention to military conditions, allied activity, Norwegian support to Ukraine and infrastructure along the coast.

“It is the sum of activity over time that is important to understand. Companies must consider both direct and indirect consequences in their risk assessments,” says Agushaj.

HOLISTIC APPROACH

NSM’s risk assessment for 2026 highlights holistic security management as a prerequisite for resilience. Their investigations reveal lack of anchoring, implementation and the ability to strengthen security measures when the risk level changes. This is consistent with Havtil’s findings in the petroleum sector.

NSM also points to personnel safety as a persistently challenging area. Inadequate follow-up and a poor information flow can make it difficult to identify vulnerabilities in time. Physical security measures may become outdated as threat actors develop new methods. Complex supply chains and unclear ownership structures can establish leverage points within value chains, making critical functions more vulnerable.

The report emphasises that being proficient in individual areas is not sufficient. Security work must include digital and physical security, roles and responsibilities, planning, personnel safety and security culture.

CYBER SECURITY MUST BE SAFEGUARDED

The threat landscape in the cyber domain is persistent and serious. According to PST, this is where the greatest threat lies. They consider it likely that Norwegian businesses will be affected by cyber operations in 2026, and that an increasing number of attacks will succeed.

“In the cyber domain, it´s a matter of ensuring that the bar hasn´t been set too low and that the measures are adapted to the current risk landscape. It’s about being prepared,” says Linn Steensrud Øverland, who works within cyber security at Havtil.

Technological developments make it easier for sophisticated actors to carry out advanced attacks. At the same time, those with fewer resources will have greater scope for opportunities.

Artificial intelligence will be a key component in future cyber operations, particularly related to influence, espionage and sabotage operations.

NSM points to vulnerabilities in unsecured industrial control systems, known as OT (Operational Technology) systems. They cite lack of segmentation, unsecured remote access, inadequate updating of software and insufficient surveillance that can be exploited when companies have an insufficient overview of their own systems. It is therefore important that the companies focus on building organizational and technological resilience.

Linn Steensrud Øverland works with cyber security at Havtil.

“Resilience is as much about overview and practice as it is about technology,” emphasises Steensrud Øverland.

HAVTIL’S ROLE

Havtil is responsible for following up and safeguarding civil protection, security and emergency preparedness within our area of authority. Section 9-3 of the Petroleum Act requires licensees to implement and maintain security measures and to have contingency plans for deliberate attacks. Havtil is also the supervisory authority under the Security Act for the petroleum sector.

The threat landscape for 2026 emphasises that security work requires close cooperation between the authorities, companies and the parties in the industry, and a continuous ability to adjust as the picture changes. ■

THE NORWEGIAN INTELLIGENCE SERVICE (E-TJENESTEN)
is Norway’s foreign intelligence service under the authority of the Chief of Defence. Provides intelligence on circumstances abroad of significance to Norway’s security.

THE NORWEGIAN POLICE SECURITY SERVICE (PST)
is Norway’s national domestic intelligence and security service under the authority of the Ministry of Justice and Public Security. Prevents and investigates serious crimes against the nation’s security.

NATIONAL SECURITY AUTHORITY (NSM)
is Norway ‘s Directorate for Preventive National Security. Advises, supervises and coordinates the handling of serious cyber attacks against critical infrastructure.

Before, not afterwards

Text: ØYVIND MIDTTUN

If important societal functions are to be maintained in crisis and war, the business sector has an important role to play. The industry organisation Offshore Norge points to several key issues that should be discussed and clarified – before the crisis happens.

"It's a simple question, but a difficult one to answer briefly," says Aud Nistov of Offshore Norge when asked to assess whether the petroleum industry is prepared for crisis and war. She believes that the Total Defence Year 2026 must be used to create a common understanding of roles, responsibilities and dependencies - both in the industry and in interaction with the authorities.

"If we read the white paper on total preparedness and what it implies, the message is clear: The whole of society must be prepared for crisis and war - civil society and each and every one of us – it´s about self-preparedness, and taking individual responsibility," says Nistov.

"For the business community, it means something else," she emphasises – "how businesses can help ensure that society, or "Norway Inc.", functions in a crisis or war situation."

"We are talking about very basic functions. That most of the electricity grid is operational. That people have clean drinking water. That plumbing, heating and sanitation work. That there are transport resources to handle waste. That food can be distributed to the shops. That the health services function, in terms of personnel, operation and deliveries of medicine and equipment."

"This list is not exhaustive," Nitov explains, "but it illustrates the breadth of challenges to be handled."

SUPPLYING ENERGY

"The petroleum industry´s most important contribution to total defence is to do what we already do: Supply energy. Norwegian gas is crucial for Europe. If Norway finds itself in crisis, it is not only we who will be affected. The consequences will be felt by much of Europe," says Nistov.

Aud Nistov (**Photo:** OFFSHORE NORGE)

She refers to new issues that have come to light this spring, not least due to the situation in the Middle East and the closure of the Strait of Hormuz.

"We are a producer of fuel and raw materials for various types of fuel, but where are we on self-sustainment? In terms of diesel, petrol and aviation fuel to the transport industry and private stakeholders - including helicopter transport to and from the Norwegian continental shelf - and for the Armed Forces?"

"Fuel supply is defined as a fundamental national function and involves meeting the needs of the Armed Forces and civilian users who are important for national security interests. We need to ask ourselves: Do today's supply chains work in a crisis or war situation? Or are there vulnerabilities that we haven´t taken seriously?"

AGREED ON THE DECISIONS

In her view, it is important that such issues are discussed jointly, so that the industry, the authorities and consumers agree on the decisions to be made.

Nistov believes the most frightening outcome is that security is taken for granted. That people assume that it will "all work out", because Norway is a large petroleum nation. Too little refinery capacity or the wrong type of infrastructure can quickly prove a false sense of security in a world where supply lines do not necessarily work as they used to.

Energy is another example. An analysis was carried out of the effect on various industries if 30 percent of the energy supply was lost. Initially, the economic consequences looked surmountable, but the figures were based on inaccurate assumptions. Realistically, the consequences could be enormous. A 30% cut in an oil producer´s energy supplies could halt production completely.

WHO COORDINATES?

Nistov also outlines challenges related to personnel and resources. Systems handling compulsory work duty and redeployment may be sensible, she says, but also raise the question of who is responsible for coordination and for avoiding or resolving conflicts.

"The same applies to transport resources. The Armed Forces increasingly use private suppliers, for example for transport capacity. But the same trucks can also be called upon by the Civil Defence or the Home Guard. Who oversees the big picture? Who ensures that the resources are, at worst, not available to anyone?"

Nistov also expresses concern about scenarios where resources such as personnel, helicopters and supply ships, are reallocated for other purposes in a crisis.

"It may then become necessary to deprioritize something else. Can we keep all the shelf activity going at the same time? Probably not. These discussions are difficult, but necessary."

STANDING STRONG

Despite this, she is clear that the Norwegian petroleum industry is standing strong. The industry handles preparedness and collaboration well and is advantageously positioned compared with many other countries. What is new is the security landscape.

Nistov believes that the first thing the companies must do in the Total Defence Year is to put the topic on the agenda.

"They must ask themselves fundamental questions about their role in total defence, what dependencies are most critical for the company, what must be prioritized in the event of a crisis and whether there is a gap between ambition and actual capability."

"The industry has already put much in place. We are used to thinking about preparedness and have a system for handling crises. The challenge now is to see preparedness in a total defence context. Before the crisis happens, not afterwards." ■

READ ABOUT THE BUSINESS SECTOR´S REMIT AT HAVTIL.NO

PREPAREDNESS IN THEIR BLOOD

Text: EILEEN BRUNDTLAND **Photo:** HARRY SAYNEVIRTA

In Finland, preparedness is not a plan. It is a way of shaping society. Join us in the country where cooperation between authorities and industry has turned crises into a driving force for innovation. →

Itäkeskus swimming hall: Within a matter of hours, the pools can be drained and the hall transformed into a shelter for nearly 4,000 people.

Photo: VESA LAITINEN

On a Friday morning in March, the Itäkeskus public swimming hall in eastern Helsinki is already alive. There is a faint smell of chlorine and sauna in the air. The three pools are bustling: a school class practises the crawl, pensioners glide slowly through the water, and in the paddling pool local kindergarten children splash and play. Steam and laughter rise from the sauna.

Above the pools hangs a massive ceiling of white-painted blasted rock. Only a small sign on the door above ground reveals what the place also is: 'Shelter'. Within the space of a few hours, the pools can be drained and the hall turned into an emergency shelter for almost 4,000 people.

This is Finland. Here, emergency shelters routinely do double duty as metro stations, parking facilities and sports halls, full of life on an ordinary Friday. Preparedness is not tucked away in a crisis binder. It is a part of daily life.

NORWAY CELEBRATES ITS INDEPENDENCE. FINLAND PROTECTS IT

To understand the swimming pool, we need to understand the history behind it. Axel Hagelstam is director of international relations and analysis at the National Emergency Supply Agency, the Finnish body that coordinates emergency preparedness cooperation between the state and the business sector. He takes a moment to put things into perspective.

"Being neighbours with Russia is a key part of Finnish identity. It is a history marked by conflict."

The following contrast with Norway illustrates the difference: While Norwegian children celebrate 17 May with parades, the Finns stay at home on their national day, light two candles and listen to Finlandia.

"You celebrate independence. We safeguard it."

The Winter War and the Continuation War against the Soviet Union demanded the mobilisation of an entire society. A small country with a small economy, fighting largely alone. Finland retained its independence but lost over ten percent of its territory. Decades of political isolation ensued. This forced the country to build a system that had to stand on its own two feet, and one in which the business sector became a natural and integral part of national emergency preparedness.

27 COMMITTEES AND 1, 500 CRITICAL ORGANISATIONS

Hagelstam explains that the core of the Finnish system consists of 27 industry committees – so-called pools – across seven sectors: energy, food, health, logistics, finance, industry and digital infrastructure.

Here, representatives from the →

FINLAND'S CIVIL DEFENCE SHELTER SYSTEM

- Around 50,500 civilian shelters
- Capacity for approx. 4.8 million people – 80–85% of the population
- Legal requirement: Must be built in buildings with more than 1,200 m² of floor space
- Must be ready for emergency use within 72 hours
- Used daily as sports halls, car parks, metro stations and storage facilities.

Source: Ministry of the Interior

In Finland, energy companies, food producers and logistics firms sit on permanent committees alongside government authorities and the armed forces. This is no accident. The country has embedded preparedness into the very fabric of its society.

Photo: NATIONAL EMERGENCY SUPPLY AGENCY

NATIONAL EMERGENCY SUPPLY AGENCY

- A government agency that coordinates the emergency preparedness cooperation between the authorities and the business sector.
- 27 industry committees divided into seven critical sectors.
- Around 1,500 companies are defined as critical to Finland's security of supply.
- Enters into commercial agreements with the most societally critical enterprises.

Axel Hagelstam is director of international relations and analysis at the National Emergency Supply Agency, the Finnish body that coordinates emergency preparedness cooperation between the state and the business sector.

Photo: NATIONAL EMERGENCY SUPPLY AGENCY

authorities, business and industry organisations meet regularly to share insights, discuss vulnerabilities and implement measures. Around 1, 500 companies and other organisations are classified as critical to the country's emergency supply preparedness.

"We enter into commercial agreements with individual companies to maintain a higher level of preparedness. The textile industry, for example, has agreements to switch production to masks and protective equipment if needed," says Hagelstam.

Less visible dependencies are also managed.

"Clean drinking water requires sodium hypochlorite, normally a by-product of the cellulose industry. If paper production is halted, the production of this chemical also stops. The solution is agreements with alternative suppliers."

The pandemic tested the model and revealed flaws, in particular the fact that a horizontal crisis like Covid-19 affects everything at once, not just the health sector. Russia's full-scale invasion of Ukraine unleashed another challenge. Finland had imported large amounts of energy and raw materials from Russia. They don't do that anymore.

"When supplies stopped, every value chain was revised again, sector by sector, together with the companies that know their industry best. The business sector holds the knowledge and the key to how this is done. We learn from them."

NORDIC COOPERATION

Despite Finland's reputation as a pioneering country in emergency preparedness, Hagelstam makes it very clear that they cannot stand alone. The country is small and the industrial base narrow. Closer Nordic cooperation, in parallel with what already exists on the defence front, is therefore necessary.

"Denmark has logistics and shipping expertise, Norway sits on energy resources and marine protein value chains and Sweden has industrial capacity, just to name a few examples."

He sees a collaboration as urgent, because Europe underestimates the threat from the east.

"There is a lack of common understanding in Europe as to how major the threat from Russia really is. Not only in military terms, but also in terms of hybrid warfare, disinformation, sabotage and destabilization of democratic societies."

Preparedness, Hagelstam says, is not solely the responsibility of government. It is a shared project, and the key is always the same: Trust. Between the state and the business sector. Between citizens and authorities. Between the countries in the north.

"Emergency preparedness is not just about plans. Preparedness is also about relationships that must be built before the crisis happens."

THE HOSPITAL THAT BECAME A STARTUP FACTORY

But the system Hagelstam describes is not just made up of structures and committees. It lives in the technology ecosystems emerging between research, business and defence. One of these is found in an old hospital building in central Helsinki.

Marian Sairaala – Maria's Hospital – was the city's first hospital, founded in the 1800s and named after the Russian Tsar's wife. Today, startup campus Maria 01 carries the name forward, but the content is entirely different: Where there were once wards and operating theatres, around 230 startup companies now sit shoulder to shoulder.

Finland's technological strength is no coincidence. It is rooted in the form the country was forced to adopt following the war.

Sarita Runeberg, CEO of Maria 01, explains:

"In the post-war period, Finland had to pay war reparations to the Soviet Union in the form of trains, machinery and industrial →

Among the start-ups at Maria 01 that have achieved great success are Wolt, Oura and Supercell – the gaming company behind major hits such as Clash Royale and Hay Day.

Foto: MARIA 01

"Before the invasion of Ukraine, defence technology and so-called dual-use was barely discussed here. Then everything changed overnight," says Sarita Runeberg, CEO of the startup campus Maria 01.

Photo: MARIA 01

goods. This forced the country to build up a massive industrial production, and with it the engineering mentality was born. Finland has few natural resources, except forests. To maintain a welfare state, we had to create value through technology, design and industry."

EVERYTHING CHANGED OVERNIGHT

Runeberg has seen many shifts over the years, but none as abrupt as February 2022.

"Before the invasion of Ukraine, defence technology and dual-use were hardly discussed here. Then everything changed overnight," she says.

Today, defence technology is one of the fastest growing categories of companies on campus. Major collaborations between the Armed Forces and startups are already in motion, and NATO is investing heavily in Finnish tech companies. Even startups that do not primarily work in defence technology are now considering dual-use opportunities.

"The Armed Forces can't always hire the most sought-after experts themselves, so they actively seek partnerships with companies that can deliver faster and more flexibly than the defence industry," Runeberg explains.

TECHNOLOGY NO ONE CAN COPY

Technology that serves both civilian and military purposes makes certain sectors particularly important strategically. Runeberg points to quantum technology as an example of Finland's strength in research based commercialisation – engineering rooted in decades of academic research and closely tied to industry.

"These are not apps and platforms, but engineering that takes decades to build and is difficult to copy. Finland is in a unique position here, because the link between universities and business is strong and deliberate," she explains.

Among companies with roots in academia is IQM, specialising in quantum technology and Flow Computing, developing a new type of processor architecture that can revolutionise computing. This makes them relevant far beyond civilian markets.

"A quantum computer solving logistical issues for a civilian customer can also solve encryption problems for the defence sector."

NEW TARGET: CENTAURS

In an emergency preparedness logic, stable revenues count for more than valuation. Runeberg highlights a different goal than the one long dominating startup success metrics. In the startup world, the unicorn – a company valued at over a billion dollars – is the ultimate badge of honour. A centaur is something else.

"We have a national goal of 100 companies with annual revenues above €100 million. A unicorn rises and falls with the market. A centaur has real income. That's something to build on." →

Jiri Jormakka and fellow Kelluu founder Jouni Lintu asked themselves a smart question: drones offer high image quality but have limited range. Satellites cover enormous areas, but with lower resolution. Could an unmanned airship deliver both?

Photo: KELLU

Today, Finland has 19 centaurs, including well-known companies such as Supercell, Oura, and Wolt. Runeberg believes the number will grow rapidly, driven by a new "Nokia effect": When downturns hit Nokia in the late 2000s, experienced engineers left and started their own companies. Something similar is happening now.

"Downsizing in large companies gives highly competent people time, capital and motivation. Many are first-time entrepreneurs in their 40s or 50s, with extensive experience and concrete problems to solve."

In 2025, as much as 85 percent of all Nordic venture capital went to Finnish startups in defence and dual-use technology, according to Maria 01's annual impact report. The startup sector is now as large as the forestry industry in terms of export value.

It shows. In the restaurant in the heart of the main building, the atmosphere is vibrant. Here, entrepreneurs from completely different companies meet for lunch. In the corridors, the smell of disinfectant has been replaced by the smell of freshly brewed coffee.

FROM BARK BEETLES TO NATO

One of the companies associated with Maria 01 is Kelluu. The company was founded to monitor Finnish forests. Then Russia invaded Ukraine. Today, its unmanned airships take part in NATO exercises in three countries over the course of a single month.

The first prototype was built in a barn in Reijola, a small village in eastern Finland, 90 kilometers from the Russian border. The year was 2018, and co-founders Jiri Jormakka and Jouni Lintu, the man behind the idea, had a simple question: drones offer high image quality but limited range. Satellites cover vast areas, but with lower resolution. Could an unmanned airship deliver both?

"Airships flew around the world 100 years ago," comments Jormakka. "We started thinking: what if we combined lighter-than-air and unmanned aviation?

THE FOREST AS A STARTING POINT

Their first customers were in forestry. Finland has vast forested areas, and the need for forest mapping is growing. With multispectral sensors on board, Kelluu's airship can identify trees infected by the spruce bark beetle.

"We see if the tree is infected before it dies. Together with the National Land Survey of Finland, we track its spread," says Jormakka.

Once the infested trees are identified, they can be felled early, preventing further damage.

> *"You can imagine the number of UFO sightings posted on TikTok and Instagram"*

Monitoring critical infrastructure came next: power grids, roads and railways. Services, not airships – that was the business model that companies were looking for.

NEW AREA OF APPLICATION

When Russia invaded Ukraine in February 2022, the Kelluu management team got together.

"We decided to explore whether our technology could support the defence sector in any way," says Jormakka.

The answer was yes. An airship that can remain airborne for over 24 hours, fly autonomously in Arctic conditions and deliver high-resolution data is useful far beyond forestry.

In 2024, Kelluu participated in NATO's DIANA programme for defence technology startups. After two selection rounds, the company earned a place in the programme, and with it, access to real exercises.

"In February, we took part in NATO exercises in three countries, including Norway's Heimdall exercise, where the Armed Forces, research institutions and industry test technology in Arctic conditions," says Jormakka.

"You can imagine the number of UFO sightings posted on TikTok and Instagram," he laughs.

DUAL-USE IN PRACTICE

What makes Kelluu more than just a tech story is that dual-use was not a strategy, but a consequence. The same technology that maps the spruce bark beetles also detects new forest roads, logging sites and vehicle tracks.

"The mission can be civilian and military at the same time," says Jormakka.

"They are not two separate worlds."

The airships run on hydrogen – both as lifting gas and energy source – enabling year-round Arctic operations. Over 24 hours of flight time has already been achieved. The next goal is several days.

The plan ahead is mass production. Thousands of airships. To cover Northern Europe in high resolution, Jormakka estimates that around a thousand units would need to be on patrol.

"Then you have covered the whole of Northern Europe," he says calmly.

FRIDAY

It's late morning at the Itäkeskus swimming hall. The school class wraps up and gathers at the edge of the pool. The pensioners continue their steady laps. From the sauna, steam and laughter keep rising.

Outside, early spring. Inside, just another ordinary Friday. ■

Airships are filled with a gas lighter than air, such as hydrogen. This provides natural buoyancy, allowing the craft to remain airborne without wings or significant engine power.

Photo: HARRI SAYNEVIRTA

The Liberty system is charged by its own battery packs and acts as an underwater charging station for various vessels. It can operate autonomously on the seabed for long periods of time, has a low power consumption in sleep mode, and is retrieved for recharging or battery replacement when needed.

DUAL-PURPOSE TECHNOLOGY

Text: OLAV HOVE **Photo:** MORTEN GJERSTAD

At a time when both energy security and national security are under pressure, the so-called dual-use approach has become increasingly relevant. Oceaneering, which has been supplying subsea technology and services to the Norwegian continental shelf for years, is now also developing solutions for the defence sector.

Liberty is an autonomous subsea platform that provides power, communication and support to underwater vehicles on the seabed.

The supplier company Oceaneering houses a wide range of functions at its Forus facility outside Stavanger. The workshop oversees the production and maintenance of ROVs (Remotely Operated Vehicles). Autonomous modular containers are also installed here, underwater drones are calibrated, and new technological solutions are tested, adjusted and returned to operations.

This co-location facilitates taking technology from the idea stage, through testing and on to actual operation, without lengthy logistical links.

Recently, the workshop has adopted a new role. Technology is being reconfigured and adapted to monitor cables, secure energy infrastructure and support military missions.

LIBERTY

In the midst of one of the numerous workshop halls stands the Liberty system, a yellow underwater container that serves as a charging station, data logging point and home base for ROVs. The system includes a battery pack, communication solutions and mechanics for launching and receiving underwater vehicles.

ROVs can be connected to the system, charge, receive assignments, and conduct inspections or surveillance routines before returning to base.

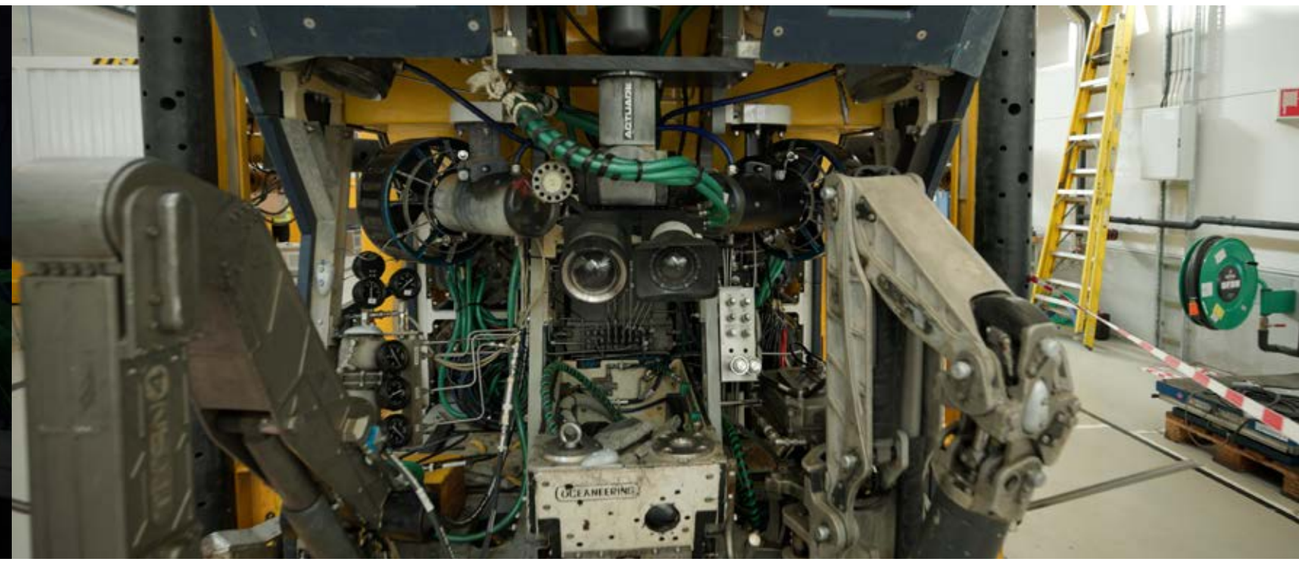
Liberty was developed in Norway and is already in use on the NCS. The system allows for long-term operations without the need for a crew to be present. It can lie on the seabed for long periods of time and be activated as needed.

The technology is flexible. The same robot can be equipped with additional sensors and be used by defence entities for surveillance, situational awareness and securing critical infrastructure.

Oceaneering's Director of Product Development and Technology Innovation, Sindre Hegglund-Dalseth, explains that this functionality has led to increased interest from defence entities, as the same platform can be used for monitoring, detection and data collection from critical infrastructure such as cables, pipelines and installations.

"The transition to use in the Armed →

OROC is the control room from which Oceaneering controls subsea operations on the shelf and internationally – directly from land.



The Liberty system represents an advanced technological solution for autonomous underwater operations and remote-controlled surveillance.

Forces mainly requires changes in sensors andmission modules, such as sonars, surveillance cameras or special equipment. The basic system is the same," explains Hegglund-Dalseth.

ROV TECHNOLOGY

The ROVs used by Oceaneering in its daily energy-related operations are basically developed for tasks such as inspection, cutting, lifting, drilling and minor repairs on the seabed.

The ROVs can be operated from vessels offshore and via remote control through the Forus operations centre.

The modular nature of the systems enables the same basic platform to be used for both the energy sector and defence operations.

"This provides a natural link between the sectors, as the requirements for situational awareness, surveillance and maintenance of installations have clear commonalities," says Hegglund-Dalseth.

OPERATIONS CENTER

The Onshore Remote Operation Center (OROC) is a key element of Oceaneering's operations. Here, pilots remotely control ROVs and other systems globally. The centre was established to transfer the workload from offshore to land.

"This allows for more predictable operations and reduced costs," says Christopher Lyon, Strategic Manager for Remote Operations at Oceaneering.

"Here, offshore operations take place, but on land. Everything that previously required a crew on a boat, we can now do from here. The pilots control the ROVs in real time; cutting, moving, welding and inspecting," he explains.

The centre also serves as an ideal test arena for new software and digital solutions, precisely because the operations take place in a controlled, land-based environment.

The operations centre features in-built physical and digital security. The premises are divided into security zones which are isolated from other areas of the building, and digital barriers such as network isolation, firewalls and access control have been introduced.

This level of security means that the centre can be adapted to use in the defence sector if needed. According to Lyon, a defence-specific control room could be added to the current structure, featuring separate networks and additional security.

"We are already monitoring critical infrastructure for oil and gas. We can do the same for national security," Lyon explains.

DUAL-USE

The dual-use perspective refers to using the same technology, expertise or system both civilly and militarily.

At Oceaneering, this perspective has been developed over time. The company's U.S. operations have been supplying technology to the U.S. military for more than 40 years.

In Norway, the focus on defence-related application has increased over the past two to three years.

Gunnar Hilsen, global head of business development at Oceaneering, tells that entities including the Norwegian Defence Materiel Agency have shown a keen interest in the application of underwater technology as a part of total defence. This applies particularly to the surveillance of critical infrastructure and autonomous systems that can operate without continuous logistical support.

Hilsen adds that several foreign delegations have already visited the Forus premises. The subsea threat landscape, the need for continuous monitoring and a growing dependence on the seabed as transport and energy infrastructure are influential factors.

"Technology such as the Liberty system and OROC can be used cross-sectorally without significant changes to the basic structure," Hilsen points out.

"It´s easy to understand why this is generating interest in the defence sector. Having autonomous platforms that can operate far from land, with no detectable signature, crew or continuous logistics, is a strategic advantage," he states. ■

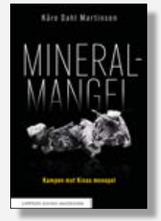
Calls for a clear mineral strategy

Text: OLAV HOVE **Photo:** ELISABETH KJØRMO

Must we, should we, or can we permit ourselves to extract seabed minerals on the Norwegian continental shelf? Yes, says Professor Kåre Dahl Martinsen, who believes that security policy must play a far more significant role in the debate for or against mineral extraction.

Green deposits of copper mineral on a darker sulphide sample, collected by the Norwegian Offshore Directorate at Mohnsryggen, between Jan Mayen and the southern tip of Spitsbergen.

Without our own mineral resources, we become vulnerable, writes Kåre Dahl Martinsen in his new book "Mineralmangel" ("Mineral Shortage") and calls for a clear national strategy.



Kåre Dahl Martinsen is a professor of European security policy at the Institute for Defence Studies at the Norwegian Defence University College.

The Norwegian continental shelf contains important minerals and metals - such as cobalt, nickel, manganese, copper and rare earth elements (REEs). Seabed mineral extraction may be a future industry for Norway, but disagreement on the topic abounds.

Those against believe that we have insufficient expertise, that we have no idea of the environmental consequences and that mineral extraction may damage our reputation internationally.

Those in favour envision a new industrial adventure – the promise of a new oil boom and a strategic security policy muscle to flex.

Professor Kåre Dahl Martinsen, who is affiliated with the Institute for Defence Studies, is on the yes side. Under certain conditions.

In his new book "Mineralmangel", ("Mineral Shortage"), he outlines the possibilities, including the benefits that extracting seabed minerals can provide politically and economically.

However, if such an industry is to be profitable and sustainable, much work is needed.

OLD MINDSETS

Dahl Martinsen views the debate, and the strong opposition to mineral extraction, as defined by inertia and outdated mindsets.

"We can´t refer to minerals solely as a part of the green transition," he emphasizes, indicating that there are many security policy aspects:

"It's about being able to make one´s own political decisions without risking China shutting off the mineral supply," he says.

He adds that China has used minerals on multiple occasions as a tool for political pressure, including against Japan in 2010. →

SEABED MINERALS

Seabed minerals are sulphides, manganese crusts and manganese nodules formed in the depths of the ocean.

On the NCS, deposits of seabed minerals have been proven in the Norwegian Sea. Metal-rich crusts and sulphide deposits exist at depths of around 1,000 -3,000 meters.

The metals and minerals in these deposits are needed in batteries, electronics, green tech and in the defence industry, and can become a strategic resource for Norway.

The challenges relate to un-known environmental impacts and the need for more research and technological development prior to any potential extraction.

RARE EARTH ELEMENTS

REEs are a group of 17 metallic elements essential to modern technology. They are used in everything from mobile phones and electric car engines to windmills, radars, sensors, batteries and defence technology. They are not necessarily “rare”, but they are rarely found in easily extractable concentrations and are therefore usually demanding and costly to recover.

Without our own mineral resources, we become vulnerable, he explains, and calls for a clear mineral strategy - in practice a national, security policy-based plan, where mineral extraction is seen as critical infrastructure.

THOSE AGAINST

“I am aware that there are major uncertainties. I am not saying that we should go for this at all costs, but we need to figure it out.”

“We must work on the issue. Research, test and find ways to extract whilst taking environmental considerations sufficiently into account.”

He maintains that since the arguments in favour of extraction are so compelling, we must strive to succeed in making it happen.

“Our own mineral supply will give us political influence and strategic gravitas. We can become part of a western supply chain at a time when minerals are becoming power politics. Also, industrial activity in our High North is an assertion of sovereignty.”

In terms of economics, he believes that the large deposits of REEs and minerals, such as in the Fens field and the Norwegian Sea, can guarantee long-term income and jobs.

“And we are set up for this. Norway has expertise from the oil and gas industry that is directly transferable in terms of technology, subsea expertise and deepwater operations experience.”

MUCH WORK IS NEEDED

If mineral extraction is to become a new industrial adventure, it will take more than good environmental impact assessments and data collection.

“We need clearer government coordination. A political willingness to assess the mineral debate at all levels is paramount. It is currently extremely polarized,” he says.

The professor lists numerous points he believes must be put in place quickly so as not to fall behind as a mineral-producing country:

“We need a national mineral strategy linked to national security to build stable framework conditions for extraction on land and at sea. We must be tech-driven and keep a close eye on international developments, especially in Japan and the US, which are both investing heavily.”

Finally, he stresses the importance of keeping an open mind, and of keeping the mineral debate knowledge-based:

“We need to take environmental advice extremely seriously. Thorough impact assessments must be carried out in the fields of health, safety and the environment, but we cannot opt out in advance.” ■

Inactive sulphide chimney on the seabed: Seawater has first penetrated into the subsurface, been warmed and taken minerals with it. When the water flowed back up and hit the cold ocean water, this chimney-like sulphide structure was formed.

Havtil and seabed minerals

Havtil has regulatory responsibility for safety and emergency preparedness in the event of future extraction of seabed minerals on the NCS.

Our work on seabed minerals relates first and foremost to building a solid knowledge base and helping to ensure that any future industrial activity can be carried out safely and responsibly.

Efforts are directed towards three main areas: Knowledge acquisition for our regulatory perspective, contribution to the industry’s understanding of risk factors connected with such deepwater operations, and the development of the necessary area knowledge to establish proper safety and emergency preparedness.

Roar Sognnes is head of Havtil’s interdisciplinary seabed minerals team. He says that a large part of the current work relates to obtaining further data on the conditions in the northern Norwegian Sea and the Greenland Sea. Havtil collaborates with the Norwegian Meteorological Institute, among others, on analyses of weather, wind and current conditions.

“We have also established a good dialogue with shipping companies, research communities and other agencies that have operated in the area for many years, to learn from their experiences with offshore operations far from shore,” says Sognnes.

FOCUS ON EMERGENCY PREPAREDNESS

Emergency preparedness is a particularly important focal point. Experience from international stakeholders who have carried out test production in the Pacific Ocean shows that distances and challenges with helicopter access, combined with demanding Arctic weather conditions, place stringent demands on safety plans.

Havtil is therefore analysing what is needed to establish sound contingency plans from an industry perspective.

The goal is clear: If seabed mineral extraction becomes a new industry on the NCS, it will be a world leader in health, safety and the environment. ■

The Statpipe pipelines transport gas from Statfjord and Gullfaks to the Kårstø plant in Rogaland, from there to Draupner S and on to the continent. These were the first pipelines to cross the Norwegian Trench.

Photo: LEIF BERGE/EQUINOR

The network beneath the waves

Text: OLAV HOVE

The development of subsea pipelines on the Norwegian Continental Shelf started as a direct consequence of the Ekofisk discovery in 1969. To produce at scale, oil and gas had to be transported safely and continuously to market, something which ships alone could not achieve.

In the 1970s, LNG technology was not well developed, and pipelines were the only realistic means of exporting natural gas in large volumes and over long distances.

The 10 oil commandments stated that, to develop Norwegian industry and expertise and create jobs in Norway, all oil and gas from the Norwegian continental shelf should, as a general rule, be landed in Norway.

AN INSURMOUNTABLE OBSTACLE?

When it came to Ekofisk, there was an obstacle: the Norwegian Trench. At that time, there was no technology that could lay pipes in the 100-kilometre-wide, 700-metre-deep trench off the coast of southern Norway. As a result, oil was piped to Teeside in the UK and gas to Emden in Germany, through the Norpipe pipeline system.

But the Norwegian petroleum policy, which emphasised national control and the landing of production at Norwegian onshore facilities, remained firm. This led to the construction of processing plants such as Kårstø, Kollsnes, Mongstad, Sture and Nyhamna.

1985 saw the opening of Statpipe, the first pipeline to bring gas ashore in Norway. It ran from the Statfjord field to Kårstø in Rogaland. The Norwegian Trench, once thought to be an insurmountable obstacle, was crossed for the first time. →

The dimensions of the pipeline network on the Norwegian continental shelf are impressive. The picture shows Statpipe being laid just outside Kårstø.

Foto: LEIF BERGE/EQUINOR

NETWORK

The idea behind the pipelines was that they should form part of an integrated system, from single pipes to a coherent network, with several fields using the same infrastructure. And from the 1990s onwards, the system evolved to do precisely that.

For Statpipe, this means that it now consists of a total of four pipelines, which transport gas from Statfjord and Gullfaks via the processing plant at Kårstø, on to the Draupner S platform in the southern North Sea, and finally through Norpipe to Emden. Draupner is a hub in the pipeline network and has the function of mixing sales gas from various sources and exporting it to the market in Europe.

Over the course of almost 50 years, a network of pipelines has emerged which now constitutes a coherent system exporting oil and gas from more than 90 fields. The network of pipes has required advanced engineering and covers long distances, in waters down to 1,300 metres. Havtil has supervisory responsibility for more than 18,000 kilometres of this network for the transport of natural gas, oil and condensate. ■

PODCAST: ”REFLECTIONS ON NORWAY’S OIL STORY”

If you want to learn more about how this extensive network came about, the decisions that lay behind it, and how it works in practice, then be sure to listen to the first two episodes of season 3 of our podcast series “Reflections on Norway’s oil history” (in Norwegian only).

THE TEN OIL COMMANDMENTS

- The ten oil commandments were adopted by the Norwegian Parliament on 14 June 1971 as the overarching principle for Norwegian petroleum management.
- The main goal was that the oil and gas resources should benefit society as a whole and that extraction should be under national control.
- A key principle was that national supervision and control had to be ensured for all activities on the shelf.
- The commandments stated that the petroleum resources should be exploited to make Norway as independent as possible from external crude oil supplies.
- Emphasis was placed on developing new business activities based on petroleum.

NEW STATUS FOR INTERVENTION

Text: OLAV HOVE **Photo:** ELISABETH KJØRMO

Intervention has traditionally been the ”little brother” in drilling and well operations, for no obvious reason. This type of activity is both complex and important, with the potential for major incidents. The field is now receiving recognition.

All work that is carried out in an oil well after it has been drilled and put into production is called intervention.

Statistics show that over the course of a year, few adverse incidents are reported in connection with intervention activity. Nevertheless, a concerted effort is being made across the industry to increase intervention awareness.

KEEPING THE WELL SAFE

An oil well lasts for many years, and over time natural changes occur necessitating adjustments, repairs and clean-up. There are many reasons to carry out a well intervention: keeping the well safe, ensuring that it produces optimally, correcting problems or preparing it for larger tasks ahead.

Whilst intervention is both complex and important, it has traditionally been ranked as the junior in drilling and well operations, and for no good reason.

NOMADS

“Well intervention operators are the nomads of the oil world. They travel from facility to facility, assemble heavy equipment, do the job – and move on,” outlines Monica Ovesen, specialist manager for drilling and well operations at Havtil.

“Traditionally, the effect of intervention work has not been directly linked to value creation, which might explain why its status is as it is,” she says.

However, a concerted industry effort to increase the focus on well intervention is now underway. Not necessarily to raise the status of the field, but to reinforce safety, learning and understanding.

“One factor is the level of activity: Three times more well interventions than drilling operations are carried out in a year,” says Ovesen, and points to several other factors which merit greater attention:

“This is high-risk work, and the risk is different from drilling. The failure mechanisms are less spectacular, but more insidious. Errors or failures during intervention can trigger the same type of major accident potential as in drilling but are often underestimated.”

AN OUTDATED REPORTING SYSTEM

Figures show that there are very few unwanted intervention-related events in a year.

This relates to the fact that the reporting system was, until recently, adapted more to drilling and less to intervention.
Ovesen and her team explain that the previous version of the industry guideline →

Vibjørn Dagestad (left), Monica Ovesen and Tor Inge Handeland work on professional development, analysis and follow-up of intervention activity at Havtil. Through the use of data, experience sharing and close dialogue with the industry, they work for improved learning and a more precise understanding of the risk associated with well intervention.

MONICA OVESEN,
head of drilling and well activities at Havtil

“Havtil places a particular focus on highlighting and understanding the risk picture of well intervention, where work in live wells and insidious fault mechanisms can result in major accident potential. Good barrier management is key.“

was very comprehensive. It was also extremely detailed, making it difficult to ascertain what should be reported and how events should be categorized. The result was under-reporting, misclassifications and a misleading risk picture.

In line with the increasing focus on intervention, the guideline has been revised. “It is now simpler, has clearer categories, leaves less room for misunderstandings and is far better adapted to well intervention. In addition, we hope that more incidents will be reported and shared, so that we can enable learning across all stakeholders,” says Ovesen.

NEW COLLABORATION

The measures don´t stop there. In collaboration with the industry organization Icota (Intervention & Coiled Tubing Association), Havtil organizes and hosts the annual Intervention Day for experts in the field.

Monica Ovesen and her colleagues Tor Inge Handeland, Siren Øsebak and Vibjørn Dagestad from Drilling and Well Operations, are behind this Havtil event. Everyone views the collaboration with Icota as unique. The feeling is mutual:

“We see ourselves as the leading intervention organization in the world. Havtil´s wish to collaborate with us is an added seal of approval,” says Max Sørensen, who holds several positions within Icota in Scandinavia, Europe and globally.

Sørensen explains that Icota’s role is to function as a professional meeting forum for the entire intervention community, where operators, suppliers, authorities and safety officials can gather on an equal footing.

According to Sørensen, this is precisely why the collaboration with Havtil is so rewarding.

“Icota is neutral territory, providing a low threshold for sharing both successes and failures. Honest discussions which progress the field are welcomed. The authority perspective allows for a more holistic approach to risk. Both professional distance and insight co-exist and complement each other, which is a strength.”

Intervention Day has swiftly become a popular event for the professional community. Here, well and intervention experts from the entire continental shelf meet for professional presentations, demonstrations, discussions and case studies from actual operations.

“It means a lot that someone takes the initiative to host this type of arena,”

VIBJØRN DAGESTAD,
Havtil

“Better reporting and more accurate classification of incidents have led to the industry gaining a more realistic basis for learning and prevention across operators.”

says Sørensen.

“It’s not just about showing off technology, but about putting a specific field on the map. Havtil´s collaboration with us adds another level of authority. Their desire to listen, discuss and learn with the industry creates trust. And trust is key to learning.”

THE INTERVENTION FAMILY

This same trust is underscored by Sigbjørn Lundal of the oil service company SLB. As chief safety representative, he has seen the development from close quarters. For him, the success behind the focus on intervention in recent years is not primarily due to technology or regulations, but to culture.

“We like to call ourselves ‘the intervention family’”, says Lundal, “and it isn´t just an empty cliché. Live wells, confined work areas, heavy equipment and many different people having to work closely make for a demanding job. It´s crucial that our working environment is one of openness, trust and mutual respect.”

He explains that the intervention community has historically been rather isolated, a field of experts travelling between facilities, doing their job and disappearing. It could easily make them feel more like guests than an integrated part of operations. But this has changed.

“In recent years, we have noticed the operators becoming much more inclusive towards us,” says Lundal.

“We sit on the working environment committee, we participate in planning and we are involved from day one when new technology or new methods are being considered. This has strengthened safety and security. You build better solutions when those who are going to use them have a seat at the table.”

He emphasizes the significance of Havtil’s role in this change:

“Havtil have been good at establishing requirements, but they have also been good at listening. They meet with people out on the facilities, they ask pertinent questions and show an interest in what happens on deck. They aren´t just inspectors – they are professionals who want to help us become better.”

TOR INGE HANDELAND,
Havtil

“Havtil attaches importance to close dialogue with operators, suppliers and safety organisations, including through cooperation with ICoTA, in order to strengthen mutual understanding, participation and continuous improvement in the field of intervention.”

JOINT EFFORT

For Lundal, it is the combination of technical development, improved reporting and stronger tripartite cooperation that is lifting the field:

“What we are doing today is better than what we did ten years ago. But most importantly, we have a better understanding - of the risks, the consequences and the importance of thorough planning.”

He is also clear that volume alone is a key factor going forwards.

“The number of well interventions carried out in a year is very high. It goes without saying that this is a field which merits attention.

And we truly appreciate Havtil´s inspection visits,” says Lundal.

“They give us the opportunity to show what we are working on and where we see challenges. Inspection is not about finding faults, but about finding room for improvement. When used as a basis, this perspective will in turn deliver far better results.”

LOOKING TO NORWAY

Max Sørensen from Icota sees things from an international perspective. He believes that Norway is in the process of assuming a leading role in well intervention work:

“What is happening on the Norwegian continental shelf is getting noticed. Other countries look to Norway because the collaboration between authorities and industry works. You simply don´t see that level of transparency everywhere. When you have a field that works in line with best practices coupled with authorities that both challenge and support, you get an environment that develops rapidly.”

Havtil’s specialist manager for drilling and well operations agrees fully that transparency is crucial.

“The most important thing we can do is to keep learning - together,” says Ovesen.

“Knowledge sharing and transparency hold the key to progress, real risk reduction and strengthened security. This is essential, because intervention will only become more important in the years to come,” she concludes. ■

Investigations – Havtil´s remit and regulatory requirements

Text: ØYVIND MIDTTUN

Investigation of accidents and undesirable incidents is an important feature of Havtil's risk-based supervision. In 2026, we will also be launching a professional seminar to share knowledge on investigations.

Investigations of accidents and undesirable incidents are key to the work on preventing further incidents in the petroleum industry.

Investigations provide insight into what has happened, what the underlying causes are and how we can learn and improve, in order to prevent similar incidents from recurring.

Havtil's investigations also have a clear purpose in ensuring compliance with HSE regulations.

REQUIREMENT TO INVESTIGATE

When an accident or undesirable incident has, or could have, resulted in injury or pollution, the responsible party has a duty to review and, if appropriate, investigate the incident. This ensues from the Management Regulations, section 20 concerning the registration, review and investigation of hazardous and accidentel situations.

Companies are free to develop their own methods for investigations, but must ensure that they provide a basis for learning and future prevention.

Havtil's investigations are in addition to, and independent of, the companies' own investigations.

HAVTIL'S INVESTIGATIONS

Havtil investigates serious incidents and incidents with a potential for learning across the industry. Our investigations cover the course of events and causal connections, and we assess whether the companies have complied with the regulatory requirements. We assess whether established barriers and routines for risk management have worked as intended.

If findings show inadequate regulatory compliance, Havtil can use sanctions, such as orders, suspensions, coercive fines and reporting to another authority.

The objective of our investigations is to ascertain proximate and underlying causes, actual and potential consequences and regulatory breaches. The intention is to contribute to learning and transfer of experience, thereby helping to prevent further incidents.

For Havtil, investigations are a means of bringing petroleum activities into compliance with applicable HSE regulations, and investigation reports are published to promote increased learning across the sector.

SPECIAL COMMISSION OF INQUIRY

In addition to the companies' and Havtil's investigations, the Ministry may, pursuant to section 10-10 of the Petroleum Act, appoint a special commission of inquiry in the event of accidents or incidents resulting in serious danger to life, major damage to property or pollution of the marine environment. The Commission shall have legal, nautical and technical expertise. In 2010, the Ministry entered into an agreement with the Norwegian Safety Investigation Authority for practical assistance in setting up an ad-hoc independent commission of inquiry.

DIFFERENT PURPOSES

The different arrangements have different purposes.

- The companies' investigations are aimed at internal improvements and learning in the workplace and within the company.
- Havtil's investigations are intended to bring the business into compliance with applicable HSE regulations, and to promote learning and improvement across the sector.
- The ad-hoc independent commission of inquiry scheme is intended to contribute to improvement and learning at societal level and means that the inquiry also comprises the role of the authorities.

SEVERITY AND LEARNING POTENTIAL

Havtil normally conducts between five and ten investigations annually. Severity is the most important criterion for the decision to investigate, but the potential for learning also weighs heavily.
In 2020, there was an increase in the number of serious incidents, and Havtil undertook 13 investigations – the highest number ever.

STRENGTHENED FOLLOW-UP OF SERIOUS INCIDENTS

We work holistically and with many different projects and perspectives to strengthen the follow-up of serious incidents. In recent years we have carried out a broad-ranging project to enhance our investigation processes and make data available for learning in the industry.

The project comprises the mapping of methods, pilots and development of frameworks, as well as improvements in work processes and knowledge sharing.

Havtil has chosen to use elements from the established HTO (Human, Technology and Organisation), CAST (Causal Analysis based on System Theory) and STEP (Sequentially Timed Events Plotting) investigation methods, as well as interview questions and performance-influencing factors from the HF (Human Factors) guidelines.

SEMINAR ON INVESTIGATIONS ESTABLISHED

Whilst working to enhance our follow-up, we have also placed emphasis on the sharing of information with the industry and its stakeholders.
To this end, Havtil has taken the initiative to establish a forum for sharing knowledge about investigations.

The professional seminar will be launched in the autumn of 2026. ■

Safe structures and robust material choices:

THE STRENGTH OF STEEL

Text: ØYVIND MIDTTUN

During the first decades of activities on the NCS, extensive research, testing and standardisation were necessary for the design, construction and maintenance of safe structures.

Steel jacket under construction at Aker Verdal in Trøndelag.
Photo: NTB/Aftenposten

PODCAST:
This article is based on a conversation with Inge Lotsberg, DNV, Mons Hauge, Equinor and Morten A. Langøy, Havtil. Hear the full conversation at Havtil.no or at your preferred podcast platform (in Norwegian only).

On many of the NCS facilities, structural steel is the load-bearing element. The steel must withstand harsh environments, absorb the forces affecting it, distribute loads and cope with the wide variations in temperature, weather and operation that accompany a long service life offshore.

It is no coincidence that offshore structures are built from steel. Steel combines high strength, low cost, good formability and the ability to be welded into large and complex structures. The challenge lies in what happens in the steel material at the micro and macro scales: grain size, alloying elements, impurities and how welding affects the properties.

TALL, HEAVY WAVES AND A DIFFICULT CLIMATE

The first fields on the NCS were developed by foreign operators, using knowledge, experience and specifications from petroleum operations in other parts of the world, such as the Gulf of Mexico.

However, the North Sea conditions presented new challenges. Nowhere else had large, fixed platforms been combined with such loads; in addition to corrosive salt water, the facilities had to withstand harsh weather, high winds, tall and heavy waves, and a difficult climate.

Much of what was built in the 1970s has proved surprisingly durable. Several of the Ekofisk and Statfjord platforms are still standing.

The structures had to be robust, but the knowledge of how steel, welds and elements develop over a long life offshore had to be strengthened. The earliest dimensioning rules focused on strength, but not equally on the impact of defects, fatigue, temperature and corrosion.

In 1977, the Norwegian Petroleum Directorate presented the first guidelines for the dimensioning of structures. These laid the foundation for a safety format based on load and material factors, which essentially remains in place today. The requirements were further developed throughout the 1980s and 1990s and included new dimensioning methods for accident loads, fatigue analyses and impact assessments. They were also adjusted to account for new types of structures under development.

ACCIDENTS AND QUALITY ISSUES

In the 1970s, the NCS was largely developed using standardised types of steel. However, there was a strong desire to improve weldability so that larger material thicknesses could be welded efficiently. There was also a desire to increase strength and improve properties at low temperatures.

Lessons learned from incidents in Norway and internationally have influenced the development of our dimensioning standards. The *Alexander L. Kielland* flotel disaster in 1980 highlighted the need for more knowledge about fatigue calculations and requirements for the residual capacity of structures in the event of a failure.

The *Kielland* accident also became a catalyst for more research and regulatory development.

In Norway, regulatory requirements were tightened for accident loads and fatigue calculations throughout the 1980s and 1990s, in line with increasing knowledge.

TEST PROGRAMME FOR WELDABILITY

During this period, the Norwegian Petroleum Directorate's safety division initiated a major project to map the weldability properties of the structures planned for the North Sea. They requisitioned approx. 10 m² of steel from all new platform deliveries. A total of 18 different steel grades were sent to Sintef in Trondheim, and tested for brittleness, crack sensitivity, and toughness at low temperatures.

The test programme showed that the steel grades had a significantly greater difference in quality than anticipated. It provided important knowledge and laid the foundation for stricter requirements for sulfur and phosphorus levels and for control of heat treatment during welding.

The oil companies – now also including the three Norwegian players Statoil, Norsk Hydro and Saga Petroleum – responded →

Ekofisk is one of many fields on the Norwegian continental shelf that stands on steel. The photo shows the installation of the Ekofisk 2/4 Z facility in 2013. The steel jacket is already in place, while the topside is being lifted into position by the crane vessel *Saipem 7000*.

Photo: KJETIL ALSVIK/CONOCOPHILLIPS /NORSK OLJEMUSEUM

The facilities on the Johan Sverdrup field in the North Sea stand on large steel jackets that are anchored to the seabed with powerful piles. The water depth in the area is 110–120 meters.

Photo: EQUINOR

by developing new requirements to ensure that the structural steel could withstand all parts of the fabrication process, while retaining weldability and other important properties.

KNOWLEDGE FROM JAPAN

Simultaneously, Japanese steelworks made a significant technological leap forward with the development of micro-alloyed, thermo-mechanical control process steel (TMCP). The steel plates were rolled at a lower temperature and with controlled cooling. This produced a finer grain structure, higher ductility and better weldability – with less need for preheating and post-processing during fabrication at the shipyards.

Norwegian operators adopted the technology, initially through company requirements and later via the Norsok standards.

The effect was more predictable material properties across material thicknesses and welding methods, and a lower risk of brittle zones in and near the weld.

FRACTURE MECHANICS

Another improvement was the introduction of fracture mechanics as a calculation tool for controlling brittle fracture and fatigue.

Fracture mechanics became important for the offshore industry. The evidence basis for the assessment of defects and cracks was improved, making it possible to avoid unnecessary repairs that could aggravate the situation by introducing greater welding stresses, whilst documenting that the structure had sufficient safety margins even with minor defects present.

This methodology was used in large field developments, resulting in better documented safety margins and fewer unnecessary interventions in critical welds.

TOLERATING VARIATION

Even with today's advanced calculations, it is still the behaviour of the material and elements that determines structural safety. Robustness means that the structure must be able to withstand variations or changes, even beyond that anticipated, at operating temperature, in unexpectedly high waves, with welding defects, etc.

This is particularly evident in the work on life extension. Many platforms from the 1970s and 1980s are still in operation, and the knowledge gained during the construction phase is now being used to assess how long they can remain in place. Inspections, fatigue calculations, and assessment of residual capacity are key aspects of this. Methods have also been developed to →

improve old welds so that their service life can be extended in a documented and safe manner.

THE NCS AS AN ARENA FOR LEARNING

The major development projects – Statfjord, Gullfaks, Oseberg, Snorre – were, in practice, full-scale laboratories. Large structures, thousands of metres of welding, and demanding fabrications gave engineers and operators a unique opportunity to understand what is important for achieving safe structures. This was crucial when the industry joined forces in the 1990s to develop the Norsok standards.

Norsok was based on three premises:

1. The steel itself had to be robust and weldable.
2. The production and manufacturing methods had to ensure consistent quality.
3. Safety-critical knowledge should be shared – not kept secret.

The standards became quickly recognised internationally. Several Norsok requirements later became the basis for ISO standards, while others are used and globally recognized without formal approval by international certification bodies.

In steel production, it is essential to remove unwanted elements such as sulfur, phosphorus, and oxygen. These impurities can make the steel brittle or weaken its strength. The photo shows work at a smelting furnace at Thyssenkrupp's Schwelgern facility in Germany.

Photo: THYSSENKRUPP

FROM INDIVIDUAL SPECIFICATIONS TO COMMON STANDARDS

Before Norsok was established in the 1990s, the requirements for structures on the NCS were fragmented. Each operator developed its own specifications and requirements. The result was a multitude of parallel specifications for steel, welding and fabrication, where the same design could have three or four different sets of requirements depending on who the operator was.

The need for a common standard was clear. Major developments in the 1980s had shown that gathering requirements was not just an administrative exercise, but a prerequisite for robustness and quality. One of the first concrete initiatives was to find a steel grade that could satisfy all three Norwegian oil companies' material specifications – a task that illustrated the challenge.

Common requirements and clear specifications make it possible to build, operate and maintain structures with predictable quality, regardless of the company, project or supply chain.

CONSOLIDATING THE ENTIRE VALUE CHAIN

When the Norsok project was launched →

From the Ekofisk 2/4 W facility on the Ekofisk field. The facility was originally a bridge support but was converted into a water-injection facility in 1989. The 2/4 W facility was removed in 2011. Photo taken 1990.

Photo: HUSMO CONOCOPHILLIPS/ NORSK OLJEMUSEUM

in the early 1990s, the objective was clear: reduce costs, simplify and harmonise requirements, and improve the ability to document safety levels. A key objective was that safety-critical information should be shared, not kept secret for competitive advantage. This transparency became one of the success factors.

The Norsok standards that followed led to fewer steel grades, more predictable fabrication and better control in dimensioning and construction. A precise "language" and better use of terminology were also developed in the standards.

COMPETITIVE ADVANTAGE

Norsok also gained an important international role. When Norwegian experts met with ISO committees, they now had a common and well-developed knowledge base. Several ISO standards are now based directly on Norsok requirements, and many countries and companies use them as "global standards" even though they are formally Norwegian.

Norsok is more than a set of requirements documents – it is a professional community. For over three decades, experts from industry, research, and government have met to discuss non-conformities, experiences and new knowledge. The ongoing dialogue has been a competitive advantage professionally, for our industry, and in terms of safety for the NCS. ■

KEY CONCEPTS

STRUCTURAL STEEL:
Steel grades used in load-bearing structures such as platforms and jacket structures. Characterised by a combination of strength, ductile properties, weldability and price-performance ratio.

MICROALLOYED STEELS:
Steel with small amounts of alloying elements such as titanium, niobium and vanadium added to achieve better strength and ductility. These were key to the transition to more robust offshore materials.

TMCP STEEL (THERMO-MECHANICAL CONTROL PROCESS):
Steel produced by thermo-mechanically controlled rolling. Low rolling temperature results in very small grains in the microstructure, which in turn provide high strength, good toughness and better weldability. Developed in Japan, it became very important on the NCS.

CARBON CONTENT:
Affects weldability. Lower carbon reduces the risk of brittle weld zones and the need for preheating. TMCP has been developed to achieve high strength with low carbon content, resulting in good weldability.

IMPURITIES (SULFUR AND PHOSPHORUS):
Residual substances in steel which, at excessive levels, can cause brittleness and poorer properties, particularly in weld zones.

HEAT AFFECTED ZONE (HAZ):
The area around a weld where the microstructure is altered by heat. Prone to brittleness.

PREHEATING AND STRESS RELIEF ANNEALING:
Heat treatment before or after welding to reduce cracking. New steel grades made it possible to reduce the need for such treatment.

COLD BENDING/STRAIGHTENING:
Forming steel sheets without heat. Modern TMCP steel allows this without any loss of properties.

WELDING IMPROVEMENT (GRINDING, PEENING):
Methods for improving stress conditions around welds and reducing the risk of fatigue cracks. Used on welded joints that are subject to fatigue loads and for extending service life.

CHARPY TEST/CHARPY V-NOTCH:
Impact strength test in which a test piece with a notch is impacted to measure how much energy is absorbed before fracture. Used to determine the transition temperature (the temperature at which steel changes from ductile to brittle).

CTOD TEST (CRACK TIP OPENING DISPLACEMENT):
Test that measures fracture toughness by analysing the opening in the crack tip when the sample is subjected to a load. Shows how well the material tolerates defects in critical welding zones.

FATIGUE:
Gradual damage development because of repeated load cycles. Crucial for offshore structures exposed to waves, wind and vibrations.

BRITTLE FRACTURE:
Sudden breakage in materials of low toughness. Critical for steel exposed to low temperatures and local defects.

DUCTILE PROPERTIES:
The material's ability to deform before breaking.

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