



DA-Group Customer Magazine 2021

DA-GROUP

Advanced Solutions from Seabed to Space

International
defence systems
manufacturer

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Small satellites
in space
technology

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Passenger
information
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**DA-Group Customer Magazine
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The cover image: Kristian Tornivaara (left) and Nestori Fabritius are photographed in the company's production facilities. Kristian acts as the Chief Business Development Officer for Defence & Aerospace and Nestori is the Business Line Manager for Space & Industry.

Building a Better Future with Competence

Through our dedication to development and expertise in the field of underwater dominance, DA-Group has successfully broken through the international defence systems market with the TURSO naval mine system. This succession has been made possible by DA-Group's long-standing support and cooperation with defence sector customers. DA-Group's TURSO mine solution is attracting the attention of international audiences because of its unique characteristics – there is no other system available like it in the world. We stand strong as true pioneers – one step ahead of the rest. Our achievements allow us to be proud of who we are and the products we provide.

We have made incredible progress on many fronts. We recently built and delivered passenger information system and CCTV system for the Tampere City Tramline – including door control systems that were developed and manufactured by us. It was exciting for us to work in collaboration with Tampere City and the manufacturer of the tram fleet, Skoda Transtech in Finland as a subcontractor on this project and to be such an integral part of the passenger experience. The whole project has already proved its worth based on very positive user experience.

The constant shift in space technology and increasing use of small satellites has opened yet another door for us. The Finnish government is under pressure to create better images of space that can be made available to various authorities and researchers. These organizations want to know what kind of satellites are orbiting in space directly above Finland and what kind of information they are recording. It is clear that our expert knowledge in satellite and radar technology is becoming more imperative.

The corona pandemic has affected the distribution of components worldwide, which has also been significantly reflected in some of our customer orders. Staying on schedule is of incredible importance to our entire operation – there has to be a compelling external cause to throw us off course.

DA-Group has the competencies and capabilities needed in the future to build a better world together with our customers.

Sami Kotiniemi
CEO



DA-Group's Development into an International Defence Systems Manufacturer

With a long-term commitment to development and resilience, DA-Group diligently combines our understanding of underwater environments and our comprehensive knowledge of sea mines. This is an interesting combination from the perspective of the international defence industry.

With our experience and production competence, DA-Group has developed into a company capable of delivering weapon systems to international markets.

– We have invested a huge amount of time and resources in the defence technology. We are also able to combine and develop different areas of knowledge, states DA-Group's Chief Business Officer of Defence & Aerospace, **Kristian Tornivaara**.

A great example of DA-Group's prowess is our TURSO naval mine system.

Tornivaara explains the background of the TURSO naval mine system:

– The system fills a gap brought on in the 1980s and 1990s, when almost all western navies gave up developing and using sea mines. The motive for this was dri-

ven by the security politics of the era – where geopolitical positions changed, and more time was invested into remote operations, like peacekeeping. Wars were not being fought on home soil anymore. For instance, countries near the Baltic Sea can rarely mine their own critical sea areas.

– Defending your own country was not a priority anymore and mines were regarded as dirty weapons that can cause civilian casualties. Additionally, finding sea mines from the World War II era damaged the image of mines. Now, new technology has changed the situation completely, says Tornivaara. Contemporary sea mines are extremely safe to stockpile, and use. They select their targets accurately and do not drift in rough sea conditions.



**SUMICO
Modular
Minelaying**

**TURSO Naval
Mine System**



**TURSO
Target Detection
Device**



The most modern and safest sea mine

Russia's occupation of the Crimean Peninsula in 2014 changed the international political climate. Defending your country and securing its borders became a top priority of policymakers, in an unprecedented way.

The status of sea mines in Finland has been an international anomaly. For the Finnish Navy, mines have constantly been the main defensive weapon system – together with guided missiles. Finland has developed and manufactured mines for the Navy for a long time. Now this long-term development process thrives in international markets. Tornivaara estimates that the TURSO naval mine system is decades ahead of competing alternative solutions, which are typically scarce.

- A contemporary sea mine is safe and selects its target, even a specific vessel, accurately. The mines offer protection from surface ships, submarines and individual divers with hostile intent. In recent years, several countries have realized that they need to upgrade their sea mines, Tornivaara emphasizes.

As a guarantee of the accuracy of the mines, they include a target detection system, a programming device and an algorithm development tool. The system also offers the possibility to simulate mine algorithms. The mine can also be programmed to neutralize itself or to explode after a specified time. The Navy using the mines has the option to program the mines themselves.

Additionally, DA-Group offers a complete modular mine laying system, SUMICO. With SUMICO the mines can be laid directly from a minelaying module. Standard SUMICO has ISO TEU footprint, so the traditional mine-layer arrangement with mine rails and dropping equipment is not necessary. An automated mine laying system can also be installed into the SUMICO system.

DA-Group uses FOXIT explosives in our mines. FOXIT is supplied by Forcit Group. Due to the safe design of the explosives, mines can be stored in one place without the threat of a mass explosion.

- From a technological standpoint, mines are an extremely safe, affordable and efficient option to improve regional security, says Tornivaara.

HIISI conducts surveillance from the depths of the sea

DA-Group offers HIISI underwater surveillance and measurement system that utilizes the sensor technology used in TURSO. HIISI is effective in the surveillance of sea borders of countries, harbors, sea lanes, fleet strongholds, underwater pipe and cable lines, power stations and underwater objects, such as sunken ship wrecks. HIISI can categorize the underwater object it detects and can locate and observe its movements. HIISI operates as "a pair of underwater eyes".

(Continues on the next page)

Underwater dominance and surveillance

HIISI
Underwater
Surveillance



Experience for the combat survivability of ships

With extensive knowledge of the effects of explosives, DA-Group can offer solutions for analyzing the Navy's combat survivability. We have developed SURMA software tools for assessing and improving the combat survivability of naval ships. With SURMA's analysis tools, you can optimize the combat survivability already the early design stages. The analysis shows for example whether or not the critical systems have built-in redundancy. The assessment of the ship's combat survivability focuses on the vulnerability and recoverability of the ship, in addition to distinguishing the degree of combat survivability of the ship.

DA-Group offers consulting services for shipbuilding, analysis services, simulation services and software programs that reflect the needs of our customers. DA-Group's expertise is based on our extensive understanding of underwater signatures, how they trigger mines, and the effect that underwater explosives have on the structure and systems of ships. This way the effects of mines, torpedoes and guided missiles on the survivability of the ship can be analyzed from the perspective of breaches of the hull and shock waves. We want to understand how the ship will survive under different combat situations.

Electromagnetic protection for ships

RAHKO degaussing system reduces the magnetic signature of ships by over nine tenths.

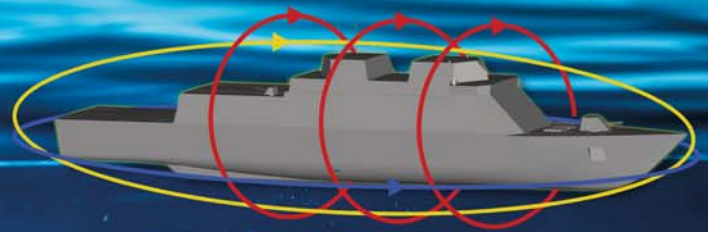
Degaussing coils are installed on the ship's hull. Electric current is passed through the degaussing coils, which changes the magnetic signature of the ship's hull – similar to the way that noise-cancelling headphones muffle outside noise. The protection that the system gives is significant, due to the change in the detection range of magnetic sensors caused by the reduction of the magnetic signature of the ship's hull. It is more difficult for the enemy to detect a ship that uses the RAHKO system.

Space situational awareness

DA-Group's knowledge of radars and satellites is utilized to provide space situational awareness. From the perspective of national security, it is important to get information about the number and nature of satellites that orbit over its territories. In addition to satellites, the trajectories of space debris can be tracked with a Space Surveillance and Tracking radar. With information from the radar, the trajectories of small satellites can be adjusted to avoid collisions.



SURMA
Combat Survivability
Management



RAHKO
Shipborne
Degaussing

Electronics Manufacturing with Recruitment Training

The lack of skilled labour can be felt all over Finland. DA-Group wants to ensure that our work force is competent and that staffing levels are sufficient by utilizing a recruitment training program created in co-operation with a local educational institute. A successful training period makes it possible for students to progressively integrate into the company and join forces with a diverse crowd of colleagues.

Eija Laukkanen from Tammela found DA-Group through the recruitment training program that began last April. DA-Group's stellar reputation and the desire to find a permanent position that was fulfilling and challenging encouraged Eija to apply for the training program.

– I was a stay-at-home Mom for ten years. For a while, I worked through an employment agency for short-term staff projects. I like manual jobs and the electronics industry has always interested me – even though I have no previous experience in the field.

Nine people joined the DA-Group training program at the same time as Eija. The fantastic nine share more than the training experience together – they formed a close-knit group of colleagues (and friends) who still share their morning coffee around the same table, every day.

– We were accepted very easily. The work atmosphere is great. I especially appreciate the flexible working hours – it makes the life of a mother of three children much easier.

Eija's work includes soldering and assembly. She describes her work as "clean work indoors." It is also important to recognize the work you do as part of a much larger picture.

– You need to be proud of what you do. I even rode the Tampere City Tram just so I could see the results of my work, Eija laughs merrily.

Precise and efficient

The production team of DA-Group is part of the electronics manufacturing process, starting from the product development stage. We make the prototype series and evaluate how suitable the product is for manufacturing.

– We are in constant communication with the design team and we offer our expertise and ideas to the product development team. This occurs whether the customer is internal, or external. Our co-operation with our customers is one of our strengths, says DA-Group's Chief Manufacturing Officer **Saila Tapio**.

When serial production of the product begins, our state-of-the-art machinery and expert personnel become important resources. Last summer DA-Group invested in automated optical inspection machinery, helping us to assemble circuit boards and inspect components.

– We have the knowledge and cleanrooms to create electronics for special circumstances – from the depths of

the sea floor to the high altitudes of outer space.

In addition to manufacturing circuit boards, DA-Group also produces mechanical assemblies, casing and packaging (including sales packaging) for our customers.

– We manage the entire production chain from acquisition to testing. We also take care of our customers' logistics. This means that our customers do not need to pay any stock costs that they normally would incur if they had to stock their own products.

For us at DA-Group, producing the products by ourselves is a matter of safety and efficiency, both for the process and the product.

– Customers want easy and risk-free solutions. We can offer our customers the complete service package for their products so they can focus on their expertise, Saila Tapio asserts.



Small Satellites: serial manufacturing in space technology

For a quarter of a century, DA-Group has accumulated substantial experience in radio frequency technology systems. We have acquired this knowledge from executing challenging deliveries of equipment and systems for satellites launched into the extreme conditions of outer space. Currently, DA-Group is part of the European Space Agency's (ESA) Arctic Weather Satellite (AWS) program. The goal of the program is to provide real-time information – derived from small satellites – about the weather conditions in the Arctic.

DA-Group is designing and manufacturing the digitization equipment for the signal from the AWS weather satellite. Business Line Manager of the Space & Industry sector **Nestori Fabritius** says that DA-Group's equipment will process a radiometric noise signal that is received on two distinct frequencies (54 GHz and 325 GHz).

– With the equipment used, the noise bandwidth is restricted to a specific width. After that, it will be digitized and sent forward for further processing. The equipment sets have a total weight of 94, 249 and 1115 grams. For us, this is an exciting new product and the first time our company has worked with small satellites. The use of small satellites has ramped up in recent years due to how inexpensive they are. DA-Group will also manufacture a frequency generator for the satellite. The frequency generator will offer a reference signal for all necessary frequency ranges, says Fabritius.

A small satellite's mass is equal to the mass of a small refrigerator. It weighs approximately 120 kilos and orbits on a height trajectory of about 600 kilometers above the Earth. A small satellite passes over the Earth's poles every 97 minutes. Larger satellites are located at a higher orbit, and their mass can be equated to the size of a bus. Large satellites are geostationary in relation to the Earth, but because they orbit over the equator, they cannot identify weather conditions at the poles. That is where ESA's small satellite comes into play. The small satellite gathers information about the declining sea ice in the Arctic by monitoring rising sea levels.

The estimated cost of a single prototype satellite is approximately €32 million. However, in serial manufacturing the unit cost of small satellites is under €10 million.

The satellite contractor of the AWS satellite is OHB Sweden. DA-Group will deliver the equipment to OmniSys, who is the prime contractor of measuring equipment.

The serial production of 16 small satellites

– The first small satellite that we manufacture will be used to demonstrate the operation and performance of the satellite. Next, 16 small satellites to complete the whole constellation will be manufactured and launched into orbit. The result will allow the satellites to sufficiently observe the exact same area from the Earth's upper atmosphere

and often enough (about every half an hour). For us, this is the first time we get to utilize serial production in space technology, exclaims Fabritius.

DA-Group should finish the delivery of the first satellite at the beginning of 2023. The small satellite project is estimated to last for a few more years.

The methods used in designing and analyzing the operation of a small satellite are easily compared to those of larger satellites. For example, heavy and time-consuming tests are not conducted on electronic components. This way the components will be cheaper because of the reduction in testing costs. DA-Group has the competence and capability to choose the correct radiation-resistant components for our satellite manufacturing.



Space situational awareness

Europe has needed to improve the snapshot of space above the European continent for a long time. This is partly because of the increasing number of small satellites and space debris. The EU has become aware of their inability to keep track of the numerous small objects progressively entering space.

China's missile test against its own satellite in 2007 underlined the need for a snapshot of space. The test was successful from a targeting point of view, but thousands of objects of different sizes resulting from the impact were randomly ejected into space. Because space debris can travel at speeds of up to 35,000 km/h, these objects are becoming a great threat to important satellites, and their delicate solar panels. Currently, the number of space debris objects is estimated to be in the tens of thousands – and thousands of those objects are dead satellites orbiting Earth.

In Finland, there is a dire need to find out what kind of satellites are moving over the country, and what kind of information the satellites are gathering and transmitting. DA-Group wants to be an active participant in the planned implementation of a radar system in Finland. The snapshot of space provided by the radar would improve Finland's (and the EU's) ability to independently secure their own space infrastructure.

DA-Group has already been part of implementing the EISCAT 3D radar system that maps out space weather. This system was implemented with help from a scientific organization. Many individual countries also took part in the project and provided funding for the system. Due to this factor, satellites and airplanes were not allowed to be tracked by the radar. DA-Group manufactured the equipment necessary for the radar system to produce and receive transmission signals – and the equipment

was designed to remove any observations of airplanes and satellites.

DA-Group collaborated with Sodankylä Geophysical Observatory to compile a report on the associated costs of the radar. Currently, we are in the process of producing a demonstrator. With the demonstrator we are attempting to show that it is possible for Finland to produce the radar. The ability of the demonstrator to discriminate objects has been specifically designed for observing large satellites. Information from the results of these observations can also be utilized in the future.

National space capabilities are in place

Within a few years we aim to create and conceptualize a road map showing how to implement a space snapshot radar system from Finland. This project would be manufactured in Kassimäki, Forssa. We could be ready to deliver the radar by 2025-2026. This would not only demonstrate our newest capabilities, but also showcase something that has the potential to be exported, says Fabritius.

In practice, if space debris is a threat to a satellite, the operator could adjust the satellite's orbit according to the information they receive. The radar needs to detect objects with a diameter of 5-10 cm. Currently, the smallest size that can be detected by the radar is a cube with a side-length of 10 cm.

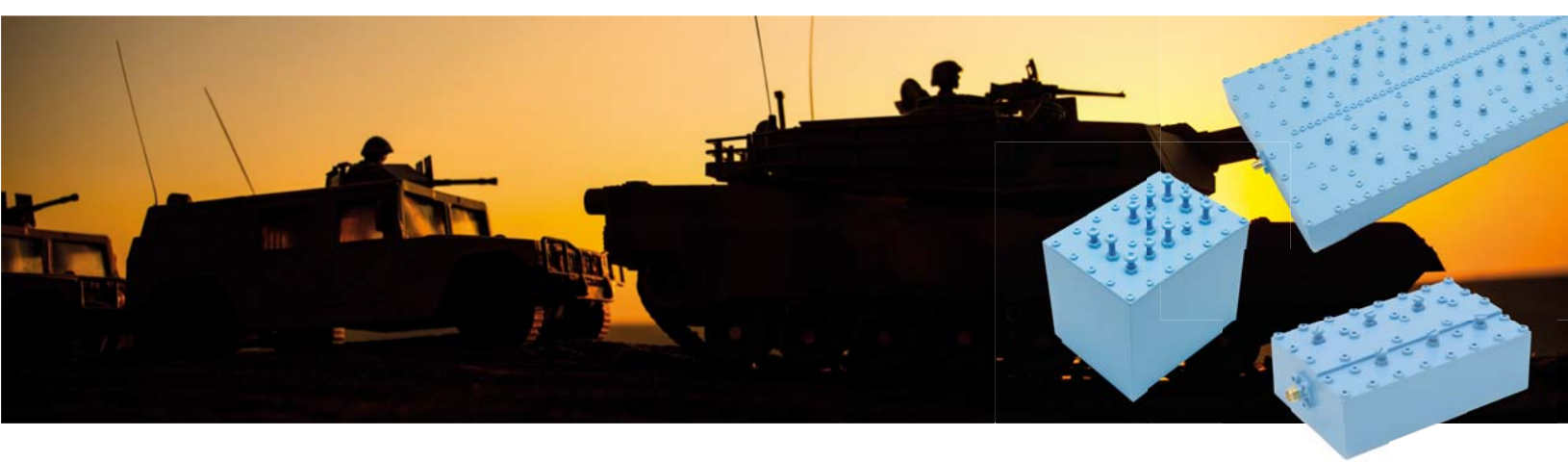
DA-Group hopes that there will be enough political drive in Finland to implement the radar system. One thing we know is that the number of satellites (and their capabilities) will increase with time, that is why we should pay close attention to space. We are the top company in Finland when it comes to space radar, Fabritius concludes.



Illustration of the constellation of Arctic Weather Satellite © OHB Sweden



Illustration of the Earth surrounded by space debris



Customized RF Filters for Extreme Conditions: a global goal

DA-Group's subsidiary Creowave Filters designs and manufactures superior radio frequency (RF) filters in Oulu, Finland. The RF filters are internationally known as the "blue Creowave Filters."

Here is an interesting fact: RF filters that are necessary for data transfer are purchased by global mobile network providers like Nokia and Ericsson. The RF filters are also used in equipment that is manufactured by the defence industry to secure wireless connections. Approximately every fifth product produced by Creowave Filters is used in the defence industry.

The excellent reputation, expertise and fast deliveries that Creowave Filters provides has brought the company its biggest sales order, which materialized after quick iterative negotiations this summer. Creowave Filters will be delivering almost one thousand RF filters to a customer in England.

- The high level of performance and the size and weight restrictions pertaining to this project were challenging for us. We happily accepted the challenge, as we can provide the best filters globally. If we cannot design them, then I strongly believe nobody can, says **Esa Turunen**, the Head of Creowave Filters Business Unit.

The filter sizes vary greatly. They can be equated to the size of a small slab of butter to the size of an average shoebox. According to Turunen, the orders for England will be finished at the end of January 2022.

Turunen also said that Creowave Filters has designed and manufactured over 2100 different RF filters, in total.

- We can manufacture a filter according to the customer's specifications within eight weeks. It is important for us to stick to the delivery times and quality criteria, both in the design phase and the manufacturing phase, says Turunen.

Creowave Filters are continuously investing in their product development while utilizing the vast knowledge and resources of DA-Group.

DA-Group's Chief Business Development Officer **Kimmo Ylander** says that the vibration tolerance of the RF filters has been greatly improved through this collaboration. The equipment must function at temperatures ranging from -40 °C to +85 °C. Now, the RF filters can be used in personnel carriers.

Focus on development and growth

The development of RF filters began in the 1960's – and there is so much more to accomplish. New applications for filters are continuously discovered, which requires analysis, design and implementation on a case-by-case basis.

This year the turnover of Creowave Filters has grown by approximately one fifth.

Creowave Filters utilizes DA-Group's areas of expertise when it comes to assembling circuit board components.

- We are strengthening our co-operation with DA-Group. It is possible to manufacture and assemble all parts inside DA-Group's facilities if the customer requires it, though this mostly applies to the defence industry, says Ylander.

Aiming at military markets internationally

Creowave Filters' proficiency is mostly known only within the industry, but a new marketing campaign targeting a global audience is in the works. The upcoming campaign will specifically target international defence industry manufacturers.

- We have a strategy in development that will allow us to handle a sudden surge in demand, including a growth plan that is already in place. After three to four years, we hope to double our production. At the same time, we need more skilled workers, says Ylander.

The Oulu region has been the center of RF filter manufacturing for the past few decades. Over a thousand people are employed in this field of expertise, and over a dozen of those experts form the core of Creowave Filters.

Turunen explains that you can't make a new designer into an expert in only a few years – gaining true proficiency and practical knowledge can take a decade.

Finland has a noticeable lack of experts in RF equipment design, and perhaps that is due to there being no engineering education available in this field, in Finland anymore. So far, Creowave Filters has found their experts, but this issue may cause challenges in the future of filter manufacturing.

An Eye for Success: superior quality assurance

Quality can be defined as: “a degree to which a set of inherent characteristics of an object fulfils requirements”. At DA-Group, this means that we offer services and products that meet the needs and expectations of our customers. With our services, we aim to enhance the profitability of your business by ensuring that your company’s products and operations are running efficiently – with the highest possible quality available on the market.

Ossi Saarinen is a member of DA-Group’s quality and product assurance team. Ossi specializes in processes and materials and works with quality assurance every day.

Here’s what Ossi had to say about his expertise in the field, and why quality assurance is important:

– Quality means doing everything that was agreed upon.

Currently, Ossi is working on a project for the European Space Agency. In this project, DA-Group manufactures receivers for MetOp-SG weather satellites. Space projects usually take years to complete, and they require an expert’s eye and attention to detail.

– In the beginning of all projects we make a quality assurance plan. During the project I make sure that the plan is accurately followed. It is important to ensure that all materials used in the project can be traced, and every hour of work can be accounted for. The results of the project are assessed at various stages throughout the duration of the project. A customer representative can also take part in some of the inspections, providing imperative feedback throughout the whole process

– For us, the amazing achievements of our quality assurance team are not about overcoming hardships – they are about recognizing imminent risks and managing them before any problems arise.

Doing the right things, at the right time

Product assurance manager **Riitta Miettinen** evaluates quality from four different perspectives: the organization, its operations, its requirements and the “Me” perspective. By considering all four of these perspectives simultaneously, the results achieved are effective, and form the basis for all developing operations.

The “Me” perspective focuses on an individual’s experience with quality and their approach to quality issues. These are influenced by the requirements of the organization and the company’s culture, both of which can be developed at all levels of the organization. This can be achieved by familiarizing personnel with long-term operations, and by making staff aware of the significance that product quality and quality assurance have for the profitability of the business. Additional requirements that come from outside of the company, such as customer requirements, also influence the company’s operations.

A good attitude and well-planned processes are part of daily life for DA-Group’s quality assurance team. These combined approaches increase the expertise of personnel, thus resulting in the timely design and implementation of the project – at all stages of the venture.

Superior quality is a huge factor of success

What do we mean by superior quality? At DA-Group we believe that superior quality means delivering a service or product on time – in a way that satisfies the customers’ requirements.

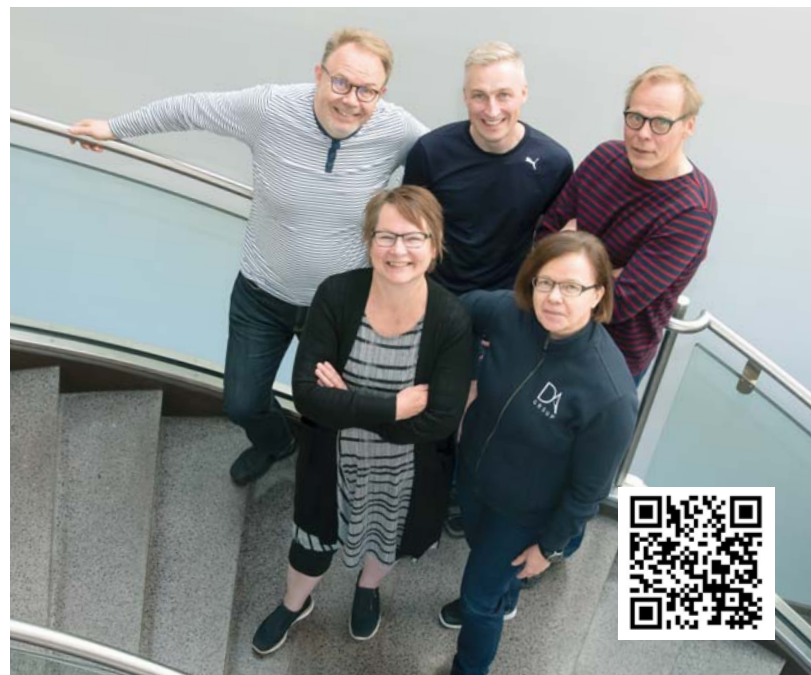
– This means that high quality is one of the central success factors for a company, says DA-Group’s Chief Quality Officer **Mika Louhola**.

– It is also an integral part of day-to-day life for companies, especially for individual staff members.

Different international and industry-specific quality standards regulate the quality requirements of DA-Group’s operations. By utilizing and combining them, we can establish uniform quality requirements and recognize the parts of our operation that need further development.

This interdisciplinary approach is challenging for us, and it makes us versatile. We take advantage of this versatility and incorporate it into our entire quality operations strategy.

The diverse specialities and wide range of experience of DA-Group’s quality assurance team allows us to respond to challenges and advance the quality of our Group’s operations, and its products.





Please see our solutions on the Tampere Tram here:



Travelling in Style: safety and satisfaction with advanced technology

Who doesn't want to travel under the umbrella of safety and advanced technology? Urbanization and climate change are challenges for the public transportation sector. We need better methods of transportation than ever before – where the significance of safety and passenger information takes top priority. DA-Group designs and manufactures innovative passenger information systems (PIS) that help secure a positive travel experience for passengers, and drivers.

It is crucial to stick to schedules for a pleasant travel experience. It is also important for passengers to get off at their designated stops. Any changes that may occur en route should be clearly communicated to the passengers – both inside (and outside) of the vehicles.

Therefore, DA-Group's PIS include information displays inside and outside the vehicles that provide announcements to convey information to passengers. We also offer solutions that help ensure the safety and satisfaction of passengers.

– Artificial intelligence (AI) will soon be used in PIS as well. In our pilot programs we have researched AI-based solutions for existing camera systems, making it possible to count the number of passengers in all vehicle carriages, says DA-Group's Chief Business Officer **Peter Hakala**.

We aim to increase positive travel experiences, and satisfaction. With the new AI-infused PIS data, we can design better transport systems that can tell passengers which carriages are full – or if there is enough room for strollers and bikes.

New vs. Retrofit

The life cycle of trains and trams is longer than their PIS. That is why information systems are replaced every 10-15 years. By modernizing the PIS about every decade, we eliminate age-related equipment problems such as liquid crystal displays getting dimmer over time.

DA-Group's passenger information systems are based on open internet protocol (IP) technology, which makes it possible to interface any third-party device with the system.

– This is a particularly significant benefit for renovation processes. For example, cameras, speakers and other devices may still be fully functional, so they can be effectively integrated with the new system, says Peter Hakala.

It is equally possible to use open IP technology in new projects, and when renovating old systems.

– Additionally, you can add advertisement displays to the vehicle, which provides an excellent opportunity for co-operation with advertisers. When advertisement displays are part of the system, campaigns can be shown

alongside passenger information. For operators, adding advertisement displays is a smart way to generate revenue, instead of incurring additional costs.

A long-term project backed by strong commitment

Providing PIS is a long-term project that takes time and dedication. Keeping in constant contact with the customer during the design and implementation stages is imperative. This is how we ensure that the customer receives the system that fits their exact needs. If our customers' needs change or updates become available, the system is modular and can be expanded to incorporate future updates.

- We completely commit to the project for many years, even decades, because we promise that the systems will have a long life cycle, states Hakala.

DA-Group understands the needs of the public transportation sector, and because of that understanding we can fulfil the expectations of our customers with our unparalleled experience and advanced technology.

- A great example of our customer-centric approach is the extra thin light emitting diode (LED) displays, designed and manufactured by DA-Group. The LED displays were first introduced into our product range due to the needs of our customers. These displays are being installed outside the tram because of their extreme weather tolerance.

PIS products must be EN 50155 and EN 45545 accredited. To test their durability and receive accreditation, the products must be carefully tested under extreme conditions - in scorching heat and sub-zero cold.

- A high-quality central processing unit (CPU) card inside the displays also guarantees that our products have an extended life cycle. We have designed, manufactured and tested the CPU card ourselves, so we are not dependent on any supplier for the products. Self-sufficiency is a huge advantage for us.

A Trailblazing Start for the Tampere Tramline

The Tampere tramline hit the streets of the growing city in August 2021. It has been an incredible honor for DA-Group to collaborate and work on the tram project from the beginning of its conception. We are proud to announce that the project was finished ahead of schedule and below the established budget.

- The acquisitions needed to efficiently complete the Tampere tramline project were obtained based on a "life cycle approach." The life of an average tram is roughly 40 years, and we expect these Tampere trams to live long lives based on the items we acquired from our equipment suppliers, says the CEO of Tampere Tramway Ltd., **Pekka Sirviö**.

The Tampere tram is equipped with an onboard passenger information system, multiple visual displays, a user-controlled interface for drivers and multiple camera displays - all provided by DA-Group. Additionally, DA-Group delivered a system for the tram door carriages. This system will ensure that the doors stay open (and closed) when necessary.

- The close-circuit television camera has been a valuable piece of technology for us. We use it as a preventive safety measure and to help us train our staff - we can access previous recordings that help us analyze close-call situations, states Sirviö.





Please register through Forum Marinum's website by scanning the QR-code. The exhibition is also virtually displayed at digimuseo.fi.

The Underwater Warfare Exhibition

DA-Group has an extensive history working with the defence industry. We have provided electronics and mechanics for sea mines and our expert knowledge in underwater explosions and signatures. We felt that it was only natural for us to host the historical collection of Finnish underwater warfare relics in an exhibition on DA-Group's premises in Forssa, Finland.

Finland has over a hundred years of experience in underwater warfare, its imminent threats and the development of underwater defence strategies.

The Forum Marinum Foundation has a vast collection of underwater warfare items collected from the time before Finland's independence right up to the present day. Until now, this unique collection has been stored in challenging conditions with limited public access.

After reading an article about the collection losing its Pansio storage and the lack of a proper venue, DA-Group immediately suggested that we hold an exhibition for the collection at our premises in Forssa.

- We seemed to be faced with only poor alternatives, but now our co-operation with DA-Group ensures the preservation and showcasing of the special underwater warfare collection. In my opinion, this is culturally a very important deed, states **Tapio Maijala**, Forum Marinum's Managing Director.

DA-Group's CEO **Sami Kotiniemi** says that hosting the exhibition on DA-Group's premises is a natural continuation of what DA-Group does, and what DA-Group wants to be involved in.

- In the exhibition, we are also able to present some equipment designed and manufactured by DA-Group, such as target detection devices for naval mines.

The security of the seas must be safeguarded

The Finnish Minister of Defence **Antti Kaikkonen** inaugurated the exhibition on the 4th of October, 2021. In his speech, he emphasized the importance of the Baltic Sea for Finnish trade, and how safeguarding the Baltic Sea is part of a bigger national agenda focusing on the security of supply.



*The HAVAS Mk IV manned submersible, an underwater vehicle for combat divers.
(Photo: Forum Marinum, Jorma Kontio)*



*The contact mines S/40-A and S/36, and a statuette of an early Finnish Navy mine expert, Master Specialist Mikko Aaltonen.
(Photo: Forum Marinum, Jorma Kontio)*

– Commercial ports must be in operation even during a state of emergency. That is why the security of seas forms a big part of Finland’s defensive position.

Antti Kaikkonen also stated that underwater mines have been – and remain to be – a crucial part of Finland’s defence system. It will continue to be necessary to invest in the development of mines.

– Seas are vital when it comes to defence. The significance of the Arctic is increasing – so have military operations in the Baltic Sea.

Forum Marinum’s Curator **Mikko Meronen** has organized the Underwater Warfare Exhibition. He states that mines manufactured in Finland are state-of-the-art, and very high quality also in comparison to other mines that are manufactured globally.

– The mines float at a depth of a couple of meters making them difficult to detect. They are cheap and efficient weapons that can be manufactured in large quantities.

A rare collection on public display

The core of the collection consists of over 80 rare naval mine items – originating from a collection of underwater warfare equipment put together from the 1920s onwards by the Finnish Navy, for training purposes.

The exhibition also includes items mostly used in the Navy’s operations, such as mine detection equipment and mine sweeping equipment, anti-submarine warfare material, torpedoes and material related to torpedo development and warfare.

Forum Marinum will manage and maintain the Underwater Warfare Exhibition and guided tours are provided by the organization. Forum Marinum and DA-Group will also offer public viewing days.



Posti Oy

Posti Green

DA GROUP

DA-Group is a provider of advanced electronics and high technology solutions and products. We serve industrial, defence and space sector customers on a global scale.

We are experts in embedded software solutions, electronics, mechanics and simulations in naval technology, as well as RF, microwave and millimeter wave engineering. Our service portfolio covers the turnkey solutions: from R&T, product development and engineering, testing and validation, manufacturing to product lifecycle management.

Established in 1995, DA-Group employs over 140 professionals. The headquarters are located in Forssa with offices in Helsinki, Oulu, Tampere and Turku.

DA-Group excels in quality and security, having the required certificates for industrial, defence and space qualified projects.

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