Sektionen för Detonik och Förbränning, SDF
The Swedish Section for Detonics and Combustion
anknuten till/affiliated with The Combustion Institute
www.sdfsweden.se info@sdfsweden.se

SDF Newsletter 2025:1

The Section for Detonics and Combustion, SDF, is a non-profit association with the purpose of bringing together people in the scientific and technical fields of detonics and combustion for information exchange and collaboration.

SDF is affiliated with The Combustion Institute, CI, which is an international, non-profit, educational and scientific society in combustion science with 13 different areas.

SDF supports the Explosives Museum in Karlstad, which shows the history of the Zakrisdalsverken and preserves munitions knowledge, education and training in the explosives field.

New members are welcome to SDF. Contact the secretary Håkan Ljungqvist hakan@gumba.nu

Membership is free, but in order to develop and continue the activities, SDF would be happy to accept a voluntary contribution to Plusgiro 196 69 42-3.

2025-01-29 SDF visits Yara AB and the Automotive and Technology Museum in Köping

On wednesday 29 January 2025 at 09:00 10 people gathered at the chemical-technical factory Yara AB at the Nya Hamnvägen 14 in Köping. The decision was made in 1942 by the KF (The Swedish Cooperative Union) board to build a factory for the production of nitrogen fertiliser and a few years later it was completed. Today, Yara AB manufactures TAN (technical ammonium nitrate) with a capacity of 360,000 tons per year. TAN is used to manufacture civil explosives for, among other, mining industries and roads.

Some years from Yara's development 1942-1995

- 1942 Decision to build a new nitrogen fertiliser factory is made by the KF board.
- 1946 Continuous production of calcium ammonium nitrate starts on 26 May 1946
- 1956 New nitric acid factory and NPK factory start
- 1958 Expansion of the KAS factory complete
- 1965 New factories start: Ammonia, urea and NP/KS.
- 1978 Sulfuric acid factory is built to reduce sulfur dioxide emissions.
- 1982 New nitric acid factory
- 1987 Urea and ammonia factories are closed
- 1988 NP/KS and calcium ammonium nitrate are closed
- 1991 New factory for the production of technical ammonium nitrate starts
- 1995 Norsk Hydro becomes sole owner and the company changes its name to Hydro Agri.

Source: "The History of a Chemical Factory in Köping" ("Historien om en kemisk fabrik i Köping") - A publication in Swedish published in connection with the factory's 50th anniversary in May 1996. Available in the archives of the Zakrisdal Explosives Museum, Karlstad.

Ammonium nitrate NH4NO3 is a salt of ammonium and nitrate ions and is produced by passing ammonia gas (NH3) through concentrated nitric acid (HNO3).

$$NH_3 + HNO_3 \rightarrow NH_4NO_3$$

The reaction is strongly exothermic and requires a lot of cooling. The hot cooling water is used to heat the factory and for district heating for the urban area of Köping. When the solution has stabilised, the excess water is boiled away and the ammonium nitrate is formed into granules or pellets which are then dried further and provided with a protective film.

After the participants were provided with full-coverage protective clothing, site manager Axel Sylvén and inspection manager Bernt Bergsten told about the company's history and processes. Safety is a very important part of the business and Axel Sylvén carefully informed about what applies.

After the briefing, Axel Sylvén and process engineer Gustavo Rodriguez showed us around the production in the large factory area where we got to see, among other things, the nitric acid factory and the granulation.

After the tour, we went across the street to Restaurang Mässen and had lunch with Axel Sylvén and Gustavo Rodriguez. www.yara.se

After lunch we visited the Car and Technology Museum in Köping which displays Scandinavia's finest collection of Bugatti cars and other legendary brands such as Pierce-Arrow, Panhard-Levassor, Voisin, Cadillac, Rolls-Royce and Bentley. Here you can also find one of Mercedes-Benz's most famous racing cars, the supercharged SSK 1929. https://biloteknikmuseet.se/

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SWEBAL invests in explosives production in Nora

Press release Stockholm, May 8, 2025

At a time when Europe's security situation requires increased self-sufficiency in the defence industry,

a decisive step is now being taken by resuming domestic production of explosives in Sweden. Sweden Ballistics AB (SWEBAL) is establishing a new factory for the production of TNT (TriNitroToluene) in Nora, an investment that strengthens European defence capabilities, reduces Sweden's dependence on foreign suppliers and creates new jobs.

Following Russia's invasion of Ukraine, Europe finds itself in an uncertain geopolitical situation. As part of Sweden's preparations for the new reality of war in our immediate vicinity, and with Sweden's NATO membership, we need to increase our defence capabilities by investing in domestic production of explosives without dependence on foreign supply chains.

SWEBAL's establishment will lead to an annual production of 4,500 tons, which would correspond to most of the explosives that Sweden needs today to be able to defend itself in times of war.

Technology and construction are being developed in the immediate area where the manufacturing technology originates from the TNT factory that Sweden once had, which means that there will be more efficient manufacturing but above all safer.

The forecast is to start construction at the turn of the year 2025/2026 in order to be able to operate the factory in 2028. During this period, SWEBAL will employ up to 50 people for a complete start of operations, while this in turn will lead to approximately 100 job opportunities.

The facility is currently being designed while awaiting a building permit from the Land and Environmental Court.

Behind the establishment are serial entrepreneur Joakim Sjöblom and validation engineer Carl Duforce.

“Our promise to our customers is clear, we will prioritise domestic inputs and subcontractors as far as possible. TNT has not been produced locally for almost 30 years, so being able to secure Swedish production over the long term will be strategically important, both for us as a producer and for Europe's defence capability,” says Joakim Sjöblom, CEO of SWEBAL.

About SWEBAL: SWEBAL establishes production of TNT in Northern Europe and becomes a vital part of the defence industry's supply chain. Founded in 2024, dedicated to strengthening Sweden's and NATO's resilience and preventing military conflict, through the production of defensive capability.”Read more: https://swebal.se

We need more explosives professors

Western governments' rapidly growing defence spending sounds like a straightforward equation: more spending equals more weapons. But skilled weapons workers are in short supply. So are explosives experts – and without explosives, even the most sophisticated weaponry is pointless. But blowing things up is not learned in a quick crash course. We need more explosives professors.

NATO member states' defence spending is on an extraordinary growth spurt. This year Poland, for example, is spending 4.1 percent of GDP on defence, up from two percent five years ago. Sweden, too, has doubled its defence spending. Germany, of course, is spending not just its regular defence budget but its Sondervermögen too. That's a lot of military equipment being ordered. Indeed, such is

the demand and such is the shortage of skilled weapons workers that defence manufacturers have massive backlogs. (When it comes to the skills required to fulfil their jobs, think tankers or bankers can't hold a candle to submarine welders.)

But that's just the first problem. An even more intractable challenge is surfacing: we don't have enough people who know how to make things go boom. "In Sweden we used to have a big explosives sector, both civilian and military, for example [mining giant] Atlas Copco and [weapons maker] Bofors," Bo Janzon told me. "People would graduate from university and the companies would train people themselves, both at the manual-worker level and at the academic level. But these days the company-led explosives training barely exists anymore, nor do university courses in it."

Janzon knows, because he's an explosives scientist himself. Until he retired in 2007, he spent four decades enhancing everything that went boom at Sweden's defence research agency, a career that included weapons and underwater effects, shaped charges, kinetic-energy penetrators, advanced armours, land and underwater mine detection and clearance, humanitarian demining, IED and explosive detection and neutralization, wound ballistics, forensic ballistics, gunshot trauma, fragmentation warheads and effects, penetration mechanics, numerical continuum dynamic modelling, and further such. In the years immediately thereafter, the explosives man remained convinced that his field had a future. "I and others launched an explosives engineering course at KTH [the KTH Royal Institute of Technology in Stockholm] in the 1990s, but it was shelved due to lack of student interest." In the nineties, bomb-making was as unfashionable as a career choice could possibly be.

Then Janzon and other explosives gurus retired, both in Sweden and elsewhere, and they did so not with a bang but with a whimper. Their skills were just not needed anymore. Countries even outsourced the production of gunpowder to China.

Now, though, explosives expertise is in massive demand again, because without things that go boom, all the sophisticated military equipment being made is impotent. This spring, Ukraine's ammunition shortage has been so acute that soldiers often couldn't counter Russian attacks. And Ukraine's ammunition shortage is so severe because its Western friends are not in a position to resupply it at the same rate Russia resupplies its troops. The US and Europe only produced a total of 1.2 million pieces of ammunition per year, while Russia produces some three million, CNN reported in March. This alarming state of affairs has prompted the Czech Republic to scour the world for existing ammo among non-Western countries that use the same Soviet-model equipment as Ukraine. The goal is to secure 800,000 such artillery shells. That wouldn't help the West's ammo production, though, and Ukraine would of course need more rounds even after receiving the 800,000 (if they can be procured).

We need more explosives engineers, and that means more explosives professors. To be sure, mining companies still train explosives experts, and a few universities – like Britain's military-linked Cranfield – offer master's degrees in explosives engineering. So too do state universities in mining-heavy US states. But even though a few ordinance experts join the labour market each year, and even though some companies have managed to entice retired explosives engineers back to their factories, there aren't enough members of this rarefied profession to satisfy the needs of the booming defence industry.

In fact, producing explosives professors ought to be one of the very first steps as we shore up the defence of our countries, because explosives expertise can't be gained on the quick. To even qualify

for an academic program that can lead to a job in industry or an academic career, applicants must typically have a degree in civil engineering, chemistry, or physics. A few universities and training colleges also run rudimentary courses for technicians. And with explosives, there's no blasting a shortcut to expertise. "The problem is just that explosives are very dangerous," Janzon said. "You have to produce extremely high pressure, and the materials involved are enormously destructive. And explosives are also very difficult and very different from anything else. That's why you need trained people." Janzon is proud to still be in possession of all five fingers on both hands.

Just like war, explosives are no business for amateurs or the faint-hearted. Although it's a good think that a few retired explosives engineers here and there are willing to do a stint in industry, these Cold War remnants won't be able to single-handedly fill the explosives industry's gaps. Their rare younger colleagues need to train the next generation. That means universities need to start offering explosives degrees. But seats of higher learning can't build the curriculum and model the workforce needed on their own. On the contrary, explosives engineering is the sort of specialisation that requires government steering. If governments, industry and academia work together to identify the explosives expertise needed and project the size the future explosives work force, we can hope for a sustainable future, explosives-wise.

Until then, our best hope are silver-haired scientists whose expertise was considered passé just a few years ago. These days, Bo Janzon is often asked to teach and even to help out in industry. Being well into his eighties, though, he doesn't feel he's got the energy for it.

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Atlantic Council Maritime Threats initiative
Goodbye Globalization (Axiom Business Book Awards gold winner)

Special blasting

Nitrex is an Italian company that has been operating internationally since 2004 in explosives technology for the controlled demolition of structures, open-air, underground and underwater excavations. The company has demolished over 140 reinforced concrete bridges, underwater excavations with drilling and with hollow charges including 50,000 m³ in basalt between 80 and 100 m underwater (never before done in the world). For more information about the company and its field of activity, please contact Hans Wallin Hewab AB <hans.wallin@hewab.se> .

- A controlled rock blasting of 3200 m³ in Taormina (a tourist town in Sicily) to remove a dangerous volume of rock on a slope. 160 holes, 2000 meters of drilling, 1200 kg of TNT equivalent explosive (dynamite and pentrite detonating fuse). Drilling with radio-controlled machines and miners attached to lifelines. Shot sequence 25 ms.
  - https://youtu.be/KDrEnTpptqA?si=Tov0MP150zL3DKk4

- Lake Mead, the largest man-made reservoir in the United States, is located approximately 30 miles (48 kilometers) southeast of Las Vegas, Nevada. The construction of Lake Mead's third water intake, which is located entirely underground, required an underwater excavation to a depth of 330 feet (100 m). This was done by means of directed blasting using special shaped charges.
  - https://www.sdfsweden.se/docs/250903_Lake_Mead_Excavation_1.pdf
  - https://www.sdfsweden.se/docs/250903_Lake_Mead_Excavation_2.pdf

Intellectual property rights and defence innovations

Europe's political leadership was convinced that a military conflict in Europe was impossible before 24 February 2022. Now, more than three years into a full-scale war, the understanding of how unprepared we were is starting to sink in and efforts to improve our preparedness are slowly beginning. It did not take long for enterprising entrepreneurs to identify that there are major gaps to fill in terms of both material supply and the development of new capabilities to meet the needs of the new military battlefield. The war that we have been able to follow, almost in real time, over the past three years was initially based on previous experiences and the application of conventional tactics but was quickly modified with new methods and, above all, the use of new technology. It is possible to identify a widespread shortage of material in terms of both conventional weapon systems, and then primarily ammunition and perhaps specifically artillery ammunition, but also a shortage of more improvised weapon systems, often including various forms of drones and countermeasures against drones.

Historically, the development of new technology and the protection of intellectual property rights have gone hand in hand. Alfred Nobel's initial inventions were not patented in Sweden, which did not have a fully developed patent law at the time (what existed was a form of privilege system), but as soon as Sweden created a formal patent system, Alfred Nobel also came to protect his inventions in Sweden. The Swedish defence industry has been continuously active in protecting new innovations and groundbreaking inventions have repeatedly originated in the Swedish defence industry. To name a few inventions, for example, Titanium dioxide as an additive in the form of a cloth for propellant charges (Swedish Additive) which had a major impact in improving the service life of gun barrels, the base flow technology which improves the range of shots and the development of precision-guided artillery ammunition, where Swedish patented innovations have played a crucial role in the realisation of a fully functional product.

Intellectual property protection of new products and subsystems of products and methods, such as manufacturing methods, will be of great importance as it is expected that there will be large economic values at stake at the same time as international competition will be extensive. Historically, national industry has often been protected through national procurement orders, but today many countries lack their own industrial capacity in defence equipment, which is why it will no longer be possible to direct orders to national actors in the same way. There may be requirements that production takes place within the national borders of a certain country or a certain region, and then various forms of licensing agreements can be expected to be of great importance. For example, by transferring technological know-how, in combination with intellectual property rights, for license production in another nation or for a specific market. Using various forms of licenses for the production of defence equipment has a long tradition and will likely once again be of great importance as the build-up of production capacity must be rapid and distributed across many actors.

It is possible to see a flow of new defence-related innovations from start-ups that understand that intellectual property rights will be of great importance. Historically, patents have also been important for obtaining venture capital as they provide security for investment, which also applies to start-ups of defence-related companies. At the same time, the conventional defence industries continue to develop new innovations, but over time the number of patents from many of the established companies has decreased, so there is more to be done to identify new inventions and protect more development and new products with patents. An important measure is to identify and compensate inventors based on the agreements that exist in the labour market. Financial compensation to inventors has a fairness aspect. For some innovators, financial compensation will also be important for the submission of more invention applications. Something that should not be underestimated, however, is that the inventors will be identified and appreciated. Showing appreciation often does not cost much, but has, in my experience, a very great importance. Examples of appreciation can be different types of annually recurring events, such as an inventors' lunch where patent plaques and similar rewards are awarded. In summary, we are facing an exciting period with an increased number of players in the defence industrial sector. The size of the market is also growing with increased investments in defence. It is also possible to speculate that further increases in defence budgets can be expected across Europe as it has been underinvested for many years. Access to capital has also been opened up for defence industrial companies as it is no longer considered unethical to invest in defence companies but rather is considered a necessary security investment to secure democratic societies.

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Is the energy transition a hopeless project?

The article SDF Newsletter 2024:1 by Professor Bill Durodie presents a very pessimistic view of the possibility of developing our energy supply. I agree with his description that cultural expressions have had a great importance for development, and environmental groups in particular have had a very negative impact on our possibilities of creating an efficient, safe and fossil-free system for energy supply, among other through their emotional opposition to nuclear power an one-sided focus on solar, wind and other time-variable energy sources.

But we can still agree that the scenario, as it now appears, with global warming of up to 3 degrees by 2100, looks frightening, and that everything that we can do must be done to counteract it. The electricity supply will, inevitably, have a major role in this work. A main problem in this work is that many of the parts of the energy system take an unreasonably long time to develop, among other things due to an unwieldy legal system that governs the processes and the attitude "… but not in my backyard". Until fusion power will, possibly, become usable, it is clear that nuclear power expansion will be an indispensable part of our energy supply and has been for a long time. Stupid and less far-sighted decisions to shut down nuclear power, such as in Germany and Sweden, have made the work difficult, while France and war-torn Ukraine have drawn different conclusions. Solar, wind and geothermal power will play important roles in the supply, but above all it is perhaps the expansion of the electricity grid that can make all the changes possible! And reasonable pricing models for consumers!

Working against the change that will probably be necessary for the survival of humanity does not appear very productive, and science and technology are the tools that can make the transition possible. There are already very strong braking factors, such as the powerful industry that produces fossil fuels, and political factors that work against all change.

Each one of us can help with the transition, and I have, myself, tried to contribute with simple measures such as improving the insulation of my house, installing solar cells and heating my house with a heat pump, which works excellently and is neither expensive nor bulky. These measures reduce my electricity cost by 50% or more. I drive a modern, highly exhaust-cleaned diesel car that runs on HVO100 and will reduce my number of flights. And this has not affected my standard of living negatively. I do not yet see an electric car as an alternative, but a hybrid might be a step on the way (but unfortunately most hybrid cars are still dependent on petrol). Anyone can easily participate with the measures that we see as effective!

Professor Bo Janzon SECRAB Security Research bo.janzon@secrab.eu

Museums related to explosives/combustion

- **Sweden**
  - Sprängtekniska Museet Zakrisdal, Zakrisdalsslingan 5, 653 42 Karlstad
    - https://sdfsweden.se/docs/231020_Sprangtekniska_Museet_Zakrisdal.pdf
  - Tändsticksmuseet, Tändsticksgränd 27, 553 15 Jönköping, Sweden
    - https://matchmuseum.jonkoping.se/
- **Norway**
  - Spængstoff Historisk Museum, Engeneveien, Hurum, Norway
    - https://www.erih.net/i-want-to-go-there/site/historical-explosives-museum
- **Poland**
  - Exploseum. D.A.G. Fabrik Bromberg
    - https://ec.europa.eu/regional_policy/en/projects/poland/exploseum-former-german-explosives-factory-turned-into-interactive-museum
    - https://en.wikipedia.org/wiki/Exploseum
- **Italy**
  - Institute for researches on explosives (IRE),Via Zanardelli, 17/a - 43126 – Parma, Italy
    - https://parmawelcome.it/en/place/explosives-museum-and-academy/

- **United Kingdom**
    - Explosion Museum of Naval Firepower, Priddy’s Hard Heritage Way, Gosport, PO12 4LE
        - https://www.nmrn.org.uk/visit-us/explosion-museum-naval-firepower
    - Royal Gunpowder Mills, Beaulieu Drive, Waltham Abbey, Essex, EN9 1JY, United Kingdom. info@royalgunpowdermills.com. Phone: 01992 707370
        - https://www.royalgunpowdermills.com/

Please send suggestions for additional museums.

/Håkan Ljungqvist Secretary SDF hakan@gumba.nu

Historical News

On October 12, 1654, a gunpowder warehouse in Delft, Netherlands, explodes. More than 40 tons of black powder explodes, leveling hundreds of houses and killing thousands of people. One of them is Carel Fabritius, known as Rembrandt's most promising student. The artist Egbert van der Poel, becomes famous for his drawings and paintings of the devastation. /Dagens Nyheter 2024-10-12

2025-03-25 Annual Meeting - At the annual meeting, the SDF board was elected

Chairman Ola Listh (elected by the annual meeting)
Vice Chairman Dan Loyd
Treasurer Leif Jilsmo
Secretary Håkan Ljungqvist
Other members Hans Wallin, Nils Örnebring, Alexis Bohlin
Administrator of the Combustion Institute Alexis Bohlin

SDF Program 2025; www.sdfsweden.se/history/default.sv.php

Suggestions for activities, webinars or study visits are welcome.

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