

Sektionen för Detonik och Förbränning, SDF
The Swedish Section for Detonics and Combustion
anknuten till/affiliated with The Combustion Institute
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SDF Newsletter 2023:1 English

The Section for Detonics and Combustion, SDF, is a non-profit association with the aim of bringing together people in the science and technology fields of detonics and combustion for information exchange and cooperation aimed at promoting education and scientific research within these fields.

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 Sprängtekniska Muséet (Explosive Technology Museum) in Karlstad, which shows the history of the Zakrisdalsverken and preserves munitions knowledge and training in the field of explosives.

Membership of SDF is free, but in order to ensure continued business, SDF would be happy to accept a voluntary contribution of SEK 100 or more to Plusgiro 196 69 42-3.

The Vice Chairman's column

Since the Thirty Years' War in the 17th century, Sweden has a very long tradition of activity in the field of explosives. This includes production, product development and research. You need only recall the pioneering efforts of Alfred Nobel's in the field at the end of the 19th century.

Activities during the Cold War were mainly carried out within the large industrial groups Bofors and FFV as well as within the National Defence Research Establishment, FOA. Research and development were carried out on explosives in a large number of different areas. The players were so large that they had their own education and training departments, which conducted extensive training activities in various fields and at different levels. Hence, the need for research and education connected to the university world was relatively limited. There was no superior body that coordinated the activities in the field of explosives. The state, through the FOA and the Swedish Armed Forces, as well as the companies involved, still had a very good view of the total activity carried out in the area.

In connection with the disarmament of the Swedish Defence during the 1990s, a very extensive restructuring of the various activities in the area of explosives took place. Some units within Bofors and FFV were merged, while other units were sold on the national and international markets. In addition, several businesses and units were wound down. This meant, among other things, that activities within research and product development became significantly smaller than before and also became very fragmented. The education and training departments within Bofors and FFV were discontinued, but a certain part of the training activities continued to be conducted through a newly created unit. Operations at FOA decreased and were conducted, after the turn of the century, within the Swedish Defence Research Agency, FOI.

If you look in the rearview mirror at the restructuring of the explosives sector, some kind of supervisory body should probably have been set up to continue to coordinate the very fragmented business that the transformation resulted in. Unfortunately, that issue fell "between the chairs" and any major change to the

activities within the area did not occur during the early 2000s.

Today the situation is completely different. We have a full-scale war in Europe and Sweden wishes to join the defence organisation NATO. This means that the state needs take greater responsibility in the explosives sector, and this applies both organisationally and financially. The connection between the explosives sector and the university and college sectors needs to be developed. Regardless of what measures are planned and implemented, it is very urgent. Otherwise, large parts of the research, product development and production will move abroad.

/Dan Loyd - Professor emeritus, Vice Chairman of the Section for Detonics and Combustion

RAVENs first igniter test completed!



First ignition test of a hybrid rocket propulsion system preparing for a static hot fire test. (Credit: Project RAVEN at the Kiruna Space Campus, LTU, email: kiruna.raven@gmail.com)

RAVEN, **R**ocketry and **A**erospace **V**ehicle **E**ngineering in **N**orrbotten, is the first student rocket project at the Luleå University of Technology. The project aims to design, build, and launch a hybrid propellant rocket with a 10 kg payload, capable of reaching a minimum altitude of 10 km. Since presenting the preliminary rocket design at the IAC 2021, a more thorough analysis of the rocket's performance and structural integrity was performed through extensive simulations, calculations, and preliminary testing. Design changes were accordingly implemented, and an extensive testing plan was developed.

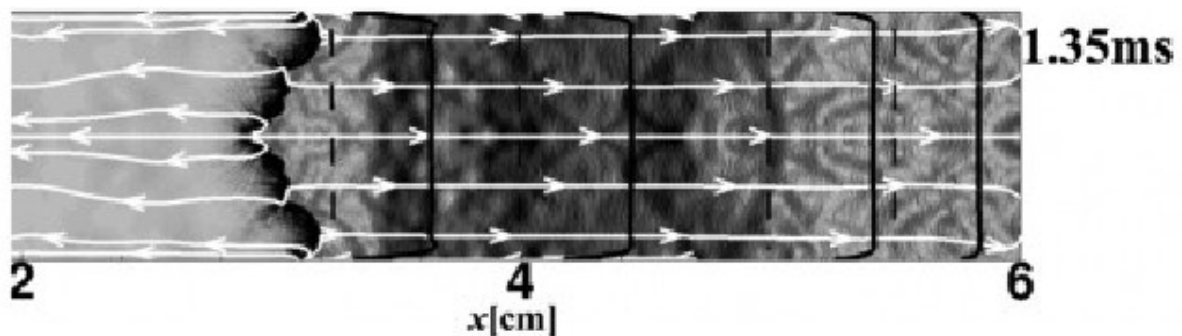
The RAVEN propulsion system comprises 37 kg of propellant, including self-pressurizing nitrous oxide and paraffin wax, which produces an average thrust of 6 kN over 12 seconds. Under the test plan, testing of the propulsion system was divided into three stages which reflect increasing complexity, from component level testing to system-level testing. In the latter phase, the motor will be subject

to a multitude of test firings; these necessitated the development of a custom test bench with versatile capabilities. During the design process, thorough review and trade-off between different technologies were conducted, in which ease of manufacturing and scalability were the main drivers.

The resulting bench design features a detached tank cage and interfaces which require little modification to accommodate differently sized rocket motors. This flexibility makes the bench amenable for reuse with future iterations of the RAVEN rocket, thus facilitating ongoing rocketry projects at the university. With the test bench, the RAVEN team will be able not only to validate the rocket motor, but to conduct an intensive study of the system. This will result in collection of important data, providing invaluable insight into the functionality of the rocket motor and hands-on experience of hardware testing. In this way, the test bench and testing plan play a crucial role in ensuring the success of project RAVEN while laying foundations and infrastructure for its successors. For more info, please reach out to the RAVEN team directly by email kiruna.raven@gmail.com

/Dr. **Alexis Bohlin** (Academic supervisor of the RAVEN team, and board member at SDF).

Dynamics of flames in tubes with no-slip walls and the mechanism of tulip flame formation



Another important result is the first time obtained explanation of the physical mechanism of tulip flame formation. Although the phenomenon of the tulip flame has been known for almost 100 years, after the first experimental observation by O. Ellis in 1925, and a huge number of theoretical, experimental, and numerical works were performed in an attempt to explain this phenomenon, the physics of tulip flame formation has remained unclear. In my presentation at 28-ICDERS last year in Naples, as well as in Comb. Sci. Techn. 195 (2023) (see link below), it was shown that during the deceleration stage, which follows the initial flame acceleration stage, the decelerating flame generates a rarefaction wave in the unburned gas ahead of the flame front. The superposition of the unreacted flow in front of the flame front generated during the acceleration stage and the flow generated behind the rarefaction wave results in a tulip-shaped profile of the unreacted gas immediately in front of the flame front. Since the velocity of any point of the flame front is equal to the sum of the velocity of the laminar flame with respect to the fresh gas flow and the velocity of the unburned gas immediately before this point (with which the unburned gas flows from this point), the flame front also takes the form of a tulip. Thus, we explain not only the qualitative formation of the tulip-shaped flame, but also quantitatively explain the shape of the tulip petals } the location of the petal apex and its width.

Now we finished 3D simulations, which show excellent agreement with experimental observations of tulip flames in highly reactive (hydrogen/air) and low reactive (methane/air) mixtures. In agreement with recent experiments (Ponizy, Claverie, and Veyssière), the development of a tulip shaped flame is a pure hydrodynamic process, which does not involve any kind of flame instability. Links to download the full article:

- https://www.sdfsweden.se/docs/Tulip_2023_Libe_Quan_Wang.pdf
- <https://doi.org/10.1080/00102202.2023.2182204>

New book: "Combustion Physics: Flames, detonations, explosions, astrophysical combustions and inertial confinement fusion"
;ISBN: 978-3-030-85139-2

Publication of my new book on Combustion Physics, with applications of combustion theory to inertial fusion and to astrophysics problems. A flyer of the book with the contents:

- https://www.sdfsweden.se/docs/Liberman_Combustion_Physics_2021.pdf

/Professor **Mikhail (Michael) Liberman**, Nordita, the Nordic Institute for Theoretical Physics,
KTH Royal Institute of Technology and Stockholm University,
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The "Dagens Arbete" examines the bombings in Sweden

Dagens Arbete, the Industrial Workers' magazine, DA (with a circulation of 365 200!), wrote in a series of articles how criminals can easily smuggle out large quantities of explosives from construction sites. Control and supervision are lacking. And convicts can keep on blasting.

- Stolen: Half a ton of explosives
- Companies blast without permission
- Explosive permits are not revoked for convicted criminals
- Richard wanted to help - was suspected of crime
- Toni: "Am I back in the war?"
- Helene: "I was standing next to the bomb"
- The municipalities: "We are not involved"
- Criminal: "Easy to steal explosives from construction sites"
- The decision that paved the way for the bombings
- Doubling of the bombings in 2023
- Explosives expert: This is why dynamite is stolen from construction sites (*Interview with Professor Bo Janzon, SDF*)
- So much damage results from different amounts of dynamite
- "You must not let fear take over your life "
- The insecurity after the blasts
- This is how much criminals pay for explosives
- Picture extra: Here they blow up in the mountain
- The entrance to Gabriel's workplace was blown up
- MSB had to back down - "unsuitable" people are now suitable

Link to articles: [Tema: DA granskar sprängdåden - Dagens Arbete](#) (in Swedish)

Explosive remnants after the war in Ukraine: Presentation to download

On Thursday 2023-03-23, **Fredrik Johnsson**, Disarmament Solutions AB, held a seminar on landmines, cluster weapons, unexploded ordnance and the large

amounts of mined property which constitute one of the main obstacles to being able to rebuild Ukraine after the war. Fredrik described the problem picture that Ukraine is struggling to deal with and what support will be required from the outside world in the upcoming clean-up work.

https://www.sdfsweden.se/docs/230323_SDF_Disarmament%20Solutions.pdf ;

<https://www.sdfsweden.se/history/default.sv.php> ;Or SDF > Activities 2023-03-23

How can theft of explosives be prevented?

Shootings and explosions occur pretty much on a daily basis in Sweden, which means that trust in the Swedish society is damaged. The government and parliament must now show that this is no longer acceptable and strong measures must be taken.

The government should appoint a special person responsible, who would have the task of restoring trust in Swedish society.

How can theft of explosives be prevented? And how may the number of illegal firearms in the country be reduced?

Thefts of explosives from construction sites etc. have, unfortunately, turned out to be all too common in Sweden. A large part of the explosives, which criminal gangs use for bombings with the aim of intimidating people and consolidating their power, consist of stolen or "misappropriated" civilian explosives, most commonly different types of dynamite.

Unfortunately, the regulatory system and organisation around permits and supervision for explosives is too complex, and the many appointed actors, mainly municipalities, often lack both the competence and resources to be able to review permit applicants and carry out supervision.

The security level requirements for explosives stores are set too low, and the storage units that are used often have substandard theft protection and may sometimes be left open all day.

Central registers of holders of permits for handling explosives are missing. Permit holders who commit crimes can often continue with their business without risk of being discovered and having their permit revoked. People who lack a license or the right skills, or who have had their license revoked, sometimes continue to work with explosives.

All of this makes it too easy for criminals and potential terrorists alike to steal or otherwise gain access to explosives.

The presence of illegal weapons in Sweden is another big problem, which also requires solutions! More on this may appear in an upcoming article!

Ten suggestions to improve the protection of explosive goods

1) Requirements to be introduced for better storage for explosives, with higher theft security and alarms, and with day locks that are opened with a personal transponder or similar, which are logged. The warehouse must be connected to a central server via WiFi, 4G or 5G. The content of this server must be accessible to competent authorities.

If a storage facility/warehouse has a sufficient level of theft protection and an alarm that is constantly connected, emergency personnel can arrive before any break-in is carried out. The requirements for anti-theft protection and withdrawal times should be adapted so that the same degree of security can be achieved at all locations in Sweden. In the case of larger stores, the police should ideally be the emergency unit.

The server should be classified, with access only to authorized personnel within the relevant authorities. If unauthorized people would be given access, important information, such as the warehouse's location and contents, will risk being leaked!

2) Mandatory blast plans to be introduced, even for smaller jobs, which will also be registered (traceably) in the central server.

The blast plan can conveniently be combined with the risk analysis that is always required. Since the plan is accessible to the supervisory authority, its reasonableness can be assessed and supervision can take place if it is judged not to be professional.

3) Explosives to be stored on shelves in the warehouse, with built-in scales. You place an explosive or combustible package (of course with different stores for these) on a shelf, which will then be automatically weighed, noted in a log and supplemented with, for example, a scanned bar code that describes the contents. The log is sent to the central server and registered there.

This is known, cheap and reliable technology, which is used in e.g. personal scales. The accuracy is sufficient to make the "misappropriation" of explosives very difficult, with risk of detection during inspection.

Each time explosives are taken out, the quantity and type will be logged by the weight sensors and supplemented with the type and number of units, name/code of the person who collects and where, according to the blast plan, it is to be used. The data is recorded locally in the warehouse, and thus constitutes the reporting of explosive goods required in regulation 2010-1075 § 11 (regulation 2016:380). Data are also logged on the central server.

4) Better marking of explosives to be introduced, with markers that can partially survive detonation, unique to at least each manufactured batch, to be able to track stolen and recovered and also used explosives. The manufacturer/supplier will register the marking in the central server.

This will enable authorities to quickly identify the origin of explosives suspected of being connected to crime. The technology is available, for example, in the form of Microtrace[®] "Microtaggant", which, among other things, is proscribed in Switzerland. There is also other, simpler technology, including microdots of metal that can survive detonation.

5) All permits for the handling of explosives and incendiaries should revert to being issued by the police, with a central state register of explosives supervisors, master blasters and all other personnel who are allowed to work with explosives, so that crimes committed by any such person would be immediately noted and result in retracted permits. Coordinated and centrally registered permits for blasting companies also to be introduced.

Today's system where the municipalities are responsible for a significant part of the granting of permits is not acceptable, among other things because many municipalities cannot live up to the requirement of knowledge to be able to assess the competence and suitability of applicants, or to exercise supervision.

6) A requirement to be introduced that only personnel with a valid permit may transfer and retrieve explosive goods from suppliers. Requirements for secure identification also to be introduced.

Today, the "law of the jungle" seems to apply, and anyone seems to be able to retrieve explosive goods from suppliers, at times.

7) Better protection to be introduced for the transport of explosive goods, for example through storage cabinets that fulfil requirements corresponding to those for fixed storage. Large transports should preferably have an escort vehicle with armed personnel. This requirement need not apply to separate shipments of binary explosive materials.

Today, there are few suitable storage cabinets for the transport of explosive goods on the market. If requirements for such units will be introduced, solutions will emerge!

A requirement for surveillance by armed personnel can be solved by making such transports objects of protection ("skyddsobjekt"), and they can then be guarded by armed security guards ("skyddsvakter") authorized to intervene against attempted theft or robbery.

8) The knowledge requirements for the various positions that come in contact with explosives should be increased, so that the handling of explosives will become more professional, and that risks of accident and unskilful behaviour will be reduced. Knowledge requirements should be introduced according to the British model, which should be subsequently made uniform throughout the EU!

Even for people involved in the permit and supervision process, requirements for an approved level of education should be introduced!

Today, the main training activities for people who are to handle explosive goods are carried out by private companies with a profit interest. The majority of these courses are short courses at high cost. It should be a task for society to ensure that well-educated personnel with knowledge certificates will be available for the industry's needs. A suitable form of providing basic knowledge can be "KY educational courses" of one or two years.

9) Today there is no academic level education on flammable and explosive goods in Sweden, and only few in Europe - that will also be needed to raise the quality of all handling in Sweden!

In order to guarantee the quality of lower education in particular, it is important that highly qualified education will be available. One possible form could be to found an industrial research institute linked to a suitable university or college. Collaboration with, for example, the FOI, can be suitably done.

10) In Sweden there are quite a few companies and organizations that work with explosives in various capacities. These should be involved in the creation of new courses in the field, and the area of flammable and explosive goods should be prioritized in research and training.

Examples are Saab AB, Saab Bofors Dynamics, Saab Underwater Systems, BAE Systems Bofors, Eurenco, Nammo, Swedish Space Corporation, Norma, Hansson Pyrotech, Hypex Bio Explosives Technology, Austin Sweden AB, SSE Sweden, Gyttorp Cartridge, Forcit Sweden, LKAB Kimit, EPC Sweden, Orica Sweden and other companies in both the defence-oriented and civil sectors.

Sweden has previously, among other things through the legacy of Alfred Nobel, had a prominent position in the field of explosives, which has now been lost in part. Among other things, because most of the Swedish explosives industry today is foreign-owned, research and development in the field has often been moved abroad. One of the reasons that this happened may probably just be that highly competent personnel in the area were not educated at Swedish universities and colleges. In the past, the large companies had their own training departments that were responsible for this type of training, but these are generally closed down now.

Well-educated and trained personnel will also be needed for the needs of Defence (including Swedec, FOI, FMV and FortV), the police (National Bomb Protection Group), MSB etc. Some municipal rescue services and the "new old" civil defence will need qualified personnel who can handle flammable and explosive goods in risky situations, e g handling of unexploded ordnance, ammunition dumps and mines. In the event of a military attack against Sweden, Defence personnel must prioritize Defence's needs, and police resources will not be sufficient for all of society's needs, so specialised personnel must be trained for deployment in the Civil Defence. In order for such an organization to be able

to function effectively and safely, competent personnel will also be needed in management and as leaders and teachers for educational activities.

Contact: Professor **Bo Janzon**; bo.janzon@secrab.eu

Peace technology - needed now, more than ever!

An average of around half a million people die annually from violence in the world, many from acts with firearms or explosives! High levels of armed violence in an area reduce respect for human life, prevent peaceful and economic development, and aid from the outside world will not reach those in need.

Explosives, which can explode or detonate, sometimes spontaneously, are toxic to people and the environment, and constitute a very dangerous type of waste, which, if handled incorrectly, can cause serious injury and fatalities. Explosives, sometimes from stolen ammunition, are the most common weapons used in terrorist attacks. Especially in Sweden, unfortunately, stolen civilian explosives are also common in bombings related to gang crime. Spontaneous or accidentally triggered explosions in old warehouses occur several dozen times per year; thousands of people die and tens of thousands are injured in completely unnecessary accidents, which can lead to the destruction of whole communities! Vivid examples are the huge blasts in Beirut harbour in 2020.

The collapse of the Soviet Union in 1990 revealed enormous amounts of military material stored in Warsaw Pact nations and in many other countries, not least in developing countries. After every armed conflict, huge surpluses of weapons, ammunition and other explosive substances arise, which quickly find their way onto the illegal market, which, especially, we in Sweden have experienced!

Ammunition and other explosive materials cannot be handled by ordinary scrap handlers, but must be destroyed or recycled using special methods. Despite the Ottawa Convention against Anti-Personnel Mines, hundreds of millions of emplaced and dispersed landmines remain in 70 nations. Ukraine is now the most affected nation, with minefields within 200,000 km². At the current rate it will take thousands of years before all mines can be cleared, if ever, and despite the convention new minefields are being added all the time. Large quantities of duds and huge stockpiles of surplus ammunition and explosives also pose risks of unwanted spontaneous explosions, theft and illegal trade. All this constitutes difficult obstacles to being able to establish a "normal" society.

Over 100 million Ak47 } "Kalashnikov" } and other similar military automatic carbines exist in the world. Millions of surplus weapons and ammunition are sold to hotbeds of unrest and used in various conflicts, and distributed on a large scale to criminals. Existing markings can be easily removed, and are sometimes missing from the outset. Registries are often unreliable, which promotes illegal trade and reduces the risk of being caught. The UN's "Arms Trade Treaty", which entered into force in 2014, affects international trade, which, however, is very difficult to follow because often all of sellers, buyers and intermediaries want to avoid transparency! Additionally, affected nations, which are responsible for implementing the agreement, do not always have full control over their territory and their arms and ammunition stockpiles. Large amounts of readily available weapons in a society make normal social functioning impossible and may mean that legal practitioners of violence - police and military - will be at a disadvantage and unable to maintain law and order.

Sweden has had a strong position in the field of explosives and their handling. But much knowledge in the field, both in Sweden and abroad, is with an older generation, and must be transferred before it disappears and is misappropriated.

The explosives industry used to be responsible for this, but now can't handle it. University education in the area is lacking.

There are also many international activities in "Peace Technology", including SaferGuard (UN), International Committee of the Red Cross (ICRC), Institute for Economics and Peace (IEP), Institute of Electrical Engineers (IEEE), NATO and its Science and Technology Organization (STO), Peace Direct, Peace Jam Foundation, PeaceTech Lab, World Peace Through Technology Organization (WPTTO). The majority of these, however, focus primarily on digital aids to promote and facilitate peacemaking. Sweden has adopted but not implemented and does not support the activities that take place within the UN's IATG and SaferGuard (see www.un.org/disarmament). Its databases and extensive knowledge can greatly improve the management of explosives, and are freely available to anyone via the Internet.

In addition to preventing surplus weapons and explosives from destroying and making impossible a more normal "post-conflict" society, making it more difficult for these to be spread to illegal actors in the outside world, and enabling the effective clearance of mines and unexploded ordnance, there are many other elements that also is required for a civil society and a rebuilt business to function, including infrastructure such as electricity, water, communications and other necessary supplies, rapid construction and repair of housing and other buildings. Peace technology is a collective name for all such technology and equipment that can support and facilitate the return to a normal society in severely affected areas, such as Ukraine!

Swedish competence and industrial resources could be used to transfer knowledge and produce equipment and materials that could, among other things, be handed over to the states concerned as a very effective part of Sweden's aid. There are many Swedish companies and organizations working in areas of peace technology, such as Cesium, Disarmament Solutions, Dynasafe, Ericsson, Nammo Vingåkersverken, Olcon Engineering, SaferWorld International, Skanska, and authorities and institutions such as the Armed Forces, FOI, Folke Bernadotteakademien, FMV, MSB, SIDA, SIPRI and Swedec.

However, this would require, for example, that the rules be changed to allow so-called "tied aid". Peace technology could then become a Swedish niche, which could alleviate the suffering and improve living conditions for hundreds of millions of people in violent environments, while at the same time it could facilitate the fight against organized crime and terrorism here at home and contribute to improving Sweden's civil preparedness.

The Section for Detonation and Combustion has, since long, a working group to develop the area of expertise and interested parties are welcome to participate in the work. SOFF (Security and Defence Companies) also works to make these problems visible.

More information: **Bo Janzon**, bo.janzon@secrab.eu
Hans Wallin, hans.wallin@cesiumab.se

Survey: What kind of expertise does Sweden need in explosives?

I have been a member of SDF for a few months and during my internship at the SOFF } Security and Defence Companies, I came into contact with Bo Janzon and Hans Wallin. I am investigating Sweden's training needs in the operational area "explosives", with the aim of clarifying the necessary measures for political actors.

SDF's participation will be seen as a very important addition because you gather unique competence in Sweden. Thanks to SDF members' answers to the questions below, the requirements picture can be improved. The questions are broad in their design, which is also intended because the respondents represent different sectors. You are therefore more than welcome to answer both in detail and "broadly".

Questions } Theme: Competence supply on explosives.

1. What ambition/s should Sweden have in terms of competence supply in the public and private sectors (explosives) until 2033?
2. How should higher academic education (bachelor's, master's, research, etc.) as well as higher vocational education be designed to instill the right skills? What is needed for the various courses to be relevant for future employers?
3. What factors limit/impede education at higher academic (bachelor's, master's, research, etc.) and vocational education levels?
4. What measures are necessary for the trend to reverse?
5. In what ways could industry and the educational system strengthen each other for increased competence supply?

Please send an e-mail to lise.stenberg@soff.se, with the heading "SDF undersökning" Please feel free to add a short note on what your connection with SDF/your profession is. Thank you very much in advance for taking the time!

Sincerely, **Lise Stenberg**, SOFF Säkerhets- och Försvarsföretagen (Security and Defence Companies).

SOFF is a trade association for companies in the security and defence field with operations in Sweden. <https://soff.se/>

Research and training and documented experience building around Explosives are needed, at all levels

Explosives are used both to create value and harm people. Humans create explosives and the risks and consequences associated with their creation and use. Experiences and knowledge must be gathered and transferred between generations to avoid repetition. Risk and consequence analysis is based on assimilating experience gained.

Society must, through a validated build-up of experience and systematic collection of knowledge, provide a correct basis for assessing risks. Specialized research at university level in Sweden should be created to honour Alfred Nobel's memory and set an example for future generations.

Hans Wallin, hans.wallin@cesiumab.se

SDF is needed more than ever

During the past six months I have been in contact with SDF members, participated in an SDF seminar and held one myself. For someone who does not have a natural connection to the issues that the SDF pursues (I am not a military, chemist, physicist or engineer) I must say that I have rarely felt as welcome and well received as with you. Thanks to recurring conversations and meetings with you SDF members, I have been given a real opportunity to understand Sweden's greatness regarding explosives as well as the challenges ahead.

An insight that more and more people are becoming aware of is the devastation that explosives can cause in everything from careless handling and theft of

explosives on construction sites, bombings in Swedish townhouse areas to systematic bombings of civilian and critical infrastructure in Ukraine.

It is also clear that Sweden faces extensive needs in terms of educational efforts and institutions for academic education and later research, as well as within the framework of the total defence mission. I would like the expertise possessed by the SDF to lead to similar insights in more young people - especially aimed at students who are educated in so-called natural science subjects, who can then work or do further research - "hands-on". However, we social scientists should not be forgotten - we are the ones who must analyse the development of society, allocate financial resources to authorities and adopt new political decisions and orientations. A deeper understanding of the importance of both a (total) defence and an academy adapted to the subject areas that explosives cover can only be positive. SDF is an important force in conveying that message and in addition acting as a facilitator between various actors to achieve that goal.

I am grateful to have been so nicely welcomed in the association and am now doing what I can so that we can start a dialogue at Riksdag (Parliament) level about higher academic education, a civil defense school in Vingåker and take important measures against the theft of explosives (please get in touch with lisenstenberg@gmail.com if you are interested and want more information). In the long term, I think that we (SDF) need to think about how we can increase the interest in explosives among high school and university students, so that more people open their eyes to this important subject at an earlier stage and then choose a professional life that somehow concerns explosives.

Lise Stenberg SDF; lisenstenberg@gmail.com

Invitations to conferences and courses

- **2023 Tsinghua-Princeton-CI Summer School on Combustionwill, Tsinghua University, Beijing, China.**

The 2023 session will offer the following six courses:

- Combustion Chemistry
- Theoretical and Numerical Combustion
- Plasma Aided Combustion and Manufacturing
- Fundamentals of Detonations in Gases
- Mitigating the Carbon Footprint of Combustion through CO₂
- Capture and Storage
- Formation of Polycyclic Aromatic Hydrocarbons and Soot through the Eyes of a Chemist

http://www.cce.tsinghua.edu.cn/en/Outreach/Combustion_Summer_School/Overview.htm

• **7-8 November, 2023 Annual Meeting of the Spanish Section of the Combustion Institute**

The 2023 Annual Meeting of the Spanish Section of the Combustion Institute will take place from 7 November (from 12:00) to 8 November (until 14:00) in Zaragoza, Spain.

The meeting is open to contributions by combustion scientists from any country and will serve the purpose of celebrating the many contributions and achievements of Professor Cesar Dopazo, on the occasion of his 80th birthday.

You can find further info in: <https://tinyurl.com/SEIC23> If you are interested in attending, please join the mailing list here:

<https://forms.gle/gE96fctKD2SknwWz8>

We look forward to welcoming you in Zaragoza in November.

Carmen Jiménez, Secretary of the Spanish Section of the Combustion Institute

- **Franklin Applied Physics - *Electroexplosives: Functioning, Reliability, and Hazards*, July 24-28, 2023.**

Topics covered will include the following: nature of explosives; the explosive train; safe and arm; EED construction; uses of EEDs; reliable firing of EEDs; inadvertent ignition; electrostatics; lighting; radiofrequency hazard; testing EEDs; determination of all-fire and no-fire levels; explosive chemistry; physical effects; detonation; military applications; commercial applications; propellants; pyrotechnics; accident prevention; storage and shipment; history; resources; explosive detection; forensic investigation.

The fee for the course will be \$2164 per person (lodging and food expenses are not included). The last day to register will be July 12, 2023.

More information: <https://www.franklinphysics.com/franklin-explosives-training-course/>

- **33rd International Symposium on Ballistics, Oct 16-20, 2023**

The 33 ISB is the prime international scientific event in the field of ballistics, and will take place in Bruges, Belgium. It traditionally covers the following topics:

- Exterior ballistics
- Interior ballistics
- Terminal ballistics
- Explosion and warhead mechanics
- Launch dynamics
- Vulnerability and survivability

Contact: see <https://www.ballistics.be/home>

- **The International 40th Symposium on Combustion, July 21-26 2024**

The International Symposium on Combustion is the major biennial meeting of The Combustion Institute. The 40th International Symposium - Emphasizing Energy Transition will convene at the Allianz MiCo Convention Centre in Milan, Italy from Sunday, 21 July through Friday, 26 July 2024. This event provides a scientific venue for sharing ideas and experiences on the applications of combustion. <http://www.combustionsymposia.org/2024/>

- **Call for Papers Released for 40th International Symposium**

The Call for Papers for the CI's 40th ISOC has been released. Program Co-Chairs (PCCs), Bassam Dally and José L. Torero have led the process to form the foundation of a successful symposium. You can find more information about the colloquia, new procedures, and more <https://www.combustioninstitute.org/wp-content/uploads/2023/04/Call-for-Papers-40th-ISOC-for-Print.pdf>

Report from the annual meeting, 2023-03-23

About 10 of SDF's members participated in the Zoom meeting.

- The statutes were adjusted according to: "Purpose and activities The Section for Detonics and Combustion, abbreviated SDF, is a non-profit association with the aim of gathering people in the scientific and technical fields of detonics and combustion for information exchange and cooperation aimed at promoting education and scientific research in the areas."

Complete statutes: <https://www.sdfsweden.se/aims/default.sv.php>

- 2023 board:
 - Ola Listh, chairman
 - Dan Loyd, vice chairman
 - Håkan Ljungqvist, secretary
 - Leif Jilsmo, treasurer (formerly Saab Dynamics AB and former shooting range manager at the Hugelsta firing range)
 - Hans Wallin, member
 - Nils Örnebring, member
 - Alexis Bohlin, member
 - Bo Janzon, auditor
 - Jard Gidlund, deputy auditor (MSc in Chemical Engineering. I have worked with questions connected to the explosives industry both in my role as a county board official and as a consultant. Interested in technology and technology history)
- Full minutes from the annual meeting:
 - <https://www.sdfsweden.se/aims/default.sv.php>

SDF Program 2023 ; <http://www.sdfsweden.se/history/default.sv.php>

Seminars:

- Thursday 2023-10-26 19.30 Gytterp's history
- Autumn 2023 FOI on weapons, protection and security ???
- ??? Do you have a topic suggestion?

Study visits that the SDF is working on implementing at some point in the future:

- FOA shock tube IV and the Armed Forces' dog service unit (FHTE), Botele Udd, Märsta
- Hanssons Pyrotekniska in Lindesberg and Orica in Gytterp
- Kiruna, with a visit to Esrange, LKAB's tourist mine/[Kimit], ???
- Epc-Group at Hugelsta shooting range, Cesium AB, Vingåkersverken
- FOI Grindsjön
- ??? Visit to your company/institution ?

Travel report from SDF Study visit Karlstad and Karlskoga 22-23 April 2023

In the sunshine on Saturday morning at 09.00 a happy group gathered outside the gates to the locked and formerly secret Zakrisdal area south of Karlstad. Today, the area belongs to Zakrisdal Fastigheter AB, owned by the Bröderna Wingefors AB, and is rented out for civil activities. The gates were opened and we drove into the area after which Property Technician Zlatko Kasunic unlocked the doors to the **11,000 sq m underground (rock) cavity** which is not normally shown to outside visitors.



Nils Örnebring from the SDF and the Museum of Explosives, worked for many years down in those rock chambers and guided us around among the many and extensive spaces with, among other things, a reserve power plant with two large (former U-boat) diesels, ventilation system, safe rooms for the manufacture of detonators, assembly halls, etc.

After the underground facility, we went to **the Explosives Technology Museum**, which preserves Zakrisdal's technical history by presenting the ammunition knowledge of older products mainly focused on the manufacture of primary explosives, primers, detonators and fuzes as well as other explosive products manufactured by the company from 1942 until 1992. Nils Örnebring, Tony Hagman and Bengt Andersson from SDF gave a special presentation of the collections.

After a good and nourishing lunch at the Bergvik shopping center, the participants continued to the Karlstad **Brigadmuseum** where Nils Örnebring showed them around, after which the day ended.

In a partly cloudy Karlskoga on Sunday morning, participants gathered outside **Alfred Nobel's**

Björkborn, where our guide, Mme. Bertha von Suttner, greeted us, dressed in beautiful period clothes, portrayed by Helena Weidt from the Nobel Museum.

The manor at Björkborn was completed in 1815 and when Alfred Nobel bought shares in the AB Bofors-Gullspång at the turn of the year 1893-94, the manor went along with the purchase. After that, Alfred Nobel came to live at the manor during his stays in Sweden during the last years of his life and the home was modernized.

Björkborn mansion was a residence until 1972, and after being used as an office for a few years, the Nobel Museum was founded in Karlskoga. The exhibitions today show some of Alfred Nobel's own furniture together with objects typical of the time during which he lived here. In reconstruction the exhibition showed how Alfred Nobel's home may have looked during the 1890s. Bertha von Suttner showed us around the furnished rooms and told us about Nobel's life, work and legacy.

After the Manor, we went to **Nobel's old laboratory**. When he bought the AB Bofors Gullspång in 1894, it was in order to have a place for experiments with gunpowder and to make test firings.

Work began immediately to build a laboratory. Construction was completed in 1895 and Alfred Nobel

employed several chemists to carry out the work he ordered. In the laboratory at Björkborn, Alfred Nobel and his chemists devoted themselves to experiments with powder metallurgy and sought solutions to forging problems. Artificial silk, synthetic rubber and rocket-assisted aerial photographs were also part of the experiments undertaken here. Today the laboratory is part of the Nobel Museum in Karlskoga and there are exhibitions about Alfred Nobel's enterprise, about Ragnar Sohlman's work with the Nobel Prize and a reconstruction of the laboratory with largely original equipment. Here is also the natural science part of Nobel's library.

We thanked Helena Weidt for the viewings and went downtown to have lunch.

The group gathered again at 13.00 at **the Bofors Industrimuseum**. Per-Eric Bolinder and Örjan Karlsson from the Old Ironworks Boys' Club guided around. The Bofors mill has a history that begins already at the middle of the 17th century. In 1646, permission was obtained from the government agency Bergskollegium to build an iron mill at Karlskoga. There was also extensive agriculture linked to the ironworks. The mill developed and from making shovels and other castings they started to make cannons at the end of the 19th century. In 1873, the mill became a limited company with the name AB Bofors-Gullspång.

The exhibitions were about the Bofors mill and AB Bofors-Gullspång (later AB Bofors) and showed how the development from hammers and agriculture to large-scale industry took place.

After the Industrial Museum, we gathered at the **Bofors' old firing range**, where Göran Sundmar from the Bofors Luftvärnsförening (Bofors' Air Defence Association) first offered coffee and then showed parts of Bofors' industrial history from the 1870s and 100 years onwards. The firing range from 1886, that Alfred Nobel used for gunpowder samples and test firing of Bofors guns, and the circular roadway range from 1922, used for road and terrain testing of gun and munitions systems. The site of wood chipper from 1940 was shown. During World War II it supplied Bofors and Björkborn with large quantities of wood chips for steel furnaces and heating. The Bofors Luftvärnsförening has done a great job by clearing lots of sly and scrub from the site.

A big thank you to Nils Örnebring, guides, all participants, and the Bröderna Wingefors AB.

/Håkan Ljungqvist Secretary SDF

Bofors Industrial Museum - Discover history that begins already in the middle of the 17th century

If you are interested in Industrial History, please visit the Bofors Industrial Museum, at Alfred Nobel's Björkborn in Karlskoga, which takes you around 350 years back in time.

Here you can see how the old Bofors ironworks developed into a major industry during the 20th century. For more information visit us at www.nobelkarlskoga.se/utställningar/bofors-industrimuseum www.facebook.com/Boforsindustrimuseum
/Stefan Nylén, Old Utility Boys' Club

Eskilstuna weapons history association www.evhf.se/EVHF

The association's task is to promote and stimulate interest in older weapons in their historical and cultural context. The association collects information from various sources, e.g. Eskilstuna city museum archive, Eskilstuna city archive and the Association Archive in Sörmland.

Some published articles:

- http://www.evhf.se/EVHF/Texter_files/Svenska_armens_handgranat.pdf
- http://www.evhf.se/EVHF/Texter_files/6,5%20mm%20o%CC%88vningssvapen%201%20fo%CC%88r%20pansarskott.pdf
- http://www.evhf.se/EVHF/Texter_files/Ammunitionsfabrik%20i%20Odlaren.pdf

Information from Cesium AB: For a safer and more secure society,

Cesium AB develops and manufactures all types of high-security buildings in concrete and steel and other materials. Cesium produces, from small warehouses to large halls to EU standard EN1143-1 Grade VI or higher. All products have a very long service life and can also be moved and dismantled, according to a unique and patented concept. Cesium AB's products offer extremely secure storage for all types of needs, including highly secure transport containers.

In an increasingly insecure society, Cesium AB has specialized in developing and manufacturing high-tech security solutions for the storage of explosive goods, weapons and theft-prone goods.

And the need has increased steadily - all over the world. Increased crime and wars contribute to the need for secure storage solutions increasing as more weapons and ammunition come into circulation. After wars, weapons and leftover munitions are left behind and the second-hand market is large, since many countries have poor control over weapons, munitions and explosives. It is important that these can be stored safely so that they do not end up in the wrong hands. Cesium AB refers to this as peace technology.

Dismountable and mobile

But it's not just weapons and ammunition that need to be protected and stored safely. Cesium's patented technology and material structure create shell protection that is more or less impossible to break into and that may also withstand gun fire and fragmentation. The product range includes certified high-security products such as weapons and explosives cabinets, storage, transport containers with satellite monitoring, production and node buildings. In today's high-tech society, server halls and data centres are vulnerable points that need strong protection. There is also a need for secure buildings for vital and theft-prone products such as medicines.

Common to all Cesium's products - from small safes to data halls of several thousand square meters - is that everything can be dismantled and moved if necessary. In addition, they are extremely durable with minimal maintenance and have a very long service life.

Local and safe production

A robust and safe infrastructure requires having the industry in the country and all Cesium's manufacturing takes place in Katrineholm and the surrounding area. All parts for the products are manufactured in the Katrineholm area and nothing is imported. It also provides jobs to the locality and is good from a climate point of view when you avoid long shipments of heavy materials.

License production in other countries

Today, Cesium supplies products to total defence authorities and is established in the defence and explosives industry. Going forward, they invest in licensed production in other countries and the goal is to deliver the patented storage solutions on a global scale.

Fact box: Cesium AB is a Swedish company with development and manufacturing in Katrineholm. Cesium AB is a leader when it comes to physical protection of socially important facilities and storage of theft-prone or critical material. In close collaboration with the customer, they develop cost-effective and customized products.

www.cesium.se

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