NEWSLETTER

EFEE

May 2016

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Conclusion drawn one year after coming into force of the EU-identification directive

„Oh, they took detonating cord…" A double misfire with a happy end

... and much more!

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NEWSLETTER

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EFEE

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We in EFEE hope you will enjoy the present EFEE-Newsletter. The next edition will be published in September 2016. Please feel free to contact the EFEE secretariat in case:

- You have a story you want to bring in the Newsletter
- You have a future event for the next EFEE Newsletter upcoming events list
- You want to advertise in a future Newsletter

Or any other matter.

Igor Kopal, Chairman of the Newsletter Committee and the Vice President of EFEE -

newsletter@efee.eu

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Dear EFEE members, the Presidents voice

Dear EFEE members and other readers of the EFEE Newsletter. According to the constitution of EFEE a president can only serve for two years. Time flies fast and I have now past that time. It has been a pleasure and an honour to work for the interest of explosive engineers in Europe and abroad. As the rules of EFEE dictate I will stay on the board for the next two years as Immediate Past President supporting the new president. The newly elected president will be my former Vice President - Igor Kopal who has worked hard for EFEE. I trust he will do a good job and I am looking forward for the next two years with him in front of the steering wheel. I congratulate Igor on his election at the Telford AGM.

My two years have been interesting and with a lot of challenges and development of EFEE. While I still have your attention I would like to summarize what I have learnt as EFEEs Vice President and President during the last four years. First the obvious; EFEE has 25 nations, 32 companies and 100 individual members that make up the Council and the AGM. We have had a growth in members in the last years, among other reasons thanks for the good work of our new president. However, EFEE is not an organisation that focuses on a large number of members but rather an umbrella organization for the European national organisations and their interests and cultures. With this introduction our main aims at the present come easy:

- EFEE should cover the intrests of all the European blasters, rather than the individual countries.
- EFEE should continue to assist the EU as the joint European body. This is done by having influence through the EU bodies we are seated in by the invitation of the EU.
- EFEE should continue to deliver our conferences on Explosives and Blasting. It is a great success at the present range among the best conferences in the world of blasting.
- EFEE should continue to focus on developing a pan-European education system that can ensure that the present high level of knowledge is preserved in Europe as well as enabling that the teaching can be spread to the rest of the world ensuring repetition of well-known failures which lead to accidents.
- EFEE should continue to develop our newsletter that has rocketed the last years. Hereby ensuring an important source of pan-European communication for the explosive sector.

With this summarising I would like to thank all the national members, both active and passive. for your support during my two years. Because of you we have been able to make EFEE an even more professional organisation. Thanks to the board and special thank you goes to Roger Holmberg, the Secretary General of EFEE, which is one of the solid pillars of EFEE. For the sake of EFEE I hope you will stay on a bit longer.

Johan Finsteen Gjødvad, Immediate Past President of EFEE

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To begin with, I would like to thank all EFEE delegates and members of Annual General Meeting held in Telford, the UK for election of the new EFEE Board with me as the President. I would like to assure all of you that I will devote all my efforts to continue great contribution and steering as was done by Johan Finsteen Gjødvad. The newly elected EFEE Board brings in new faces. The first one is Mrs. Viive Tuuna, representing Estonian Association of Mining Enterprises, and the second one is Mr. Doru Anghelache from Romania, representing EFEE Corporate members as well as Romanian Association of Explosives and Blasting Engineers. We welcome both new EFEE Board members and we will employ their skills and energy to achieve federation's primary objectives. Unfortunately, on the other hand I regret to inform you that Mr. Ricardo Chavez, representative of French Group of Explosives Engineers, leaves the EFEE Board. Ricardo, thank you very much for your great work done in relation with the organization of our 8th EFEE Conference 2015 in Lyon.

I take this opportunity to introduce myself. My path in EFEE started in 2000 on 1st EFEE Conference in Munich. I am representing in EFEE a National Association member - Slovakian Society for Blasting and Drilling Works. In 2012 I was elected an EFEE Board member and subsequently in 2014 I became Vice President and took over the leading of two standing committees - Marketing and Membership committee and Newsletter committee. As for my education, I graduated with degree in engineering from Slovak University of Technology in Bratislava and continued with licence study of "Theory and Technology of Explosives" at the University of Pardubice in Czech Republic. During my 22 years of professional career I have been involved in explosives industry, including production of explosives, sales of explosives, as well as blasting operation.

In the near future we want to meet our new EFEE National association members. Therefore our next EFEE Board meeting will be held in July 2016 in Bucharest, Romania where we will meet the representatives of Romanian Association of Explosives and Blasting Engineers, which was founded only last year. In December 2016 we will organize EFEE Board meeting in Ankara, Turkey to meet the representatives of the Association of Civil Explosive Industrialists from Turkey, which is our newest EFEE National association member. In September 2016 we have planned to organize an EFEE Council meeting in Stockholm, Sweden where the 9th EFEE World Conference will take place from 10th to 12th September 2017.

Finally, I thank all of you one more time and I will be very glad to meet you all in our next meetings where we will continue to promote our growing and reputable federation.

Igor Kopal, President of EFEE

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Blasting approach on Arctic icebergs

Abstract

The increasing economical interest on oil and gas fields in the Arctic causes new challenges for this special environment. A previously unknown risk for production platforms and supply vessels is the existence of icebergs. Their appearance has significant impact on a smooth, continuous operation. To master this problem, the Department of Arctic Technology at the University Centre in Svalbard investigates a possible application of explosives for the fragmentation of Arctic icebergs. First results of an integral analysis give hints to additional exogenous factors which are to be considered aside of the application of explosives.

Why to blast icebergs

The hazard of approaching icebergs is well known in the consciousness of society since sinking of Titanic in 1912. Actually, the danger of icebergs is not a fear of the younger past, but already known since shipping crossed the Polar Circle. Having less commercial passenger navigation crossing the Atlantic with the ascent of aviation, this topic got out of focus again in the last decades. Only with the rise of oil and gas explorations by the beginning of the 21st century, interest on this topic emerged again, as quite some resources are located in the immediate vicinity of iceberg endangered regions.

First professional engagement for icebergs was performed with the introduction of the International Ice Patrol (IIP) in 1913. This happened as a consequence of the Titanic event the year before. Having only limited knowledge on dealing with icebergs, first operations concentrated on surveying areas around shipping routes. First approaches on destructing icebergs by the use of ship guns made aware on the dimensions to deal with. Following, researchers as Barnes, Livingstone and Mellor & Kovacs started activities using thermite and explosives, which confirmed the previously discovered challenges. Only for icebergs of smaller size a rather unconventional method was detected, by simply pulling icebergs with the use of a net and tug boats out of the current.

For today’s problems of oil and gas exploration, shipping with supply vessels, the operation of platforms and the installation of pipelines in shallow waters must be taken into account. In all cases icebergs can become extremely harmful. While vessels are capable to avoid a collision, platforms and pipelines are stationary. Technically, floating production units can be decoupled from production units on the seafloor. Taking such a decision, however, leads to noteworthy production downtime and extra workload to all involved contractors. Hence, a solution making icebergs harmless in front to an expected impact, reduces the risk factor of corresponding operations significantly.

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Challenges of blasting icebergs

Scientific evaluation on blasting ice masses is limited. Areas of blasting application had been constricted to ice masses in rivers, immobilizing ship operations or causing floods by water blockage. Science of aeronautics and astronomy is interested into high velocity impacts of ice, but draws conclusions only on small specimen. Dimensions of large compact ice masses, as presented by icebergs, have hardly been investigated into detail.

Scientific research on blasting icebergs started with experiments of Barnes (1926). His idea to make use of thermal energy by the installation of thermite and bermite sound promising. Without experience he installed the load almost on top of the iceberg, causing a huge flare on the surface, but not achieving the desired result. Therefore, IIP repeated his experiments in the year 1960, installing the load into a drillhole. However, apparently the heat energy generated by thermite is by far not sufficient to show impact on icebergs.

Livingstone (1960) was first making trials with explosives for the destruction of glaciers. Transferring knowledge from rock to ice blasting, he decided to go for crater blasting, to achieve highest yield in respect to mass/explosive ratio. With a ratio of 16/1 he managed indeed successful results. However, blasting an iceberg was not accomplished by him. Mellor & Kovacs (1972, 1975/1976) proceeded experimental research by conducting bench blasting and controlled perimeter blasting tests. Exposed as a successful approach for open pit mining, too much explosives and too many shotholes were needed. Last tests were performed by the North Atlantic Pipeline Partners in 1999, but results are not published.

Obviously, to attack this problem is not that easy as preliminary expected. Transferring approaches from mining industry to blasting icebergs was a logical step. However, there was only limited knowledge on the coherences of ice masses, which is decisive for the development of blasting schemes. Hence, the experiments were primarily trial and error based.

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Preconditions on blasting icebergs

To attack the problem, the most important question is the final goal. It is crucial to consider the critical point for impacting icebergs and to check on the prerequisites for fragmentation. For this, the structure of icebergs has to be analyzed more into detail from macro down to micro level, in particular in respect of coherence and physical properties. Drawing conclusion from experiments out of the past, fragmentation will hardly be achieved only by the use of explosives. Hence, a more general contemplation on the entire problem will most likely allow for more promising solutions.

Table 1 Categories of sizes for Arctic icebergs

Small	5 – 15	15 – 60
Medium	15 – 45	60 – 120
Large	45 – 75	120 – 200
Very Large	➢ 75	➢ 200

The first challenges to face are the various forms of icebergs, along with their sheer volume. Their circumference can be larger as 200m, accompanied with a height of more than 75m (see Table 1). Characterized by masses of up to 1 Mio tones, they are comparable to the yearly production rate of several mines. Moreover, the forms of icebergs are far more manifold as the traditionally known pinnacle iceberg. Figure 1 presents some typical forms and shows that even the sail to keel ratio differs from each other. Consequently, there will not be a universally valid blasting scheme. In addition, external aspects, as environment, transportation and safety issues are more sophisticated for a corresponding contemplation, as they are for standard blasting operations onshore. A more holistic consideration of the entire problem is required.

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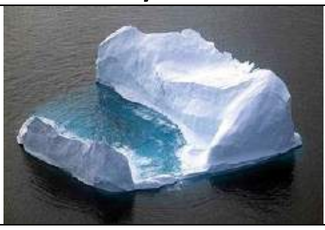
Drydock		Pinnacle	
	1:1		1:2
Photograph: Ansgar Walk/CC BY-SA 2.5		Photograph: Philip Hall, NOAA/CC BY-SA 2.0	
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	1:4		1:5
Photograph: Christopher Michel/CC BY-SA 2.0		Photograph: Michael Clarke Stuff/CC BY-SA 2.0	

Figure 1 Selection on categories of shapes for Arctic icebergs with sail to keel ratio

The aim is to prevent platforms from injurious impacts by icebergs, as discussed in the introduction. For this it has to be distinguished on impinges being considered hazardous and those being tolerable. Taking into consideration, that most platforms operating among the Arctic sea will be floating platforms, being fixed by a mooring system, a spring constant can become integrated into the equation. In addition, even at stormy weather icebergs are floating at low speed with not more than 0,5 m/s. Thus, platforms are able to cushion significant blocks, why there is no need to have fragmentation as homogeneous and fine like at commercial mining activities. Thus, a first assumption points out that a fragment of 50.000 tones should not represent a hazardous impinge for a platform.

For ice mass cohesion, glaciers show quite some similarity to rock masses due to their origin. Ice emerges by local freezing of water or by sedimentation of snow. Sedimentation - as commonly known - compacts layers, which is the origin for the formation of rock masses, but as well of glaciers. This is interesting for blasting considerations, bending the bow from rock mass classification Systems to the application on ice masses, as after all icebergs are a product of glaciers. Unquestioning, the particular characteristics are not transferable one to one, but more important is the general statement that the overall coherence depends only to little extent on the strength of a small, perfect specimen. Selby indicates this value with 20%, pointing out that the total strength is more dependent on the interplay of impacts as cracks, fissures, impurities, among others. In particular for icebergs, having crawled for years in the ocean before reaching hazard zones, corresponding impacts are significantly pronounced. However, to have a detailed analysis on the individual pronunciation will hardly be possible in the field of contemplation, open sea. A fragmentation approach, consequently, will have to consider a situation with significant undetermined inhomogeneity.

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The longer an iceberg has crawled in the open sea, not only inhomogeneities become more pronounced, but as well the temperature gradient amongst it rises. This gradient results by the difference between the core storing the glacier's cold energy and the comparable warm temperature of the surrounding sea water and air. As sea water freezes in dependence on salinity at a temperature around -1,9°C, the outer surface of an iceberg cannot be colder. The core of an iceberg, however, has a temperature level of -17 ± 3°C. The cohesion of ice, at this, depends largely on its temperature, being an interplay of Young's Modulus, Poisson's ratio and the shear strength.

These parameters compose the ultimate strength of a material, being defined as the greatest stress before failing in consequence to rapid loading at complex stress states. In this connection, the term homologous temperature states that physical properties of a material change the more significant, the closer the material approaches its natural melting point. Taking granite with a melting point around 1260°C for example, a change of temperature in natural conditions will not have impact on its physical properties. For ice, however, having its melting point around 0°C, the environmental temperature is much closer. The impact of already slight deviations in temperature is way more significant, hence. This means, the ultimate strength decreases from the inner to the outer. Consequently, for blasting approaches a lot of work can be realized already, by impacting the cold, strong core of the iceberg.

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Conceptual approach on blasting icebergs

Resuming these assumptions, fragmentation will have to be regarded differently in contrast to a blasting operation at open pit mining. Blasting will be only considered as one part of the entire fragmentation, while exogenously factors play a decisive role among the process.

Falling back on the bench blasting experiments of Mellor & Kovacs (1972), it can be explained easily why this approach working so well at open pit mines, has no chance at the application at icebergs. The concept behind this approach is to have a free face in the horizontal level. P- and s- waves are reflected at this free face, causing the formation of cracks and the displacement of material. Having a free face, almost all of the detonation energy is reflected backwards into the material. At an iceberg, however, there is no free face, but water surrounding. With an impedance factor of = 2,431 between water and ice, 58% of the pressure energy is transmitted into the adjacent water. Hence, this energy is not available for fracturing.

A new approach must allow not to transmit significant energy into the water. As it is not possible to stop waves to propagate into the adjacent material, this can be only realized by having less energy pending at the boundary. The energy distribution within a body, and hence the available energy at each point, depends on the match of impedance pending on the blasthole wall. The idea is to adjust the impedance factor between explosive and ice in a way, that energy will not transmit through the mass homogenously, but exerts its impact in the close borehole region. Like this, more energy is available to shatter the comparable strong core of the iceberg. For sure, the fragmentation will not be as homogenous as at commercial mining activities, but like presented previously this is not a necessary prerequisite.

Following, the formation of cracks must be supported by displacement, being triggered by emerging blast fumes. However, aiming for an impedance factor considerably larger than one, blast fumes will be primarily available in the close vicinity of the blasthole. For the remaining part of the block this effect will have to be compensated. For this, the environment of an iceberg is of interest. Naturally an iceberg experiences buoyancy as a floating mass with a density slightly lower as water ($\rho seawater=1.025 > \rho ice=0.917$). Tensional forces are continuously acting on the bottom according to the principle of Archimedes. This comes along with forces acting rotational and translational created by waves and currents. These external forces are for sure not comparable in intensity with detonation impacts, but they act continuously on the weakened structure of the iceberg with its smashed core. With ice having a very low tensional strength, this will not automatically result in an immediate breakup of the iceberg after detonation, but in a comparable short period of time.

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Experimental validation

For the validation of the concept a wide range of parameters from fragmentation to environment have to become analyzed into detail. The intention of the first experiment is to regard impacts of varying detonation velocities on the fragmentation process of ice masses. In particular the investigation of differing behavior between a close matching to a significantly differing impedance factor is of interest for enhancement of fragmentation efficiency. For contemplation, a test with artificially created ice blocks was performed, being blasted onshore in the close vicinity of Longyearbyen, Svalbard.

The experiment was realized by the use of a high speed camera, allowing to record the fragmentation process with a framerate of 128 µs/pic. With ice as a transparent material, this approach allows to distinguish on the fragmentation behavior of ice in respect to differing impedance factors by usage of a slow and a high speed explosive, namely Dynamite with a detonation velocity of ~3000 m/s and PETN with ~7000 m/s. As a consequence, an impedance factor between explosive and ice of z,Dyn = 1,098 and z,PETN = 3,357 was available. For stemming, fine grained, sharp gravel was used. To allow for comparability of results, it was decided to go for artificially created fresh water ice blocks and not for field samples, which are mostly pronounced by environmental impacts such as cracks, fissures and impurities. To avoid such impacts entirely was even not possible for the artificial ice blocks created, but had been minimized largely. This was achieved by cooling down the water layer by layer to a temperature level of -17°C over a period of three months. The final dimensions of the blocks were 1,15 x 0, 75 x 1m, resulting in a volume of 0,86m³ or a mass of 750kg, see Figure 2:

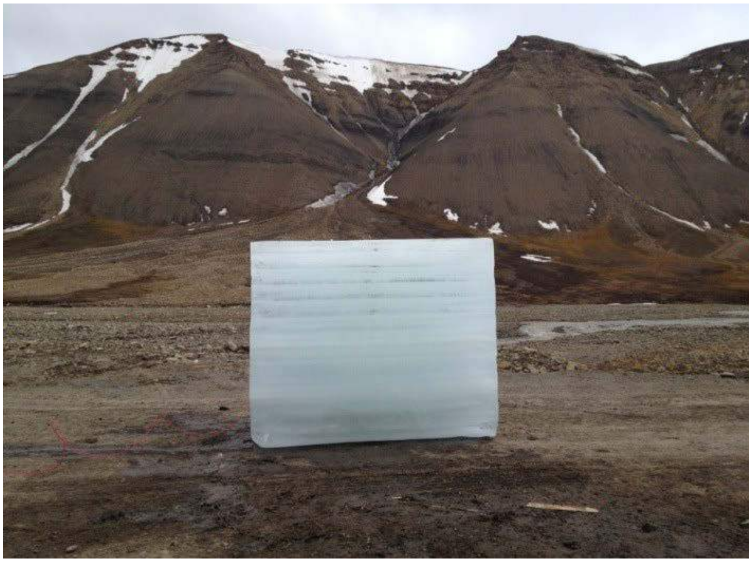

Figure 2 Artificial created sample ice block

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For reasons of simplicity on the first analyses, it was decided to conduct the experiments onshore. Working environment on floating icebergs is challenging and icebergs with a stable equilibrium in the close vicinity of their origin are not easy detectable. For the desired objectives, however, these simplifications met the prerequisites for experimental validation.

The performance in the field caused an increase of temperature to -10°C ± 1°C of the ice blocks. The experiment was realized with a decreasing load of explosives per shot, to find a critical load for both kinds of explosive. As a consequence of a blow-out in the first test-run, the drillhole depth was adjusted from 50 to 57 cm. Having five blocks available, the use of explosives was realized as illustrated in Table 2:

Table 2 Borehole placement

Test	Explosive	Amount [g]	Charge Length [cm]
1	Dynamite	35	8
2	Dynamite	32	7,5
3	PETN	16	10
4	PETN	12	8
5	Dynamite	23	6

The fragmentation process is best demonstrated at samples N°3 and N°5, showing the most characteristic behavior (Figure 3). The first process of the blasting operation, the formation of cracks, causes a shattering of the ice blocks' structure within 5ms. Visible cracks form out starting from 10ms, being entirely pronounced at 40ms. In all cases the blocks split horizontally and vertically aligned outward from the blasthole. However, there is a demarcation of energy distribution between the fundaments of the blocks and the bodies. This suggests, that significant energy is transmitted into the adjacent soil. At Dynamite, sample N°5, the picture of the energy distribution among the block appears homogenous, confirming the expectation for an impedance factor of 1,098. The result is a noticeably uniform fragmentation of the ice mass, only being influenced by the dissimilar dimensions of the block. In case of PETN, sample N°3, with an impedance factor of 3,357, the split into uniformly seized sub-blocks is predominant. In general, cracks appear to be more pronounced, but not showing a corresponding dense net as for Dynamite. In addition, the dissimilar dimensions do not show such remarkable impact on the overall result as in case of Dynamite. Interestingly, for both explosives best results are obtained at the lowest load of explosives installed.

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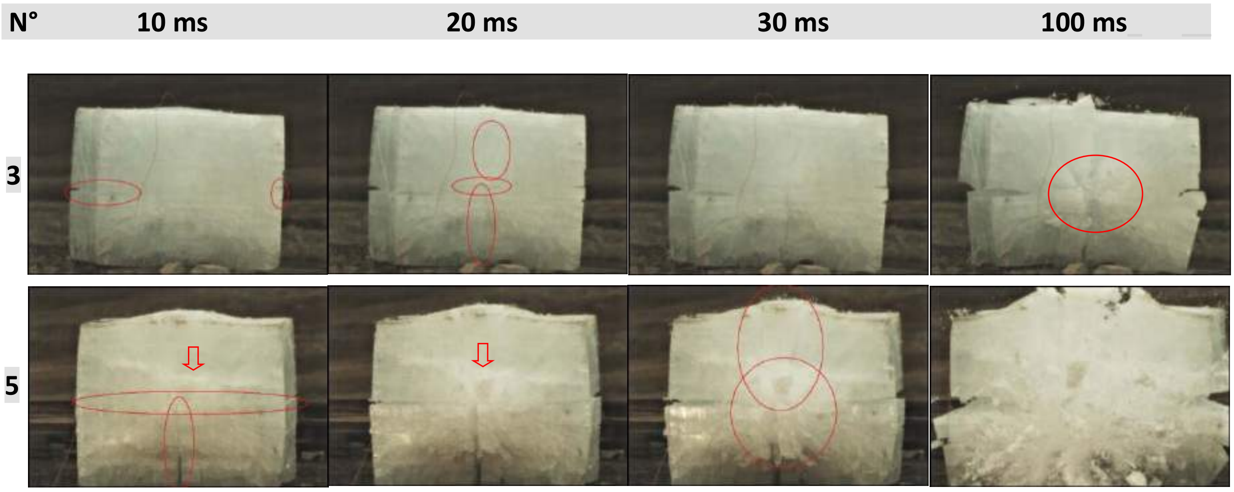

Figure 3 Timeline of fragmentation processes

The second action, the set-up of bubble energy, exerts its impact as well more uniform in case of Dynamite. This, however, causes a significant outburst on energy at the faces of the short dimension of the blocks. At the use of PETN, only little energy is released into atmosphere by an outburst, but pushes the created sub-blocks remarkably outwards from each other. For the fundaments of the blocks, however, apparently no energy is available for displacement. This causes to have the fundaments remaining as a whole.

Analyzing the fragments following the blasting process, all blocks are entirely cracked independent which explosive was used. This counts as well for the fundaments, which just remained as not displaced. However, the impact of present little inhomogeneities within certain blocks becomes apparent, as quite some larger fragments are resulting at selected areas, concluding on a disuniform energy distribution.

Discussion on results

The experiment confirms the previously stated assumption largely. The use of Dynamite delivers a more homogenous fragmentation, but is susceptible to inhomogeneities within the material. Associated significant energy gets lost and is not available for the fragmentation process any longer. In respect to large masses, which shall become blasted at a single ignition, however, energy is precious. At PETN, the picture is twoedged. The suspected effect of a lower energy transmission into adjacent material cannot be confirmed considering the remaining fundaments not differing significantly by those of having used Dynamite. On the other hand, the fragmentation confirms the expected process nevertheless. A significant vertical and horizontal split of the block along its axis is created radiating out from the blasthole, splitting the block into multiple sub-blocks. In addition, while the amount of overall cracks is lesser compared to the use of Dynamite, the existent a more pronounced. Having moreover the entire structure smashed, being responsible for the cohesion of the mass, will ultimately lead to a fail of the entire ice mass.

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Anyway, the material will most likely not be pushed apart from each other in water, as simply not sufficient bubble energy will be available. Due to the well defined fragmentation, however, it can be expected that external effects will be indeed capable to overtake the job of displacement of the fragments.

Outline

The aim of the presented considerations and experiment was to get on a first idea on how to encounter the problem of approaching icebergs successfully. First time the problem is considered more holistically, not simply trying to adopt approaches from rock blasting. The use of the high-speed camera allowed to distinguish on the impact of differing impedance factors and to confirm the previously introduced concept of focusing on the creation of pronounced cracks instead of homogenous. In a following step it will be necessary to perform tests in water, to analyze the transmission of energy into the adjacent water and its impact on the creation of cracks. Moreover, it will be interesting to experience to which extent energy will remain available for displacement of the material.

In general, to have access on physical statements of the dependency on temperature and deformation in respect to Young's modulus, Poisson's ratio and the shear strength would allow to support the analysis analytically. Current statements are still subjected to high scattering. In respect to the significant masses to attack, an intelligent adjustment of the impedance factor will improve the overall result considerable. Hence, it is quite of interest for following investigations to have the fundamental physical behavior of ice analyzed more into detail.

David Horner, Prof. Dr. Aleksey Marchenko

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Controlled Hard Rock Trench Blasting close to a buried Gas Pipeline under pressure

Austria's biggest supplier of oil and gas, transports gas through the West Austria Gasline for domestic consumption. In addition, the OMV also works as gas carrier and ensures the transit into neighbouring countries.

In 2005 the OMV gas company and the Russian Gazexport signed new contracts to guarantee the gas supply until 2027. Instead of 7 billion m^3/year, now 11 billion m^3/year should be delivered through pipelines. Therefore the OMV has planned to build a new gas pipeline through the North-Eastern part of Austria, parallel to and only 10 meters an existing one, the capacity of which is fully utilized.

The geology in this area is shaped by granites and gneiss formations of the Bohemian Mass. Mechanical excavation was only partially possible.

The paper proposed will initially present the test blast procedures, which took place 9 meters away from an existing pipeline that was in use with a nominal working pressure of 70 bar. In the second part of the paper the change from test blasts to production blasts with a depth of 3,20 m and a width of 1,6 m will be described. In this project, the task of a blasting engineer was to carry out the operations economically – 300 m of trench blasting a day - maintaining high standards of safety. The national and international standards for vibration limits had to be kept. Daily updates and regression analysis of the exceeded Peak Particle Velocities "PPV ´s" had to be carried out in order to succeed in this project.

Introduction

The existing pipeline so called WAG 600, was built in the 1970 ,s in the North-Eastern part of Vienna/Austria. The plan was to increase the capacity of the existing West Austria Gas Pipeline system by 600,000 Nm^3/h to 1,800,000 Nm^3/h max. by looping and boosting.

The main problem, which all authorities and engineers were concerned about, was the unknown quality of the welding seams of the existing pipe. The welding seams were more than 35 years old and there was no accurate documentation about a former quality check available. The next safety risk factor was the bedding of this pipe. Normally a 30 cm sand layer is required. This could not be guaranteed either.

Technical Data:

- Installation of approx. 80 km, 48" loop lines
- 4 gas turbine driven turbo compressors
  (3 x 12MW ISO and 1 x 15MW ISO)
- 2 turbo compressors with electrical drives
- 1 gas dehydration plant

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Highlights

- Extreme fast track project for first phase
- Very detailed environmental impact investigations for loop sections
- Extension of existing stations with minimum down time for tie-in

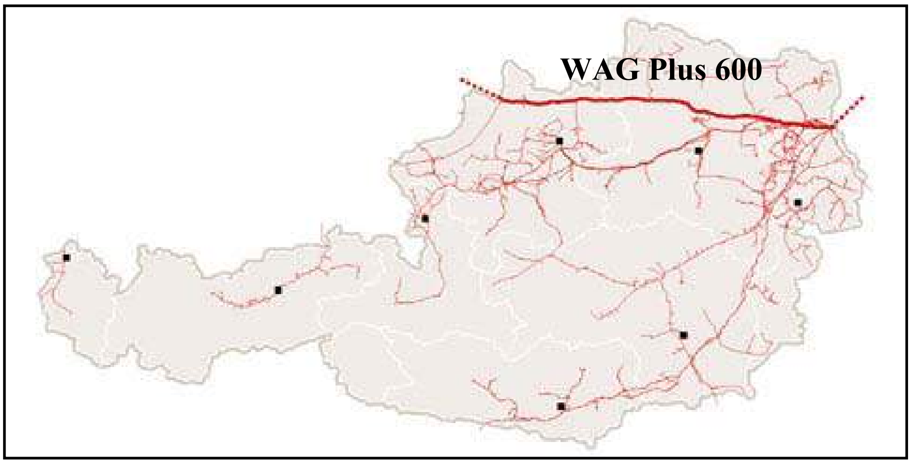

Figure 1. Plan view of the West Austria Gasline

Geology

The pipeline was opened in the Moldanubian Zone of the Bohemian Massif in the northeastern part of Austria. The structure of the Moldanubian Zone is very complex and has a dominance of crystalline units such as high grade metamorphic rocks and voluminous granitoid plutons with an age of ~ 600 Ma.
The local granite-gneiss complex may be rated as very tough and abrasive and is very difficult to blast.

Standards

DIN 4150 – German Standard

Part 3 of the German Standard – effects on structures - describes in Part 3 limit values depending on the material and connection of buried pipes. This looks as follows:

Table 1. Limit values of the DIN 4150-3 for pipes.

Line	Material of pipe, connection	PPV on the pipe [mm/s]
1	Steel welded	100
2	Concrete, reinforced concrete, metal flanged	80
3	plastics	50

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National Grid – Requirements for third parties

No blasting should be allowed within 250 meters of a pipeline without an assessment of the vibration levels at the pipeline. The peak particle velocity at the pipeline shall be limited to a maximum level of 75 mm/s. Where the peak particle velocity is predicted to exceed 50 mm/s, the ground vibration shall be monitored by the individual / company undertaking the work and the results made available to the responsible person at their request.

Table 2. Prescribed Distances within which the advice of National Grid shall be sought.

Activity	Distance within which National Grid advice shall be sought
Piling	15 m
Surface Mineral	100 m
Extraction Landfiling	100 m
Demolition	150 m
Blasting	250 m
Deep Mining	1000 m

Where ground conditions are of submerged granular deposits of silt or sand, an assessment of the effect of vibration on settlement and liquefaction at the pipeline shall be made.

Test blasts

To carry out the test blasts a prediction of the PPV which will be exceeded for a certain amount of explosives (charge weight) had to be done. Two different prediction formulas were used, and compared.

$$PPV = 1140\,(D/\sqrt{Q})^{-1.60}\ \mathrm{mm/s} \qquad (1)$$

where D = Distance of instrument location to blast site [m]
Q = Maximum charge weight per delay [kg]

$PPV = k \times (D/\sqrt{Q})^{-1.6} = 1140 \times 8.58^{-1.6} = 36.58$ mm/s

$$PPV = k\,Q^{b}\,D^{m} \qquad (2)$$

where b = 0.6
m = -1.5
k = 969

is suggested for hard rock after Lüdeling (1986).

$PPV = 969 \times 1.1^{0,6} \times 9^{-1,5} = 38.00$ mm / s

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The maximum charge weight per delay was chosen to be 1.1 kg. The distance from the blast site to the pipe was 9.0 m. The predicted PPV was much lower than the levels permitted by the standards in 3.1 and 3.2. To obtain a safety factor, the charge weight per delay was reduced to 0.833 kg for the first test blast.

Two instruments were positioned. The first one was fixed with a tape directly on the pipe and the second one was buried 1.2 m above the pipe in the ground. This was done to correlate the results for incoming measurements which took place directly above the buried pipeline, on the surface.

Results of the test blasts

Measured values for the PPV´ s are shown in Table 3. After the first test blast the measured PPV was found to be much lower than expected, therefore the charge weight per delay was increased for Test Blast No. 2 and No. 3. Also the number of boreholes blasted changed from a single hole shot in Blast #1 to 12 holes in Blast #2 and 21 holes in Blast #3. The PPV measured on the pipe compared to the PPV measured on the surface shows, that the PPV´s on the surface are significantly higher than on the pipe.

Table 3. Overview of test blast results

Test Blast No.	Charge weight per delay [kg]	Distance [m]	PPV on Pipe [mm/s]	PPV on Surface [mm/s]
1	0.833	9	14.99	23.11
2	1.40	9	29.21	36.45
3	2.1	9	34.26	39.18

Data Analysis for Test Blasts

The results from the test blasts have been used in a square root scaled distance empirical relation between the PPV and the scaled distance for a regression analysis to calculate the values of site parameters K and n with a 95% confidence level, as shown in Figure 2.. The quality of the fit, that means the correlation coefficient R, was calculated to be 0.858. The new prediction formula for the existing situation, calculated from the test blasts is as following:

$$PPV = 1356\ (D/\sqrt{Q})^{-1.82}\ \text{mm/s} \qquad (3)$$

Prediction equation (3) was used to calculate the maximum charge weight per delay for the production blasts on a daily basis. Therefore 50 mm/s as a critical alarm value and 75 mm/s as limit value, as described in 3.2, had to be used. The distance was constantly 9.0 m.

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$Q = 0.0293\ PPV^{1.0989}$ (4)

The modified maximum charge weight per delay was calculated using the new equation (4) with 2.15 kg to remain under 50 mm/s and with 3.36 kg to maintain levels below 75 mm/s.

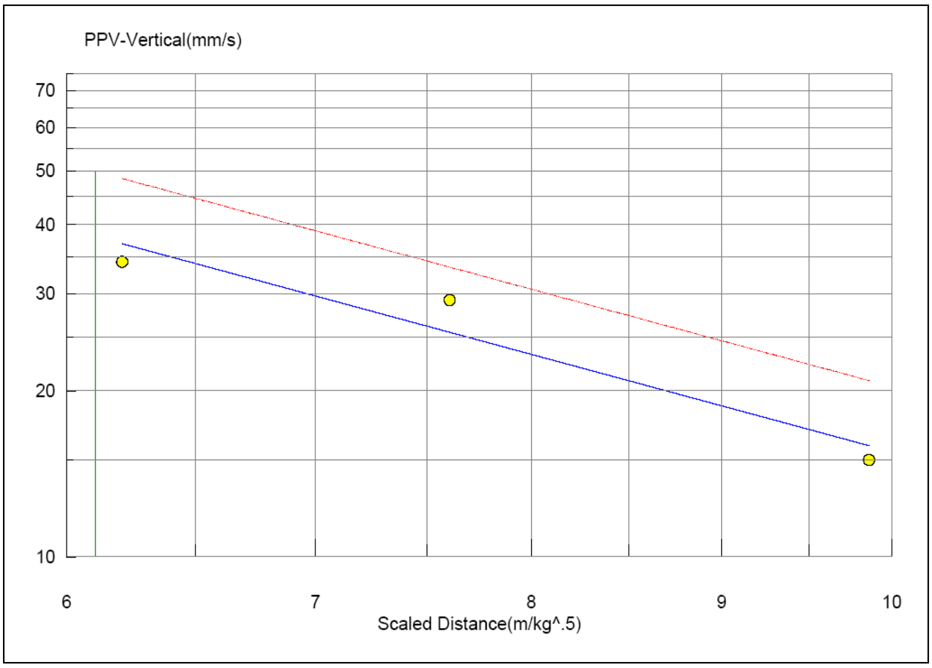

Figure 2. Regression Analysis of test blasts

Production blasts

All possible blasting areas had to be investigated. This could be done with exploration holes located every 250 m along the 40 kilometer line where the pipe became buried. After the possible shot areas were located, a time schedule was worked out, regarding the needs of the construction company. In total 7 kilometers of trench blasting area could be located.

To carry out the operations economically, it was necessary to guarantee 300 m of trench blasting a day.

The excavation depth was 3.20 m and the trench had a width of 1.60 m. The blasting operation itself started at the same time as the pipe construction did. This means, that in the whole construction area a lot of different teams were present.
The drill diameter was chosen to be 41 mm, this ensured a good distribution of the cartridge explosives used, these being a combination of 1/3 gelatinous explosives (Dynamite) and 2/3 emulsion explosives with a diameter of 35 mm each.
The change from test blasts to a daily blasting operation was achieved with acceptance of two supervisors during the blasts. It was necessary to forward the data of the vibration measurements immediately after the blast to both supervisors. Also the exact shot report had to be prepared and handed out to the responsible people before the shot was fired.

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Figure 3. Construction Site

Drilling & Blasting Pattern

Drilling was done by two Top Hammer Drill Rigs of the 8 tons category. The position of the holes was an irregular staggered pattern, which means one row had three holes and the next row only two. The drill hole depth depended on the overburden which could be removed with excavators.

Holes were drilled 10 cm deeper than the trench depth. Hole spacing was chosen to be 0.8 m and the burden was also set to 0.8 m. The powder factor was calculated as 1.30 kg per m^3. After the first production blast the burden was able to be extended to 1.1 m and the spacing to 1.2 m which resulted in a new staggered pattern as shown in Figure 4. The powder factor for the new design was calculated as 0.79 kg per m3. The stemming was constant at 1.0 m +- 0.10 m.

Drill Depth [m]	Maximum Charge weight per hole [kg]	Burden [m]	Spacing [m]	Powder Factor [kg / m^3]
3.20	2.60	1.1	1.2	0.79
2.5	1.50	1.0	1.2	0.64
2	1.2	0.9	1.2	0.72

Table 4. Blast Pattern and loading conditions for different hole depth

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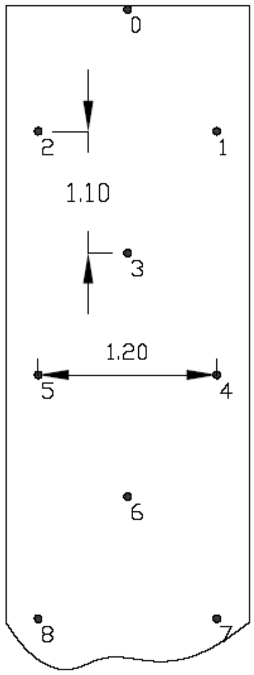


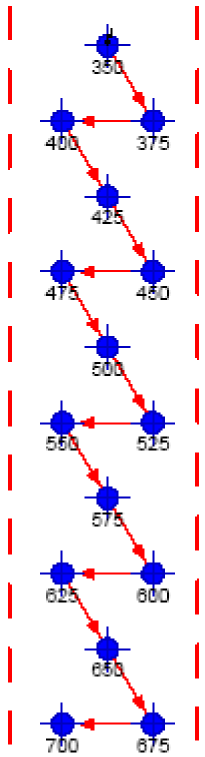
- Determining Burden & Spacing

Explosive Diameter (mm)	Hole Spacing (m)
30	0.7 – 0.9 m
35	1.0 – 1.2 m
40	1.3 – 1.6 m
45	1.6 – 2.0 m
50	2.0 – 2.5 m
55	2.4 – 3.0 m
60	2.8 – 3.6 m
65	3.3 – 4.2 m

Figure 4. Final Blasting Pattern for Production Blasts

Initiation - timing

Figure 5. Timing



For initiation of the blasts nonelectric Dual Delay detonators were used, to create the blasts as big as possible. The timing between holes was 25 ms. Down hole delays were set chosen to be 500 ms to ensure that no fly rock can hit an uninitiated shock tube. The distance from the detonating front to the initiating front was at least 14 m. In a total of more than 6000 holes fired there was no reported incidence of cut off of a shock tube recorded. The largest shot contained 491 holes and 985 kg of explosives.

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Wall Control - damage

The first production blast showed that there was more damage caused to the trench wall than expected. This was because of the alteration (influence of weather, rain, frost, etc.) of the granite in the first 1.5 m below the surface. As a result of this damage, the energy distribution was investigated as shown in Figure 6. The new extended blast design, shown in Figure 4 had one hole less per row. This blast design with a spacing of 1.2 m and a distance of at least 20 cm to the final wall, delivered a perfect result regarding wall stability and digability over the whole trench depth. The excavator shovel was a trapez shovel with a geometry of 1.6 m for the bottom of the trench and 2.2 m for the top of the trench.

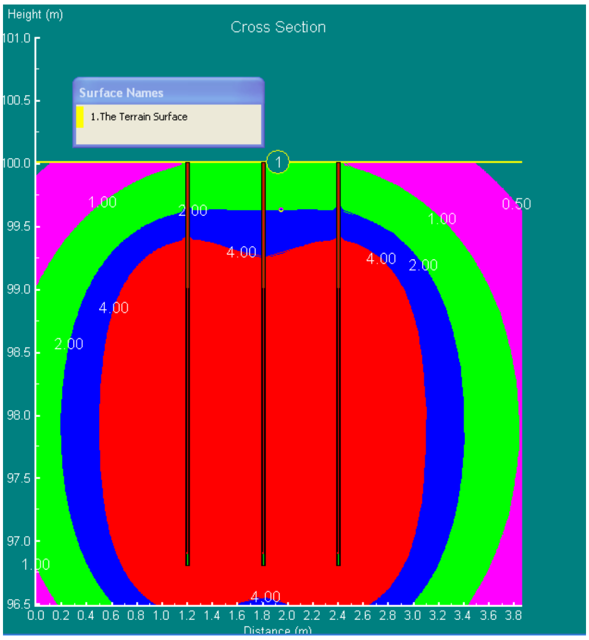

Figure 6. Energy distribution

Regression Analysis for Production Blasts

The peak particle velocity was measured with 2 vibration instruments (geophones) installed directly on the surface above the existing pipe. In the event of exceeding 75 mm/s the instruction was to x-ray two welding seams of the existing pipe before the instrument location and after the instrument location. Based on this data, a daily update of the regression analysis had to be done. The calculated K and n values at a 95 % confidential level have been used to predict the PPV for the blast to be fired on the following day. This procedure guaranteed a better accuracy by getting more and more data out of the blasts. A difficult situation was created by changing weather conditions. A couple of days featured snowing and freezing temperatures down to -10°C. Some days later it was melting at +10°C.

A total of 47 blasts were carried out in 63 days. At 4 blasts the alarm value of 50 mm/s at the surface was exceeded and the maximum PPV was 54.61 mm/s. This implies that the PPV on the existing pipe as shown in able 3, was less than 50 mm/s. The decreasing factor from PPV´s measured on the surface interpolated to structures buried in 1.2 m depth was at least 0.8.Therefore no x-ray scanning of the existing pipe was necessary and no damage was recorded.

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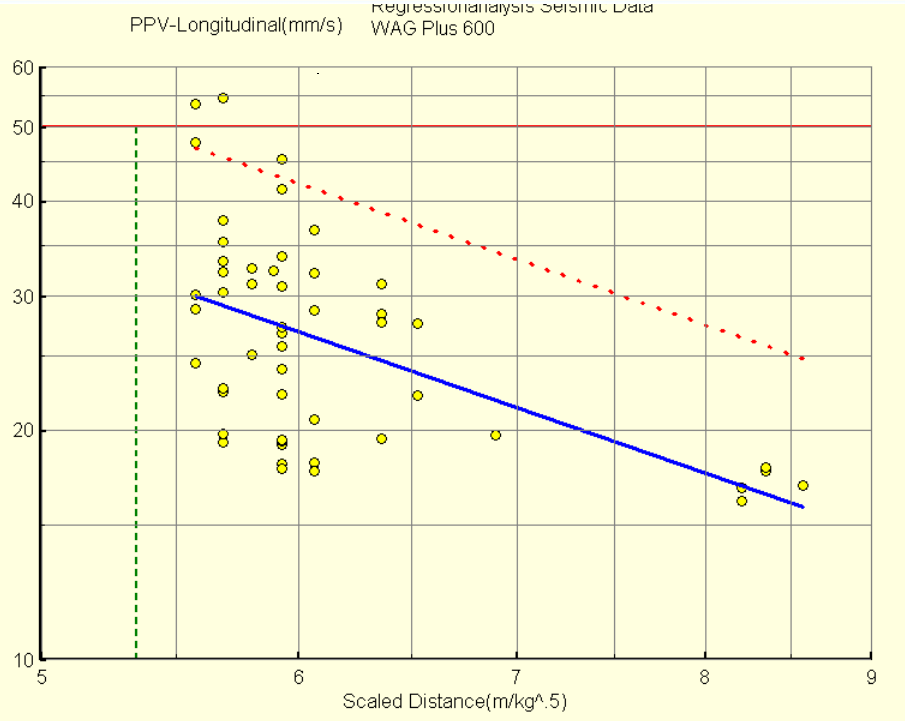

Figure 7. Regression Analysis for Production Blasts

The results from the production blasts have been used in a square root scaled distance empirical relation between the PPV and the scaled distance for a regression analysis to calculate the new K and n values with a 95% confidence level, shown in Figure 7.

The new prediction formula for the existing situation, calculated from the production blasts is as following:

$$PPV = 600.8\ (D/\sqrt{Q})^{-1.482}\ mm / s \qquad (5)$$

This gives a PPV of 47 mm/s when using a maximum charge weight per delay of 2.6 kg with a confidence level of 95 %.
The mathematical calculation showed a very good correlation to the reality of a daily blasting procedure.

Summary and conclusions

In all planned blasting operations close to buried pipelines under operating pressure, different prediction formulas have to be used to get an idea of a PPV reached. These predictions have to be compared to the national and international standards of safe blasting close to structures.

The predicted PPV for a certain amount of explosives at a given distance should be confirmed by the monitoring of test blasts. The standard prediction formulas, published in the literature, have a high "safety factor", so that in most cases the measured PPV is lower than the predicted.

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Therefore another prediction formula must be assumed, adapted to the geological situation and blasting procedure. This implies that a daily update of the regression analysis must be done. The prediction formulae should correlate as closely as possible with the reality.

Therefore another prediction formula must be assumed, adapted to the geological situation and blasting procedure. This implies that a daily update of the regression analysis must be done. The prediction formulae should correlate as closely as possible with the reality.

The German Regulations in this matter refer to 100 mm/s as a limit for welded pipes. This standard does not take into account the effect of frequency and the bedding of the pipe. The effect of the quality of the welding seams is also not respected.

Earthquakes can produce PPV´s of several hundred mm/s at very low frequencies. There is no reported damage on a pipeline as a consequence of earthquakes worldwide.

A well prepared blasting procedure from the very beginning should make it possible to carry out production blasts on a daily basis close to vibration sensitive structures.

The development of blasting solutions, which permit the adequate fragmentation and removal of rock, while meeting levels of vibration within limits specified by National and International standards, will provide a major contribution to the economic viability of both mining and civil projects.

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The Use of Tubing/Casing cutters in the Oil and Gas industry

While drilling or during any operation which involves leaving the equipment in the hole the problem of pipe being stuck can occur. To solve this problem the oil and gas industry has a variety of tubing cutting systems available.

Stuck pipe can occur while drilling, making connections, logging, testing, or during any operation which involves leaving the equipment in the hole. The initial reaction of an operator in this case would be to try and free the pipe mechanically, often assisted by the spotting appropriate fluids and using jars. Time is often of the essence and maximum effort should be applied to freeing the string from the outset.

Possible causes for getting stuck would be amongst others, unconsolidated formations, fractured & faulted formations, mobile formations, naturally over-pressured shale collapse, induced over-pressured shale collapse, tectonically stressed formations, reaction of drilling fluids with the formation, etc. To offer a solution to the Oil & Gas industry there are different type of tubular cutting methods available for which the advantages and disadvantages are described below:

Chemical cutters use hazardous chemicals (Bromtrifluorid BrF_3) that may be difficult to handle and pose environmental risks. They do offer a flare-free cut but the pipe to be cut must be clean as it will not cut greasy, waxy, corroded, scaly, coated or lined pipe. High alloy type pipe may be difficult to cut and may require over pull.

Electromechanical cutters use one or more blades to sever pipe the offer a clean cut but the device needs to be anchored the reliability offered is less than other systems and is the slowest form of cutting and comes with higher costs than the chemical cutters.

Abrasive cutters propel sand or carbonate pellets in oil or water to cut pipe. High static pressures in deep wells can require expensive high pressure pumps and ask for more time. Controlling cutting depth can be difficult and may cause holes, grooves or washouts if tool stalls off depth.

Radial thermite cutting torches burn metals to produce molten plasma ejected through a nozzle onto the pipe. The advantage that these do not require any explosives and thus do not need to adhere to the rules and regulations towards the use of explosives for oil & gas wells. The use of this system requires experienced personnel and is seen as the most costly pipe cutting method.

Tubular jet cutters cut tubulars using an explosive radial shaped cutting charge forming a jet and are often the most economical choice. They offer a method that is very fast with very high chance of successful first cut. These will cut corroded, scaly, plastic-coated or lined pipe and less likely to cause pipe damage than abrasive cutters. The cutting depth can be predicted and can be used in environments for up to 2.400 Bar. The standard handling of explosives is required and no reported surface detonations and very low misfire rate (1 in 1000+) are giving an advantage. A portfolio for different types of tubular types, sizes and applications are offered for example by DynaEnergetics as productline DynaBlade™

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Tubular cutter for Coiled Tubing.

Tubular cutter for dril pipe.

When using the tubular cutters it should be taken into consideration that always the optimum size is chosen. Should the diameter chosen be too small then the possibility exists that the target tubing is not cut completely and only a bulge (sometimes combined with small cracks) is created but not the complete severing of the pipe. In general the rule is that the largest possible diameter fitting inside the target tubing should be used. The centralization of the tubular cutter is also important to achieve an optimal and homogeneous cut.

Tubular cutters for casing and control lines.

Tubular cutters for retrieval of casings

Tubular cutters for mandrels to unlock packers.

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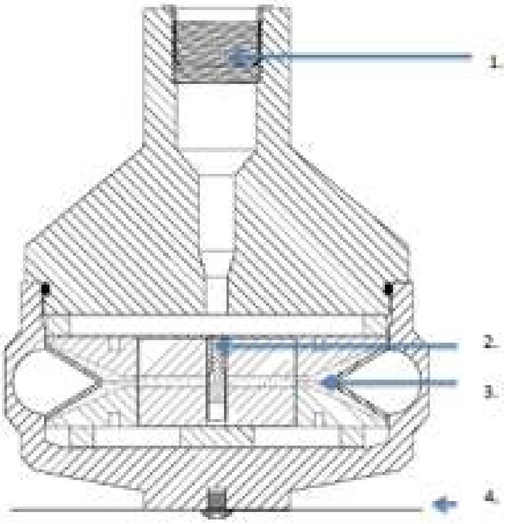
The general schematic of a tubular cutter is as follows



1. Threaded top connection (to cable head/ shock absorber). 2. Initiation Point. 3. Shaped Charge. 4. Centralizer.

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Conclusion drawn one year after coming into force of the EU-identification directive

Progress report on the implementation of the Track and Trace of explosives

Just in time for the 38th Congress for blasting techniques in Siegen, Germany the coming into force of the European-wide directives 2008/43/EG and 2012/4/EC will exactly become one year. At the beginning, involved companies had to face many challenges. However, as soon as the manufacturers, distributers and end users of explosives have succeeded in overcoming the initial phase, a last year's conclusion and a forecast on the future development and innovation of Track and Trace in the explosives branch can be made. An insight on the events of the last year will also be given from the point of view of the TTE-Software supplier for explosives tracking.

Track and Trace , what are the key issues

The legislator required the implementation of the first step of the EU-directive that contained the identification of each explosive already since April 5th, 2013. The second step however, had to be realized just from April 5th, 2015 on. It demanded, that each company that deals or uses explosives, is required to use a system to guarantee the gapless traceability. To ensure the information exchange, each company has to name a contact person, who is available twenty-four-seven. This person must have the ability to hand out the relevant information. The necessary tracking and tracing information has to be stored for at least ten years after making use of the explosives. Furthermore it has to be protected against accidental or intentional destruction and modification.

But how can you implement these requirements at daily routine? Considering, that the identification might consist of 30 digits numbers, which are not consecutive number anymore, it becomes clear that a manual registration of data is only worth considering to just a few very small companies. Although the EU-identification-directive is not demanding a computer-aided system for track & trace it is indispensable for most of the enterprises. The manufacturers concerned needed to depict processes as production, goods receipt, packaging, labelling and goods issue out of the company.

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However, the new software also brought some advantages, as the data capturing of explosives and the illustration of processes could be improved significantly. Electronic stock books replaced the manual and complex paperwork and can now record and depict stocks automatically. Further, they capture all relevant information, which is mandatory for the new EU-directive.

After some hesitation at the beginning due to feared extra effort and expense it is clear nowadays that the software solutions help enormously at the realization of the EU-directive requirements. The advantages in using outweigh the disadvantages in most cases.

Implementation for manufacturers and importers of explosives

By the clear labelling which is demanded by the EU especially manufacturers and importers faced challenges. TTE-Europe GmbH wants to help these institutions to meet the certain requirements of the new EU-identification-directive. TTE-Europe, which was founded in Dresden, has lots of experience with track and trace of goods in the tobacco-, automotive- and food-industry. Its software solution can be used online and locally installed. Meanwhile over 500 customers in Europe and the USA make use of the TTE-software.

Besides the track & trace of explosives across the whole supply chain from manufacturer to end user, the internal backtracking and process optimization played a major role in the development. Different production- and logistic processes have to be analyzed and adjusted to the new circumstances. Manufacturers for example have to label every single packaging level and to save the reference to its content (i.e. item, packaging, pallet, etc). The requirements to the new track and trace system to be implemented were as diverse as the products and the customer groups of the different explosives manufacturers.

The company MAXAM started early to equip its European production sites with new printing- and labelling-technologies. Main motivation of MAXAM for working with TTE-Europe was the requirement to offer a standardized comfortable tracking system for the products of all of their European customers.

“It was important to us to offer our customers a system, which can provide all the necessary information for the backtracking of their products in a simple and fast way.” as stated by Susanne Dschjedzik from MAXAM. “The information will be transmitted full-automatically and without any intermediate steps across the whole supply chain via the TTE-Trustcenter.” Another service is offered by MAXAM for example for tunnel-builders, whose warehouses are run on their own: “Due to managing our customers’ warehouses and using the TTE-Online solution for this we are able upon their request to view their current stocks. If the stock of one article runs short, we can initiate the delivery process precautionary. This guarantees that, if the customer confirms the order, we are prepared and are able to provide the replenishment as fast as possible.” This prevents the tunnel builder against long delivery times and ensures an efficient ordering process for MAXAM.

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The Swiss company SSE is another customer of TTE-Europe GmbH and belongs to the important manufacturers, who support the TTE-Trustcenter. The production- and distribution-sites of SSE are scattered all over Europe. They use the locally installed TTE-software, which ensures that all of them are connected with each other online via the TTE-Trustcenter. Thus the data transmission to the customers and between the own sites can be managed by the same interface. This minimizes the effort for the installation and the ongoing business of the solution, which is used across the whole SSE group.

“We were looking for software, which could be integrated in our production processes in a supporting way. Furthermore it should minimize the extra effort deriving from the EU-directive to our customers, as much as possible. Because of the data transfer via TTE-Trustcenter we can send the delivery data in parallel with the delivery, which ensures that the customer can realize a fast and easy receipt of goods.” as Gilles de Preux from SSE point out.

The mentioned examples shows how the implementation of the new EU-identification-directive could be integrated optimally into the production processes of the different explosive manufacturers by the use of the TTE-solution. Company-specific demands for printing technologies, the usage of mobile devices for data capture and the data transmission required individual adaptations and services. Also the correct generating of XML-files needed several agreements with the providers of track & trace software. Some data also had to be adjusted to the XML-standard first. However TTE helped quickly by finding and correcting the errors and the company was giving hints for the proper creation of the XML-data. The following data-transfer via the online platform TTE-Trustcenter allowed it to connect all enterprises internally or across the whole supply chain and to ensure an easy transfer of delivery data through secure networks. Thereby it is possible to send data via the TTE-Trustcenter even though this data came from other systems than TTE. If the data does not correspond to the FEEM standards (Federation of European Explosives Manufacturers) – a predefined XML-format – the data will be transformed into the right format automatically by the Trustcenter. Customers, who use explosives of different manufacturers benefit additionally, as the TTE-Trustcenter is supported by all important European explosive manufacturers. Therefore individual interface adaptations may be omitted.

Although lots of the initial difficulties were solved; there were some open questions, which were challenging for many manufacturers and importers. Thus inkjet-printed codes that were printed directly on explosives were difficult to read, which led to the case that some mobile devices could not handle them. Sometimes their content was not correct at all in some other cases or did not match the FEEM-standards. This is why Track & Trace software rejected these codes in the past. Meanwhile the manufacturers improved during 2015 and solved lots of their problems. Nearly all new products were correctly labelled and can be used now without any complications.

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Print examples: inkjet-printed codes are difficult to read

Use by suppliers and consumers

In 2015, customers of Track and Trace software providers already received ready solutions for the track and trace of explosives. The registering and tracing of explosives, as second challenge of the EU-identification directive became the new aim. The TTE-Software should work appropriately to the user requirements and the hardware should be adapted to the particularities for the use in warehouses and at blasting sites. Therefore, TTE offered different software and hardware solutions for large, medium and small sized companies, as e.g. powder suppliers. Thomas Busse, owner of Ruppiner Waffen und Munitions-Handel confirmed: "We were able to implement the requirements of the EU-identification directive by means of the TTE-system, having a manageable budget and without purchasing large devices. The small TTE-solution is ideal for us to handle the compact quantities that we distribute."

Moreover, the Track and Trace has been amplified to other branches as the oil industry or the tunnel construction, where particular requirements are expected.
To keep record of small quantities, there is also the possibility to perform the registration of explosives by means of the TTE-App on a smartphone. The advantage is that it is almost always available and when having internet access the data can be transferred directly into the Online-system.

As well as for many software innovations, there was lot of potential for changes and improvements in the system, which however could be solved with the aid of close cooperation between user and provider.
Furthermore, each company performs different processes and thus the systems needed to be adapted correspondingly. Whereas some companies could solely use the locally installed solution without internet access, the TTE-Online Software was the most favorable solution for other companies due to a faster data transfer and the ability of an access from any site.

"The usage of TTE-Online Plus enabled the implementation of the EU-directive. The integrated electronic stock book substantially reduced the time exposure for the fulfillment of the record keeping obligation according to §16 SprengG (German Blasting Law), as the explosives do not have to be registered manually", stated Frank Heydecke from FelsWerke GmbH. "We decided to choose the Online system in order to keep efforts low and stay flexible when entering our data from any sites. We benefit from the newest updates, the related enhancements and improvements, which are initiated by TTE and systems users".

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To realize trainings for all companies was another challenge. Thousands of employees needed to receive instructions to handle the new software, which on the one hand meant a time and financial exposure for the companies and on the other hand an organizational effort for the software providers. With the help of clear appointments and additional partners in Germany, the trainings have been performed targeted and successfully.

In the first semester of 2015 mobile devices and scanners were customized and delivered to clients. Due to large order quantities in a short period of time, however delay occurred with the delivery of devices by suppliers. Arrangements with suppliers enabled TTE to optimize the order and delivery processes in order to shorten times of supply and finally to solve the problem.

At the beginning of the implementation of the EU-directive, even explosives that were labelled were containing errors. Often, the delivery data in the XML format did not correspond to the regulations of the FEEM. The user data also needed to be imported manually into the system. Since manufacturers and suppliers do use the TTE-Trustcenter, the customers do not have to have separate contact with the XML files. Importing the delivery data automatically into the own system and onto the mobile devices enables the user to perform goods receipts with random samplings immediately without any manual steps.

One of the main obstacles for all parties involved in the supply chain, however, was the first inventory process of all explosives that were existent in the warehouses. Many of the items already had correct labels, however did not have the right delivery data as XML format. In order to be able to use them after April 5th, 2015 they needed to be scanned one by one. One opened question remained: what should have happen to explosives, which still were not labelled after April 5th, 2015?

Still now, this question has not yet been answered completely from the legal point of view. In order to avoid the effort of resetting or destroying, TTE has found an own solution for its customers – a subsequent labelling of the goods.

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Conclusion

One year after the implementation of the EU-identification directive a positive conclusion can be drawn. By means of close cooperation between all parties Track and Trace systems are compatible and customized to user requirements. Despite of initial obstacles the expected additional effort remained in most cases below the expectations and the Track and Trace systems significantly helped with the realization of the EU-identification directive. Additional functions, as the electronic stock book besides, replaced the manual effort and offered the possibility of an easy and rapid overview on all stocks. The TTE solutions will continuously be developed and improved. In cooperation with customers, associations and partners constantly potentials for improvement are being looked for and approaches are being found.

Tracking and Tracing Explosives

Practical Experience at a worksite - six months after the introduction

It is at 7 o’clock in the morning. The autumn day promises to be beautiful. There is a truck with a delivery of explosives in the courtyard. The explosives are being unloaded by forklift s and placed in the bucket of the wheel loader, which will then take them to the blast site.

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Goods receipt - the responsible easy and fast

Alfons Planken, responsible demoliti on expert at Sauerländer Hartkalkstein-Industrie GmbH (SHI) in Bad Wünnenberg, Alme Stone Quarry, examines the delivery once again. Using the delivery slip, he goes through the individual items and checks them off . This is routi ne; he has received every delivery and inspec-ted it for years. Since April he has used a rugged tablet computer with a small hand held scanner to check the incoming goods. Aft er 10 to 15 scans, he releases the goods for transfer to the blast site, presses on the tablet computer's display and posts the explosives in the electronic explosive stock book.

„I am extremely pleased with the Ontaris system. Overall, the cost is lower, the whole thing runs faster and easier. I do not want to have the paper book any more."

Alfons Planken (Demoliti on Expert, SHI)

„Due to the situati on with the explosives manufacturers, an intro-ducti on phase was not feasible for us, even if it had been planned in advance. This was mainly due to the electronic delivery notes, which were not available everywhere."

Katharina Hermsen (Executi ve Assistant Technology)

The new EU directi ve

This new technology was introduced six months ago throughout the enti re Mitt eldeutsche Hartstein-Industrie Gruppe (MHI); the Europe-wide directi ve came into force a few months before April 5, 2015. Since then, every company that deals with explosives and detonators is obliged to ensure the traceability of the products used. Alfons Planken can report that this was not initi ally well received in the industry but was rather fraught with many fears: „There was no opportunity to familiarize ourselves with the new system prior to its introducti on and there was no ti me to practi ce, mainly because the manufacturers of explosives were not ready."

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Since April 5, 2013, all manufacturers of explosives have been obliged to label each detonator, each cartridge and detonati ng cord with a unique number. It was agreed to print a data matrix code on each item in additi -on to the alpha numerical representati on for each item. Then on April 5, 2015, the tracing obligati on entered into force for consumers. This means that all the individual numbers must be documented upon goods receipt as well as when they are used.

To make the whole thing practi cable, the European explo-sives manufacturers established for every supply a digital delivery slip in the form of an XML fi le, which includes all the individual identi fi cati on numbers of explosives supplied.

Everyone is waiti ng, but for what

Before the directi ve entered into force in April 2015, the theme of „Tracking and Tracing Explosives" was very controversial. Since 2013, it was repeatedly a major theme at conferences and seminars. Only the implemen-tati on did not take place. Time passed, without producing tangible results. The manufacturers did not provide digital delivery notes, because there were supposedly no users who wanted to get this informati on with the delivery. Everybody was waiti ng. But for what?

„Our goal in developing the stock book was to create an easy to use system that gives complete infor-mati on about the stock all the ti me and which does not cause any extra work."

Marti n Schüssler

(CEO Ontaris)

Development of a soluti on by Ontaris

At the end of 2013, the company Ontaris GmbH & Co. KG in Wuppertal in close cooperati on with several quar-ries, mines and explosives dealers started to develop an easy-to-use system opti mally matched to the applicati on and on its part sought companies where practi cal experi-ence could be gained. "Everything was new. People autho-rized to perform blasti ng in companies were not used to working with computers. Moreover, the processes, such as how digital delivery slips would be transferred from the supplier, were completely unclear. One had the feeling, no one wanted to take the fi rst step," says Marti n Schüssler, Managing Director of Ontaris GmbH.

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At the same time, MHI addressed the new guidelines early in the Group and looked for a suitable supplier for implementati on. Thus, in the summer of 2014 initi al discussions took place with the company Ontaris.

MHI was quickly impressed with Ontaris' explosives stock book. People authorized to do blasti ng in the indi-vidual faciliti es recommended the soluti on for MHI Group, so that introducti on could take place in early 2015.

Unfortunately, at that time the explosives manufacturers were not so advanced with their IT and training that they could regularly and reliably supply digital de-livery slips with their shipments. „That took a lot of energy, and the authorized blasters barely had ti me to familiarize themselves with the new system before it had to be converted by April 2015," explains Katharina Hermsen, Executi ve Assistant Technology at MHI Group.

Return of unused explosives

In the meantime, the explosives are ready at the blasting site. The holes are filled, the initiation system connected. The explosives not needed have been re-turned to the supplier's truck. There Alfons Planken scans the cartons and some detonators going back to the supplier using the Ontaris system. One click on the stock control immediately gives him the certainty that he has carried out all bookings correctly. The inventory indicates an empty warehouse and the stock movement includes all acti ons performed.

Conclusion

Martin Schüssler talks about the fact that in practi ce there are always things not regulated in the law. „Nowhe-re is it writt en, what I should do if I have to take explosives from the blast site back to my warehouse or return them to the supplier when the label with the barcode has become dirty or lost. We have found a very simple, practi cal soluti on for these cases. We have conti nually developed our system further in recent months, so that our customers can work even bett er with it."

Although initially extremely skeptical, Alfons Planken is able to draw a positi ve con-clusion from the fi rst six months of practi ce using the tablet: „I am extremely pleased with the Ontaris system. Overall, the cost is lower, the whole thing runs faster and easier. I do not want to have the paper book anymore."

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Further information

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„Oh, they took detonating cord…" A double misfire with a happy end

After the reunification of Germany a power station in Berlin became futile. It was to be demolished. The power-station had been fired by coal. (Fig. 1 + 2)

Fig. 1

Fig. 2

A one-man-company was engaged for this job. He used 2x50.9 kg of linear shaped charges to cut the 13 beams and 25 kg ammon-gelite for kick-charges. The charges had been initiated by 292 shock-tube-detonators with delays from 2 – 5.

The results of the first blast and a second two days later were disastrous. Only a stairwell (1^{st} blast) and an elevator (2^{nd} blast) came down. But splinters scattered up to 400 m in living areas. Fortunately nobody was injured.

An analysis showed that several shaped charges had not initiated.

The main reasons for these misfires have been:

– the shaped charges had been put on the beams in a wrong way. They formed a to flat angle to allow to form a gap. Some charges had been fixed on the beams nearly horizontally.

Therefore the kick-charges could not work, but they caused scattering of steel splinters.
(Fig. 3 – 7)

Fig. 3 cut after two blast attempts

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Fig. 4: nearly horizontal cut

– the application of 292 shock-tube detonators is not appropriate for such an operation. The tolerances of the delays may have led to the cut-offs.

Fig. 5: improper cut

Fig. 6: improper cut

Fig. 7: insufficient cut after blast (attempt)

– a structural engineer was engaged to calculate the stability after pre weakening. But he was neither a specialist for demolition nor especially for blast operations.

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For retrieval of the honour of the demolition company is to say that they cancelled the contract with the "lonesome cowboy" and engaged an experienced structural engineer and a well respected blast contractor for the continuation of this job, which became now very difficult. Some charges had worked, others did not.

Some of the cuts had to be closed by welding because the buildings had not been absolutely stable. (Fig. 8)

Fig. 8: insufficient cut caused by splitting of shaped charges.

Another problem was the uncertainty of the neighbours.

Thanks to a proficient design and years of experience the third blast was a convincing success. The 100 m tall chimney (reinforced concrete) was tilted by an application of steel hinges. (Fig. 9)

Fig. 9: steel hinge

With about 20% of the quantity of explosives which had been used for the first two blast attempts the buildings came down as perfect as a textbook. (Fig. 10, Fig. 11 a – d, Fig. 12)

Fig. 10: falling chimney

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Fig. 11 a: blast result


Fig. 11 b: blast result


Fig. 11 c: blast result


Fig. 11 d: blast result

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Fig. 12: blast result

The unhappy "cowboy" visited his former site and was interviewed by a TV-team. His answer when regarding the initiation system: "Oh, they use detonating cord to ensure the simultaneity. Nobody has told me to do that. I did not get instructions from the manufacturer about this!" His answer to the question about his meaning and feelings: "I feel to be fooled, really fooled" (Remark: he used an expression we did not translate word for word ****).

The quintessence: Someone who is competing for such a demanding job should be informed and educated for it. The "cowboy" never was seen on our seminars and meetings. But he must have argued convincingly.
It is to underline that quality seals (like RAL 509 "Blast operations") find more appreciation and acknowledgement.

Epilogue: This is a shortened version of a report from Dr. Rainer Melzer (Project office of structural demolition, Dresden, Germany) published in the German magazine "SprengInfo", 3/2008.

Walter Werner

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The ISEE Conference in Las Vegas

I and Yvonne flew from Sweden 22 February to San Francisco where we met Roger and Daga who had coming from Malta.

After spending some days in San Francisco we had a week of lovely scenic drive long California's west coast together. Small beautiful towns along the coast way Highway 1 were given us a wonderful view in the sun and with the company of sea lions, dolphins and surfers. Delicious sea food and drinks is not forgetting. The last day drive through the Nevada desert took us to the real goal Las Vegas.

Las Vegas, we have been before, but the City has getting bigger. The hotel we stayed at was the Paris which we could not miss as the Eiffel Tower standing beside. The one armed bandits stood guarded in line in the hotel lobby and waiting for us but we have learned that the biggest win is not to play at all.

More than 1,600 people from around the world met Jan. 31 - Feb. 3 in Paris Hotel for the 42nd Annual Conference on Explosives and Blasting Technique.

The event, sponsored by the International Society of Explosives Engineers (ISEE), is the world's largest conference on explosives engineering. It features five days of workshops, technical sessions and entertainment.

James Tyler, Roger Holmberg and I were invited to present our next conference in Stockholm at the International luncheon. We had as well a booth in the exhibition hall which was well attended.

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Our EFEE conference has had a major impact in the world and with a drawing power of Alfred Nobel and the Stockholm´s attractive archipelago, many exhibitors and potential paper holders have pre-signed its great interest.

We were very well cared for by the outgoing President Mike Kohler and ISEE's CEO Winston Ford and was invited to sit at the head table at the gala dinner. The gala dinner is as always with many grandiose speeches and had a nice entertainment with three beautiful ladies singing almost on a par with Lyon.

James presenting EFEE´s next conference in Stockholm

The annual awards on the Gala dinner banquet honored people who made outstanding contributions to the explosives engineering industry. One of the most prestigious price went to Cameron McKenzie, Ph.D., Blastechnology, was honored with the Distinguished Service Award. McKenzie has been very involved with ISEE, volunteering countless hours of serving on the ISEE Board of Directors, and authoring and presenting papers at the annual conference.

After honoring the award winners, Jack Eloranta was officially taking the reins of new ISEE Board of Directors President. Eloranta is the principle of Eloranta & Associates Inc., a consulting firm established in 1999. He holds a Bachelor of Science degree, a Bachelor of Arts degree and a master’s degree in mining from the University of Wisconsin.

The next Annual ISEE Conference on Explosives and Blasting Technique will be Jan. 29 – Feb. 1, 2017, at the Caribe Royale Orlando Hotel in Orlando, Florida.

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Skål for the next EFEE conference with the ISEE President Mike Kohler

After that week Yvonne and I had some days in New York and Roger and Daga took an extra week by travelling in the great Canyons by car.

Donald Jonson

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"Innovation"- the 2016 Conference of the Institute of Explosives Engineers

It was a wonderful sunny day on 13th April, when more than a hundred people gathered in Telford Shropshire. Not just any people, but those who are somehow connected to explosives and blasting on their everyday work. Sounds dangerous, but it is not. It was time to hold the Annual Conference of the Institute of Explosives Engineers.

This years subject was innovation, which was also the reason for the conference to be held in Telford, as it was Thomas Telford himself, a famous Scottish civil engineer, architect and stonemason, and a noted road, bridge and canal builder, who is to be blamed for some of the greatest industrial innovations in United Kingdom during the 19th century.

Even if explosives and blasting can be related to demolition in common knowledge, the truth is that it is hard to build anything withouth the help from explosives. If it is used to get gravel or cement or build a magnificent rocket or to make memorable effects in entertainment business, it is the thing to start from when we create something big.

Everybody were greeted by the official Journals of Institue of Explosive Engineers, free to take home with.

A good start to the day - President's Opening Address, by Dave Welch

There were a lot of impressions, changing of ideas and warm greetings to share

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14 countries represented on the Conference

More than half a hundred people

2016 will probably be a memorable year in a long line of Annual Conferences for the Institute of Explosives Engineers as there were a number of very interesting presentations from various subjects for example:

- a known Macondo Incident in the Gulf of Mexico where explosives were used as a solution to a problem with Oil Well, by Andy Pettitt
- as well as explosives might be used to solve a grounded SS Montgomery Problem in Thames Estuary with good Innovation and Collaboration, by Rob Leary and David Wyse
- and on the other hand a nice presentation about a magnificent Sixty Years in Firework Manufacture, by Ron Lancaster
- and last but not least among others were very interesting presentations by Charlie Adcock who talked also about Innovation Through Re-Interpretation while using explosives in movie Industry and showed some of the great James Bond for us and also Daniel Jubb who is a remarkable Rocket Engine Consultant, showing off with some of the latest innovation on the Falcon Project and the Resonant Acoustic Mixing.

It was not only the presentations which made the conference, but also the people, as there were quests from 14 different countries, interesting layouts from the sponsors and good organization by the Events Team of the Instutue of Explosive Engineers.

Discussions and reflecting on presentations

One of the presenters, Ron Lancaster on the left with the Vice President of IEXPE

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The day in Telford went by too fast. In the morning the Conference rooms were filled with warm greetings which turned into lively discussions during midday and ended with exchanges of ideas and thoughts for the future, for Innovation in the evening. A great productive day it was.

More impressions from the Conference

Erik Nilsson and Ken Cross standing in front, EUExImp workshop

Those who were interested, could stay for another day in Telford to participate in a workshop by EUExImp - European Explosives Sector Implementation of Occupational Standards which was organized by KCEM AB and is partially funded with EC moneys through the Erasmus+ scheme.

For more pictures please visit the following link: http://teeletuuna.grimsun.eu/failid/Telford2016/album/

Teele Tuuna,
Editor of EFEE Newsletter

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New EFEE members

EFEE likes to welcome the following Members who recently have joined EFEE

National Members

Patlayici Madde Sanayicileri Dernegi (PAMSAD), (The Association of Civil Explosive Industrialists), TURKEY

Company Members

Instantel, Canada http://www.instantel.com/

Individual Members

Juho Rahko, Pöyry Finland OyAalto University, Finland (Previous Student Member)

Hikmet Sinan İNAL, SOLAR Patlayıcı Maddeler San. A.Ş, Turkey

Avid Lindsay, Bibby Offshore, UK

Sunil Somani, Beezaasan Explotech Private Ltd, IndiaNicolay Georgiev, Dundee Precious Metals Chelopech, Bulgaria

Student Members

Zean Lang, Laurentian University, Canada

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Upcoming Events

World Tunnel Congress 2016
April 22-28, 2016
San Fransisco, USA
http://www.wtc2016.us/

MINExpo 20166
Las Vegas, USA
www.minexpo.com

24th World Mining Congress
October 18-21, 2016
Rio de Janeiro, Brazil
http://www.wmc.org.pl/?q=node/127

ISEE 43rd Annual Conference on Explosives and Blasting Technique
January 29 – February 1, 2017
Orlando, USA
www.isee.org

World Tunnel Congress 201
June 9-16, 2017
Bergen Norway
www.wtc2017.no

EFEE 9th World Conference on Explosives and Blasting
September 10-12, 2017
Stockholm, Sweden
www.efee.eu and http://efee2017.com/

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43RD ANNUAL

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CONFERENCE ON

EXPLOSIVES & BLASTING TECHNIQUE

January 29 – February 1, 2017

Orlando, Florida USA

Deadlines

May 13, 2016
Last day for submission of abstracts.

June 15, 2016
Notification of abstract acceptance.

August 15, 2016
Last day to submit completed papers.

November 1, 2016
Notification of final acceptance of papers.

December 1, 2016
Conference registration deadline for authors.

January 29 - February 1, 2017
Annual Conference - presentation of papers.

Call for Papers

The International Society of Explosives Engineers is issuing an industry wide Call for Papers to be presented at the 43rd Annual Conference and published in the Conference Proceedings.

Ideas should be submitted in the form of a 200-400 word abstract (summary) highlighting the major points of your 8 to 10 page paper. Papers may not be commercial in nature.

Abstracts must be submitted by completing the online abstract submission by May 13, 2016. The submission site, guidelines, instructions and deadlines can be viewed at www.isee.org. Please contact us if you do not receive confirmation within two weeks of submitting your abstract.

International Society of Explosives Engineers

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EFEE

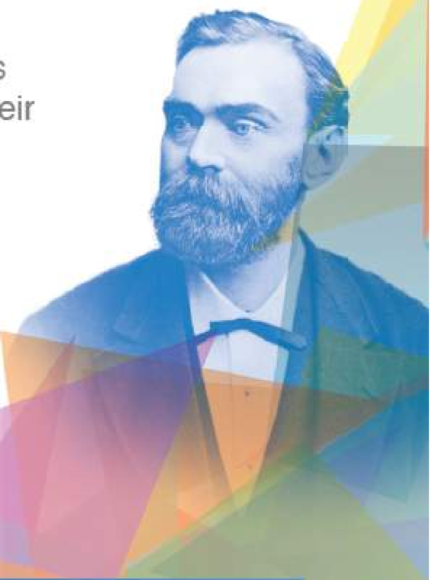
9th WORLD CONFERENCE
THE BREWERY,
STOCKHOLM, SWEDEN

BERGSPRÄNGNINGSKOMMITTÉN

STOCKHOLM 2017

10th – 12th September

The World Conference on Explosives and Blasting is an excellent platform for becoming familiar with the current developments in the blasting sector.



Stockholm provides an excellent arena for experts from all over the world to extensively exchange their experiences in the home of Alfred Nobel.

The conference includes:

- Large Industry Exhibition
- Technical Programme Featuring
  - Blast vibrations
  - Explosives
  - Blasting experiences.
  - Demolition etc
  - Instrumentation
- Partner Programme
- Industry Specific Workshops
- Gala Dinner at Alfred Nobel's Factory

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