Experiences with the pan-European implementation of a track and trace software:
challenges, solutions and future

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Due to the terror attacks using civil explosives in Madrid (2004) and in London (2005), the European Commission decided upon a range of counter-terrorism actions, of which the EU identification directives are part.

The goals of the EU-directive 2008/43/EC, which was published in 2008 and its extension 2012/4/EU, are the identification and traceability of all explosives from the manufacturing location or the first circulation within the EU up to the end user. They are also used to support the enforcement authorities when tracing lost or stolen explosives and the prevention of their abuse.

To achieve this, all manufacturers, distributors and end users of explosives within the EU are obliged to implement a tracking and tracing solution in their company processes. Regarding the latest upcoming deadline for implementation in April 2015, analyses and experiences with the already developed solutions and integrations can be done now. This paper will address the experiences and results of first implementations that show the problems developers of track and trace software had to solve and give an insight on upcoming challenges.

Requirements of the EU-directives

Besides the already mentioned traceability of explosives over the entire supply chain, manufacturers, distributors and end users need to retain the storage of the tracing data over a period of 10 years. In case of a request by the responsible authorities, concerned companies are obliged to give information about the disposition of the explosives immediately on a 365 days a year and 24 hours a day basis. A name and contact of a person able to provide the required information outside normal business hours has to be provided to the responsible national authorities. The used system has to be tested regularly to secure the efficiency and quality of stored data. The first deadline for the implementation determined by the EU-directive 2008/43/EC, the 5th April 2012 was extended by the directive 2012/4/EU to 5th April 2013. Manufacturers and importers have then to make sure a unique mark is labeled or printed directly on every explosive and the package. Goods without unique identification that have been produced or imported into the EU before 5th April 2013, either had to be used or given back before 5th April 2015. On this date all companies possessing explosives were obliged to execute data collection and record of all explosives.

The leading explosives manufacturer organised in the FEEM took three years of lead time to fulfil their new marking duty at the time of the commencement of the EU regulation. In 2010 the complete industry organised itself in task forces and committees who agreed upon the two-dimensional data matrix codes ECC 200 as a FEEM standard. The developed FEEM guidance note helped the manufacturers and importers to implement the EU-directive in a standardised and easy way.

Development of the tracking and tracing software

By publishing the EU-Directives the German Blasting Association began to search for a software company which was able to develop a tracking and tracing system to fulfil the requirements. Due to the experience with other track and trace solutions in tobacco and automotive industries a contact to the association soon arose. Analyses of the directives and the requirements at any part of the supply chain had to be done. In cooperation with the German Blasting Association a tracking and tracing software for explosives was developed by TTE-Europe GmbH.

First steps in development

Before a system could be developed it had to be decided how the requirements of the EU-directives could be realised in practice. Considering that a unique identifier consists of up to 30-digit numbers and not only continuous numbers are used, a manual registration of data would only be possible for a very small amount of products.

Even if the EU-directive did not demand it, a computer-based system was indispensable for most companies. For the first deadline (5th April 2013) a specification analyses for marking explosives had to be undertaken and the development of a printing solution to generate labels and XML-files compliant to EU-directive began. At the same time the company decided to create its own company for tracking and tracing of explosives.

At the EFEE World conferences in Lisbon and Moscow their Tracking and Tracing solution was presented to the public. By winning over the first bigger manufacturers of explosives in 2011 and 2012, new knowledge about production processes and requirements could be achieved.

Since 2012 the software is deployed as an internal aspect of explosives manufacturers across Europe and the US. One of the first difficulties that the company had to solve in collaboration with the future users was that the speed and thus the profitability of production were not allowed to be reduced due to the application of the new labels. The solution had to be implemented in already existing systems of the big manufacturers.

After finding a satisfying answer to the physical labelling, the digital data were given attention. It was supposed to be administrated quickly and easily and later also be transferred in the framework of the second level of the EU-directive. Therefore the system was constructed in a way that entire packaging hierarchies can be saved. The information of single items is summarised in small packaging units and these are assigned to a higher packaging unit. For example: all tracking numbers of single detonators are listed in the data for the single outer packaging, which again is part of an entire pallet.

manufacturing country
(2 letters) and
a 3-digit number of the
production plant

product
identification
number

name and address
Of manufacturer

unique identification (serial
Number) of the individual item

electronic readable
identification

DE999 1305A00010001
EX2

DYNABlast
Manufacturer
dynablast
Buschweg 34
54621 Winsen, Germany
12345/67890

Supplier / Importeur
Example Supplier
Example Street 1
12345 Example Town
+(0)123-456-789

Sample label referring to EU-directive.

Implementation on manufacturers and importers sites
In 2013, when manufacturers and importers of explosives already had to fulfil the EU-directive, the German Blasting Association made an analysis of the implementation. Almost half of all codes, which were produced at that time, were problematic. 20 to 30 percent of markings did not accord to the data matrix codes required by the FEEM. Furthermore, the coded data was partly erroneous. They were partially incomplete or incorrect. In total only 20 to 25 percent of the tested labels were without errors. This alarming result made an impact. Most manufacturers repaired the recognised errors before Summer 2014.

Some non-standard explosives still existed until April 2015. These had to be destroyed or given back. The main goal of the manufacturers was to remedy defects until the end of 2014 – just in time to rollout the second part of the EU-directive with a due date of April 2015. Therefore it was important for every party to set up with new hardware and software. The ambition of the tracking and tracing solutions was and is to make the directive achievable for every user with the lowest possible effort. Regarding this, some software vendors offer, besides the required track and trace functionalities, an electronic stock book to avoid the manual paper work. Due to the time-saving effect in administration of the stock book, a practical benefit can be found in the EU-directive.

Because of the requirements of the EU-directive, most companies had a problem with their internal organisation. The process of generating the new labels and at the same time save data, generate XML data and deliver all information to the clients, were new in this field . To find a solution, suppliers of tracking and tracing software and the manufacturers had to engineer new process-organisations in cooperation to optimise the internal processes. It was necessary to keep the speed of the production on the same level, raise the quality of markings as demanded by FEEM, have alternatives for marking in case of errors and to avoid additional manual effort.

For the selection of hardware, partners had to be found, which offer a variety of all kinds of devices for several areas of operation. The mobile devices had to be robust and protected against dust and rainwater. It was necessary to not only involve the manufacturers


Scanning at SSE Germany.

but the entire supply chain in the selection of hardware. Two world-wide acting suppliers became new partners to deliver handheld scanners. They offer different robust and handy devices to give the client the opportunity to choose the most appropriate one for their business.

Differences can be found between price, area of operation (stock or outside) and individual requirements. At the end, the range included low-priced handheld scanners, which are connected to PCs or laptops and small portable computers with scanner, keyboard and usually pistol grip. They are standard in logistics and have maximum stability, longevity and are easy to use. They can be delivered in several protection classes. In some cases robust tablet-PCs were also requested. Due to the bigger display more information can be shown at the same time. But the display also has the significant disadvantage that the device cannot be as robust as smaller mobile devices; it is much heavier and the battery doesn't last as long.

European wide support – Partner network
Originally the plan was to create a track and trace solution only for the German market, because it was assumed that other countries have similar software products. Before 2013 it turned out that very few solutions existed in the European market. That is why the work was done together with European-wide associations like EFEE and
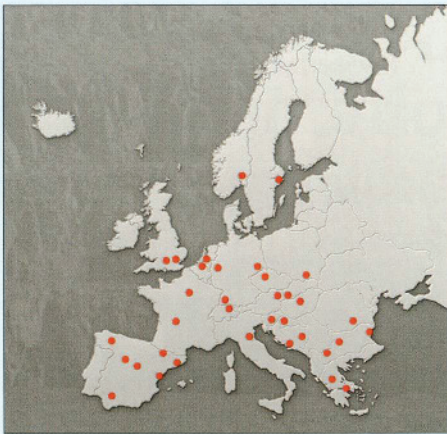
European partners.

FEEM. A European Partner network was built up to provide consulting and services in the local language in every country of the EU. The benefit from this network is the local support and consultation for customers in the whole of Europe, contacts of the partners to national authorities and blasting associations to gain more information about new developments and adaption of the solution to national needs, and the exchange of experiences within the partner network.

FEEM Guidance note/XML

As already mentioned, manufacturers were the first who had to fulfill the requirements regarding FEEM-compliant labels and data transfer. From 2009 until 2013 FEEM members came together to prepare the FEEM-guidance note. The aim was to outline a method to achieve a harmonised system for the implementation of the EU-Directives. The system is not binding for the FEEM members, but recommended and will minimise logistical problems by considering the entire supply chain up to the end user.

The most beneficial solution for FEEM was the bar-coding technology. With a unique number, an item can be traced throughout its life cycle. With a database maintained by each user of the explosives the traceability can be achieved. Because of the high number of explosives manufacturers a harmonised system of database management is essential to prevent considerable effort for all users by maintaining different records of each supplier.

As a result a code structure had been designed and adopted that was flexible enough to enable the use in already existing IT systems of all companies. Mandatory fields in the bar codes on the labels enable them to track and trace the products. Further data is needed to keep an electronic record within the electronic stock book in accordance with national legal requirements in all EU member states. (More Information can be gleaned in the FEEM Guidance Note).

Data transfer within the supply chain

After completing the FEEM Guidance Note, the software developer had to ensure, that all requirements are fulfilled with their software. As part of the FEEM guidance note, information has to be sent in XML-files through the whole supply chain. An option to transfer the XML-files in a safe and fast way had to be found. There was no binding consensus in the industry on how data was supposed to get from manufacturer to the rest of the supply chain. Most of the transmission forms involve a manual effort to different extents. There are for example data carriers like USB sticks accompanying the delivery. They are applicable almost everywhere, but cause considerable manual effort and entails, besides other security risks, the danger of transmitting viruses to the computer.

Explosives suppliers may also charge extra for the USB-Sticks and for additional logistical effort. Data transfer can also be done by normal emails, which are used nowadays in every company. But for this, manual effort is necessary which might result in errors, loss of data, spam attacks and security holes. More security against loss and the access by unauthorised persons are offered by automatic electronic transmissions.

It was necessary to provide a platform that supports every way of transmission and also to be compatible to track and trace systems of other providers. To enable the simple and secure data transmission across Europe with all suppliers and customers, this data transfer platform is available as European standard. For the Europe-wide exchange it was necessary to have the platform available in all countries, independent from producers of explosives and from the software itself. It can also be connected to other systems. The fed in XML-files are automatically audited on correspondence to the standard. This way the data transfer platform protects its users from problems in data processing and transmission. Little effort is necessary to implement the software but an internet connection has to be available. On the other hand it is the safest and most timesaving option.

Implementation on distributors and end users' sites

From 2013 distributors and end users were supported, where they had to implement a solution for tracking and tracing of civil explosives by 5th April 2015. They are not only obligated to undertake data collection; every single item of civil explosives has to be completely traceable over the entire supply chain from its manufacturer to the distributor or importer to the end user. The data of every single element has to be recorded in time. Afterwards the data has to be stored for a minimum of 10 years, protected from any falsification.

A special challenge was the availability of information about origin, position and disposition of the explosives for the responsible authority. Every company has to name a responsible contact person, which is available for the controller at all times of the day and every day of the week to give information in a short time period. The tracking and tracing software had to take into consideration this aspect to facilitate the permanent obligation for disclosure. It was possible to develop software, which allows one unique temporary access by the authority to check a single tracking number. This access can be closed by the customer at any time. The controller receives no sight of the entire stock book, only the data of the investigated tracking number. The safe and long lasting storage of data is undertaken in secure IBM data centers in Europe.

Due to the requirements of scanning every item and making sample scanning, with the ability for relocations and usage of explosives, internal work processes had to be adapted to avoid additional expense. Also data transfer had to be included in these. Information should be provided by the manufacturers before delivery. Without this, receivers of explosives would have to register every item manually. The data transfer also has to be done in reverse direction in case of returns. The entire life cycle has to be registered and fully traceable. As already mentioned a fast and automatic data transfer over an electronic platform ensures that. The problem was that some manufacturers could not provide FEEM-compliant XML-data by the end of 2014.

Not only software, but also hardware had to be delivered to the customers. They had to be suitable for different environmental conditions (e.g. in quarries) and weather. The techniques were new for most of the companies and employees needed to be trained. Further training for several companies had to be undertaken.

Registration of explosives.

Selection of mobile devices for every use.

In some countries an electronic stock book was required by law in the explosives sector. For this reason, this feature was included in the software to fulfil the national demands and EU-Directive at the same time.

The experiences when implementing the software were that every user has their own processes. Some carry their scanner from one point to another, some just need a local scanner and other companies cannot even transfer data via internet, because their site is outside of a stable internet connection.

The challenge was to create a solution for all these companies, which was still flexible enough to be easily adapted to individual requirements.

Roll-out of tracking and tracing software

A big issue which especially arose in the field of explosives end users was that the EU-Directives were not well-known in the beginning. Many companies were late in engaging with the problem. That required not only training for the software but training for the requirements of the EU-directives.

Due to tardy orders late implementation in some companies' systems was inescapable. Intensive usage of the system was necessary in February and March 2015, because of some companies' winter break. In the first quarter of 2015 mobile devices and scanners had to be adapted to the customers' demands, but one problem was that the hardware deliverers were not able to supply so many devices on time, because of the late orders. Processes to reduce the delivery times had to be created and the problem could be solved.

One of the main problems for all parts within the supply chain was the first inventory of all explosives, stored in their stocks. A lot of them were marked with labels, but without corresponding XML-files. To use them after the 5th April 2015 they have to be scanned piece by piece. If not, all explosives not marked had to be given back to the manufacturer or had to be destroyed by 5th April 2015 according to the demands of the EU-directive. To avoid this manual effort, a solution was found to label all the unlabeled explosives afterwards.

Conclusion

After the implementation in April 2015, when the EU-directive came into force for all companies possessing explosives in the EU, there is still a lot of work to do for track and trace software suppliers.

It is necessary to increase the usability and flexibility of the software to be more adaptable to all users without losing any features of the system. For future work between all parts of the supply chain of explosives, ways for data transfer should be expanded and become even more reliable. Adaptions of the system to improve companies' processes for faster and easier work are already planned. Better implementation into already existing systems is included in new releases of the software. Individual adaptions of the system will follow. Many companies first notice the need for special features, when they are working with the system intensively.

Over the last years since the issue of the EU-directive and appropriate papers, we developed a tracking and tracing solution for explosives for civil uses. An important fact is that knowledge in tracking and tracing and strong cooperation with the blasting associations and selected end users were the main support to develop this solution. Feedback from the customer helped to improve the software and to find the right hardware-software combinations. Due to the new process of integration additional work may be required but it can still be kept to a minimum through a tracking and tracing software.

It is important to say that this paper and the included results only concern the work and experiences of the authors' companies. It may not apply to the experiences of other track and trace software suppliers.

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