

Wireless Detonators

By Bruno Pimentel.

Hello my friends, I hope you are all well and have performed great detonations, safely and with good quality.

We are in a very tight routine, which is why we were unable to publish the article at the beginning of the month, but we are trying to optimize and focus on topics that we are already involved in on a daily basis to make it easier in these difficult times.

As always, we leave here the links so you can check our previous articles, as well as register, so that you are automatically notified of each new article we publish (monthly):

Português

<https://www.linkedin.com/newsletters/desmonte-de-rocha-c-explosivo-6941709482355748864/>

English

<https://www.linkedin.com/newsletters/rock-blasting-6959820770344595456/>

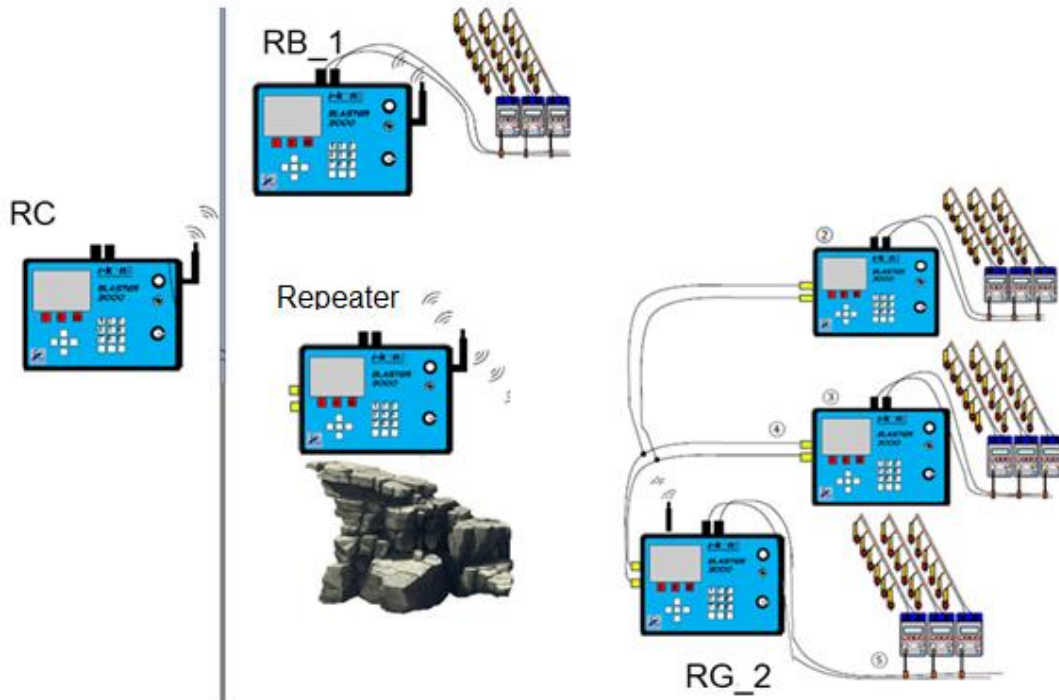
Os detonadores eletrônicos já conquistaram seu espaço no mercado e não são mais grandes novidades, inclusive suas vantagens já bem divulgadas e os preços cada vez menores, quando comparados com os sistemas tradicionais, tem feito eles ficarem cada vez mais populares, inclusive cada vez mais perto de alcançar a maior parcela de uso, substituindo em grande parte os detonadores pirotécnicos, tanto em cenários a céu aberto como no subsolo, por isso decidimos no artigo de hoje fazer alguns comentários breves sobre o que chamamos da próxima “evolução do sistema de detonadores eletrônicos” que são os detonadores sem fio, conhecidos pelo termo em inglês “Detonadores wireless”.

Consideramos esse novo sistema como uma evolução dos detonadores eletrônicos, porque todo o sistema segue os mesmos princípios e tecnologias, inclusive em muitos deles o detonador em sim é praticamente o mesmo mudando ou eliminando o sistema de conexão de fios e interligações direta, por a wireless communication system.

We already have some good options on the market, some more evolved and already available for consumption and others still in the testing phase and trying to gain more space. Where the "technologies" or "principles" do not change much, but we can say that there are two main types, where on the one hand we have the completely wireless systems and on the other we have the system that eliminates the connections between the detonators, which we could say that it would be a system without connections, considering that there are still cables inside the holes that connect each detonator to a device that is on the outside of the hole.

Before giving a little more details about this new technology, it is important not to confuse the wireless detonators with the wireless initiation system or better known as remote activation,

which consists only of the conventional electronic detonators system, which are all connected by wire. to an initial equipment, which is located close to the dismantling and will later be activated by another remote device, usually by radio frequency commands, eliminating the need to extend a connection cable hundreds of meters to a safe place to carry out the activation.



This differentiation is important because the remote activation system is available even for pyrotechnic detonators and although the technology is also present in wireless detonators, this remote activation is not what characterizes this new technology.



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So making this point clear, because we have already seen some people causing some confusion between the technologies, we can say in summary that the new wireless detonator system is a technology that reduces (no connection cables) or completely eliminates the cables of the detonators , replacing them with a “device” that is responsible for receiving communications from the equipment and transmitting the information to the detonator.

As we said, we basically have two technologies in progress among the different manufacturers, where one of them only eliminates the connection cables between the detonators and has an external device/antenna connected to the internal detonator of the hole by its cable. An

example of this technology is the DaveyTronic@Edge detonators, where we can see some pictures below and we leave here a link where there is a video talking more details about the technology: (https://mine.nridigital.com/mine_apr20/davey_bickford)



On the other hand, we have completely cable-free systems, where the communication device is connected to the detonator inside the hole, eliminating detonator cables and connection cables.



Each model, according to its manufacturer, will have its particular characteristics, but basically they are composed of 3 parts that are joined together inside the hole (booster, detonator and communication device) and the equipment that are used to program and trigger the detonators posteriorly.



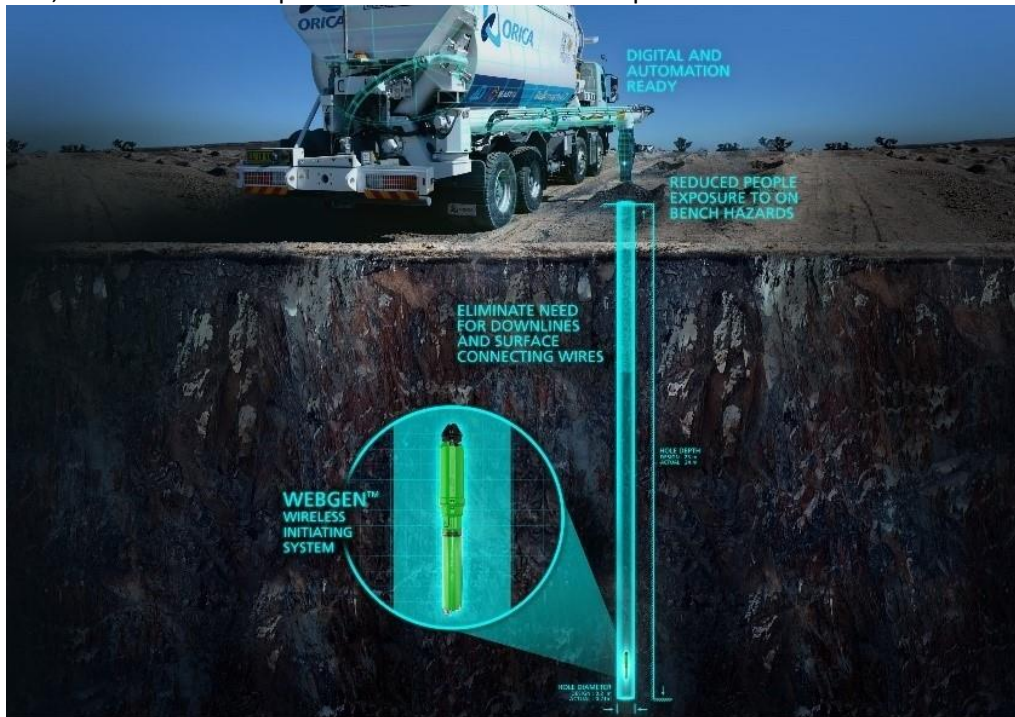
- Our objective today is not to go into detail about the technologies, we will try to do another article later on about that, but we invite you to do a quick internet search and you will find a lot of information, both on the pages of the manufacturers themselves, as well as videos on YouTube that are very illustrative and bring more details about each system.
- There are several applications for this new technology, both in the open pit and in underground operations, including enabling new mining methods and making it possible to increase recovery in areas that previously the risk of operating was unacceptable and now it is possible to load in advance and detonate later without exposing people to risky situations.
- In addition to the various advantages already recognized and validated by electronic detonators, which most are still present in this new system, we will take advantage of this article to comment on other new ones that are being tested with this new technology:
- The key point of this new technology is that in addition to the absence of explosives on the surface, which are already a strong point of electronic detonators, we have the expansion of the absence of connection cables, further reducing the risk of damage to the accessory and especially the risks of failed hole due to damage to the cable, which is very common during tamponade, slipping of material from the hole or handling the wires themselves. We still have the elimination of the risk of interaction between equipment and cables during the execution of the activities of loading and preparation of detonation, or even of people stepping and tripping on the cable, in the case of open-air operations, are a prominent advantage for this system .



- Another benefit, but strongly identified in larger operations in the open, is the elimination of the need for the presence of an auxiliary in the tamponade, who is normally responsible for guaranteeing the protection of the cables, and with this system we reduce the risk of interaction between people and equipment, as well as exposure to dust and the need for extra cable care.



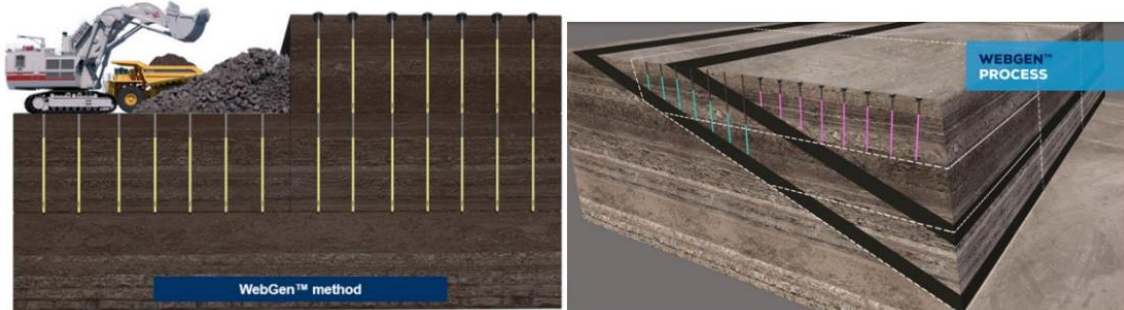
- The absence of explosives and cables outside the hole also increase the safety of leaving fireworks loaded for several days, even if they are not covered, due to the lower risk of damage to the material and even attempts to remove material from the holes for theft, which has been a point of attention in several operations with lesser controls.



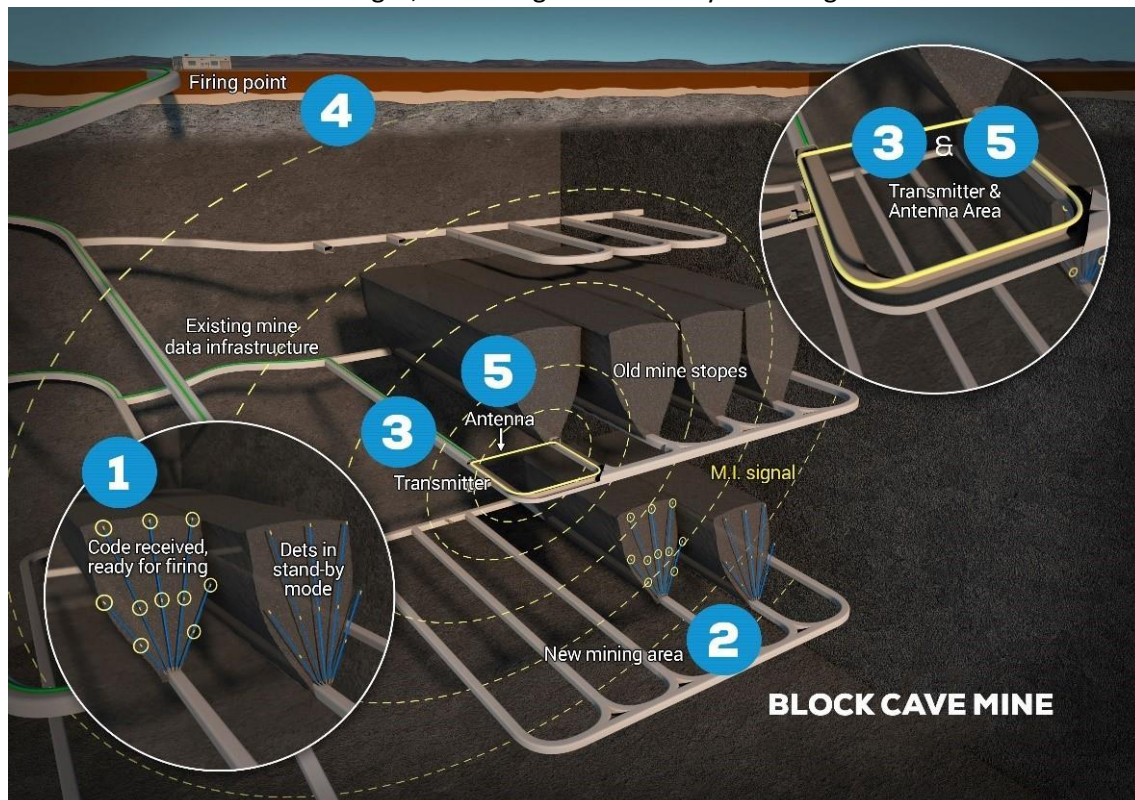
- The absence of cables on the surface also allows for the creation of maneuvering areas in open-air operations, including some operations that are testing safety levels to leave charged areas and create temporary access while partial detonations in the area are being carried out.



- An operational benefit or time saving is the elimination of the need to connect the cables and programming the detonators in parallel with the loading, optimizing process steps, increasing productivity.
- A very broad possibility in underground operations, which has also gained ground in open pit mining situations, is the possibility of loading several panels and detonating them in different events, making it possible to streamline preparation operations and carry out mining by stage without exposing people new risk scenarios. A point of attention to this possibility is just the need to maintain a safe spacing between the panels to avoid occurrences of damage by dynamic pressure to the holes that were loaded for the next detonations.
- In parallel, we also have detonations in multiple layers, when we carry out several loading decks in the same hole and detonate them in separate events, as is common in underground chimney openings or in high energy techniques or impact control in mining at open sky, it is also necessary to take the same safety precautions with respect to the risk of dynamic pressure.



- The possibility of leaving charged areas and detonating later is helping the development of several new mining techniques for underground mining, increasing the possibilities of recovering pillars and areas, as well as greater control of dilution, where it is possible to detonate different levels of different stages, increasing the selectivity of mining.



- In addition to increasing the possibility of remote mining in areas of greater risk, this technology also boosts the possibility of robotization and automation of the drilling and dismantling process, since the absence of cables allows a greater possibility of manipulating the accessories to carry out automatic uploads.



- Another point that has justified the use of wireless detonators is the lower exposure (absence of cables on the surface) to possible accidental activations by lightning strikes, which despite still being a very controversial topic and we hope to write more about it in the future, it is undeniable that less exposure brings less risk and this is a fundamental point for open pit operations.



But as the old saying goes, not everything is rosy, so there are still some questions and concerns about the new technology, which still needs to gain its space to start being representative and consistently replace the conventional electronic detonators that are still going strong. replacing the pyrotechnics:

- The first concern with the wireless system is the lack of constant two-way communication, which in short means the ability of the “detonator” to send information regarding its status (communication, battery level, system health, etc.) after it is applied. The completely wireless systems available only make two-way communication with direct contact, so once the detonator is inserted in the hole, it is no longer possible to have information about it, only information being sent from the equipment to the detonators, but without the responsiveness. This brings the system back to the concerns

of conventional systems, where we do not have complete confirmation of detonation, running the risk of having unmapped failed holes. This is probably the biggest point of concern for this new technology and what has most hindered its advance, so manufacturers need to work hard on this issue, which will be the crucial point of validation and key turning point for the new technology.

- • The lack of two-way communication makes it necessary to carry out signal tests and map the areas of influence of the trigger antennas in all detonations, to ensure coverage at the time of detonation and increase the level of confidence in the system. As a result, in some situations it is necessary to drill the holes in advance, at least those at the ends, so that the tests can be carried out in more detail. This is an important point because the upload can only proceed if the signal quality is within the proper parameters. Otherwise, the positioning of the antenna must be reassessed considering the distance to the dismantling site and the presence of possible interference.
- • Another concern is related to the capacity of the batteries, which are normally 1 to 2 months, which meets most operations, but there is no way to guarantee or prove their correct operation before detonation, especially after several days inside the hole. Most systems will test the battery status before charging, giving an initial prediction of battery life, but the reliability of this information over time can vary.
- • A common practice with the use of electronic detonators is the application of backup detonators, which are used in the absence of communication with the detonators, and which with the wireless system limits its application, summarizing the use of more than one unit of the same system.
- • One last point that is worth highlighting is of course the price, because like any new technology it still demands a lot of investment and thus it will take some time to be economically viable for most operations.

As all new technology still needs to be tested and approved in different application scenarios, which should not only raise several other concerns, but also new possibilities of benefits from its use.

We are currently testing Orica's Webgen detonators and we hope to be able to have greater contact with other technologies and systems, so that we can continue to follow the evolution of this technology, which seems fantastic, but of course, as with any new technology, there are still some important steps to be taken, which are fundamental to guarantee the security and reliability of the systems.

Well that's it guys, let's stop here today, the objective was just to highlight the main advantages and disadvantages of this new technology, which continues to evolve constantly, and we hope to be able to make a new article soon with more details about the systems and their operating mechanisms and security.

As we always ask, please comment and share, so that we have increasingly safe and quality detonations!!!

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