Brief theory of air decks in production blasting

In conventional blasting much of the explosive energy is lost in the generation of undersize fragments or super fragmentation. The production of oversize fragments on the other hand, lowers loading and transportation efficiencies of equipment which requires secondary blasting.

Melnikov and Marchenko (1971) reported that, by introducing one or more air gaps in the explosive column, a secondary shock wave can inexpensively be generated thereby increasing the duration of the shock wave action on the surrounding rock mass by a factor of 2-5. Explosive costs were reported to be reduced by between 10% to 30% with benefits on both fragmentation and movement. Fourney et al in 1981 conducted further studies with Plexiglass blocks and supported the above findings.
Benefits of Air Deck blasting include

1. Improved fragmentation in the collar zone of the blast
2. a Faster loading cycle
3. Reduced or no crushed rock being required for stemming material
4. Reduced vibration and over-pressure (airblast) levels
5. Improved costs and production in wall control drilling and blasting
6. a Saving in overall explosives cost
Theory in Action using Infladeck
Typical air deck application

1. Lower the design top of the explosives column (normally 1 meter or 3.28 feet)

2. Set a barricade using Infladeck gasbags between explosives column and stemming material. (Place Infladeck gasbag at normal stem depth at first, stemming lengths can be reduced after initial trials have been performed and results accessed)

3. Stem from the Infladeck gasbag to the top of the hole, as usual.

The explosive gases will be able to expand into the air deck created above the column and exert a reduced but prolonged stress in the collar zone of the blast. This can result in significant reductions in explosives load in production holes without loss in fragmentation or movement of the collar zone.
Vibration and Over Pressure reductions using Infladeck

1. Reduction in vibration is mainly due to the reduction of explosives in the hole

2. Some evidence supports the claim that the gasbag acts as a “accumulator”, trapping previously wasted energy in the collar zone and converting it into useful work, reducing vibration levels in the near field.

3. Infladeck gasbags are stemming enhancers, keeping the explosive energy for a prolonged period in the hole to break rock, “accumulating the energy in the air gap and reducing venting and therefore over pressure (stemming ejection)”
Hard cap formation

Infladeck gasbags serve as a stemming enhancer where it locks and prevents energy and gases from escaping out the top of the hole. The energy that would otherwise have been lost, is directed into the material being blasted.

The energy being utilized more efficiently is great for breaking hard cap rock formation.
Some other uses for Infladeck gasbags

Pre-splitting
Common Applications
Wet Blast Holes

To a maximum depth of 6 meters, Infladeck gasbags can easily be lowered using a aluminum ramming rod. The Infladeck gasbag must however be supplied with an additional conduit pipe attached to the bag to which the ramming rod is secured. The conduit pipe is inexpensive and therefore bag can be supplied with or without the conduit attachment with no difference in price to the user.
Gasbag vs Imported Stemming Material

Testing has shown that Infladeck gasbags provide for a better blasting result than imported stemming material. To demonstrate this, below is the result of a test conducted at Middelburg Mines in South Africa.

Test Hole 1
a Full column of E6000p explosives with 5 meters stemming using imported aggregate material

Test Hole 2
a Full column of E6000p explosives to a 5 meters stem height and gasbag placed at 4 meters from the collar of the hole and stemmed to the top using drill cuttings

Test Hole 3
a Full column of E6000p explosives to with 5 meters stemming using only drill cuttings

<table>
<thead>
<tr>
<th>TESTHOLE NR</th>
<th>SEISMOGRAPH NR</th>
<th>AIRBLAST (dB)</th>
<th>FREQUENCY (Hz)</th>
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<td>1</td>
<td>1776</td>
<td>128</td>
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<td>1277</td>
<td>126</td>
<td>8.6</td>
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</table>

Hole 2 with Infladeck gasbag showed best result
a Infladeck gasbag was placed inside a concrete simulation pipe 9 7/8” in diameter. Some fine sand was placed on top of the Infladeck bag and a metal plate 240mm in diameter was used to spread the load.

The press stem was centered on the metal plate and the results were as follows:

Force Applied before puncture: 2500kg/5500 pounds
Calculated pressure: 5.4Bar or 78.643 PSI

No Slippage occurred before the bag was punctured.
Quality Management

To ensure top quality product

All Infladeck gasbags are manufactured to ISO9001:2008 and the Responsible Care environmental standards
Technical & Sales Material

As part of this presentation we would like to present a CD to your mine which contains the following relevant documentation:

- Some mine test results supporting some of the info presented in this presentation
- Infladeck brochure
- Safe storage, handling & transport manual for Infladeck
- MSDS report for Infladeck bag inflator
- UN flammability test for Infladeck bag inflator

Thank you