The #1 best practice is good communication between driller and blaster.

A successful blast begins with the planner, followed by the driller and blaster.

Most flyrock is launched out, rather than straight up.

Fine-tuning your drilling and blasting will reduce flyrock and improve other processes.
The issue of flyrock in aggregate blasting is diminishing. “Our practices, the products we use, and our understanding of the process are all getting better,” notes Frank Sames, corporate manager of blast development for Austin Powder Co. “At the same time, though rarely, flyrock still does occur,” he says, adding that there appears to be a general trend to present problems in surface and underground blasting are flyrock, misfires, and fumes.

As these incidents occur, the producer or contractor must look at what the cause might be. Was it human error? Was it a problem with explosives initiation through product failure? Was there an error made in the planning phase, resulting in a systems failure? Or was it Mother Nature? “The best planning can still result in a failure, due to some uncertainty with nature,” Sames says.

According to Bob Archibald, president of Archibald Consulting Group, most flyrock incidents can be traced to four root causes.

1. Improper stemming: Stemming is the space between blasthole rows. If there is not enough burden, between the face and the front row of blasthole, flyrock can occur. “An irregular face often will contribute to this,” Archibald says.

2. Improper timing: Timing is the sequence at which the blast occurs. If, for instance, a hole in the second row shoots before the hole in the first row, there is no relief for the energy, except for rock to go right up,” he says.

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4. Geology: Irregularities and discontinuities in the geology, such as a clay seam, can create a flyrock incident. “The blaster needs to know if there is a clay seam, so that he can stem through that section,” Archibald says.

These four top causes of flyrock can, alternatively, be addressed by experienced drilling and blasting professionals. Understanding the geology of a site means knowing the native stone structure or type in the region, and how to design a blast accordingly.

The blast pattern must take into account the amount of burden, especially at the face, to ensure proper blasthole placement and loading. The driller must know the exact parameters of the blast pattern — including hole depth, burden, spacing, diameter, and angle. The blaster must know the proper products to use and the correct timing of the shots.

“It all speaks to the human element — with experience and communication at the top of the list,” Sames says.

Producers who contract their drilling and/or blasting do so because the contractor brings experience, expertise, equipment, and materials to the shot that the producer might not be able to provide in-house. That said, it is important to designate someone on staff who understands the best practices to monitor your contractor(s) and ensure there is the correct documentation and communication between the parties involved.

The issue of flyrock in quarry blasting is diminishing, due to a number of reasons, but it still can happen. Practices, products used, and the overall understanding of the process have all improved over the years to make blasting a safer undertaking. When flyrock incidents do happen, the common perception is that the rock launches vertically. In reality, most damaging flyrock launches horizontally from the face.

Flyrock incidents can usually be traced back to four root causes. Insufficient burden (i.e. space between rows), especially in the front row, will result in energy causing rocks to travel farther out than is desirable. Improper stemming may launch rocks up and out. Improper timing, with back rows shooting before front rows, can have the same effect. Irregularities in geology, such as a clay seam, can also cause issues.

Communication — with thorough documentation through the use of logs and checklists — is imperative amongst the planner, the driller, the blaster, and operational personnel to ensure a safe, successful shot. For instance, the driller can help the blaster know where he might have lost pressure during the process, which can indicate such anomalies as a clay seam that can affect the shot.

In contracting out your drilling and blasting, it may be tempting to hire the lowest bidder. From a safety standpoint, this could easily be a mistake. But from a cost standpoint, the lowest bidder may not provide the best overall cost, either. Any additional cost incurred by hiring a superior drilling and blasting contractor may easily be realized two to three times over in reduced crushing and screening costs.

You can prevent flyrock, just like you do in your plant — with communication, monitoring, and oversight. And remember, it pays to be proactive. "Communication is key," Sames says.

Prevalence is dropping
Common causes
Communication is key
Monitor your contractors
Take advantage of technology
Lowest bid may not be best

November 2015
Voices of Experience

Frank Sames

As corporate manager of blaster development for Austin Powder Co., Frank Sames admits that he is biased toward the pros of working with a contract driller and blaster. "As suppliers, our experience in different environments is more diverse," he says. "If you are working as a driller or blaster in-house, you experience a similar [almost the same] environment with every blast. It’s possible to become complacent if you don’t challenge the status quo on a blast and adjust at the first sign of trouble." He adds that it is a long-time disagreement in blasting whether the "same environment" argument is an advantage or a disadvantage.

Sames says that, regardless of whether the work is handled in house or by contract, the technology available today offers a distinct advantage for blast designers, drillers, and blasters. "For instance, it once was a real challenge to accurately measure the burden of every blasthole along the front row of the blast (due to the irregularity of the face)," he says. "Today, with the use of two-dimensional and three-dimensional profiling, it is not so much of a challenge."

Face profiling systems in 2D are good for simple faces, allowing the blast designer to determine a perpendicular cross section of the face at each blasthole location. He can then adjust the hole accordingly to the correct distance from the face. More irregular blast faces may require the use of a 3D laser or 3D photogrammetry profiling system to determine the burden in relation to each blasthole. A 3D laser will place points on the face and generate a 3D mesh drawing of the blast face. A 3D photogrammetry system will use digital pictures of the blast face to create a 3D digital image of the blast face. Both types of profiling also help the blaster to more accurately load the hole for the shot.

"Along with laser profiling and photogrammetry, there are flyrock models we can use to determine the probability of flyrock and where it might go," Sames says. "It is a decision-making tool for many purposes, including clearing the blast area of personnel."

Bob Archibald

"Blasting is a subject that is near and dear to my heart; I love the blasting aspect of the industry," says Bob Archibald, president of Archibald Consulting Group. He explains that, while the elimination of flyrock in aggregates blasting is a worthy goal from a safety standpoint, perfecting the blasting process can reap numerous benefits.

"For example, one quarry I managed near Chicago was having a fines problem off of the primary. We brought in a technical guy from Austin Powder who looked at our blasting, and, based on his recommendations, we changed how we did our surface blasting," Archibald says. "After analysis, we were astonished at the improved fragmentation we had in our muck pile and resulting plant processing costs — all from careful design and monitoring of the blast."

Archibald says he feels that, if all producers would analyze their blasting programs similarly, there would be a large reduction of fines issues in the quarry business. "If you fine-tune your blasting for better product, you will, by default, reduce your flyrock," he says, "and vice versa."

If he had to cite the number-one best blasting practice for safety and quality, Archibald says he feels there needs to be open, regular, and thorough communication between the driller and the blaster — including proper documentation and dialog.

"The blaster needs to know what geology and irregularities the driller encountered. Based on that, he can plan for proper stemming and timing," Archibald notes. "If the driller does his job correctly, the blaster has a better chance of a safe and effective blast." He adds that, in the case of contracted drilling and blasting, this communication needs to also include the producer, who should monitor all logs carefully.

Although the dilemma of whether to contract or to bring blasting in-house will undoubtedly endure, Archibald has a final thought on blasting contractors. "If we bring in quotes for drilling and blasting, we’re all guilty of looking at the lowest cost-per-ton," he says. "But we also have to consider that safety and cost go hand-in-hand. The best contractors, with a rigid safety protocol, will ultimately give you the lowest overall cost-per-ton."