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ANALYSIS OF THE MAY 10TH 2014 KABOOM

As published on www.accurateshooter.com (http://bulletin.accurateshooter.com/2014/05/ammo-failure-detonation-in-3-gun-match-watch-and-wince/) we can watch the video footage of an amazing kaboom with an AR-15 in .223, which happened May 10th 2014 in the US.

What happened exactly is the question asked on AccurateShooter.com. Quickly, people were writing down lots of conclusions. Today, July 1st the only conclusion everybody agrees on is that this accident is due to an overpressure. But the next question is "What might have caused this overpressure?"

To this last question, the main answers were "the wrong powder during reloading" and "a barrel obstruction by a previous bullet". The first answer is inconsistent, knowing that the ammo was manufactured. As for the second answer given, before agreeing or not, let me tell you something. A normal ammunition power is usually not powerful enough to push two bullets out of a barrel. So do you really think that with a broken case (lost of power) the ammo will have enough pressure to push more than one bullet out of the barrel ? Remember, the bullet of the Kaboom went off the barrel. So this second answer is inconsistent too.

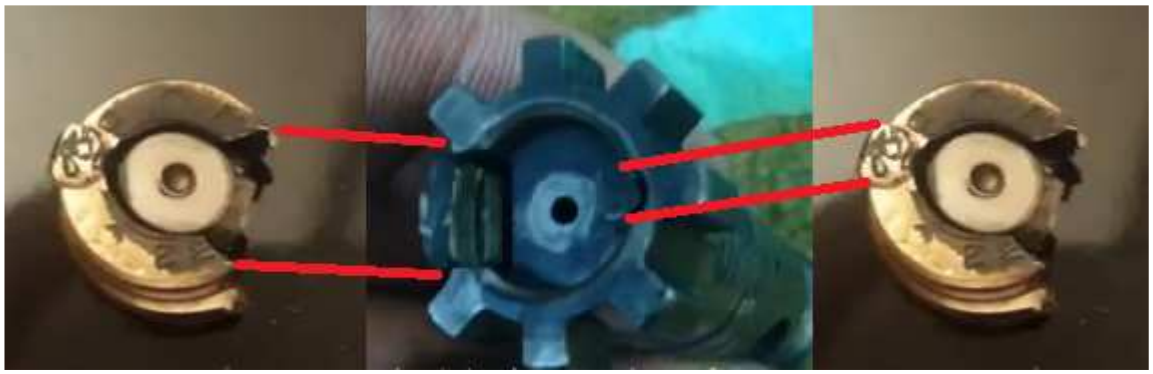
Because of the two precedent jams (clic), we could imagine that the bolt was not correctly locked. In others words, the bolt was closed enough to release the hammer but not enough to fire. I would say yes but I can't. The first reason is that mechanically, when the head of a flat rotating bolt is turning to lock, there is no unusual gape between the chamber and the bolt. The ammo is adjusted to it. The second, which we will see later, is that there is no trace of a wrong locking on the extractor's lug shown.

So, let's look at the elements given to have a chance to get a scientific answer.

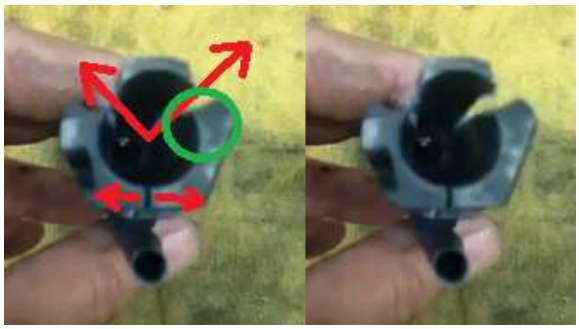
1. The bullet of the Kaboom went out of the barrel.
You can see a smoke in front of the barrel at 0:53 video time. (red circle)

2. The circular break of the case is clean but a deformation shows that the bottom part broke first (green circles), then around the case.

3. You can see the stretch on the bottom of the case body before the break in the last 10-12 millimeters. (green area)

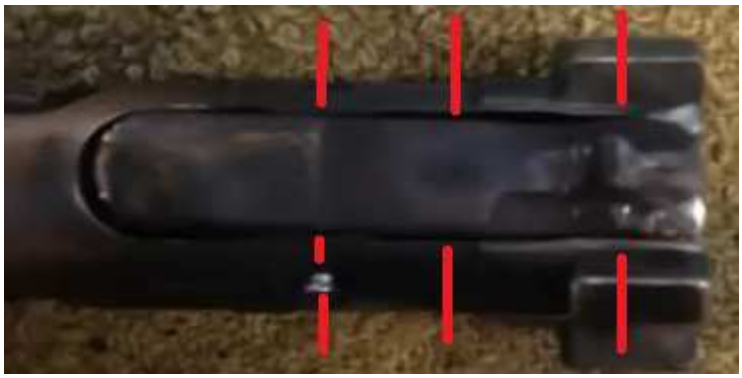


4. The two significant traces left on the bottom of the case are the extractor zone and the ejector hole. But a clother look at the primer shows that it was overpressured but the fire pin mark is still clearly there. This is strange for a normal overpressure.



5. The rear part of the bolt carrier is broken in the tiny part areas and the deformation is more important on the extractor side. (green circle)

6. As "Cade" wrote online on May 15th : "the bottom of the bolt carrier at 1:20 in the vid. Perfect imprint of the next round in the magazine – you can even see the cannelure. Gives an idea of timing/bcg position when overpressure occured". Let's add that there is no trace of any movement of the bolt carrier at the time of the impact.



7. The extractor lug doesn't seem so be damaged by a bad locking (right). Marks of deformation are detectable on the extractor on the axis (left) and between the lud and the axis (center).

8. Because the bullet went through the barrel, the mechanism, activated by the gas, worked perfecly and unlocked the bolt.

9. The flash-hole is unusually big. It seams to be nearly 3 millimeters (>0.1 inche). (red circle) Usually with this kind of brass the flash-hole is approximatively 1/5 of the diameter. (green circle) See examples of other brasses (0.080 and 0.062 inches flash-holes)

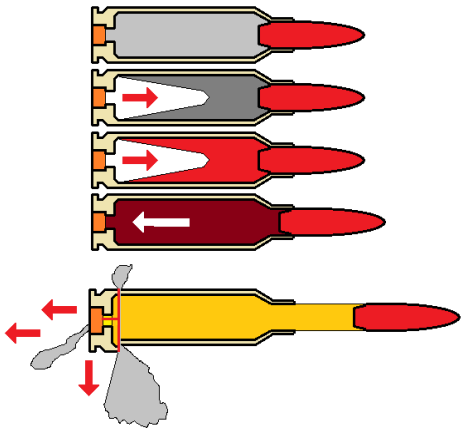
Let's talk about size of the flash-hole. First we have to remember the reason for the flash-hole. The brass is like a frame comprising two rooms a big one and a small one. The big one is the one where the powder is waiting for ignition. The small one is the one reserved for the primer, which is waiting for percussion. Both are explosives.

Just a fast track course about how explosion works. Explosion is a burning session. The difference between different types of burning sessions is the speed of the burn. Wood burns. Powder burns fast, we say it explodes. Primers deflagrate or detonate and they burn amazingly fast (at least some miles per second). So, in a brass, we have two different explosives, the primer and the powder. The flash hole is small enough to "manage" the distribution of the primers' energy into the powder to let it ignite at the right speed without being "shaked", or worst, broken. If shaking might not have any consequence, breaking the powder changes its burning speed (vivacity) which grows. A broken powder gives more surface to burn, so burns faster and might create overpressure.

Why "might" create overpressure ? Because it depends on the new speed the powder will have. Then, we go from the overpressure to a kind of shock wave. What is the difference between a pressure and a shock? Ok, let's say it is the same difference between a bullet you drop on a paper target and the same bullet you shoot on the same target. When you drop the bullet, its speed is enough to move and damage the paper but not enough to make a clean hole. When you shoot the bullet, its speed is enough to make a clean hole but too much to move or "damage" the paper. Got it? Old and very old ammo are dangerous for this reason, broken powder due to vibrations through the years.

Anyway, even if the powder is not damaged, a bigger flash-hole gives a faster ignition than a normal one and that faster ignition create overpressure. Reloaders, do not play with your flash-hole size!

Finaly, let's talk about the "shaped charge". Shaped charge is a form using an empty space to concentrate the energy in one point. Using a shaped charge is the guarantee to destroy whatever you want. So, with the same explosive in quantity and in quality, using a shaped form or not does not give the same result. The reason I talk about shaped charge is because in a brass, we can get this phenomenon when a gape is created in the "powder room". So, if the flash-hole is too big, the primer can push the powder close to the bullet and thus create a gape and compress the powder until it breaks which in turn leads to an increase in vivacity. Taken all together, this can give you a Kaboom.



10. A to big flash-hole also can crate a "shaped charge" and breaking the powder

But in fact, to have a real shaped charge done, first the explosive should be compressed, which can be in this case, and second the form of the empty space have to be conical, which had only a few chance to be in this case. Who knows ?

WHAT MIGHT HAVE HAPENNED...

Because the bullet left the barrel (1), I don't think that the two previous jams are involved in the Kaboom it self. So, as the ammo was correctly chambered, no trace resulting of a bad bold locking is visible on the lugs (7). The bullet is shot and the unusally large size of the flash-hole let the primer push the powder next to the bullet bottom, breaking the powder, changing its vivacity and, perhaps, creating the gape needed for a shaped charge (10).

The violence of the "new" charge is so impressive that first the brass case has been stretched to the rear (3), then from the wild flash-hole the energy wanting to escape pushed perpendicularly and found an exit way in the extractor area (4) so that the bottom of the brass broke (missing part) generating the first cut for the clean circle break of the brass (2). The two parts of the bottom of the brass were separated due to the pressure. The part in the ejector area went partly into the ejector hole in the bolt head (4). The speed in which we are talking is so important that even the fire pin haven't got the time to go back in its initial position and that is the reason why the primer does not seem to have been impacted by the pressure except around it (4). The gas started to escape by the generated exits into the extractor, which was maintained by its lug and its axis but damaged by the gas (7) and entering the bolt carrier, breaking it in three light points (5). The breaking of the bolt carrier is still so powerful that an impact on the first cartridge of the magazin is imprinted showing that the bolt was in its normal position at this time (6). Surprisingly, the bullet passes normally through the barrel and the gas in the barrel helps to open the bolt (8).

All is over and at this time, the actual missing part of the bras is still in the gun. It falls with the first manipulation and is not found.

To determine wether this theory makes sense, we should be okay to sacrifice an AR-15 and be shure to use an extremely wild flash-hole in normal ammo. Now, if the problem of this accident is effectively the size of the flash-hole, two new questions can be raised : "How can a manufacture making a such flash-hole (accidentally)?" and "Should we recall this series of ammo or not?".

Florian
Simplyright.ch – July 1st 2014