

## FIREARM INVESTIGATION DETERMINES INCORRECT POWDER IN THE AMMUNITION WAS THE CAUSE OF AN EXPLOSION

An ESI investigation combines metallurgical, mechanical and chemical analysis to determine the cause of a rifle accident. ESI ultimately contributes the powder analysis to the National Center for Forensic Science Smokeless Powders Database.

### SITUATION

In September 2015, a Winchester Model 70 rifle was taken to a gun shop to have a new scope mounted and sighted in.

The gun had been originally manufactured in 1949 with a .300 Holland & Holland (H&H) Magnum chamber. The rifle had been modified into a .300 Weatherby Magnum (WBM) chamber prior to its sale to the current owner.

Upon completion of the installation of the scope, the gunsmith fired the rifle to check the scope. A new box of commercially reloaded ammunition was used for the testing. The first round fired successfully.

When the second round was fired, an explosion broke the rifle apart with a catastrophic failure of the rifle's receiver, injuring the gunsmith.

ESI was retained to investigate the cause of the explosion.

**Practice:** Firearms, Ordnance & Ammunition

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#### Services Utilized

- Gas Chromatograph-Mass Spectrometry
- Fourier Transform Infrared Spectrometry
- Optical Microscopic Analysis
- Scanning Electron Microscopy (SEM)

#### About ESI

For over 30 years, ESI has leveraged its multidisciplinary team of engineers, scientists, and professional technical staff to investigate many major accidents and disasters. Our technical expertise, hands-on experience and state-of-the-art facilities, combined with diagnostic, analytical and physical testing capabilities create an ideal environment for quickly identifying and interpreting the facts of a case.

#### Contact ESI

For more information visit our website or call us toll free at 866.596.3994

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## SOLUTION

The rifle was evaluated to determine if there was any preexisting damage prior to the incident. The methods used were nondestructive and non-altering, and included visual, photographic, and optical microscopic analyses in addition to scanning electron microscopic (SEM) evaluations.

The cartridges in the ammunition box were examined to determine their consistency and adherence to the maximum reloading ranges. A lab exam measured the overall length, headspace, pull force, and weights of the powders and components. ESi reviewed the SAAMI (Sporting Arms and Ammunition Manufacturers' Institute) standards, chambering and cartridge drawings for the .300 H&H and .300 WBM. NECO QuickLOAD<sup>®</sup> software calculations were run for Alliant Powders Reloader<sup>®</sup> 25 and Reloader<sup>®</sup> 15 along with the powder recipes listed in the bullet manufacturer's guide.

The cartridge contents were also chemically characterized and evaluated to identify the type, brand and size of the powder. Documentation of the powders included shape, dimensions, luster and perforations. The powders were ultrasonically solvent extracted and analyzed using gas chromatography-mass spectrometry.

## RESULTS

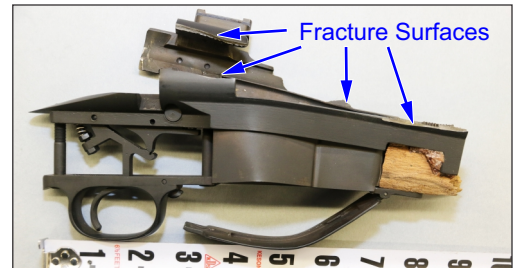
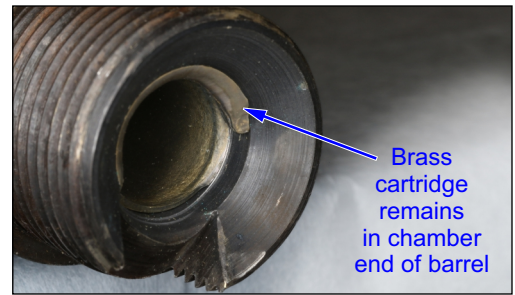
Metallurgical evaluations determined that the force that caused the damage originated from the cartridge during firing and that there were no preexisting fractures, fatigue striations, or damage to the rifle prior to the incident. This force was oriented backwards against the bolt face and was sufficient to force the bolt backwards and upwards against the receiver, causing the receiver to deform and fracture. All the receiver fracture surfaces were ductile in nature, demonstrating they were all caused by the single overload event from the discharge of the cartridge.

The mechanical investigation showed the cartridge's powder weight within a range from 85.0 to 85.4 grains with an average of 85.2 grains. This would be within commercial tolerance and should not result in unsafe loadings with the proper powder.

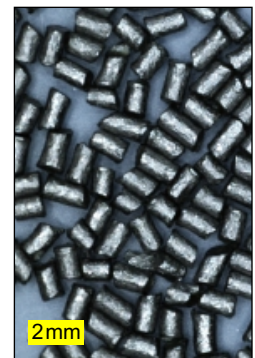
During the chemical examination, one cartridge was found to be loaded with a different powder based on the size of the grains and chemical analysis of the powder. The powder examined for all but one cartridge was Alliant Powders Reloader 25. The powder examined in the one cartridge was Alliant Reloader 15.

It was determined that the cartridge used during the unsuccessful firing contained the Reloader 15 powder. Using the incorrect powder within the ammunition was the causation of the excessive pressure and ultimate explosion.

As an additional outcome from the extensive work on chemical characterization and identification of powders using methods outlined in ASTM E2998-16, ESi was able to contribute a comparison of the results to the National Center for Forensic Science (NCFS) to be added to their Smokeless Powders Database.



15X magnification of the bulk powder from cartridge 9.2 from cartridge 9.9



**Why ESi.** The Firearm, Ordnance and Ammunition group is comprised of consultants with backgrounds in:

- Component Codes & Specifications
- Criminal & Evidence Issues
- Design & Performance
- Fabrication & Manufacturing Support
- Fracture & Failure Mode
- Gun Shot Residue Analysis
- Hazardous Ammunition
- High Pressure & Velocity
- International Suppliers
- Metallurgy & Materials Adequacy
- Propellant Composition
- Reload & Velocity
- Scenario Replication & Testing
- Storage & Fire Modeling
- Tool & Witness Mark Identification
- Wildcat<sup>™</sup> Misuse & Abuse



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