RIO GRANDE

RICHARD RAWLINGSON VISITS UEE OF SPAIN AND FINDS THINGS ON A MUCH LARGER SCALE THAN ANTICIPATED

"That's the factory there," said my guide, Sales and Operations Manager for the US, Inigo Rodriguez, gesturing in the direction of a tall, heavily forested mountain. Seeing nothing but 1000 feet of rock and trees, I must have looked puzzled. "You can't see much from here", he admitted.

We were in the village of Galdacano, close to the city of Bilbao in Northern Spain to visit the production facility of the UEE group's explosives division. It is here that the propellants for the company's Rio cartridges are made and I was to be given a crash course in gunpowder production, the first call in a tour to see the whole cartridge making process from start to finish. UEE is one of the very few companies in the world that can do this, for only a handful of businesses have all the production processes under their control. Most cartridge manufacturers should more properly be called loaders, because they merely assemble components bought from a variety of suppliers; at UEE they make it all.

First a brief history. The group was formed in 1896 as an amalgamation of Spanish businesses involved in the production of explosives, including one founded by Alfred Nobel to produce his invention – dynamite. The initials stand for Union Espanola de Explosivos (Spanish Explosives Union). Galdacano was chosen as the site for production because of the region's iron ore industry and it has remained one of the key sites in what has now become a major international group.

But why a mountain? Well, explosives are dangerous things – very dangerous. Every part of the production process is risky and safety is of paramount concern. "Most businesses are concerned with quality, safety and profitability", Javier Jimenez, manager of the powder production plant told me. "Here our priorities are first safety, safety, and safety, then quality and hopefully, after all that, profitability.

"And a key principle in safety is separation, keeping the processes as far apart as possible. The bigger the risk, the smaller the quantity of material and the greater the distance. This site covers over four million square yards and we have over 25 miles of roads, all hidden by the forest."

The forest element of the site is only lightly managed. Deer and wild boar flourish among an abundance of wildlife, while to keep the undergrowth under control a herd of over 100 wild horses grazes the land. This is truly unlike no other factory I have ever seen. The safety element is visible at every turn. Massive concrete walls – many with sand infills – enclose each operation. All are designed to keep people one side and product the other. Each building has one weak wall, designed to blow out first, usually towards the sheer rock face of the mountain.

Today 500-600 people are employed, according to season, and from the mountain top you can see the sprawling city of Bilbao, just a short drive away. 100 years ago that was a far more difficult journey and the factory and village were one and the same, the company providing homes, a school and hospital and even building the church which carries the date 1912 above its main entrance.

Galdacano produces not just the powders and primers for sporting cartridges – my main interest – but also bulk explosives for civil uses such as mining and construction. "We like road construction", said Jimenez. "To build roads in a mountainous country like Spain you need lots of explosive!" As if on cue, there was the muffled thump of an explosion in the distance. "Just testing," said my guide. "If we go white – then you should worry!"

By now we had driven several miles up the hill to the start of the powder production line – a line that itself is almost two miles from start to finish. Here UEE's famous PSB and CSB powders are made, used not only in the company's own Rio brand, but a favorite of many loaders around the world.

It starts with containers of nitrocellulose, produced by another UEE division. This is the raw material of all modern gunpowder and deceptively harmless in appearance, looking just like fluffy cotton wool. In fact it is very unstable in this state, made manageable only by being mixed

THE CARTRIDGE LOADING COMPLEX AT NANCLARES DE LA OCA.

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with water, 30% by weight. "Nitrocellulose burns at the surface," explained Jimenez, "and in this state it is virtually all surface. The production process is all about making it stable and controlling the surface area and hence the burn rate. Predictable and consistent burning is essential for each type of powder we produce because that is the key element in the formula for each different load."

Around 20 different powders are produced, covering the needs of all the different shotgun gauges and the range of loads from light to heavy. The market drives the product development and production process; for example, the Type 5 powders were specifically developed for use in 28 gram (1 ounce) competition loads. When the Olympic shooting disciplines changed to 24 gram maximum this presented loaders with fresh ballistic challenges and the Type 6 powders were developed by the Galdacano R&D department to meet this need.

This is a key part of the operation, with its own pilot plant able to replicate the main production processes in miniature to deliver batches of trial product. Within the same complex is a test range that allows velocity and pressure testing to be carried out immediately. It is the link between the commercial operation and production, able to respond swiftly to requests for new or amended products.

All UEE's powders are single base (nitrocellulose only) rather than double base (a laminate of nitrocellulose and nitroglycerine based components). "Double base powders can be dangerous to make and many production plants around the world are closing." I was told. "We also think single base is superior because it is cleaner burning and easier to make a homogeneous product. With double base powders the thickness of the flakes is critical and very difficult to control throughout the production process."

THE GUNPOWDER PLOT STEP BY STEP

- The water content of the nitrocellulose is replaced by alcohol, pressing the mixture together to expel the liquid and produce what looks like a large cheese
- The active solvents and soluble salts (potassium nitrate) are added along with colorants in what looks like a large food mixer. The solvents determine the porosity of the finished product and hence the burning characteristics.
- The resulting paste is then extruded into long strands like spaghetti which are air dried and then cut into flakes (square for PSB powders, round for CSB)
- The powder now goes to the laundry! Hot water is added to remove the potassium nitrate, which has now done its job.

Transferring to giant drum dryers, the powder is given clean water washes and then dried under vacuum at 35 degrees Celsius.

- Graphite powder is then added. This is a key ingredient which not only improves the flow characteristics in loading machines but also gives the powder conductivity and prevents the build up of static electricity. Static and gunpowder is never a good combination!
- The output from up to eight dryings is blended together for a more consistent end product before final quality control checks, sieving to remove surplus graphite dust and packing. Job done!

The whole process takes at least a week from start to finish before the drums of end product are ready to be shipped. Around 30% of the production takes a short journey south to the UEE loading plant near Vitoria, our next destination

THE ROAD TO RIO

Leaving Galdacano, we set off to the cartridge factory at Nanclares de la Oca, with just a brief pause for a splendid lunch at a typical Basque restaurant in Vitoria.

I have been to several loading plants in Europe but the UEE facility is without doubt the most impressive. It even has its own access road from the highway.

The Rio brand is relatively new to American sportsmen – although the recruitment of Jon Kruger, Scott Robertson and a host of other top shots to the Rio Star Team is sure to raise the brand's profile in the coming months – so some idea of scale would be useful.

The factory produces around 400 million shotshells a year, a figure that puts them firmly in the world major league. Laid end to end, I calculate that they would stretch for over 17,000 miles – or more than enough to take you around the globe from UEE's Madrid headquarters via Beijing in China and New York and back to Spain!

Both loaded cartridges and the components are produced at Nanclares de la Oca, the cases starting life as sacks of raw polyethelene and brass plated steel strip. Extruding machines stretching into the distance turn

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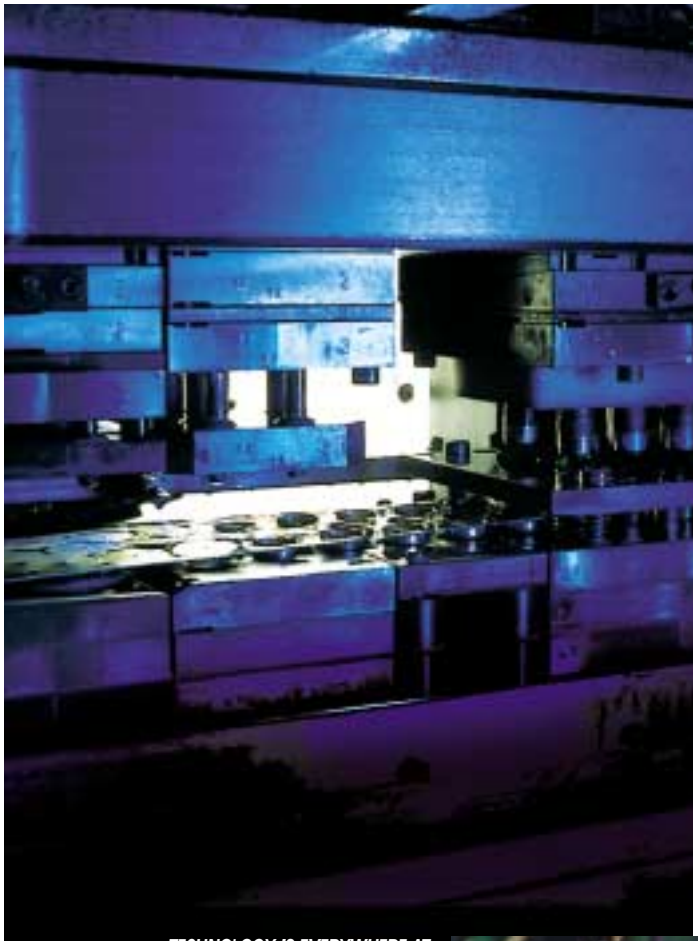

plastic chips into tubing, while stamping machines form flat steel into the heads. This is a progressive operation, six stages being required for the deepest. Heads, base wads, primers and tubes are then combined, ready either for the loading machines or for sale to other companies.

Our next stop was something of a let down. A line of ancient loading machines, of the type you find anywhere, cranked out small-gauge loads at a pace best described as sedate. This was not the high-tech marvel I was expecting. "This is just the short run production for specialist lines", said production manager Antonio Fernandez. "My 12-gauge lines are wonderful but I can't show you those." It would appear that in the ever present search for speed and efficiency – vital in a market where profit margins are paper thin – UEE has come up with some very clever tweaks that their competitors haven't thought of yet. Were they about to let a big mouth journalist with a camera anywhere near – no they were not!

They were happy however to show me the QC and testing facility, where production is constantly monitored and new ideas are tried out. It comprises a indoor range equipped with three test barrels and a sophisticated array of chronographs, piezoelectric pressure sensors and associated computer hardware. When each new production run is started, a sample of ten shells is tested against the standard specifications. Only when they are confirmed as within the specification can the line start running. The same checks are made at shift changes and the target range of variation from the nominal is impressively small. In any cartridge it is consistency that is most important. Chamber pressure is obviously one of the key measurements for any loader, primarily from a safety point of

TECHNOLOGY IS EVERYWHERE AT NANCLARES DE LA OCA TURNING RAW MATERIALS INTO LOADED CARTRIDGES IS A CONTINUOUS STREAM, (FAR RIGHT) LONG STRANDS OF POWDER BEING GATHERED READY FOR CUTTING.

TESTING AND MONITORING OF PRODUCTION FOR QUALITY CONTROL PURPOSES IS A MAJOR PART OF THE OPERATION. THE FACILITIES INCLUDE A TEST FIRING RANGE.

view. When a new load is developed the pressure is controlled principally with the powder type and dose and also wad design. The center section of a modern wad has a vital role to play because the rate and extent to which it collapses will have a direct bearing on the maximum pressure generated. The QC checking picks up production related problems that can also impact on pressure, notably crimps that are too deep or closed too firmly. Velocities are measured at one and ten yards (meters), the European standard figures. A photo cell also measures 'barrel time' – the elapsed time from the firing pin striking the primer to the ejecta leaving the barrel.

The range also provides the facility for pattern testing at any given range, with paper rolls allowing a number of shots to be fired in quick succession for later analysis. It was reassuring in amongst all this technology however to see the familiar 30 inch circle grid and manual counting. "The most boring job in the world", said Antonio, "I've done thousands!"

We had an interesting discussion about shot hardness and antimony levels and the current 'more must be better' trend. Antonio's view is firmly that 3% antimony is the most cost effective level. "Our tests show that the results from using 5% antimony are only marginally better and beyond that it is a waste of time. The antimony does not mix properly and density suffers, sacrificing down range energy. What many people don't realize is that the way the shot is made is also important; shot made by the 'long drop' tower method is, in our experience, harder and more consistently spherical, so a 3% antimony shot made in this way could be superior to another with 5%."

The latest product from Rio is the new Star Shot Silver, a one ounce load with highly polished shot that has been developed especially for sporting clays and particularly the new FITASC 28 gram (1oz) rule.

UEE's long term commitment to the US market is clear. They may have been late arriving but they intend to stay around a long time. Rio Ammunition Inc. has been established with a base in Houston since 2002 to handle the Rio brand and of course UEE are also the producers of the Kemen range of target loads. Despite the difficult dollar-euro exchange rate, the Rio division is on track to sell over 30 million shells in the US this year. In addition to the target loads they are extending the hunting and law enforcement ranges, as well as making those fine components available to reloaders. As one of so few totally integrated manufacturers they have both the know-how and the resources to get it right. ■

Prime movers

The Galdacano facility also makes the UEE-G primers for both UEE's production and outside customers and this small component is the result of some clever chemistry and impressive quality control procedures, all under the watchful eye of production manager Jose Luis Uriarte.

Each primer is formed from three separate brass parts – the outer case, the cap which holds the explosive material and an internal part called the anvil. These are all made in the same department of the cartridge loading factory that produces the brass heads for cases. The detonating mixture is very sensitive and both the temperature at which it burns and the shape of the flame are crucial elements in cartridge performance. Because of the dangers of handling it in bulk, the mixture is kept wet throughout the production process in a solution of PVA glue, drying of the finished product being the final step. All the processes that involve handling the mixture also take place over a water bath to keep the humidity levels high.

After filling the caps, they are covered with paper – and paper is also used to cover the flame hole in the outer case. The anvil (which transmits the force of the firing pin to create detonation) is dropped into the case and the case and cap are pressed together.

Although the production process is relatively low-tech, the QC checks are anything but. For example, the depth of the anvil within the outer case is crucial to proper performance and the tolerances are very small. An optical device scans every single case. Any that are outside of these tolerances are marked with a blob of dye and replaced.

Each batch is tested for pressure and also for ignition sensitivity with a weight dropped from varying heights. "Everyone knows when a primer does not work", said Uriarte "It either goes bang or it doesn't! And even when the gun is at fault, the primer gets the blame. We have to set the tolerances so that we get 100% 'go' from a normal primer strike without compromising safety in any way. Cartridges have to be safe to handle and carry in your pocket."

Rio brand type 209 primers have recently been introduced to the American market in new packs of 100 for home loaders.