The Science of Australian Rifle Manufacturing

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Rifles have come a long way from the original 17th Century muzzleloading firearms, however, even today it is hard to get a definitive answer to what is and what isn't a rifle. For example, most would consider a firearm that has a barrel with specific grooves cut into it to improve accuracy and velocity of the round to be a rifle. However, artillery guns often have rifled barrels, as do many machine guns. Some say to be a rifle it must have a stock that rests in the users' shoulder, but shotguns have stocks, yet their barrels are not "rifled". Either way, the rifles of today are vastly different from the old-school muzzle loaded rifles seen in action during the 17th and 18th centuries.

Despite the many advancements, the requirements of a rifle have remained constant – to fire a projectile accurately to target, and to be reliable.

While this sounds simple, it takes decades of experience and a team of qualified engineers, production trades persons, and highly trained test and evaluation staff to meet the changing demands of the modern customer.

DESIGN

Jason Jonker is a Design Manager for Lithgow Arms, a facility located in regional New South Wales, a 2 hour drive across the Blue Mountains from Sydney. The factory has been producing Small Arms for the Australian Defence Force since 1912.

Jason did his apprenticeship as an Armourer/Fitter with the Army, then spent the next 9 years fine tuning his trade within Defence. After his service, Jason moved into design drafting whilst also completing his Mechanical Engineering degree, and more recently his Masters.

As a former soldier and an avid shooter himself, Jason takes a combination of the marketplace desires and his own ideas of the "perfect rifle" into account during the design phase.

"My first design at Lithgow Arms was the LA101," he says. "It was our first branch out from military rifles in a long time, and it was the first of the Crossover rifle series. Before the 101 you had to buy a different rifle for different needs. But with the Crossover it was a truly versatile option that could do hunting, varmint and target shooting all in the one rifle.

"I took into account what the market was asking for and what I wanted in a rifle, put it all together and came up with this concept. It meant people could invest in just one product and not need to spend their hard-earned money on a group of rifles. Thankfully, it worked, and it sold at much, much higher volumes than we could have ever expected."

During the design phase, Jason and the other engineers work closely with the test and evaluation team.

"We're involved in every step of the design," says Small Arms Test and Evaluation Manager Richard Basladynski. "We start straight away with the basic system requirements, levels the rifle has to meet, what it needs to be able to do etcetera. Things like the calibre of projectile the designers intend to use will define the barrel length and twist rate of the rifling. There's a lot to consider before the first prototype is even drawn up."

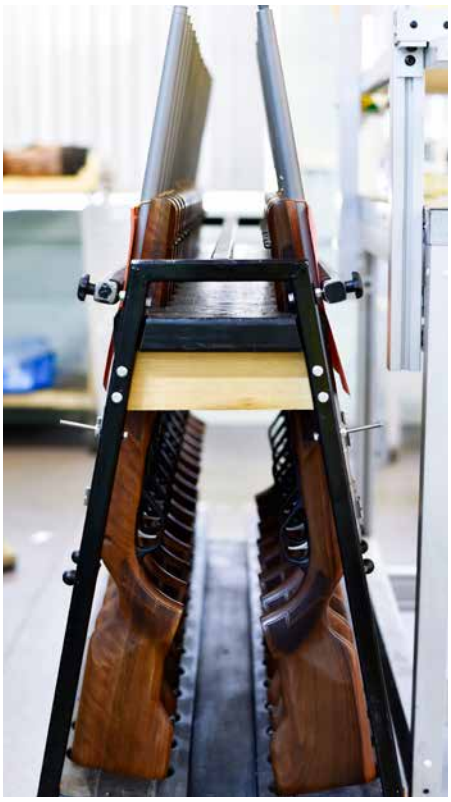
"The test and evaluation team are vital even at this stage," Jason adds. "We set requirements from the outset, even about how we will test the rifle. We take this extremely seriously. First off, we need it to shoot sub-minute angle, which means it is extremely accurate straight out of the box, but is it three-round sub minute or five? What range will we test it out to? We also need it to be reliable, so we test to ensure the rifle feeds ammunition from the magazine with less than a two per cent stoppage rate.

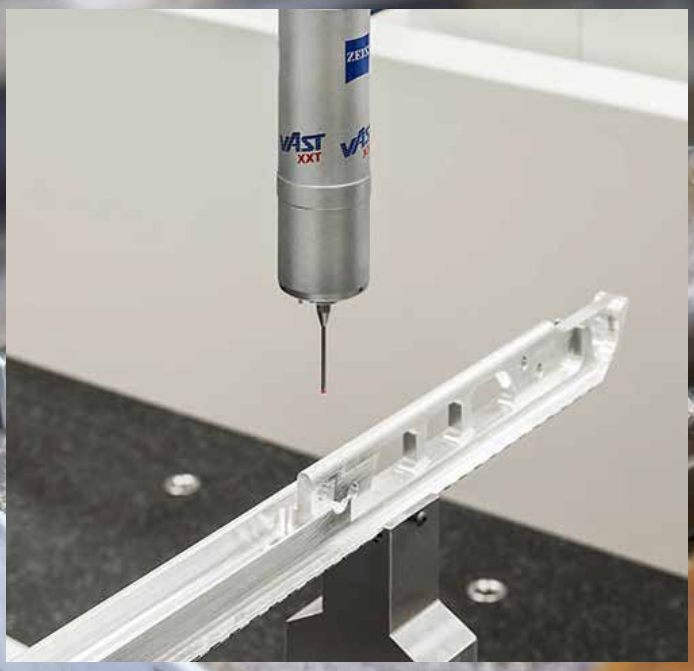
"We also put the rifle through our Military Abusive Handling safety tests," he says. "Drop tests, jar off tests. We set all of these technical requirements during the initial design stage."

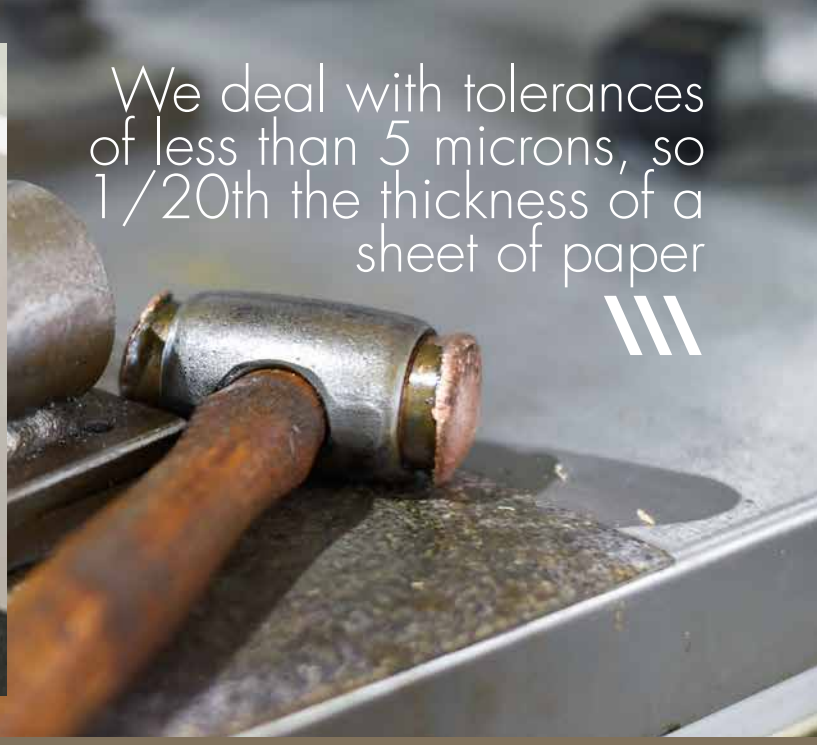
Jason also works closely with the Tool Makers on the production floor during the initial design phase.

"The engineers will come to us with a design and there's usually some back and forth discussions at first," says Continuous Improvement Manager David Forbes, a veteran of the facility having started as a Tool Maker himself 37 years ago.

"There needs to be a balance between the design and what is feasible in an industrialisation sense. Our relationship with the engineers is really good here and we always find that balance point between the dream and the practical."







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TRADECRAFT

The next phase brings the Tool Makers in to begin creating prototyped sections of the new design, using a blend of old school hand tooling and state of the art machine cutting.

"Our tool makers will work here in this section," says David, pointing to a large section of the top level of factory. The area is filled with various machines, some older and traditional, and some new and incredibly high tech. "They will work to hand build sections of the design, and then pass it to the test and evaluation team to proof. This process continues until everyone is happy with the result and it has met all of the technical requirements."

Once all of the design aspects are thoroughly put through their paces and the concept is feasible to industrialise, the rifles are then placed into production.

"The timing between design and industrialisation is usually around 18 months to two years," says David.

FORGING STEEL

Lithgow Arms is a unique facility, with a team of skilled technicians working on shifts to take raw blocks of steel and manufacturing precision-built barrels from them. Each block is put through a series of processes to shape, stretch, forge and rifle it into the perfect barrel, undergoing intense scrutiny at every stage to ensure absolute precision is achieved.

"The tolerances we've set here are quite incredible," says David. "Take a piece of paper, that is 100 microns thick. We deal with tolerances of less than 5 microns, so 1/20th the thickness of a sheet of paper.

"As you can see with our staff here," David says, gesturing at several of the workers on the barrel line, "If they aren't 100 per cent happy with a single test they do on any given barrel, they don't pass them on to the next phase. They measure them down to the micron, and evaluate them constantly to ensure no steps in the process has had an adverse impact on the barrel."

TESTING AND EVALUATION

With Richard's experience as a soldier for a decade and a member of various shooting teams in the Army, an engineering degree and years spent working as a rifle design engineer and production engineer, he brings plenty of experience to Lithgow's testing team.

"After a while you get to know what to look for in a new design," he says. "Even still, I tell my team to ask the hard questions and thoroughly investigate every aspect of the rifle. We take a lot of pride in our products and we want every rifle that leaves the factory to be world class."

Richard says that his team, the majority of whom also possess an engineering degree or technical trades background, add value to the rifles right from the very onset.

"For example, when the LA105 Woomera was in the design stages we wanted to test magazines to ensure the ammunition fed reliably every time so the customer ended up with fantastic value for money," he says. "So, we spent four days just testing the feed and function of 6 down-selected magazines through as many rifle bodies as possible with as many rounds as possible. It is about getting some breadth and depth into your testing.

"After the four days we selected one magazine, and then spent more time testing that one magazine to make sure we'd made the right choice. We want the customer to have a reliable rifle, and all of your reliability comes from being able to feed the rounds into the chamber."

Richard notes that by doing this type of vigorous testing it helps to project the life of type for other elements of the rifles, including springs, ejection ports, barrels and coatings.

"We continue to test the rifles throughout their production cycle," he notes. "We'll literally walk onto the floor and take 1 out of every batch of thirteen rifles and test them, from the safety testing, over-pressure, (proofing the high pressures that go through the chamber), to accuracy testing. And then every single rifle that leaves the factory is proofed and accuracy tested. We've got the only over-pressure proofing facility in the country. Nobody else can do that for the customer.

"The other significant differentiator about us here at Lithgow is we do our own extensive Self-Funded R&D and use the same rigorous testing and use the same products like our Cerakote coating that we use on our military rifles. We produce the F90 battle rifles for the Australian Defence Force here, and we use the similar testing on our civilian rifles. You just don't get that anywhere else. So, we're a very unique facility and we're extremely proud of our heritage and what we do here."

THE FUTURE

Jason, David and Richard all agree that the future for Lithgow Arms is looking bright.

"We have more designs in the works at the moment," says David. "With our history of forging barrels and making accurate, reliable rifles here on site, shooters know our future products will bring all of that experience with it. Customers are not just buying any old rifle, they are buying an Australian made product, manufactured in a facility that has been producing rifles for Defence for over a century.

"The demand for our products is only growing, and with what I've seen of the current and future designs, that demand is going to continue to climb. We're a regional facility, and we employ a lot of the locals here at Lithgow. They take a lot of pride in their work and will always go that extra mile to make sure that whatever leaves here with a Lithgow Arms logo on it is the very best quality product, every single time."

Lithgow arms™