February this year Kalashnikov Concern announced that it was considering a joint venture in India with a new plant capable of manufacturing 50,000 weapons per year. It was suggested that any venture would involve the production of combat weaponry as well as firearms for civilian use. “India is a very promising market, and the best way to enter it is to set up production there,” stated Alexei Krivoruchko, Chief Executive and part-owner of Kalashnikov Concern, in February 2016. “We will begin to set up production this year.” [8]

Other Asian countries
Japan, an early adopter of MIM technology, is understood not to have any significant MIM firearms production, with its key markets being automotive, medical devices and industrial equipment. Likewise, there is understood to be little MIM firearms production in Singapore or Taiwan.

**Bringing HIP into the MIM plant**
Leading continuous MIM furnace manufacturer Cremmer Thermoprozessanlagen GmbH, based in Düren, Germany, is developing a HIP system specifically for the processing of MIM parts. Ingo Cremmer, the company’s General Manager, told PIM International, “The MIM process is becoming more and more embedded in the weapons industry. In order to achieve the all-important dense and non-porous surfaces, HIP plays a key role. Part manufacturers, however, would much rather avoid sending components to HIP service firms, which takes a lot of time and adds cost. In addition, HIP service companies may be located in other countries and this requires the necessary knowledge of formalities, transportation modes and legal provisions.”

Cremmer added, “It is therefore becoming more and more important for the future development of the MIM industry to integrate the HIP process into the manufacturing chain of MIM parts as an essential link. It is obvious that we need to optimise plants with specifically adapted processes. Cremmer Thermoprozessanlagen wants to play a role in this market with a new system that can process two production line sizes, 150 x 380 mm and 300 x 900 mm. Process time is reduced to a minimum thanks to the use of highly effective rapid cooling. The charge material is adjusted to the components and the maximum utilisation.”

Cremmer stated that as well as ensuring components reach full density, mechanical properties such as tensile strength and elongation are increased and machinability is improved, resulting in cost reductions for the whole manufacturing process, potentially helping MIM to replace forged and machined parts.

**MIM versus Investment Casting**
As a division of the Spanish investment casting company Econtrusa, Mimocrisa has the opportunity to see the changing balance between the use of Investment Casting (IC) and MIM technology in the firearms sector. Mimocrisa’s Manuel Caballero commented, “For us MIM and IC are complementary technologies; there are parts that for their size or metallurgical characteristics must be IC and other parts that are without doubt MIM parts as you can achieve better tolerances and reduce machining costs.”

“Most of the small parts, say under 50 g, such as safeties, triggers, hammers and even heavy duty internal parts have moved to MIM. Saving on machining operations and better surface finish compensates for the higher costs of the injection moulding tool. The competition is now in bigger parts for new designs, however frames or slides are still mostly produced by investment casting and machining.”

IC still has the distinct advantage over MIM in that the cast parts can be bigger or heavier than the MIM parts. Batch sizes with MIM, however, can be significantly higher thanks to the speed of the process and limited requirements for finishing operations. MIM parts can also be produced with greater material and energy efficiency, without the need for manual finishing operations, with more design details such as embossed lettering, blind holes, slides and thinner walls. Other advantages for MIM include superior tolerance control for smaller dimensions and the need for less space for the injection point as compared with investment casting gates.

**CASE STUDY: Desert Eagle .50 AE**
A case study that offers insight into the application of MIM technology into a firearm is that of Magnum Research’s Desert Eagle .50 AE pistol. Founded in 1980, Magnum Research, Inc., based in Minnesota, USA, worked with US MIM manufacturer Phillips-Medisize Corporation to produce 12 of the 92 parts in the Desert Eagle .50 AE pistol by MIM [9].

This collaboration saw, for the first time, all components of the Desert Eagle pistol manufactured entirely in the United States. According to Todd Snyder, Partner at Magnum Research, the move to domestic manufacturing of the Desert Eagle .50 AE not only reduced costs, but eliminated freight expenses and uncertainties around foreign currency exchange rates, as well as enabling
CASE STUDY:
MIM in Ruger’s LCR® (Lightweight Compact Revolver)

In a keynote presentation given at MIMAS annual conference in 2012, and later reviewed in PIM International [10], Joseph J. Zajk, Chief Engineer, Pistols, at Sturm, Ruger & Co., Inc. offered an insight into the development of a new firearm and the factors that have to be considered before a component manufacturing route is selected. Sturm, Ruger & Company, Inc., commonly known as Ruger® Firearms, was founded in Southport, Connecticut, USA, in 1949 by William B. Ruger and Alexander Sturm. Today the company is one of the US’s leading firearms manufacturers.

Zajk explained that for over 50 years the company’s famed reliability and value have largely been due to Ruger’s expertise in precision investment castings and the process had become the company’s technology of choice for producing small, intricate components. Investment casting is still at the heart of the company’s component production capability with pistol barrels, slides, hammers, receivers, frames, bolts, hammer and triggers, to name just a few, all in high-volume production.

The trend towards more compact firearm designs with smaller, more intricate parts made investment casting these components challenging and Ruger turned to MIM to complement its expertise in investment casting. Zajk commented that William B. Ruger Sr. once said, “The key is complexity of the component you are considering to make as an investment casting. If it isn’t complex, the casting process is hardly beneficial.” The same approach isn’t complex, the casting process is investment. Zajk commented that when MIM to complement its expertise in investment casting. Zajk commented that William B. Ruger Sr. once said, “The key is complexity of the component you are considering to make as an investment casting. If it isn’t complex, the casting process is hardly beneficial.” The same approach isn’t complex, the casting process is investment. Zajk commented that when MIM to complement its expertise in investment casting. Zajk commented that William B. Ruger Sr. once said, “The key is complexity of the component you are considering to make as an investment casting. If it isn’t complex, the casting process is hardly beneficial.” The same approach isn’t complex, the casting process is investment.