

# The Castool Story: Evolving Tooling Technology

In the 1980s, "Castool Precision Turning and Honing" was a very small division of the Exco Technologies group of companies. Castool specialized in turning hardened tool steels, and made containers, liners, and stems for aluminum extruders, and shot sleeves for die casters. The shop also machined housings for two local bearing companies. All production was strictly to the customer's drawings and specifications. It had no proprietary products. At that time, Castool was simply another small job shop.

Today, Castool Tooling Solutions is recognized as one of the leading tooling and equipment suppliers to light metal extruders and die casters. It is a respected player in the global market, with customers in almost a dozen countries. Castool was the first supplier in its field to qualify for ISO 9000, and again, the first to meet the stringent requirements of QS9000. How did a small job shop evolve into a world-class supplier in a relatively short period of time?

## *Brief History of a Die Shop*

Castool's origins begin with Harry Robbins, a Canadian toolmaker (Figure 1). He specialized in making high-quality dies for aluminum extruders, first in his basement, then garage, for Corman Engineering for



Figure 1. Harry Robbins, founder of Extrusion Machine Corporation, and his wife Audrey.

several years (assisted by his wife). In 1952, he opened his own shop in Toronto, called the Extrusion Machine Corporation, a small company with a big name, since there were only seven total employees (Figure 2). The business was always a family concern. By the early 1970s, Harry's sons were involved. Extrusion Machine



Figure 2. Extrusion Machine Corporation in Toronto, which gave birth to the modern-day Exco Technologies group of companies.

Company was split into two entities: Exco (extrusion dies), Lawrence Robbins, president, and Exco Engineering (die cast molds), Brian Robbins, president. Exco Engineering continued to build tooling until the early '80s, when Castool was broken off as a separate entity. In 1986, another son, Paul Robbins, took over the sales, marketing, and product development for Castool. Castool concentrated on die cast and extrusion tooling as well as bearing housings. Around this time Alcan's Markham Machining facility was purchased by Exco and renamed Alu'Die. The purchase included Alcan's die and tooling technology and related patents. Lawrence was originally president of both die companies (Exco and Alu'Die). In the mid '90s, Exco made a further acquisition of Nova. At that time, Lawrence became president of Alu'Die and Gabe Piccinin became president of Exco and Exco USA (formerly Nova).

In 1987, Castool was making custom tooling for anyone who was prepared to pay for precision work, short lead times, and dependable deliveries. At that time, Castool was not specialized. But its sister companies, Exco and Exco Engineering, were recognized as industry leaders in the manufacture of aluminum extrusion dies, and die casting molds. Castool had a close association with these two industries, and the company realized that no single supplier provided a comprehensive range of support tooling for either. An extruder might have one supplier for dummy blocks, another for containers and liners, a third for lubrication, and so on.

Originally, Castool management decided to concentrate on the support tooling required by extruders and die casters, and to either design and produce, or import, the best products possible. These now include fixed dummy blocks, temperature controlled containers, and single-cell die ovens developed and manufactured by Castool, as well as lubrication systems from the U.S., and remote computerized pyrometers from Israel.

The spotlight soon focused on R&D. The predominant attitude then was that there was no reason why the company couldn't either develop, or obtain the rights to, the very best tooling products available. At the time, according to Paul Robbins, who became general manager in 2002, this certainly appeared rather presumptuous for a company of its size, but enthusiasm is contagious. The R&D department, and in fact the entire workforce, small as it was, embraced the challenge.

Realizing that loose dummy blocks would eventually become a thing of the past, the first major project tackled by Castool was to analyze the features of all the fixed dummy blocks then available, and develop a better one (Figure 3). Meanwhile, a small engineering design company in Switzerland called Allper had apparently patented a unique die cast plunger tip that was getting outstanding results. Soon after confirming that this new tip, with its expanding wear ring, really was as good as Allper claimed it to be, Castool obtained



Figure 3. Patented fixed dummy block by Castool.

exclusive rights to manufacture and market it in both North and South America.

Around the same time, the company name was changed to Castool Precision Tooling, to reflect the change in company policy, that it was no longer a simply a job shop, although it would, of course, continue to make tooling to its customers' specifications.

The company put its newly patented two-piece expanding dummy block on the market. It was soon adopted by several major U.S. extruders. These two products, the fixed dummy block and the Allper plunger tip, really established Castool as a significant presence in the light metal extrusion and die casting industries.

#### Castool's Process

Neither extrusions nor castings are really made by individual products; they are made by a process. A die produces extrusions, and a mold produces castings. How well they convert aluminum alloy into these useful parts depends on extrusion tooling and die casting shot end components. Historically, these were considered to be consumables, and some people still treat them as such, but the key to success for any extruder, the place where the opportunity for improvement most often occurs, really lies between the press and the die (for die casters, between the casting machine and the mold). Each process is holistic, and anywhere near maximum productivity can only be achieved when all components of the process are each operating at close to optimum efficiency.

For the extruder, Castool has patented dummy blocks, state-of-the-art thermal controlled containers, stems, single-cell die ovens (Figure 4), boron nitride billet lubricators, remote pyrometers, and even an easy to use alignment device, plus many other aids to help the



Figure 4. Castool's single-cell die oven.

user approach maximum productivity. solutions, making clear the fact that the company doesn't just supply tooling, it provides solutions to its customers problems.

#### Going Global

Today, Exco Technologies Limited, Castool's parent corporation, is a multinational group of 15 companies with more than 2000 employees. It is a major technology provider serving the extrusion, die casting, and automotive industries in the global market. The expansion into the international market has brought its own inherent challenges and new ideas to the company.

Acetylene is still acceptable in North America as a release agent to facilitate the separation of the dummy block from the butt. European extruders, however, stopped using acetylene almost completely several years ago. This led Castool to introduce boron nitride in America, where it is increasingly used to lubricate billets.

Most Americans still use graphite-based products to

lubricate shot sleeves, whereas in Europe, graphite has long been viewed with disfavor due to the difficulty it creates in maintaining cleanliness. Part quality is also a factor. Whenever excess lubrication actually gets into the part, it causes a non-metallic inclusion that can result in rejection, and if any graphite remains on the part, welding is prevented.

The application of graphite is very difficult to control. Someone once said, "Anything that hits the floor didn't do its job." Usually, more than half of the graphite-based lubricant being applied to shot sleeves hits the floor, and with long shot sleeves, the lubricant often doesn't coat the interior surface completely. The company now also provides boron nitride to die casters who find it to be an excellent lubricant for shot sleeves.

In contrast, there is much still to be learned from some of Castool's large offshore customers. For example, some large extruders in Japan were using single-cell die ovens more than twenty years ago, at a time when few extruders in North America had even heard of them.

#### Perspective

Castool has demonstrated that understanding trends in the continuing evolution of extrusion is vital to the company's success. Asked to comment on these trends, Robbins described how Castool has adapted to industry changes (Figure 5).

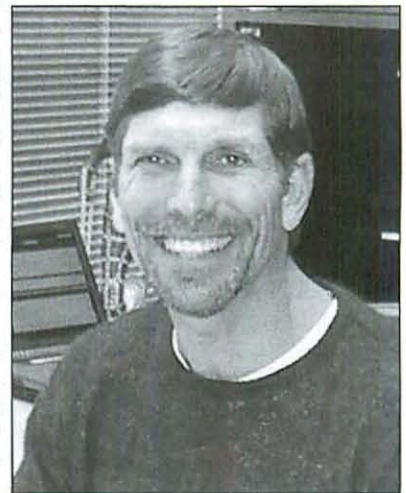


Figure 5. General Manager Paul Robbins.

"One change is a forced change in response to market demands. The other is a change in management philosophy, keeping pace with a change in business that is just now occurring throughout much of the world. This change is a direct result of the development of the computer.

"Aluminum extrusions are now being used in applications for which extrusions have never before been considered. The diversity of the available market for extrusion is steadily increasing. Many of these new applications are found in the automotive industry, just now by far the fastest growing sector of the extrusion market. Automakers form a huge potential market. It is, however, a market that is difficult to serve. For example, auto design engineers are not constrained in any way by the commonly accepted limits of complex profiles, surface finishes, and tolerances. Their primary concern is simply strength and weight. They then design a product that best suits their need, and the extruder must produce it.

"In addition, the automotive industry demands 100% quality, plus complete delivery of each release, on time, every time. And all of this must be provided at a price often set by the buyer, not the seller. Having seen what can be gained by automakers because of the volume of their business, some other major extrusion customers are beginning follow suit. A major problem facing extruders today, however, is that most large volume customers in the automotive industry will now carry virtually no inventory. They may place a large order, but want it delivered in a series of small releases. Extruders are now beginning to lose the economy of scale that they always counted on.

"For example, if an extruder is starting a fifty-billet run, he is not too concerned if he is halfway through the second billet before getting acceptable product. If, however, the run is only five billets long, this would result in a completely unacceptable 30% scrap loss. For short runs, the extruder can no longer use the first one or two billets to bring the die to the precise required operating temperature. The solution to this problem is to quickly and accurately preheat the die in a single-cell die oven. With an increasing demand for short runs, the single cell die oven is perhaps the most cost-effective addition to the extruder's production process since the introduction of the fixed dummy block.

"The second trend that I anticipate is that many extruders and their suppliers will become, as we already have, knowledge-based companies. A knowledge-based company is simply one that recognizes and profits from the fact that throughout the industrialized world we are now moving from an information economy into a knowledge-based economy.

"Changing technology is driving the next wave of economic growth. To take advantage of that growth, we will have to apply not only new technology, but also new thinking. But first, we should clearly understand the shifts in the economy from data to information to knowledge. Data is the basic building block of both the information economy, and the knowledge-based business. We collect data primarily in the form of numbers, words, sounds and images. When data is arranged into meaningful patterns, it becomes information. The importance of data as an economic factor first became apparent in the 1950s and '60s, when room-sized computers made it possible to collect, sort, and store vast amounts of data. This then had to be programmed by users to produce information. With the advent of increasingly powerful, smaller, and cheaper computers, as an economy we are now beginning the transition from information to knowledge. We can define knowledge as the productive and profitable use of information. For an extruder, effective use of knowledge will have a positive impact on costs, productivity, and profit."

#### *Profiting from Change*

"Anything that can be measured can be improved," says Robbins. "The mere fact of measuring the real worth of something often results in improvement. This becomes a self-fulfilling prophecy. If you keep on simply buying the cheapest product, it becomes very hard to become a better extruder."

Castool's philosophy also includes:

- Emphasis on change, not on stability
- Effort is made to customize work, rather than standardize it
- Human capital rather than financial capital is considered a scarce and valuable resource
- Employees are considered an investment, not an expense
- Governance is distributed, both internally and externally, rather than the usual internally-focused top-down type of administration
- Information is open and freely distributed, rather than kept simply on a "need to know" basis

Case studies are another way that the company tests the perceived knowledge of the extrusion industry, to better understand how best to hone the company's own skills and abilities. In extrusion, as in any other industry, there are a few commonly accepted theories that seem so logical that they are perceived as factual, and remain unquestioned. For example, "If a heated die is exposed to atmospheric air for an extended period the bearings will oxidize. It naturally follows that if the heating occurs in an inert atmosphere, such as commercially

pure nitrogen, oxidation will be minimized, or eliminated. How accurate is that statement, really?

Castool commissioned a series of trials at the Institute for Microstructural Sciences at Canada's National Research Council to measure the growth of oxide on nitrided and unnitrided H13 extrusion die bearings, and specifically to measure the effect on oxide growth of heating bearings for 2 hours in an inert atmosphere before exposing the samples to air. All measurements followed parabolic curves, with oxidation proceeding rapidly in the first hour. Samples heated for 2 hours in commercial grade nitrogen containing less than 5 ppm of oxygen, followed by exposure to air for 10 minutes, were proven to have gained the same amount of oxidation as those exposed to atmospheric air throughout the heating cycle. The appearance of the samples was different; possibly causing previous observers to believe that oxidation had been eliminated or considerably reduced. Precise measurement, however, proved that there is no practical advantage to heating dies in an inert atmosphere.

In the North American light metal extrusion and die casting industries today, through finite element analysis and computer modeling, the company can now envisage products that previously could never have been even imagined. Says Robbins, "We already have far more technology available to us that is designed to measure and predict, than most suppliers are currently using. It is in this field that knowledge-based companies such as Castool excel, and pioneer innovative technology that benefits the industries they serve."

#### *Looking Forward*

Castool has a strong vision of future development. The company has completed its lines of products for both extruders and die casters, coinciding with a market that is expanding at a greater rate than ever before. The automotive industry just now wants to use light metal alloys wherever it can to reduce the weight of its vehicles, and thus reduce fuel consumption.

Through acquisitions and mergers, the market for both extrusions and castings is also consolidating. Customers are becoming fewer in number, but larger in size. Taking their lead from the automotive industry, they are also reducing their number of suppliers. This change is, of course, primarily to get cheaper prices due to efficiencies of scale. A second reason, however, is to benefit from the synergy that results from a closer relationship between customer and supplier. It is impossible, for example, for any company to have a close and productive relationship with six or seven suppliers.

This trend benefits Castool, because it has a much broader range of products to offer than any other supplier in the two industries it serves, and can also provide undivided responsibility for complete process systems. Castool also promotes a close association with its customers by offering technical assistance that is not limited to only its own products.

At the present time, the company is singularly well-positioned to profit from both the expansion and the consolidation of the markets it serves. Regarding his vision for the company's next move, Robbins says, "Just now, our focus is to look very hard at every item of tooling that we now market, and make it as good as it can possibly be. We want to be number one in both technology and sales in each individual item that we sell. Our goal for the next four years is to completely integrate all the separate extrusion process components that we now provide, connect them, and win the "Paper of the Year" award at ET'08 with our dissertation on how we did it."