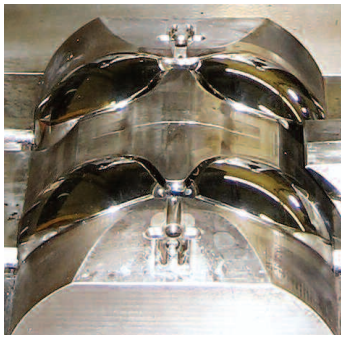
CONNECTING THE MOLDING COMMUNITY
INJECTION MOLDING

Visionary specialists

A keen-eyed Cape Cod moldmaker spotted opportunities for growth in lens and optical molds on the horizon more than two decades ago, set sail, and never looked back. **—Carl Kirkland**



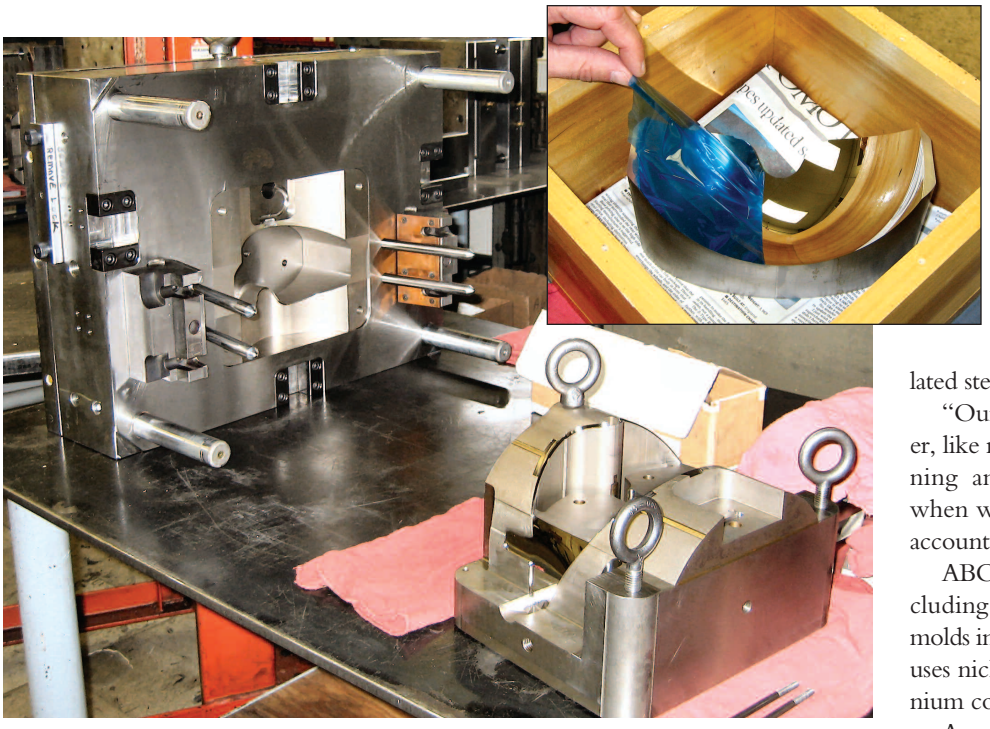
Above ABCO Tool & Die has polished up its expertise in designing and building optical tooling for more than two decades. Right David Bourque, president of ABCO, says, "We're never going backwards in technology in this country." Below Equipped with 40 tools, ABCO's Boston Digital high-speed mill runs around-the-clock, thermally stable at ±79°F.

ANSI Z87.1 may be one standard unfamiliar to many moldmakers, but there's a shop in Hyannis, MA called ABCO Tool & Die Inc. that knows it by heart. The ANSI Z87.1 standard details the design, build, testing, and use requirements for eye protection devices, as well as the standards for penetration resistance and impact resistance for such products.

"Outside of having a PhD on board, ANSI Z87.1 helps us solve the optical 'formula' in engineering and building our molds," says David Bourque, ABCO's president. "It's almost like a plug-in formula we can use, as if we were working on molds for simple widgets."

His father, moldmaker Raymond Bourque, started ABCO more than 30 years ago, tooling up customers like Polaroid. These days, up to 60% of ABCO's production is in optical molds.

Its customers serve a variety of markets, including automotive, computers, electronics, industrial, optical, medical, sports, and safety eyewear. ABCO also builds molds for parts like reflectors, mirrors, face shields, and lenses for the military and for first responders. It also can provide tooling for eyewear frames, temples, and brow attachments.



Technologically challenging projects, like building molds for toroidal, edge-gated PC face shields, are ABCO's specialty.

ABCO itself is the first responder to many Fortune 500 firms sourcing precision Class 101 lens and optical molds, especially molds involving complex, unconventional geometries and tolerance accuracies down to ±.0002 inch.

Optical molds, ABCO's specialty, require a very different approach to moldbuilding because of the complex geometries involved and the surface finishes required. Special fixtures, holders, laps, and other tooling aids also are required. Therefore, ABCO often must do much more than many other moldmakers to make its molds.

"We take on projects we're not sure others would dare to," says Bourque. "Every job we do involves difficult, challenging geometries. Only a handful of moldmakers out there do what we do . . . only a handful, if that!"

Temperate zones

ABCO builds about 30 molds a year. Cavitation typically ranges from two to eight and lead times can vary from 12-16 weeks, depending on the mold's complexity. As mentioned, more often than not ABCO's molds are quite complex, sometimes involving multiple side actions, or hot manifold systems.

Still, most of the molds it builds are cold runner tools. "Most lenses need a protective hard coating—they're dunked into a tank. Therefore, they need to have something to hold onto to be dunked with," Bourque explains. "Cold runners also reduce stress and flow marks."

He says hard coating adds to surface tension, which can exacerbate cracking. Big runners and gates reduce such stress. Most of ABCO's optical molds may be cold runner tools, but all of them are insulated stem-to-stern, Bourque says.

"Our optical molds are not run cooler, like most molds. They're usually running anywhere from 190-215°F and when we make a tool we take that into account. PC runs at 200°F, for instance."

ABCO uses a variety of materials, including 420 stainless steel. It also builds molds in H-13, A-2, and O-6 steel; and it uses nickel, aluminum, bronze, and titanium coatings.

As part of its one-stop-shopping service, ABCO works on specialty engineering projects, providing reverse engineering and 3D CAD modeling for its customers. In addition, it provides optical mold consultation and design analysis assistance.

"We never disappoint our customers by delivering less than what's expected," says Bourque.

ABCO's shop tools

Milling/drilling: Matsuura three-plus-axis high-speed milling machines (3); Boston Digital Model 32G high-speed milling machine (1); Fadal 4020HT CNC milling machine, with tool changer (1); Fanuc T10A CNC milling/drilling machines, with tool changer (1); two-axis CNC Bridgeport w/ Proto-Trak (1); Bridgeports with DRO (5); Cincinnati radial drill (1)

EDM: Fanuc Robocut 1B-S/AWF four-axis wire (1); Fanuc Robocut OC-S/AWF four-axis wire (1); Agie Mondo Star 100A, three-axis CNC RAM (2); Eltee Pulsitron RAM (2), Model EP 30/RD and Model TR 35L *(Note: All EDMs are equipped with System 3R tooling)*

Surface grinders: Harig 6 by 12 inches with DROs (4); Harig 6 by 12 inches with fine feed (3); Kent (wet) 12-by-24-inch AHD (3); K.O. Lee 6 by 18 inches (1); Thompson (wet) 14 by 48 inches (1); Harig AD spin indexer for ID/OD grinding (1)

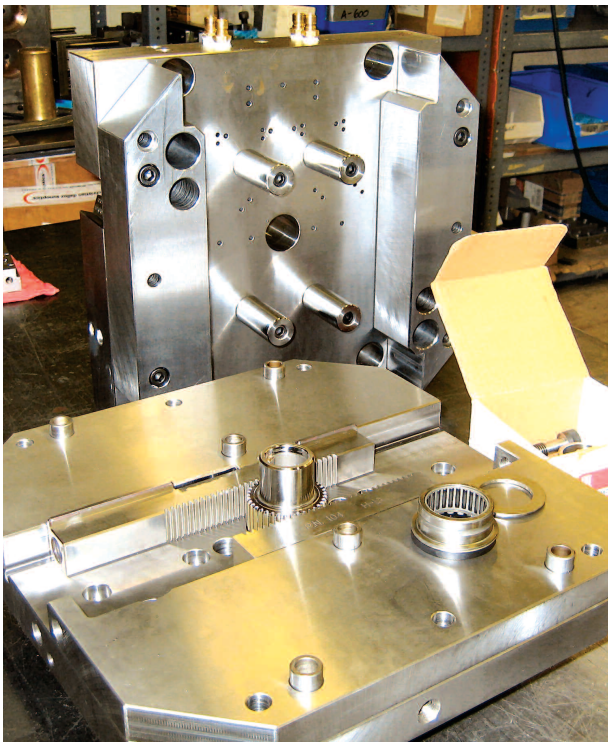
Turning/lathes: Mori Seiki SL-3 CNC lathe, 7.5-inch cut, 10-inch swing (1); Howa Sango with 17-inch swing, optics, and Aloris tooling (1)

Cutting/sawing tools: Powermatic band saw with 20-inch throat (1); Kalamazoo cutoff saw with 24-inch capacity (1)

Polishing: Fully equipped optical-quality polishing department with three-axis CNC lapping/polishing machine

Inspection: Brown & Sharpe CMM (1)

Miscellaneous: Branson Ultrasonic parts cleaner (1); Hansford Mold 20-ton Tryout Press (1); Linde Heliarc welding machine for mold repair (1)



ABCO's multicomponent mold business is increasing. "About 30% of our work today is two-shot tooling," Bourque says.

Optical parts run on ABCO tooling include an aspherical, toric, and conical lens.

Masterful mariners

ABCO works out of a 12,000-ft², fully CAD/CAM-networked plant in Hyannis. There are two 2-ton cranes out in the tool shop—the company builds molds up to 2500 lb. Bourque says he buys his mold bases 95% finished from the likes of Craftsman Mold, D-M-E, and SME, "all the 'high-end' guys."

All machine programming is done out on the floor. As detailed in the company's facilities list (see "ABCO's Shop Tools," p. 67), ABCO has a number of high-precision CNC machining systems to program. A room on the shop's mezzanine serves as a conference room and as the company lunchroom.

Bourque offers nothing but praise for his workforce. "These guys are artists," he says. "Most of them have been doing this for more than a decade."

ABCO employs 14 in its shop, working 5½ days/week; only one shift is manned. Ten are moldmakers/machine operators and two are engineers manning the company's SolidWorks, Mastercam, and Cadkey stations. ABCO's crew also includes two very, very highly skilled polishers.

"We have to hold the geometric optical form that the customer specifies. The closer we hold to the form, the less time is required for polishing," says Bourque. "We need a control drawing from customers, containing all the production information for the complete, finished product. We know how to check our work against control drawings.

'Every job we do involves difficult, challenging geometries. Only a HANDFUL of moldmakers out there do what we do.'

"Anyone could handle molds for lens inserts. But how do you hold the clarity, polish, and form? That's the nature of our expertise."

Charting new courses

ABCO never has delivered a mold that didn't work, according to Bourque. He says that the only reason tools come back in is for repairs.

"It's like owning a Ferrari—like a car that's in the shop once a month. I'd say that at least double the normal level of care is required for optical molds. All the moving parts have to move in a clean way, for instance, and many components often are made in exotic and unconventional materials."

For the past couple of years, Bourque says ABCO has been driven into more

According to Bourque, ABCO's most competitive resource is its human resource. "These guys are artists," he says.

complex multishot molds. Though multishot molds are nothing new for ABCO, some of the newer applications are. One involves the overmolding of large, transparent, thermoset polyurethane face shields onto a directly valve-gated thermoplastic PC frame, for instance.

The company is also seeing more work in engineering and manufacturing molds for newer aspherical lenses. These are higher-performance, more technologically advanced lens designs, involving a nonspherical cross section that allows for a more ergonomic fit to the face.

ABCO makes steel inserts for such molds, sends them out for nickel plating, fits them into the mold, programs the formula in, and finishes them off in a diamond turning machine with millionths-of-an-inch travel capabilities.

"Knockoff safety glasses go offshore," says Bourque. "We go after anything that's innovative."

Like this Agie Mondo Star sinker, all of ABCO's EDMs are equipped with System 3R tool changing systems.

Contact information

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