

Going deep

Fabricating tools for the oil sector requires tight tolerances and engineering expertise

Oil supplies more than 80 percent of the world's transport fuel needs and nearly 50 percent of its energy requirements, according to Manning Offshore Solutions, Australia-based international recruiters for the oil and gas industry. There are more than 5,000 companies drilling for oil and gas in fertile regions such as the United States, Canada, Saudi Arabia, Kuwait, the United Arab Emirates, Venezuela and Nigeria, according to Houston-based Oil Rig Job International.

Companies such as Manufacturing Services, Cypress, Texas, and Sobot Tool and Mfg. Co., Northbrook, Ill., understand technology drives the oil and gas industry. When their tools are installed in a multimillion-dollar piece of equipment several thousand feet below the ocean surface, they have to work.

Manufacturing Services supports the oil patch with a range of tools and components. When the company needed to source components for a subsea tree manufacturer, company owner Steve Bailey tapped Carlson Tool & Mfg. Corp., Cedarburg, Wis. A subsea tree can consist of as many as 362 parts and is used in off-

shore oil and gas fields to monitor production of a subsea well. The tree controls the flow of hydrocarbons out of the hole. Attached to the wellhead of a finished well, a subsea tree also can manage fluids or gas injected into the well.

"To fabricate the tools and parts for one involves crazy geometry, tight tolerances and exotic materials," says Bailey. "Carlson is one of the better tool and fabrication shops in the country. They are diversified and provide a turnkey process that covers a project from start to finish. They get things right the first time."


Carlson has a large tooling and manufacturing company in North America with

an international reach. The company's 104,000-sq.-ft., ISO-certified facilities house services including engineering and design, tooling, gundrilling, deep-hole drilling and contract machining for customers in oil and gas, energy, heavy equipment, medical, mining, metals and forging.

Subsea tree

Carlson made close to 30 individual parts for the subsea tree, including some of its most complex components such as a tubing hangar running tool outer stab, tubing hangar running tool stab sub, slick joint flange and extension sub housing.

"For a complex tooling job like this one, we employ the engineering expertise and technological skills of both our east and west plants," says Randy Sisk, sales engineer for Carlson. The first step is to source the material, in this case steel alloys, and make sure it meets the OEM's chemical and mechanical requirements.



Carlson's laser inspection scanning equipment captures millions of data points to ensure the tool meets required tolerances.



Carlson uses a specialized CNC cable gundrill deep-hole boring machine on a component of a heat exchanger for the oil and gas industry.

OEM specifications are highly detailed, which demands strict scrutiny. The material is heat treated and a sample sent to a certified laboratory for mechanical testing.

Once the alloy has been proven, tools are machined for a semi-finish, milled and, depending on the tool, can receive other processing treatments such as outside diameter and inside diameter turning and gundrilling. Electrical discharge machining is used to make small, angled holes. EDM is able to pierce very hard metals while maintaining tight tolerances. A coordinate measuring machine is used to check critical dimensions and even can perform reverse engineering for components that do not come with a blueprint. Once processing is complete, the parts are plated or coated and

drop shipped to the customer. Medium to small lots are typical of production volumes for the oil and gas industry because of fairly regular technology advances. "The industry is always coming up with something new," says Steve Sobot, president of Sobot Tool. Since 1969, the company has specialized in manufacturing high-tolerance, precision-engineered and machined products. The company serves primarily the oil and gas industry and has a 30-year work relationship with Carlson. Using a range of materials that include titanium, steel, bronze and other exotic metals, Sobot Tool can produce complex tooling, components and assemblies as well as develop prototypes for new technology.

Down-hole drilling

"We work together," says Sobot of Carlson Tool. "If we evaluate a job and find

it's more practical to use Carlson Tool, we turn production over to them. We also use them for some of our gundrilling applications. They offer a bigger-capacity machine and are very strong in this type of application."

Originally developed for gun barrels, the method allows the full length of the barrel to be drilled without retracting the tool. In fabrication, the tool drills long, straight, smaller diameter holes in a variety of materials. Self-centering bits make it possible to maintain a high degree of accuracy when drilling long holes. A depth-to-diameter ratio of 300:1 or more is typical depending on the type of tooling. Drilling speed depends on the material but is generally performed at high speeds with low feed rates.

Carlson also has produced compo-



Tooling for an oil and gas application has been gundrilled, milled, deep-hole bored and turned.



Tool & Die

nents for a data-logging tool for both Manufacturing Services and Sobot. The tool is used in down-hole drilling applications. Made from materials ranging from medium carbon alloy to high-chromium high-nickel stainless steel alloys, the data-logging tool uses magnetic resonance imaging, sound, electrical resistivity and other techniques to gather intelligence about the ground such as the density of the dirt, its porosity and permeability as well as soil chemistry and the possible presence of hydrocarbons. "The fabrication process to support this tool involves rough machining, heat treating, mechanical testing and finish machining," says Sisk.

Workload and delivery schedules also sometimes can determine whether or not a job goes to Carlson. "Carlson Tool provides a very good turn-around time," says Sobot. "It's an advantage that helps us deliver parts on time."

Streamlined fabrication

The company's fabrication approach streamlines parts production, which supports quicker response times. "Typically, we discuss each project with a group of people from machining, quality inspection, manufacturing engineering and management," says Sisk. "The project is then signed off by the plant manager, Ron Klas, before it hits the shop floor. This process helps determine production scheduling and clarify questions that can sometimes arise. Due to the critical nature of the tools we produce, it's important to have the right processes in place so that information can be quickly analyzed without missing anything."

Jobs for the oil and gas industry can range from developing and machining angle head tooling for compound internal angled holes to producing smart tools that can gather intelligence about a drilled hole and help an oil company decide if a site is worth developing.

The company also has programs to de-

velop its workforce. "Our ability to partner with companies is due, in part, to our commitment in maintaining personnel with the skills we need from machining, plastic injection molding and cast metals tooling to inspection and engineering," says Sisk. "We have programs in place to train individuals internally from scratch if necessary. These programs also include our area's high schools."

For Manufacturing Services and Sobot, the ability to treat Carlson Tool as an extension of their businesses defines a partnership dynamic that can make the difference when it comes to meeting customer requirements.

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