

## Cover Story



The collector grid assembly for the Genesis spacecraft, launched in September, will collect a sample from the solar wind and return it to Earth for analysis.

# Dedicated EDM Expertise Makes The Cut

This is another exclusive *MAN—Modern Applications News* interview with industry leaders: Brian Hagmayer, president, and Dave Carlson, vice president—sales of Adron.

**MAN - Modern Applications News:** What is some of the background to the EDM industry and Adron in particular?

**Dave Carlson:** “We have been in this facility

since 1988. We have about 70 people and more than 50 EDMs. We have gone through some expansion, from 20,000 sq.-ft. to 30,000 sq.-ft. Now, by just reorganizing and changing the floor layouts and storage areas, we are going to increase manufacturing by 50% - 60% without having to go to a new building. Brian Hagmayer took over the company from his dad, Ron Hagmayer. He came up through the ranks and has done everything, including being instrumental in arranging one of our largest contracts by his rapid response to the needs of this particular customer.

“I have been in the EDM industry since 1975, at about the time that wire EDM started. About 19 years ago, I left the manufacturing side of the industry and went to the job shop side of the business. I have seen a number of performance increases. For many years, machines ran at 1 – 6 sq.-in. per hour. Most machines today run in the 18 – 20 sq.-in. per hour range and with ideal conditions, 28 – 30 sq.-in per hour is possible. We have been happy with our relationship with Mitsubishi. There are 300 – 400 very diversified jobs each month, with new customers and old customers coming back, and a couple of good sized players staying involved.”

**MAN - Modern Applications News:** What have been some of the primary technology considerations in EDM?

**Dave Carlson:** “EDM cutting performance has been increasing over the years. In production, the job has to fit several parameters: the material, tolerance, intricate shape, and so on. When the right job comes along, EDM competes with high-end machining. Under the right conditions, EDM might be just a bit more expensive, but the result is a more repetitive part. If you apply the right technology and the right speeds, and look at it from the proper perspective, EDM is probably more cost-effective.

“The heart of the EDM is the power supply and switching transistor technology. The original machines that we worked with would blow out power transistors. The EDM manufacturer had to devise ways to use switching transistors that could handle turning current on and off. In EDM, you have a tiny wire with the current flowing that is doing the work. You have to control the energy in the gap or that tiny wire is going to disappear. Advances in wire followed along and made cutting faster through other technology advances. The sensing circuitry, the power supply, and the switching transistors handling the current are the factors that made the difference.

“Control in EDM is not as it is with a machining center running at 400 – 1000 ipm (inches per minute) or more.

Cutting speed is still relatively slow; so, the operator interface, the setup, and the planning are more important before you actually start running. The control determines the sensitivity and reaction to changes with the power supply. Some future breakthrough may involve the delivery of the power and how the energy will be applied. Because of the learning curve involved, the industry is still growing. As in the past, if we are lucky, we will have the next big improvement in a machine, right here on Beta test.

“One of the key things that influences EDM performance is flushing. Flushing technology and pumps have improved. However, even submerged, when there is not good flushing, you may not have the pressure to clear the gap. On one particular 38" job, we had good flushing, but we could not determine whether the fluid was getting inside the gap enough to do the job. As it happened, the pump was delivering fluid, but not at high pressure. We paid for it in performance, since the job ran relatively



Brian Hagmayer, president of Adron

slowly; but we still made the cut. When you look at the square inches that we cut on that job, it was tremendous.”

**Brian Hagmayer:** “It is still surprising that many people do not understand EDM. People may have an application that makes sense for EDM; and, when they call, they have no clue as to why they would use it. Waterjet, for example, has many more applications than it did five years ago; and, many EDM shops also have waterjet and laser. Those technologies have gained, percentage-wise, more so than EDM. However, waterjet just does not fit our niche. If there were to be a technology advance in waterjet, laser or anything that had to deal with our type of core business, we would be the first people to jump in.”

**MAN - Modern Applications News:** How has partnering benefited Adron?

**Dave Carlson:** “We have formed alliances with some of our bigger customers. We have done work for companies in Japan, Israel, and others, internationally. I think that e-commerce and our website have helped bring in some of those. The raw blanks, near-net shape material or sheet material produced in China comes in through our customer supply base. Rather than buying that material directly, customers bring it in for application with the job.

“We have worked with Mitsubishi and given them detailed ideas on improvements in cutting speed and production. We depend on some very good sources, Mitsubishi and others, who do a lot of testing. We have worked with some filter people, for example, through development and basic testing. In some cases, we have become a test bay, while still running a lot of production.

“The consumables continue to be a commodity market; we can buy brass wire from 10 or more sources. What we have done is to learn how to use different wires in conjunction with basic machine-design factors, such as the power supplies, the guides, etc. With so many different applications, we are constantly determining what is the best wire for the particular job, application, as well as the timing and machine. The usage of special wire is a key point;

it’s not just a cure-all with one wire being the answer. You will see a lot of different wire in the shop, including brass. We use about 10,000 spools, enough to stretch 2½ times around the earth, based on 11-lb. spools.”

**MAN - Modern Applications News:** Would you describe some of the applications at Adron?



**Dave Carlson, vice president—sales, Adron**

**Brian Hagmayer:** “It has been very interesting over the years to see the changes on all the projects: the wind tunnel testing models, proportional scales, and some other jobs on the floor. I will guarantee you that on any aircraft that you fly, our parts are on it: from engine blades to parts in the navigation system, to thrust reversing parts. It is amazing that our company touches everyone’s lives in one way or another; whether it is power, energy, aerospace, medical or automotive. Representatives from NASA, JPL or some large company often call us, strictly on the basis of reputation and referrals.”

**Dave Carlson:** “Carbide tool steel dies and alloy cutting tools are between 18% to 20% of our business. Aerospace (basically nickel, titanium, stainless alloys, etc.) constitutes about 25%. Electronics, which is about 10%, involves a variety of exotic alloys. Energy-related parts, for the gas and steam turbine industry, run about 25%. Medical, with exotic ma-

terials such as titanium and surgical grade stainless, tungsten, and molybdenum, runs about 22%. The rest is automotive, defense, and so on. Prototyping in automotive has resulted in some big EDM jobs, with 100 parts of various designs.

“One of our biggest industries right now is aerospace, where we take bar stock and turn it into critical parts. With EDM, you are able to write a program, do nesting, and use all the material; and it is fast. In the energy industry, gas or steam turbine parts require a fast turnaround; when a turbine is down, people are losing a million dollars a day and such. We do consumer/defense tooling and simple dies for people nationwide. Our big machines, such as the big Mitsubishi 400, give us an advantage, because very few people have that capacity to handle a 10,000-lb. block or large diameters. One of the unique advantages that Adron has over a lot of machines and people doing the process is delivery: that is a big issue.

“A 10,000-lb. part, or a 27" or 38" part, has become a typical Adron job. We have had 9,600-lb. molds on our largest Mitsubishi machine, which we modified for cutting big molds and parts. Some time ago, we decided to modify an older 110 Mitsubishi bridge machine by increasing it 10" to cut tall parts, which gave us advantages in cutting 21.6" with full tapering. Also, we can take the heads off to increase clearance under the bridge clearance to around 27". Recently, with some unique modifications, still on the machine in the tank, we were able to cut 38". We have done some 22" parts with thin ribs for wind tunnel balances, on the machine, contained, and holding tolerance.

“Stamping dies and mold dies are made with EDM – period. We hear about laminated dies made of laser-cut or waterjet-cut layers that are stacked together. These low-end, inexpensive dies for short-run stampers, with one-cut punch and dies, are getting better. Laser and the waterjet technology improved for laminated dies, but the short-run stamper is still ahead by using EDM. Now, the short-run stamping industry is going to EDMs to create Class A dies, because EDMs have evolved to the speeds that these short-run stampers are able to build

really good dies. And, obviously, the high-end Class A dies and molds are all EDM.

"We have been 24/7 for quite a few years, and we log more than 170,000 wire-hours each year. Some machines run 3,200 to 3,600 wire-hours per week; but, on average, that is about 75 hours per machine each week. In running 24/7, expert operators are here at all times. Volume EDM production usually involves a high-end part where there is close tolerance and a lot of value. Some typical EDM production, where parts are stacked and stripped, often involve quantities of 10,000 to 30,000 parts, strung together and nested, and held by a 0.002" – 0.003" tab in a web. You set up the machine and let it run, and an operator just stacks the material and finished parts. A sheet of parts might run for 10 – 14 hours."

**MAN - Modern Applications News:**  
*What are some of the key features of Adron's operation?*

**Dave Carlson:** "It is common for a company to farm out large wire EDM jobs. Years ago, the philosophy was to buy a half-million dollars worth of equipment, for example, and just do the job. Later, if the business slowed on those machines, there would be the problem with excess people and idle equipment sitting on the floor. For those few weeks of doing the job, the decision looked great; but, after that, they would realize that they could not sustain their EDM business. For one particular customer, coming to us turned into a 10-year partnership, adding up to seven-figures per year.

"We get recommendations on tall and big jobs, because of our large machines. Earlier, we operated with two shifts. We started operating 24/7 when one operator wanted to work on third shift and keep one of our first big EDMs running. Now, we have a majority of the jobs on first shift, with many of the projects and startups on second shift as well. We do a lot of planning on Monday for running on the weekend. We move jobs around, and there have

been times when, late on a Saturday, there are two people here and every machine is running. Some of the tricky production runs are shut down over the weekend, however, if a mold is not quite right or another job is running.

"With the Internet and electronic files, we can accept the customer's design at just about any level. Then, when the customer hand-delivers 20 – 40 lb. of stock, we cut a template or a sample finished part within a few hours, and it is on the next flight back to the customer. Overall, it probably takes less than 12 hours to prove the part. Once we have received approval on the design, we are able to start production very quickly. If the material is customer-supplied, our turnaround is very fast. If we have to buy the material, we are still bound by the normal purchasing cycle. Some aerospace parts and the higher-end parts will require a certified process, which specifies the options as to what we can do during processing.

"How the part is fixtured, and how the datums are established, are all worked out with the customer. We may want to hold a datum or a surface a little tighter with a particular material to make manufacturability and loading a little easier. The subtlety of it is that a little more effort may make the part work a lot better afterward. In addition, the life cycle for high-end products is getting shorter and shorter. For large manufacturers, the practice of tooling for massive projects is going to change. That gives the advantage to EDM, because a manufacturer can make parts using EDM without tooling up.

"The advantage for EDM is always the stacking issue. You can make better parts, with better edge quality, with stacking in EDM. The thinner the part, the more parts in the stack, and the greater EDM's efficiency. We use waterjet and laser blanks as near-net shape blanks for production on continuing jobs of a few thousand parts each month. We buy the laser blanks, for example, restack them, and cut the critical zones. These intricate, close-toler-

ance parts are unique enough that they probably could not be stamped. For extremely expensive dies and part volumes that do not justify stamping, or higher-end parts with the more exotic alloys in aerospace and medical, that is another EDM advantage.

"With product life cycles getting shorter, by the time a company has spent money on tooling and equipment, it is obsolete. A company now has to get a part in and out of production quickly. No customer these days will allow even one-day, a 24-hour period, to wait for a quote. The applications where robotics and automated loading and unloading seem to apply are in smaller shops with one or two machines and a 1- or 1½-shift operation. It is convenient for them to have the parts mounted and ready to cut overnight, with a robot to load two or three die plates in a machine.

"Most EDM jobs are unique, with such tight-tolerance applications and specialized fixturing that it would be very difficult to load and unload automatically. Some of these production jobs have multiple cavities and involve multiple steps. With EDMs, the tiniest sliver slug can jam a head and cause the head to move or the wire to deflect, which could ruin a part. Some EDMs have automated threading, and that is convenient for machines that run unattended on multiple shifts."

**Brian Hagmayer:** "It is smart business to see EDM as service-center oriented. In CNC turning, for example, we farm out about a half-million dollars in business each year. Shops considering wire EDM should think about having us do the job for them for the same reason. At its core, success in manufacturing is doing what you know best and farming out the rest. Our approach to process control includes ISO auditors, and we have people who are dedicated to QC and production control. As for delivery, we are going to beat any schedule, even compared with any in-house EDM processing for the right type of work."