Vericut

Cascade Engineering Technologies

Starting With the End In Mind

User Story

Dirk Ellis founded Cascade Engineering Technologies 30 years ago as a contract metrology shop. The Canby, Oregon based outfit began adding CNC machining services around the turn of the century, but their core competency remains steeped in their metrology expertise.

With just under a hundred employees and 70,000sq.ft. of manufacturing space Cascade Engineering Technologies (CET) is set for continued growth. This Pacific Northwest manufacturer might have got their start checking other shop's parts, but today they are a world-class aerospace manufacturer in their own right. "My dad founded the company back in the 80's with a single Zeiss CMM," tells Cascade's director of engineering Devon Ellis. "As the business grew, we added light manufacturing to support our customers. Today, we have 20 CNC machining centers with a specialty in machining critical investment castings. Our sales pitch is that we are who you want when it comes to manufacturing large, complex, monolithic, thin walled structures because of our metrology focus." Large and thin are relative for sure, but with a 60" work envelope on their larger mills and 78" on the lathe, large is actually pretty large.

CET's north cell is made up of Haas vertical machining centers, including (3) new 5 axis machine. The south cell houses their 4 and 5 axis horizontals. They have twin Makino T-1s, a pair of Matsuura MAM72-100H and their latest acquisition, a Toshiba TUE 150 vertical lathe. A state-of-the-art metrology lab supports all the machining. The lab alone is 4000sq.ft. and houses seven Zeiss CMMs. Cascade is an ISO9001 / AS9100 Rev D registered ITAR facility and everything begins and ends in their quality lab.

Investment castings are a nightmare for most shops not equipped with the tools and experience needed to do the job right. "An investment casting is where you want to make a component out of metal by first making a wax pattern," describes Devon. "You build a shell, burn out the wax, pour metal in it, and inspect and repair the part until it meets the customer's requirements. What's left is a rough shape that requires finish machining. Each casting is a snowflake, the same, but with its own uniqueness. More often than not our customers are essentially consigning to us very high value material that we have to machine." "The value comes from the time it took for the casting house to make the casting," adds Troy Greenberg, CNC programming manager. It could be three months worth of time before the casting gets to us. They need someone to machine it right the first time. There are no do-overs. If you mess it up, you can't just go grab another a piece of metal off the shelf." There is a nuance with each casting that you don't see in traditional machine work. That is where "best fitting" comes in. Casting is not a perfect science; each casting has a variance that is large in relationship to the machining process assigned to it. "You get five castings of the exact same part, made from the exact same wax tooling and they won't be the same," continues Devon. "There might be a little more material on this face, or it is rotated slightly. You have a non-perfect

casting that has to be perfect when you machine it, and perfect when it goes on the airplane. This is where our core competency in metrology comes in. We can see in space through inspection modeling how it fits, and how it will fit after we are done machining it."

Cascade takes in the casting and runs it though an extensive intake process that begins with a trip across one of their 7 Zeiss CMM machines. They inspect the piece of material and gather data on it. From there they are able to do an analysis and determine if it will yield a good part, and if so, how best to get that part. "We have created a methodology that allows us to verify component compliance at the raw material stage, before any chips are cut," explains Devon. "From there, we define the exact path that will get us there. The result = no surprises. We call it "Starting with the end in mind." We essentially have to find the statue of David in the marble. We know it is in there, but how do you physically adjust on the machine to match the perfect part inside the casting. That is where our 30 years of experience in metrology pays off."

Cascade's programmers write extensive probing routines before, during, and after machining the part. From start to finish they verify what they are doing matches the predicted accuracy from the information they already gathered. They verify all their probing routines in CGTech's Vericut software. They simulate the part in Vericut and run the probing routines from there. "We have our simulated part completely probed and verified in Vericut before it even gets on our CNC machines," details Troy. "The entire probing process is run through Vericut same as you do on a machining center." Cascade also utilises Vericut on their larger 4 and 5 axis machining centers. The probing module is an addition module available through Vericut and something you don't find in every shop. "The programes we run in Vericut are our own," continues Troy. "We tell it what we want to measure, and it does the simulation work. Check here, here, here and these other critical areas. Every probing routine is verified to work before we commit CNC time to the process." Only after the routine is verified do they have the confidence to put it on the CNC. At Cascade probing verification is less about probe crashes (though still important) and more about confirming the logic of how they are going to go after manufacturing the part. "We leverage probing a lot more than most shops," adds Devon. "Some shops might touch off 3 points to find a zero and that is about it, our probing programes are very complex with hundreds if not thousands of measurements. There is direct communication of dimensional data between the metrology lab and the CNC machines. And, all our machining centers are equipped with Renishaw probes, ensuring exact part placement every time."

Cascade purchased their first seat of Vericut in 2013 to support a specific programe that they felt would elevate their position in the aerospace manufacturing game. "My dad had his eye on this external airflow inlet for years. It was his white whale. He wanted to get this job so badly," tells Devon. "Originally it was an aluminum investment casting, but a design change necessitated the part being changed from

a casting to that of a billet hog out. We bid on it and got the job. Then we had to figure out how to manufacture it. At the time it was the largest, most complex part we had ever done. We really wanted this project to set us apart from other manufacturers. And it accomplished just that. It's a showcase part for us still, one we are very proud of and like to show off. The challenges of manufacturing this air inlet are essentially machining a tin can from a block of billet." The airflow inlet starts out as two pieces of billet weighing 1400lbs. The finished part when assembled together weighs a scant 18lbs. Cascade leaves a lot of chips on the floor, and if they inadvertently had a problem and scrapped one, someone would notice. "You have to machine it a certain way to relieve the stresses in the metal," describes Troy. "At 60" with features as thin as .060 you machine one side and if everything isn't right you flip it over and it can curl up and become a potato chip. Managing thin walls requires a lot of finesse."

Cascade's management team knew a lot was riding on the success of this project and wanted every available advantage. They turned to Vericut for a couple of reasons. "This was a high visibility job and we wanted it right the first time," tells Devon. "It is expensive material going onto a really expensive machine. One slip up in programming could cost us hundreds of thousands of dollars. Spindles are not cheap to replace, and you can't replace lost time, it is just lost forever. You don't want to make a call that your machine is down, and the customer can't build planes because of it. With no errors, and no problems in our process, customer confidence is reassured every time we deliver 22 beautiful parts a month." Troy has been a Vericut user since the early 2000's and reaffirms how it has saved his butt many times. "As a programmer you pride yourself on being good at your job, but we all make mistakes. Vericut ensures those mistakes are not costly mistakes. When you start messing with giant machines chewing though large quantities of metal at a high rate of speed you want to know before that button is ever pushed that everything will be just as you planned. That security starts with management buying the seat of Vericut, but every step of the process builds more and more confidence. I know my programmers did their job, and thanks to Vericut the people out running the machines know that too. Vericut isn't cheap, it's priceless. We thank Vericut every time it catches something we missed."

Cascade's 30 years of experience helps them thrive in a mission critical environment. As a tier 1 supplier to the biggest names in aerospace they take pride in the challenges that come with that responsibility and privilege. "The average run of the mill shop doesn't want to deal with the complexities of managing the snowflake," concludes Devon. "Here at Cascade the snowflake brings out the best in us, because we start with the end in mind."

Article published in CNC West, April 2019