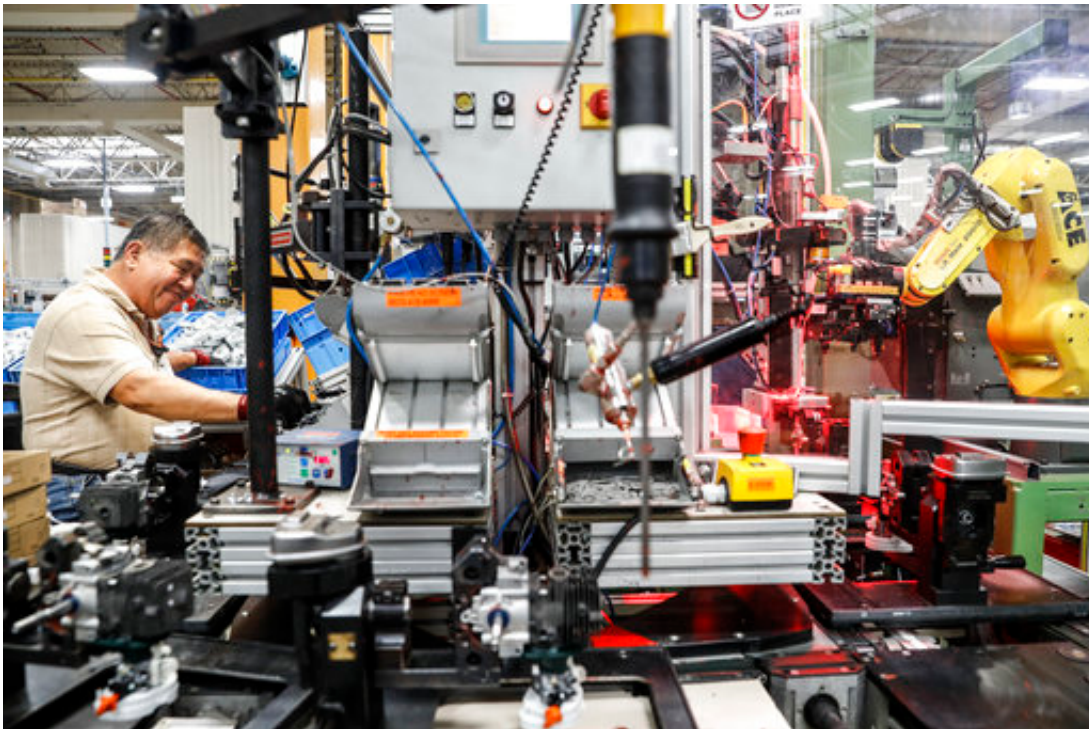


## As the laid-off struggle, high-tech US plants offer jobs

August 15 2017, by Dan Sewell And Christopher S. Rugaber

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In this Thursday, May 25, 2017 photo, an assembly line laborer works across from a collaborative robot, right, at the Stihl Inc. manufacturing facility in Virginia Beach, Va. At the plant human workers are interspersed with computers and robotics that require trained technicians to service and maintain while reducing the company's need for pursuing traditional manual laborers. (AP Photo/John Minchillo)

Herbie Mays is 3M proud, and it shows—in the 3M shirt he wears; in the

3M ring he earned after three decades at the company's plant in suburban Cincinnati; in the way he shows off a card from a 3M supervisor, praising Mays as "a GREAT employee."

But it's all nostalgia.

Mays' last day at 3M was in March. Bent on cutting costs and refocusing its portfolio, the company decided to close the plant that made bandages, knee braces and other health care supplies and move work to its plant in Mexico.

At 62, Mays is unemployed and wants to work, though on the face of it he has plenty of opportunities. Barely 10 miles from his ranch-style brick home in this blue-collar city, GE Aviation has been expanding—and hiring.

In the state-of-the-art laboratory in a World War II-era building the size of 27 football fields, workers use breakthrough technology to build jet engines that run on less fuel at higher temperatures. Bright flashes flare out as GE workers run tests with a robotic arm that can withstand 2,000 degrees (1,090 Celsius).

The open jobs there are among 30,000 manufacturing positions available across Ohio. But Mays, like many of Ohio's unemployed, doesn't have the needed skills.

"If you don't keep up with the times," he said, "you're out of luck."

This is the paradox of American manufacturing jobs in 2017. Donald Trump won the presidency in great measure because he pledged to stop American jobs and manufacturing from going overseas. His message helped him capture Ohio and other Rust Belt states with the support of Mays and other blue-collar voters.



In this Wednesday, May 17, 2017 photo, a robotic conveyor uses laser guides to sort through materials storage at Festo's distribution facility in Mason, Ohio. "This kind of factory has nothing to do with the factory we knew in the 1960s or 1980 or even 2000," said Yannick Schilly, vice president for North American business for Germany-based Festo, a global industrial automation company. Floors clean and aisles uncluttered, the plant is mostly quiet as workers monitor a robotic distribution system that self-adjusts its work flow to prevent backups. (AP Photo/John Minchillo)

It's true that many jobs have gone overseas, to places where workers are willing to toil for less money. Yet at the same time, American manufacturers have actually added nearly a million jobs in the past seven years. And federal statistics show nearly 390,000 such jobs open.

The problem? Many of these are not the same jobs that for decades sustained the working class. More and more factory jobs now demand

education, technical know-how or specialized skills. And many of the workers set adrift from low-tech factories lack such qualifications. Meanwhile, the dearth of qualified applicants has forced some manufacturers to pay more to fill those jobs.

Training opportunities are limited, particularly for older workers.

"The United States trails virtually all its industrial competitors in public and private spending on training," said Scott Paul, president of the Alliance of American Manufacturing, adding that corporate spending on training has declined over the past two decades.

And though industry experts advocate more funding for retraining, the track record for such programs has been mixed. Not enough participate. Returning to school for up to two years can mean accepting much-reduced income during that time, sometimes an impossible step for older workers with families or nearing retirement.

Still, there are efforts underway to bridge the "skills gap," and lessons to be learned from how it has been done successfully overseas. Many political leaders and CEOs are promoting apprenticeships and other training programs as a way to help address the problem.

Jaylen Britton, 18, studied robotics through Butler Tech's program at Colerain High School near Cincinnati, and is not planning right away to attend a four-year college. He took an apprenticeship with Charlotte, North Carolina-based Duke Energy and will earn a two-year degree while working for the power company.

He expects his apprenticeship to prepare him to benefit from automation rather than fall victim to it.





In this Friday, April 14, 2017 photo, Herbie Mays pauses during an interview at the Ohio Means Jobs employment assistance offices in Cincinnati. Mays voted for Donald Trump, drawn to his pledges to stop American jobs from going overseas and to revitalize manufacturing in the United States. Trump's election, though, "was too late to help us," Mays said. "If you don't keep up with the times, you're out of luck," he said. (AP Photo/John Minchillo)

"If you evolve with the robots that are evolving, you'll grow with whatever is growing," Britton said.

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After years of job losses, filling 2 million new American manufacturing jobs in the next decade—the number forecast in a report by Deloitte Consulting and the American Manufacturing Institute—might seem easy. It's not.

That's because factory automation has changed what companies need from their employees.

Assembly-line workers now need to run, operate and troubleshoot computer-directed machinery. Manufacturers maintain complex websites with thousands of product and pricing options to be updated and maintained. And where forklifts are still driven by people, drivers often use software programs that track inventory.

"There are more computers on the manufacturing floor than machine tools and other types of equipment," said Judy Marks, CEO of Siemens USA.

Siemens, which makes turbines, medical equipment and HVAC systems, employs 7,500 software developers—nearly 15 percent of its U.S. workforce.

Last year, software developer was the second-most-common job advertised by manufacturing companies, behind only sales, according to data provided by Burning Glass Technologies, a company that analyzes labor market data.



In this Thursday, May 25, 2017 photo, A.J. Scherman, 37, left, works with fellow apprentice Ryan Buzzy, 18, right, on a robotics control computer at a chainsaw assembly line at a Stihl Inc. production plant in Virginia Beach, Va. Scherman, with only a high-school degree, wanted to earn more money when his daughter was born and took a chance with a mid-life career change. Scherman is earning a college degree as part of a Stihl apprenticeship and will finish debt-free thanks to financial aid provided by the company. "We're safe, because we're the guys who fix the robots when they malfunction," Sherman said. "We're going to need people to fix the more advanced systems. This program trains us." (AP Photo/John Minchillo)

Once-simple household appliances are now loaded with sensors and internet-enabled semiconductors. The shift has been particularly dramatic among automakers, with their expanded use of complicated onboard computers. Five years ago, they posted just as many jobs for mechanical engineers as for software developers. By last year, a sharp change had occurred. There were twice as many openings for software

jobs as for mechanical engineers, according to Burning Glass.

Vicki Holt is CEO of Proto Labs, which employs roughly 1,000 workers, including 120 software developers, to make components for the auto, aerospace and medical device industries. Holt said "advanced manufacturing"—employing "hand-held computers, scanners, using Google Glass"—is a trend that will accelerate with growing use of robotics.

But when it comes to robotics, American industry is only beginning to catch up with much of the rest of the world. In Germany and Japan, higher labor costs and aging populations have spurred faster adoption of industrial automation.

Workers in many European and Asian countries are more likely to already be working with robots than U.S. workers, studies show. China is now the fastest-growing robotics buyer.

"The Chinese and Europeans and South Koreans are aggressively embracing robotics," said Howie Choset, a professor of robotics at Carnegie Mellon University in Pittsburgh. "We definitely are at a point where we have to keep up or get left behind."

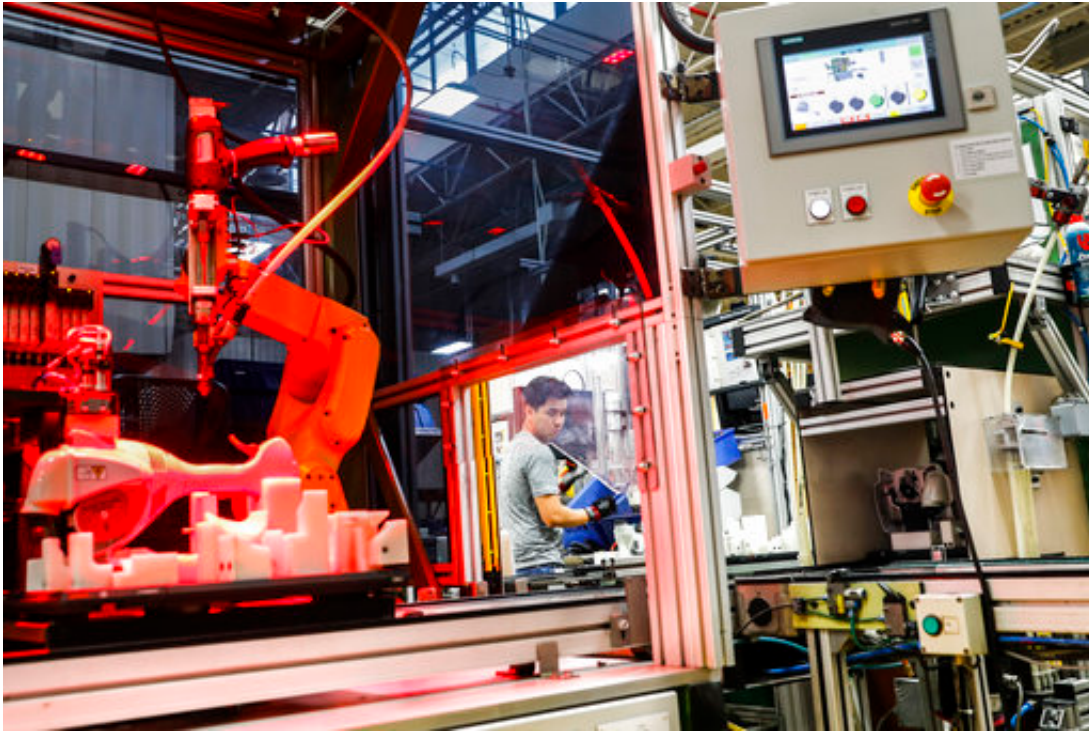
Choset is chief technology officer for the Advanced Robotics Manufacturing Institute, a new public-private partnership to help U.S. companies adopt robot technologies, create and retain jobs in the sector, and help American workers compete with low-wage workers overseas.

In other countries that have forged ahead, robotics and advanced automation have created solid jobs while increasing efficiencies for manufacturers.

The Japanese have long embraced automation, and robots are



increasingly becoming a part of everyday life. Sales of "companion robots" for households are surging. A tradition of "lifetime employment" by major Japanese companies means they try to retrain, not replace, workers.



In this Thursday, May 25, 2017 photo, an assembly line laborer works alongside a collaborative robot, left, on a chainsaw production line at the Stihl Inc. production plant in Virginia Beach, Va. Despite efficiency increases and lessening the need for manual laborers, companies require workers who can program, oversee, operate, and maintain the automation. A report by Deloitte Consulting and the American Manufacturing Institute estimates 2 million such jobs will need to be filled over the next decade. (AP Photo/John Minchillo)

On the Danish coast, a few hours from Copenhagen, Novozymes employs thousands to make enzymes for detergents, baking and other uses.

Jesper Haugaard, the vice president of Novozymes' European unit, said automation has allowed the company to keep production—and jobs—close to the market, rather than outsourcing to China, where labor costs might be cheaper but transport and duties would outweigh the benefits.

Henrik Olsen, 61, remembers his early years at Novozymes doing manual lifting all day among workers who were "only arms and legs that followed the recipe." There were fears of job loss when automation came, but today, he's an operator seated behind a row of computers, with "a better day at work and much more interesting job."

Dan Piil Petersen is another operator in the control room, where abbreviations for tasks adorn two whiteboards posted above dozens of monitors with graphic representations of the enzyme-making process. The six people in the air-conditioned room wore white T-shirts with the company logo and white pants.

"No stains," Petersen said, smiling as he moved his hands down his spotless uniform.

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In the U.S., Trump continues to make promises about adding manufacturing jobs. In blue-collar Youngstown, Ohio, he talked about passing by big factories whose jobs "have left Ohio" on his way to a July 25 rally, then told people not to sell their homes because the jobs are "coming back. They're all coming back."

But U.S. Sen. Rob Portman, an Ohio Republican and a former U.S. trade representative, insisted in an interview: "We're not going to see the kind of manufacturing renaissance that we all want in this country unless we focus on skills training."



In this Wednesday, May 17, 2017 photo, workers operate packaging stations that feed into an expansive system of conveyor belts connecting separate factory areas at a Festo distribution center in Mason, Ohio. "None of these technologies work without the people," said Carolin McCaffrey, head of Learning Center Midwest for Festo Didactics, which last year launched two-year apprenticeship programs in mechatronics. Skip Johnson, a trainer in STIHL's apprenticeship program, said the key is getting bright students into plants, where they see that the grimy, dusty factories they have seen in books and movies are giving way to clean operations using futuristic technology. (AP Photo/John Minchillo)

Otherwise, Portman warned, there could be another wave of jobs going offshore.

"Companies will vote with their feet," he said.

Labor Secretary Alexander Acosta, in a visit to a Detroit factory in June,

acknowledged the need to address the "skills gap" by developing advanced computing skills. And when Trump visited Pewaukee, Wisconsin, in June with his secretaries of education and labor and daughter Ivanka, he touted the value of training while doing.

"Apprenticeships teach striving Americans the skills they need to operate incredible machines," Trump said. "This is not the old days. This is new and computerized and complicated."

Of the 146 million jobs in the United States, only about 0.35 percent—or slightly more than a half-million—were filled by active apprentices in 2016. Filling millions of open jobs through apprenticeships would require a substantial increase in government resources. So far, the Trump administration has called for more funding but hasn't made any progress securing the funding from Congress.

Apprenticeships are much more common at some European companies, notably German firms. At Germany-based Stihl Inc.'s plant in Virginia Beach, Virginia, for example, A.J. Scherman is learning to be a "mechatronics technician." Mechatronics combines electrical and mechanical engineering, as well as computer skills.

Stihl makes chain saws, leaf blowers and weed trimmers at the factory. Once he has completed his final year in Stihl's four-year apprenticeship program, Scherman will read diagnostic software on computer screens attached to each robot to repair and upgrade them. If necessary, he'll hook up a laptop to program changes.

Scherman, 37 and with only a high-school degree, wanted to earn more money when his daughter was born, so he took a chance with a mid-life career change. Previously, he worked 80-hour weeks putting together special events, including Stihl's company picnic.





In this Thursday, May 25, 2017 photo, a robotic forklift autonomously transports materials throughout a Stihl Inc. production plant in Virginia Beach, Va. The self-driving forklifts deploy flashing lights and constant beeping sounds to navigate around corners, through doors, and operate safely around their potentially unpredictable human counterparts. (AP Photo/John Minchillo)

Scherman is also earning a college degree as part of the apprenticeship. Thanks to financial aid from Stihl, he'll finish with zero debt.

The prospect of increasing automation doesn't faze him. After all, he'll be a robot repairman.

"We're safe, because we're the guys who fix the robots when they malfunction," Scherman said. "We're going to need people to fix the more advanced systems."



There are assembly lines at the Stihl plant, but human workers are interspersed with computers and robotics. Two robot arms in one corner of the plant tie cords to the black pull handles used to start the company's outdoor power tools, a mundane job formerly done by people.

Self-driving forklifts with flashing lights and constant beeping sounds, akin to R2-D2 from "Star Wars," navigate around corners and through doors. They are programmed to slow down when people are nearby.

Skip Johnson, Stihl's apprenticeship coordinator, said the company has succeeded in attracting young people. The key is getting bright students into the plant, where they see that the grimy, dusty factories they learned about in books and movies are giving way to clean operations using futuristic technology.

"When they actually come here and they see the robots and how they interact and the programming involved, it's almost like a laser light show," said Johnson, 56. "They just come in here and they're wide-eyed."

The company says it has never laid off a worker because of automation.



In this Thursday, May 25, 2017 photo, a collaborative robot uses a power drill to attach parts of a chainsaw body on a assembly line at Stihl Inc. production plant in Virginia Beach, Va. "The Chinese and Europeans and South Koreans are aggressively embracing robotics," says Howie Choset, a professor of robotics at Carnegie Mellon University in Pittsburgh. "We definitely are at a point where we have to keep up or get left behind." (AP Photo/John Minchillo)

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There are American success stories in automation. Lou Morales, who trains young apprentices at the Festo Corp. plant in suburban Cincinnati, understands the negative images associated with manufacturing that cause many young people—often steered by their parents—to shun the sector as a career. Years ago, he showed up at his steel mill at Glen Cove, New York, to find he no longer had a job. It had shut down.

"I've never seen so many padlocks in my life," recalled Morales, 60.

But now he assures young people that their "future is endless" in manufacturing because new kinds of jobs are being created and the skills they are learning are in high demand.

U.S. manufacturing workers, excluding managers, make an average of \$44,000 a year, according to government data. That's just 2.8 percent higher, adjusted for inflation, than a decade ago after years of shifting of jobs overseas or to nonunion states. And it compares with a much higher 8 percent gain for the labor force as a whole over the past decade.

But a typical mechatronics engineer with a four-year degree can earn \$97,000 a year; a typical software developer makes just over \$100,000.

Festo Didactic, the education arm of Germany-based Festo, last year launched two-year mechatronics apprenticeship programs in Ohio with Sinclair Community College, and is already expanding its U.S. apprenticeship offerings.

At Festo's plant in Mason, a northeast Cincinnati suburb, the floors are clean, the aisles uncluttered. The plant remains mostly quiet as workers monitor a sophisticated robotic distribution system that self-adjusts its work flow to prevent backups.



In this May 25, 2017 photo, employees work a factory floor at a Stihl Inc. production plant in Virginia Beach, Va. There are assembly lines at the Stihl plant, but human workers are interspersed with computers and robotics. Two robot arms in one corner of the plant tie cords to the black pull handles used to start the company's outdoor power tools, a mundane job formerly done by people. With the efficiency gains comes a calmer, more open and orderly workspace that contrasts with the traditional stereotype of chaotic, dirty manufacturing plants. (AP Photo/John Minchillo)

"This kind of factory has nothing to do with the factory we knew in the 1960s or 1980 or even 2000," said Yannick Schilly, who heads global supply for Festo's North American business.

At GE Aviation, internships and co-ops with colleges attract younger prospective employees, while veteran workers are retrained.

With a machining background, Terry Cox, 54, works in testing of

ceramic matrix composites, which make engines more durable, heat-resistant and efficient.

"It's the design of the future," Cox said. "There is a lot of opportunity here."

But there's not much demand locally these days for the kind of repetitive tasks, such as sewing-type work, that Herbie Mays has done. He picked through personal papers on his dining room table one recent morning, grumbling about jobs going to Mexico.

"I guess those people overseas who make \$12 a day, you can't compete against them," he said. But he acknowledged there are "plenty of jobs out here. ... What you have to do is get training or education."

He'd like to do that, but he also needs work to supplement his benefits.

He sighed.

"I've been fighting to figure out the best thing to do ... and haven't come up with no answers."





In this May 18, 2017 photo, engineering instructor David Campbell, center, assists his students as they operate a robot designed and built for competition by their fellow classmates at Colerain High School in Cincinnati. Campbell's team entered into the 2017 FIRST Robotics international high school robotics competition, serving as a showcase for local talent while encouraging students to pursue engineering, software development, and technology design fields. (AP Photo/John Minchillo)



Apprentices stand at workstations at the automation learning center at the Festo distribution facility, Wednesday, May 17, 2017 in Mason, Ohio. Lou Morales, who trains the apprentices, understands the negative images associated with manufacturing. Years ago, he showed up at his steel mill at Glen Cove, New York, to find he no longer had a job after it shut down suddenly. "I've never seen so many padlocks in my life," recalled Morales, 60. But now he assures young people that "the future is endless" for them in manufacturing because new kinds of jobs are being created and the skills they are learning are in high demand. (AP Photo/John Minchillo)



In this March 7, 2017 photo, Colerain High School students in Cincinnati huddle in groups to design and build a robot for the FIRST Robotics competition. The international contest draws corporate sponsors looking to recruit students interested in engineering, software development, and technology design careers. (AP Photo/John Minchillo)



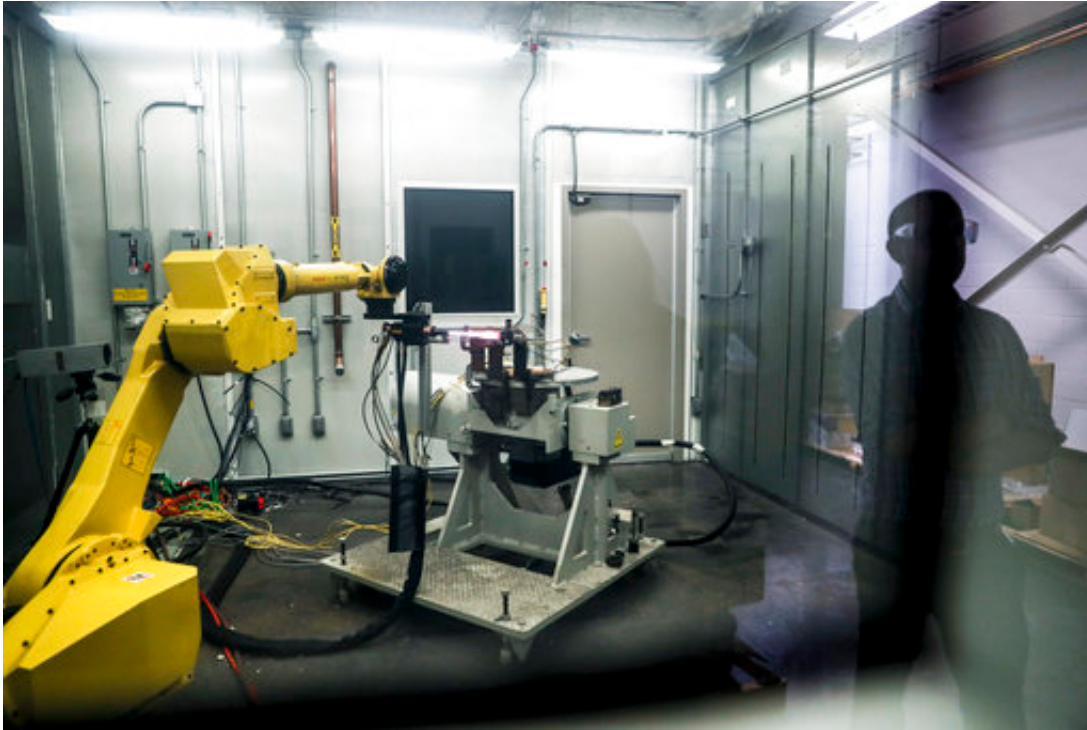


In this May 25, 2017 photo, apprentice Ryan Buzzy, 18, right, works with Skip Johnson, left, a trainer for the Stihl Inc. apprenticeship program, on a metalworking lathe in their training area at the Stihl Inc. manufacturing facility in Virginia Beach, Va. Buzzy is being trained as a "mechatronics technician" at Stihl, which makes chain saws, leaf blowers and weed trimmers at its factory in Virginia. Mechatronics combines electrical and mechanical engineering, as well as computer skills. After completing Stihl's four-year apprenticeship program, he will read diagnostic software on computer screens attached to robots for repair and maintenance. (AP Photo/John Minchillo)



In this Wednesday, May 17, 2017 photo, an employee stands at her workstation at the Festo distribution center in Mason, Ohio. As manufacturing automations grow, specialized technical jobs are forecasted to increase. The need to fill those jobs "will happen very quickly," said Yannick Schilly, vice president for North American business for Germany-based Festo, a global industrial automation company. "Those who are positioning themselves the best to cope with technical evolution will be the winners of tomorrow." (AP Photo/John Minchillo)





In this Thursday, May 18, 2017 photo, a robotic arm with a high-intensity blowtorch is remotely operated to test ceramic matrix composites, which make engines more durable, heat-resistant and efficient, at the General Electric Aviation plant in Evendale, Ohio. At GE Aviation, internships and co-ops with colleges attract younger prospective employees, while veteran workers are retrained. The giant Building 700 is home to white-coated scientists clustered in the FastWorks Lab nestled inside the decades old building, while much of the rest is relatively quiet. (AP Photo/John Minchillo)



In this May 25, 2017 photo, an employee works on a factory floor at a Stihl Inc. production plant in Virginia Beach, Va. There are assembly lines at the Stihl plant, but human workers are interspersed with computers and robotics. (AP Photo/John Minchillo)

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