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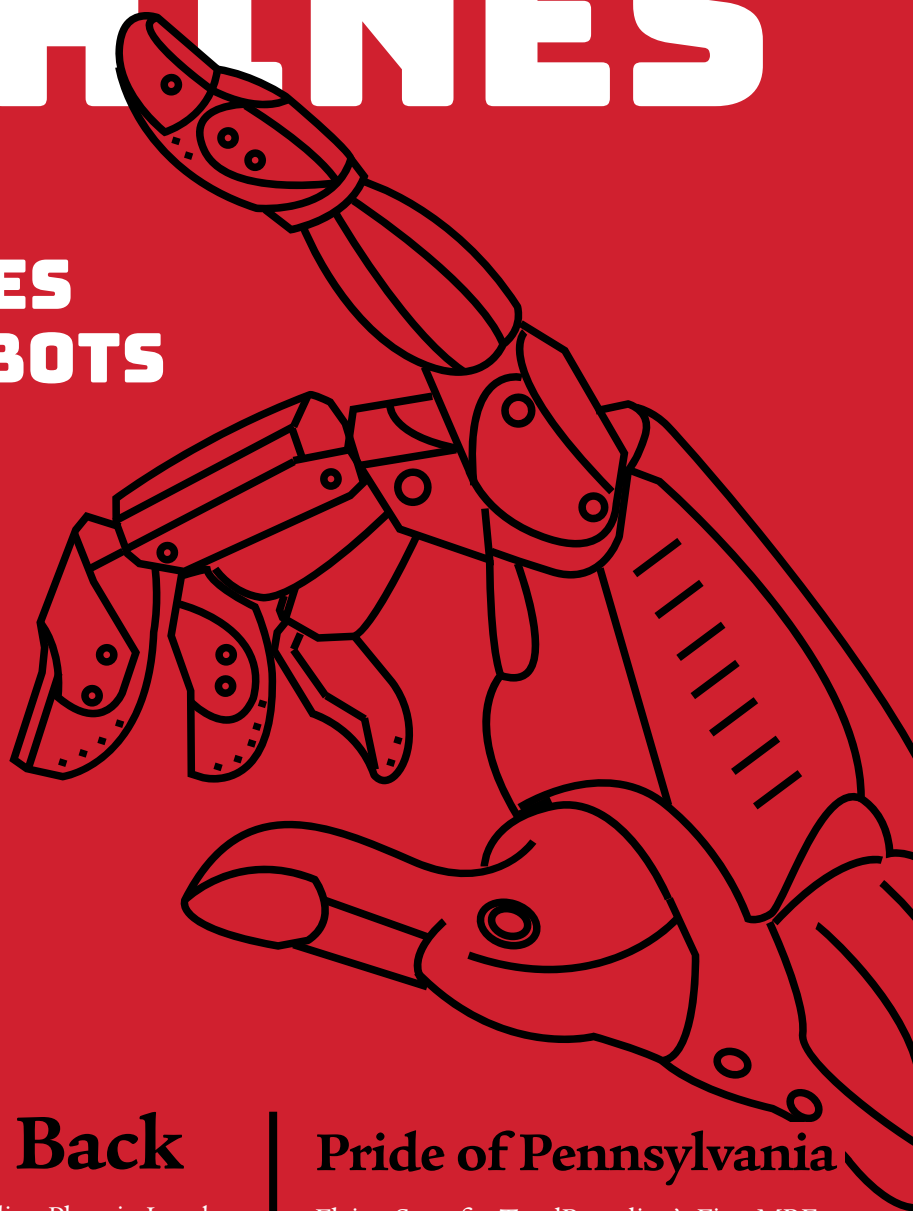
WASTE MANAGEMENT WORLD®

**Special Edition**  
RECYCLING

Euro 12,-

# RISE OF THE MACHINES

**WITH ADVANCES  
IN AI, THE ROBOTS  
ARE COMING**




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## **Pride of Pennsylvania**

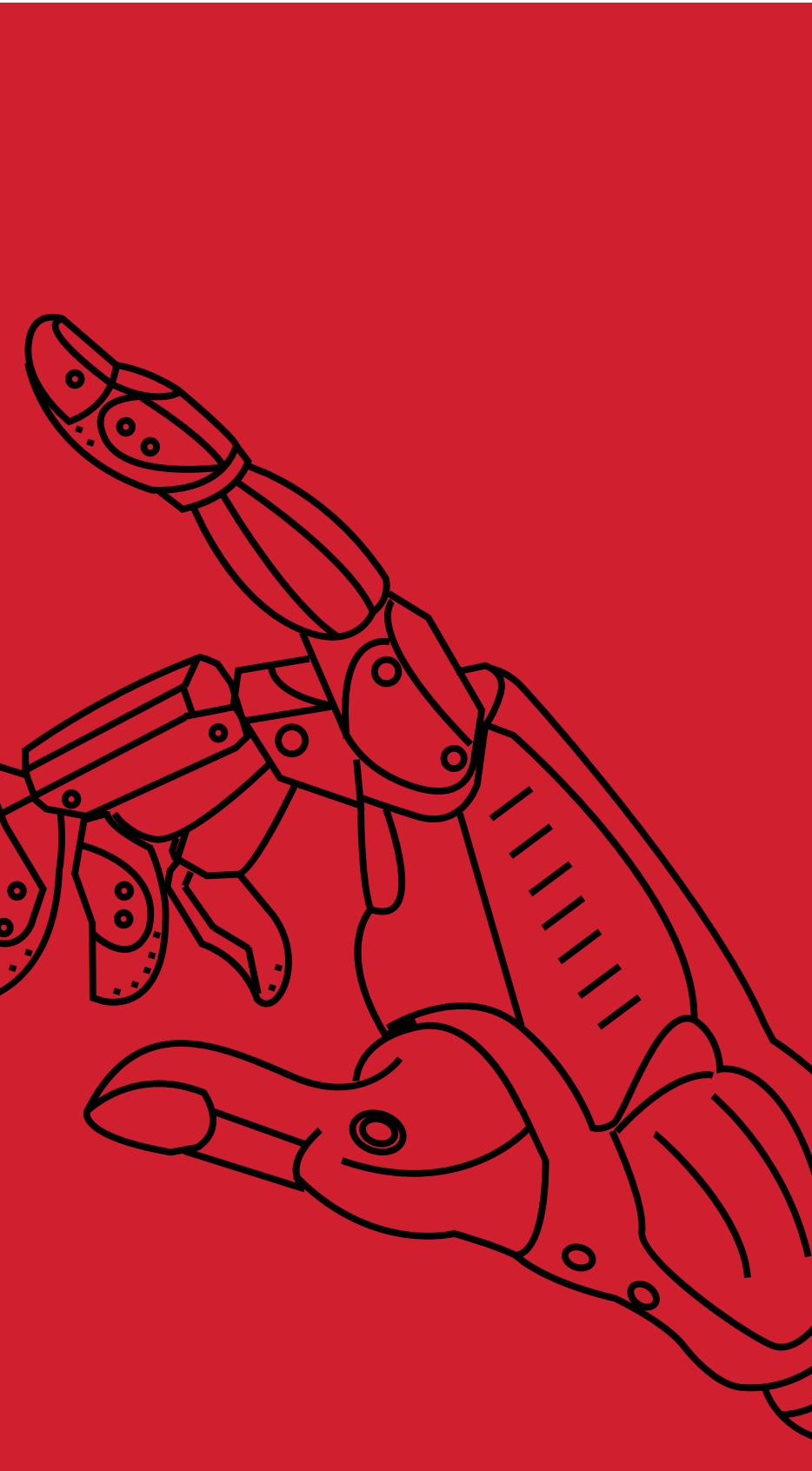
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# BATTLE OF THE BOTS



Automation is a hot topic. Some will tell you the robots are coming, but they're wrong. The robots are here! In the waste industry, Finnish firm ZenRobotics is leading the charge for the C&D sector, while BHS has teamed up with Spanish company Sadako to roll out the Max-AI Quality Control robot for MRFs.

By Matt Clay



**T**he future of human civilisation is often portrayed in science fiction films using flying cars, hoverboards, giant holograms and teleportation. The subject of how we might handle waste in years to come is often left on the cutting room floor. It's out of sight, out of mind, even in fictitious worlds created for our movie-going pleasure. Yet the question of how the materials recycling facilities (MRF) of the future may operate is an interesting one.

Imagine a MRF without a need for parking spaces outside. Or without platforms or human walkways. Imagine this same facility operated entirely by an Artificial Intelligence (AI) system, in turn controlling a series of sorting bots. And these very bots are not just sorting, they're stocktaking; counting every single item that passes their metallic yet dextrous grabby hands. The centralised AI knows exactly what is coming in and what is going out. This same facility is operating 24/7, without the need for breaks or human interaction. This MRF, along with several others, is monitored remotely.

Terminator and Skynet jokes to one side, this sounds like a very enjoyable



topic for a film, especially for the global waste sector. Yet such a ground-breaking vision is not as far-fetched as you may think. Groups of companies are working towards creating an “autonomous MRF.”

Over the years, Waste Management World magazine has covered the developments of the robotic sorting industry, from the versions of Finnish company ZenRobotics’ C&D waste picking machines, through to the rise of Spanish firm Sadako. It’s one area of the industry that, like the picking pace of the robotic arms, moves at lightning pace.

### BULKING UP

Since our last in-depth coverage, there have been some developments of note. Sadako has teamed up with US-firm Bulk Handling Systems (BHS) to bring out the Max-AI system. By definition, Max-AI (Max for short) “employs both multi-layered neural networks and a vision system to see and identify objects similar to the way a person does”. Many will remember how Sadako’s Wall-B early robot sorting systems looked: individual arms with suction cups.

Well, now imagine Wall-B has had an extreme make-over. He’s been to the gym, bulked up and is now wearing a shiny new suit to emerge as Max-AI – it’s like a “before and after” robot picture. Watching the video, Max moves in an arachnid fashion; the grabs bolstered with supporting struts moving at a phenomenal pace. The evolved bot essentially combines the best from each side of the Atlantic: the AI developed in Spain but the new beefed up,

**“MAX-AI TECHNOLOGY WILL SOON BECOME THE ACTIVE BRAIN OF OUR MRFs, CONTROLLING VARIOUS ROBOTIC, OPTICAL, AND OTHER SORTING EQUIPMENT.”**



**Thomas Brooks**  
BHS Director of Technology  
Development

mechanised body from the US. “There was a huge amount of mechanical development that went into the system,” says Thomas Brooks, director of technology development, BHS Group.

Speaking to WMW magazine, Brooks says the team is pushing for around 65 picks per minute with the robot, which compares to 14 picks for its predecessor.

“A human will typically pick, when they’re motivated and focused, on average between 35 and 40 picks per minute.”

He adds: “The grasping has also been a major development for our team. That’s what BHS brought to the equation. We built out this next mechanical evolution of a system that accomplished the key task of visual recognition. It’s built around the fundamental design concept of replicated human behaviour – to see, to think and to act.” The first commercial installation of Max was to the Athens Services’ Materials Recovery Facility (MRF) in Sun Valley, California. Already in operation, Max is complementing advanced screen, air and has been integrated with existing NRT optical sorters to provide a “fully autonomous PET sorting solution”.

A revenue sharing model is in place between Sadako and BHS, although neither party would provide more detail when pressed.

Belén Garnica, co-founder of Sadako and CFO, said the company is retiring the two Wall-B robots previously in operation in Spain and are working on finalising Max-AI for other applications. “It made no sense to dedicate further effort to



those two robots,” she tells WMW. “They have little capability now compared to the next gen AI. Max-AI is nearly three times faster than the Wall-B. They haven’t been dismantled yet but we are planning to.”

She says Sadako is now looking at how AI can disrupt other sectors. “AI will come and there will be a big revolution in other industries,” she says. “This could include health applications, for example. We still have plenty of opportunities out there.”

#### SNICKERS & MARS BARS

Elsewhere in Europe, Finnish company ZenRobotics, which has almost become the household name in the robot movement, especially for construction waste, is progressing with its global development. In Japan, the company is now in the latter stages of commissioning its second plant there, as well as having sold robots to China and Singapore. Australia, too, now has a ZenRobot with commissioning taking place in Melbourne. In Europe, as well as its home nation of Finland, the company is present in France, Switzerland and Holland. In an attempt to “crack” the US market, which Johan Mieskonen, head of sales from the company describes as “the biggest market for us right now”, the company has an installation in Austin, Texas, with “many others on the way”.

The biggest changes since WMW first covered ZenRobotics have been on the software side, namely the “unlimited fractions” version. Earlier versions of the robots came with pre-set software, which were able to pick certain materials. “We’ve

ZenRobotics' automated sorting system for C&D waste has tuned is Carl F's business “upside down” in Malmoe, Sweden.



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It's not only speed and endurance where robots are beginning to revolutionise waste sorting, but also power. ZenRobotics advertises a 30kg capability for the ZenRobot, but lifts of 100kg are possible.

developed it so that the plant operator is able to teach the machine to pick anything," adds Mieskonen. "Essentially, just show the machine an impressive collection of your target objects, say red bricks...it will look at the object to determine what makes a red brick a red brick. A rule of thumb is whatever makes an object easy to recognise for a human also makes it easy for a robot. It has much better sensors than us humans – we're practically blind compared to the robots."

Previously we've differentiated the ZenRobot from Wall-B in its ability to deal with the heavier construction and demolition waste. Yet, the system can now be trained to "pick anything".

He adds: "You can teach it to pick up a business card, or a pencil, or your Snickers bars from your Mars bars... there's no restrictions in them picking up small objects." So does this mean the Finnish team will be looking to start fishing from the 'other pond', namely municipal recyclables such as bottles and cans?

"It's a no-brainer: we will roll out other systems for lighter materials as well," he says. "The main focus has been and remains the heavy picker. That's a more interesting flow from our point of view."

**SWEDISH HOUSE MATH**

Carl F Jonsson is the head of operations at Carl F in Malmoe, Sweden. His father is the CEO of the family's construction waste sorting business which has been in operation for 27 years now. It was six years ago that ZenRobotics caught the compa-

ny's attention. Today, they are operating one of the systems which he says has "literally turned our business upside down".

"Last week we ran the system for 16 hours a day," he tells WMW enthusiastically. "We use a huge trailer, so we can load around 60 cubic metres of waste at a time. This way you have material for the robot to pick for between four to six hours, depending on speed."

Many waste management operatives will have no doubt salivated over the corporate videos from both companies demonstrating their robots but would have soon sobered up with questions over the cost and return on investment (ROI).

Jonsson says he has done the math. "For one tonne of mixed construction waste, we are talking 80 euros per tonne, which is low compared to, say, Germany. For us, on that price level, we are estimating around five to seven years for our company for the return on investment. We have done our calculations, but it depends on the day-to-day prices. You don't know the market in three years – so much can change. ROI could be quicker, but it's better to be safe than sorry."

**MAN VS MACHINE DILEMMA?**

With the evolution of robot waste sorting continuing at a rapid pace, it raises the question of how man will fit in this digital journey. Teams of waste pickers around the world are still needed and depend on the jobs. How do these individuals feel about potentially being superseded and even replaced by machines?

Mieskonen tells an interesting story. For one installation, ZenRobotics thought the manual sorters may in fact sabotage the robots for taking their jobs. Instead, it was quite the contrary. The employees put pictures on Instagram, shared with their families and were proud to work alongside them.

"People actually like working alongside the systems because they can leave the heavy lifting to the robots and they can focus on the complex materials, like untangling wrapped plastics for example. We advertise that the robots can lift up to 30kg but when people see one lift a block that can weigh 100kg, then everybody realises their job is

**FACTS**

**FIRST**

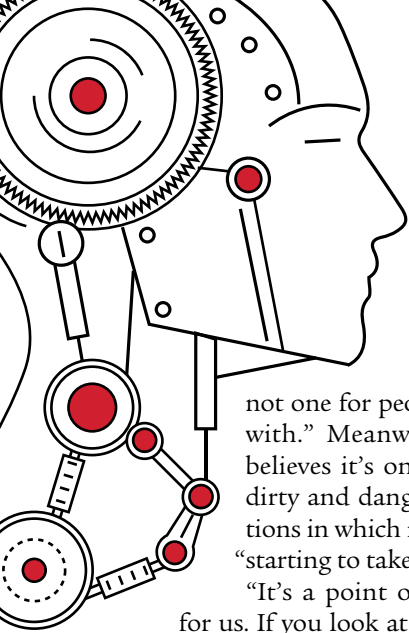
The first available machine utilising Max-AI technology is an Autonomous Quality Control unit that sorts container streams following optical sorting.

**ATHENS**

The first commercial Autonomous QC unit entered service at Athens Services' MRF in Sun Valley, California.

**MILLIONS**

Max-AI learns to classify objects it's never seen before by through millions of interactions.



not one for people to begin with.” Meanwhile Brooks believes it’s only the “dull, dirty and dangerous” positions in which machines are “starting to take over”.

“It’s a point of discussion for us. If you look at many of the locations where we have recycling facilities, they are typically city-run or state-run where they want to create jobs.” He believes that eventually Max-AI will become the “brain” of an MRF, as it becomes a fully autonomous facility. “Our objective is to apply that to a facility and reach the point of having an autonomous system that doesn’t have people touching waste anywhere, and has the ability to cross communicate between all machine centres and operate itself,” he says. “There would be still be some level of maintenance staff.” When WMW first covered the ro-

**“LABOUR IS A SIGNIFICANT CHALLENGE FOR MRF OPERATORS.”**



**Steve Miller**  
BHS Chief Executive Officer

bot development, it seemed a distant vision that they would ever be competing with humans. This was especially the case as the development just focused on heavy construction waste. Fast forward to today and the vision is now a fully autonomous MRF, sorting municipal recyclables. The speed in which ZenRobotics is delivering systems globally, and with which Sadako and BHS have teamed up and turned Wall-B into Max is impressive, if a little scary.

Every industry is being disrupted by technology. Whether it’s the iPhone for mobiles, Netflix for movie rentals, Airbnb for hotels or Uber for taxis; change is sometimes needed to drive the competition and market forward.

Waste handling may still not feature as the core topic of summer movies, yet the way a handful of companies are disrupting waste handling certainly has the makings for a blockbuster. —

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