Son of WHYACHI

Meet the Ewert family from Dorchester, Wisconsin USA and their other 'family' – of robots.

When he isn't building robots (or hunting, fishing or coaching the local football team), roboteer Terry Ewert makes automated meat processing equipment – work that requires heavy-duty, high-quality precision engineering. Not surprisingly, Terry puts the same skills to use when designing and making fighting robots.

BUTCHERY SHOP

Though his workshop 'production line' knocks 'em out with sausage-machine like efficiency, each bot is unique. There's been Superheavyweight Whyachi, and its three 'progeny' – various Sons of Whyachi (SOW) (two now retired). Then there's Heavyweight Warrior, Heavyweight Y-Pout, Middleweight Y-Not and newbie Red Square, and Lightweight YU812. They're all really mean, and each is capable of its own brand of butchery! So what's this?

SOW suffers battery problems in season 5.0. The spinning rotor would normally prevent it being lifted.

TECH SPEC

Son of Whyachi

Type:	Modified spinner
Weight:	150kg
Dimensions:	Clipped 1m diameter circle
Power:	Six Team Whyachi Astro 40 Gear motors powered by four 16Ah Hawker Genesis batteries
Weapons:	Rotary hammers

SOW SLAUGHTER

"Son of Whyachi," says Terry, as we regard the underbelly of a great disc-shaped beast. And why 'Whyachi' – some word borrowed from the North American Indians, perhaps?

According to Terry, non-one has ever ripped apart BioHazard like rookie SOW did in the May 2001 (then) Heavyweight finals.

Pat Verner shows us round SOW's under-belly, which features (*inset*) Vantec speed controllers (*top left*), Hawker Genesis batteries (*left*) and tiny 1hp motors (*right*).

Terry: "The guys came up with it when they were playing cards. It means to bring someone down hard – to really hurt 'em."

In May 2001, rookie SOW 'whyachied' the (then) reigning BattleBots Heavyweight champ, legendary BioHazard. That version was a 'stompbot'. But then BB changed the rules governing stombots, and their three phase walking beam-style walker no longer qualified. For the latest version they've changed to wheels, and apart from the triangular rotary weapon, it's an entirely different bot.

THE POWER OF GOLD

"It's driven by these six, one horsepower Astroflight, modified model aircraft motors," says Terry, pointing to some titchy gold cylinders spread around the robot's periphery.

It's hard to believe each one is capable of supplying about the same power as the much larger 750W Bosch motors on most UK bots. "They use rare earth magnets and spin at 1600rpm," Terry explains. "We mate them with our TWA40 gearboxes to bring them down to useable speeds," he says. (Check out www.teamwhyachi.com for more info.) So how do they steer it?

"Basic skid steer – Pat'll tell you about it," says Terry, dashing round the other side of the pit bench. (He's frantically trying to get Red Square ready for inspection in two hours time. If it doesn't pass, it can't fight!)

SKID STEER

"Okay, what you've got are two motors at the front, two at the back and one on each side," says new team member and machinist Patrick Verner. Pat explains how, if the robot wants to steer to the left, say, the left front, left back and left side wheels reverse or slow down, while those on the right continue at the same speed or speed up (see diagram). So why not go for a couple of really big motors driving three wheels a side, say?

"If you burn out one, you've still got five left, and being so small you can keep the robot's profile low – making for a low centre of gravity."

Making it harder to turn over, right?

"Right."

What happens if you do get flipped?

"Then we've had it," he concedes. "But hey, the base spins pretty fast too!" he jokes.

SIMPLY SUPERB

There's such a bewildering array of machinery here at BattleBots that at times it's hard to take in. Here alone, there are five robots in various stages of completion. In fact, on closer inspection, SOW turns out to be fairly simple – mechanically. But it's superbly constructed.

Pat: "The base plate that goes right over all the stuff inside to

Inside View

A SOW TO STEER

With a separate motor for each of its six wheels, SOW's steering might appear to be more complicated than it actually is. In fact, the wheels all point in the same direction and the robot has basic skid steering.

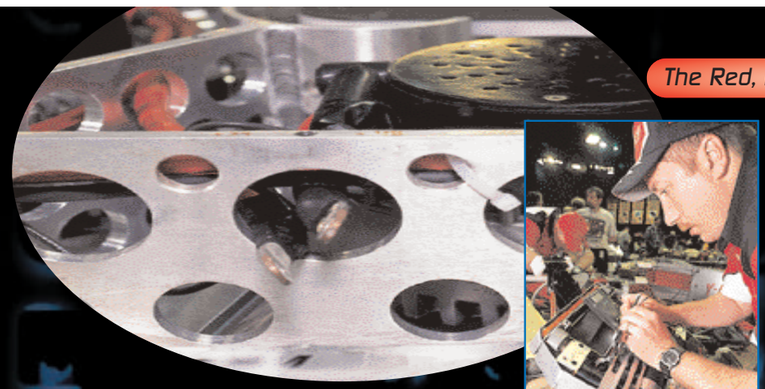
protect them from the arena floor saws is titanium. Then you've got the supporting structure – three-eighths of an inch 3003-H14 aluminium. The upper shell is three-sixteenths T5."

It's all expertly welded together by Craig Kawa. The struts have been drilled out to make the robot lighter. Both sides of every hole are chamfered so there are no sharp edges to chaf any cables passing through.

The cabling itself is heavy-duty industrial stuff and the connectors very positive and robust. Cable-ties pull loose wires tight against the structure; no wire is longer than needs be – it's a tidy robot.

If you were wondering why the upper shell can afford to be thinner than the inner structure, just remember it has that awesome rotor whirling around above to protect it! Parts designer Dale Hammel takes over on Red Box, while Terry nips back over to tell us about it.

(*Inset from top left, anti-clockwise*), three Stratton motors power the rotor; Hammer heads can be removed for replacing or re-sharpening; pivoting tie bars strengthen the whole structure.



Each weight-saving hole is chamfered (has a bevelled edge) to protect against chafing cables.

Distinctive team colours help team members spot each other in the pits.

THREE'S COMPANY

Terry likes triangles (as as you'll see from two of his other robots – Y-Not and Y-Pout, which we'll be looking at later). "They're inherently strong shapes," says Terry. "Each side supports the others." SOW's triangular rotor dominates the robot's appearance. So how does it work?

Terry: "You've got these three, 12hp Briggs & Stratton motors on to three 16-tooth spur gears. These mesh with the main rotor gear – with about 40 teeth.

The rotor arms are made from titanium. Each hammer weighs 12lb and is made of S7 tool steel. The rotor spins at 922rpm and has an impact energy of about 20,000 ft lb – that's like hitting a 20lb weight 1000ft in the air. The hammers are set so they just skim the floor."

PRO OUTFIT

Even the geometry of the hammer faces is designed to cause max damage. The thinking here seems to be: why use sledgehammers when you can make something from scratch that works better? This is typical of US bot design, and in this respect, UK teams have some catching up to do. But in all fairness, most US teams seem to have better resources. Terry's outfit is a good example.

The team is a family and business affair with Terry's four sons – Jake, Clint, Luke and Reese – helping out and wife Lisa lending moral support. Then there are Dale and Pat, Terry's cousin Darin Ewert and general helper and cheerer-on Tyd Tydsedale. To give you some idea of their skills, SOW took only two weeks to design and three weeks to build. Beat that!

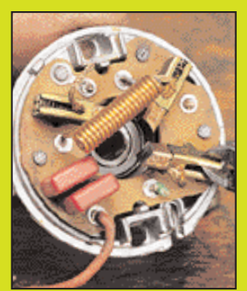
REX'S ROBOT CHALLENGE

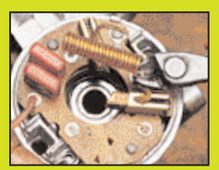
I'll continue to show you how to make that improvement to your motors.

The final stages of the wiring modification require soldering – if you can't do it you'll need to get help. (I'll be showing you how to make a good soldered joint later on.)

1 The last thing we did was to cut off the green wire and one leg of one coil. Now cut off the other leg of the coil and at the same time cut the brush wire next to it (The coil will come away entirely, now.)

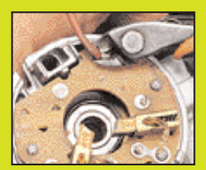
2 Pull off the carbon brush holder whose wire you've just cut. Look carefully at the picture here to make sure you get the right one! (It's next to where the green wire was.)





3 Remove the other coil. (These coils are actually chokes.)

4 Take off both the red components (capacitors). They can interfere with your speed-controller.

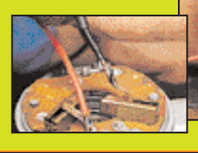


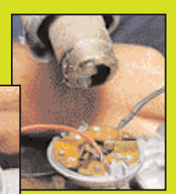
5 Then cut off the red wire. (All you are left with is two of the original three carbon brushes.)

6 Now you need to extend the brush wires. 'Tin' the ends with solder to prepare them for soldering.

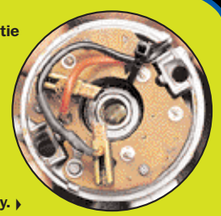
7 Then solder on your two extension wires. I've used red and black wires, but to be honest, it doesn't really matter what colours you use, or which wire you connect to which battery terminal. (So long as you do it the opposite way round on the other motor.)

8 A sleeve of heat-shrink helps insulate any bare wires.





9 Thread a cable-tie under the circuit board and fasten the wires down so they're both out of harm's way (clear of the armature). They should exit the motor casing tidily.



10 A quick spin of the drill twists the wires together neatly, and helps to cancel out interference! One last job remains.

Coming Next: The Master reveals its identity, and more from Rex's Robot Challenge.