BATTLEBOTS

The box is locked, the lights are on, it's robot fightin' time!

by Dale Hall

Thus begins another televised half-hour of Battlebots, a cable television show with a modest but enthusiastic audience who enjoy watching mechanized monsters locked in mortal combat. Every week, pairs of angry gizmos square off in three-minute bouts to decide which is the mightiest of them all. Piloted by their builders via radio controls, the robots fly around a walled arena full of deadly obstacles, wheeling and turning, always probing for the opponent's weak spot — perhaps a tire, or a projecting feature that can be grabbed, torn off, sliced, or beaten into a pile of twisted metal.

Their array of weapons is dazzling: sharpened lances, spikes, lifting arms that can flip three hundred-pound opponents completely over, spring-loaded hammers capable of punishing force, mechanical jaws that can crush foes or hoist them off the ground, titanium carbide-tipped saws that can shear through 10 mm steel plate like butter.

The competition proceeds through a series of elimination rounds, until the two final survivors face off for the championship. The winner is awarded the coveted Giant Nut, a large hex nut trophy that seems right for this odd competition.

Watching battlebots duke it out is great, mindless fun. At the end of a long, hard day, it's an amusement that demands only enough attention to watch the combatants flail, pound, crush, flip, and saw each other until one has had enough or the bell rings, whichever comes first. The show doesn't take itself too seriously, and neither do most of the contestants. Whatever intellectual pretensions the show has come in 30-second spots by Bill Nye, the Science Guy, talking about drive trains, armor, design, the concept of torque, and the like. (I can hear a million ten-year old boys now: "But Mom! It's educational!")

How about robot combat as an exemplar of family values, a sense of humor and whimsy, and good sportsmanship? It's not as much of a stretch as you might think. Short video profiles of the robot builders often show fathers and sons, husbands and wives, and whole families hard at work in their garages, engrossed in welding, sheet metal bending, wiring, and testing in the pursuit of a leaner, meaner, fighting machine. The builders have a variety of motivations. Most simply want to win, but others construct elegant, clever machines that they must know can't win against the ferocious and relentless onslaught of killer 'bots like Vlad the Impaler or Techno-Destructo. The challenge and fun of building a writhing, segmented, snakelike robot spurs them on. And while contestants who watch their robots get taken apart in the ring grimace in real pain, good sportsmanship generally prevails. In post-fight interviews, winners are gracious toward their opponents, while losers praise the mechanical prowess and driving skill of the victors.

As a scientist with a materials background, I like to see what happens when material meets material on the field of combat. How much punishment can 10 mm Lexan take, anyway? (A lot, judging from recent combat.) Is there any real advantage to Kevlar in the robot battle pit? (The jury is still out.) Is aluminum armor a strong deterrent to a determined, titanium carbide-tipped saw whirling at high speed? (Nope.)

But mostly, I enjoy watching Battlebots because of the raw creativity that charges onto the floor every time the starting siren sounds and the intrigue of a practical puzzle that has no absolute answer. As many tournaments have shown, the most successful robots embody Mies van der Rohe's dictum that form follows function. These 'bots have no-nonsense designs that waste no weight or space on extraneous details. Their builders pursue the ultimate in traction, stability, maneuverability, defensive armor, and lethal weapons with single-minded focus. If, for example, a saw blade is the weapon of choice, then it should be the meanest, fastest, most powerful, heaviest one that can be crowded into the robot's design. As in real life, however, there are always trade-offs. One must allow for the other necessary elements, such as motors and wheels, while still staying within the weight limit. Offensive weapons must be balanced against defensive armor and design. And cost is a constant constraint.

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Free Radicals

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The state of the art constantly advances as builders develop and react to new design concepts. One early successful robot had a rapidly spinning shell with flailing weapons to batter opponents. Low, flat wedge-shaped robots proved adept at avoiding weapons and riding under opponents, upending them or driving them into hazards. Mechanical jaws and flipping arms had their day, too. Later, brutal, low-riding circular saws seemed unstoppable, ripping opponents' armor and tires. Every new design concept poses a new challenge that spurs still more innovation.

In a sense, Battlebots is a lot like the challenges we face every day in our technical work, in the other work we do, and in our daily lives. We're constantly faced with the need to solve amorphous, ill-defined problems that keep changing in scope and nature. The first step toward solution is to define the real problem. Conceptually, is the task to develop the perfect floppy disk? No, the problem is to develop the most practical and economical form of compact, easily transportable data storage. Is the goal to build the best wedge-bot ever? No, the goal is to be good enough to beat whatever 'bot shows up in the other corner of the arena. We must be focused on the real need and not wedded to a particular approach. History is littered with defunct companies that couldn't or wouldn't adapt to changing circumstances.

Electrochemists take note: almost all of the battlebots are battery powered. The simplicity and reliability of electric power and drive trains has proven itself on the field of robotic combat. If you're impatient with the lack of similar market penetration on our highways, tune in to Battlebots; maybe you'll get to see an internal combustion 'bot take a packaged power pounding. It doesn't really help, but it feels kind of good. ■