

**Guide to inside news & features**

**NATIONAL**

- Mavroules expected to head key defense subcommittee. 3
- Diver Kimball gets 17-year term for fatal crash. 3
- Bush lauds civil service at Dole swearing-in. 6
- Drug shown to help prostate cancer victims OK'd. 8
- How cold was it in Alaska? Minus 64 - and windy. 10

**INTERNATIONAL**

- Rabin drops a condition for vote plan. 3
- Warsaw Pact gives its military figures. 3
- Amid strife, Army Intervention hinted in Yugoslavia. 4
- Concerned over security, US closes Kabul embassy. 5

**EDITORIAL/OP ED**

- Editorials 14
- McNamara's departure. Bush's test in El Salvador. New light on an old crime. Ellen Goodman: The Sullivan difference. 15
- Robert L. Turner: Dukakis quietly digests his presidential run. 15
- David Nyhan: Tower's revolving-door-itis. 15
- Art Buchwald: When in doubt, relax. 15
- Helena Kolenda and Yvonne Chan: Outsiders in China. 15

**METRO/REGION**

- Four plead innocent to beating homeless man. 17
- Dukakis rebuts judge on sobriety tests. 17
- Arrests of youths in bank robbery shocks Methuen. 17
- Newton man pleads innocent in hostage standoff. 19
- A kinder, gentler police academy greets cadets. 54
- Harvard poised for report on minority recruitment. 72
- State to spend more funds to fight homelessness. 73
- New England news briefs 62

**LIVING/ARTS**

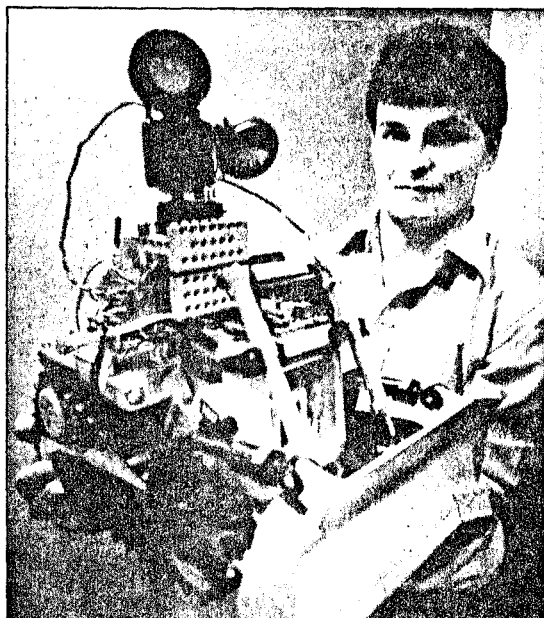
- Susan Sontag on being a writer. 55
- Video review: Springsteen anthology a letdown. 55
- Morgan Memorial's goodwill ambassador. 55
- Over 60: Alone again - happily. 55
- Choreographer James Kudelka sets feelings in motion. 55
- Literary Life: Gun nuts and other subscribers. 62

**BUSINESS EXTRA**

- Chelmsford's company's machines that make new TV technology. 25
- Federal plant closing law is effective this week. 25
- The new top leadership at Jordan Marsh - an interview. 25
- Robert Metz: Why President Bush should cut interest rates. 26
- Robert J. Samuelson: The corporate debt crisis is a phony. 28
- Cost cap would be helpful for parties paying DEQE oversight costs. 28
- Consulting is one way to avoid being sent out to pasture. 31

**BUSINESS**

- Dow average posts 1.25 gain to close at fifth straight high mark. 38



**Robot builders** Ron Chaney (left) and Panayotis Skordos show off their entry at the Robot Talent Show at MIT last week. At right, Henry Minsky with his orange robot.

**CENTERPIECE**

# Lessons in artificial intelligence

By **Simon L. Garfinkel**  
Special to the Globe

**C**lint roams around the floor, looking for robots to shoot down with his laser gun.

A robot himself, Clint is constructed from Lego building blocks and state-of-the-art mobile electronics. Approximately 10 inches high and a foot around and covered with an array of electronic eyes and sonar and touch sensors, his only purpose is to play Laser Tag.

Suddenly, Clint spots another robot several feet away. A flashing beacon on the enemy's turret makes it an easy target.

"Dead meat!" says Clint, as he lines the enemy robot in his sights. "Go ahead, make my day."

Clint, as well as the 20 other robots from the Massachusetts Institute of Technology's Artificial Intelligence Laboratory, were gathered last week at the MIT Faculty Club. They were the products of a month-long effort by students, faculty and staff members to construct entries for the laboratory's first Robot Talent Show.

Robots that could ski, imitate inch worms, fly and clean living rooms were shown. The finale was slated to be a game of Laser Tag between four of the most sophisticated robots, but not everything went as planned.

"It all came about because people said, 'How come there aren't more robots around the AI lab?'" said Anita Flynn, a research scientist at the laboratory who builds mobile robots.

Recently, Flynn said, her group started building extremely small robots - some less than a cubic inch. "That started getting cheap," she said. "Everybody could build their own robot."

Every January, when MIT suspends classes for its Independent Activities period, Flynn runs an olympics for the members of the laboratory. This year, she decided to incorporate a robot talent show in the award ceremonies.

She purchased dozens of high-tech sensors for the contestants and had Henry Minsky, a graduate student at the labora-

ry, design a circuit board to serve as the robots' brains. She also bought several thousand dollars worth of Lego building blocks for the robots' bodies.

In late December, she handed out the robot kits.

"It's very AI-ish," Flynn said. "There's not a specific problem to be solved. You get to pick the problem and solve it. Basically, build something that intelligently connects perception to action."

Almost immediately, students started building robots with the Legos and playing with the microcomputers. Others scrapped the Legos and, instead, bought motorized toy trucks and cars for starting materials.

"If you are going to build a robot, you might as well start with something classy," said Andrew Christian, a graduate student in mechanical engineering. Christian bought a model Ferrari Testarossa 49 for the body of his Laser Tag robot.

The Ferrari let Christian and his partner, Michael Caine, devote their time to designing the sensors and writing the software for their robot.

"We're theoretically mechanical engineers," Christian said, "and we're trying to avoid doing mechanical engineering."

Indeed, one of the ideas behind the Robot Talent Show was to get students at the laboratory to experiment with systems not normally part of their studies.

**Series of compromises**

Building a mobile robot is a series of compromises, the students learned. Try to move too fast and the on-board computer has difficulty staying in control. Try to save space and weight by using a single motor and the robot's movements are drastically limited.

Marty Hiller's project was to "build a robot that clears off a table top by picking up whatever is on the table and dropping it on the floor."

Hiller discovered on the day of the talent show "the bumpers aren't sensitive enough to detect an object that is light enough to lift."

No project made those compromises more apparent than a computer-controlled

blimp built by Christian and Caine.

Because the blimp could lift only 100 grams, Christian said, sacrifices had to be made in designing its sensors, microcomputer and motor control systems. The biggest obstacle was with the sonar system that was supposed to act as the blimp's eye. Because the sonar weighed so much, Christian and Caine were forced to power everything on the blimp - the motors, the sonar and the microprocessor - from a single battery.

The problem, the two soon learned, was every time the computer fired its sonar to make a distance measurement, the sonar generated a power surge that reset the computer. Finally, the two ran out of time, lifting power and new ideas, and turned off the sonar to let the blimp fly around blind.

But that was OK, said Flynn, adding "the main thing is to have fun."

**Not exactly as planned**

As for the Laser Tag game, it did not go exactly as planned.

"No one really knew what we were in for," said Colin Angle, an undergraduate who organized the event and oversaw the construction of Clint.

The Laser Tag robots had to display a flashing beacon to make themselves visible to other robots. They had to locate the flashing beacons, aim, fire and register hits. Some of the engineers considered elaborate strategies of darting around obstacles on the course.

But, nobody brought a fully functional Laser Tag robot to the event. Christian's "robot couldn't fire back, and my robot couldn't [detect a] hit, so it's not clear who would win," said Angle.

"We don't need luck, we need time ... two more days to finish," said Uwef Wildner, another contestant. "Most of us have never built a robot before."

As for his robot, Wildner said: "The tracking mechanism works, the bumpers work, but not together."

The plan, Angle said, is to hold a second contest in two months, after contestants have caught up on work they neglected while working on the robots.

## Names and faces