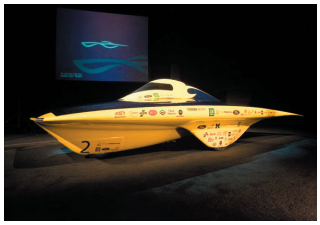
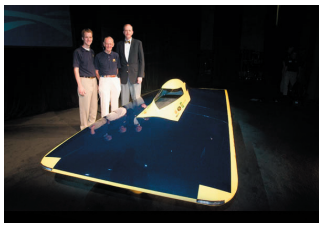
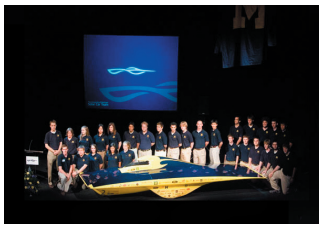
CASE STUDY

Supporting the University of Michigan Solar Car Team in Advancing Planet-Friendly Energy Technologies







Overview: University of Michigan Solar Car Team

In response to an ecologically driven 1989 challenge to universities by the U.S. Department of Energy and governments of a number of other countries, the University of Michigan (UM) formed a student-run organization to build and race solar-powered cars in competitions around the world. The team is made up of students from a wide range of academic disciplines, including the College of Engineering, the School of Business and the College of Literature, Science and the Arts. In July of 2005, utilizing Motorola-provided wireless communications equipment, the team won the North American Solar Challenge in a race beginning in Austin, Texas and ending 2,500 miles later in Calgary, Alberta. Later that same year, the team finished third in the World Solar Challenge across the formidable Australian outback. Using lessons learned from these and other successes, the team prepared for the 2007 race from Darwin to Adelaide, Australia, a 3,000 kilometers (1,864 miles) distance that also included long stretches of outback.

The challenge: build, equip and race a new solar-powered car in compliance with new World Solar Challenge vehicle specifications.

As they began planning their new vehicle, the team faced a number of new challenges. One was driven by new event regulations that were designed to create cars that would be closer to actual production models. Among other changes, regulations specified that drivers must be sitting up instead of lying prone; that the vehicles must include a steering wheel; and that there would be a reduced solar cell area of only six square meters instead of the previous eight. In addition, the team wished to improve communications not only among the five cars that comprised the on-site race team, but also with project managers and personnel in Ann Arbor and other U.S. locations. Again, the University of Michigan turned to Motorola, which assisted the team by providing advanced intelligent transportation technology solutions.

The solution: a MOTOMESH™ network combined with satellite communications and advanced wireless radios and cell phones.

Motorola supplied the UM team with secure mobile technology solutions that included satellite communications links, two-way radios, cell phones and a high-speed mobile wireless MOTOMESH network. For communications between the five cars that comprised the actual race team (weather car, scout car, lead car, the solar car itself, and a chase car) and other onsite personnel, the team installed mesh vehicle-mounted modems inside the cars.

CUSTOMER PROFILE

Enterprise

University of Michigan Solar Car Team

Applications

Wireless communications system for competition in North American and World Solar Challenges

MOTOwi4™ solution

- Mobile wi4 Mesh in-vehicle wireless network
- Mesh broadband modems
- Motorola cell phones
- Motorola digital two-way radios with encryption

Solution features

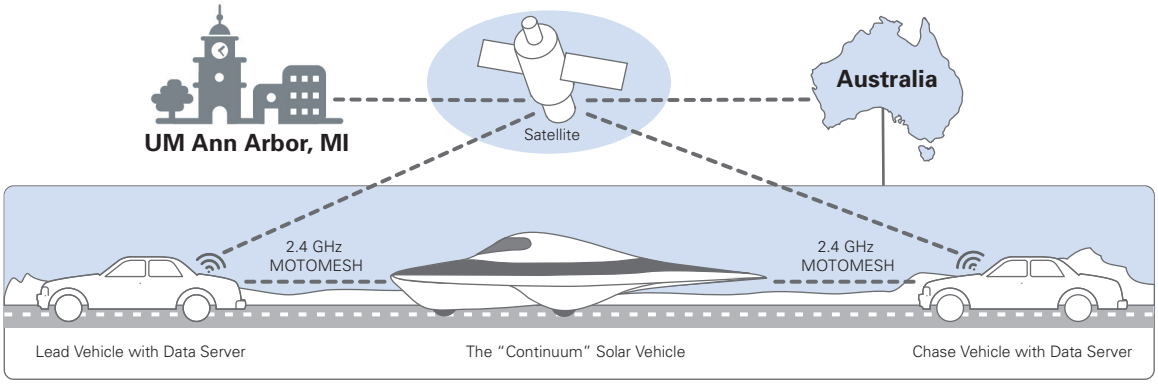
- High-speed wireless mobile connectivity
- Telemetry modem and sensors for continuos data monitoring
- Continuous chat and text messaging capabilities

Benefits

- Reliable high-speed global and local connectivity
- Software downloads direct to moving vehicles
- Maintaining optimal solar car performance

MOTOwi4™

"For the last half of the race, our car was fastest or second-fastest overall so we were able to finish very strong even after such a disastrous start. The reliable, high-speed wireless connections we enjoyed played a significant role in our comeback."
– Jeff Ferman, Head Strategist, University of Michigan Solar Car Team



Race From Darwin to Adelaide, Australia

MOTOROLA TECHNOLOGIES IN SUPPORT OF PROGRESS

Technological support of efforts to harness solar power is one of numerous ways Motorola uses our worldwide wireless communications leadership to advance global progress. Our technologies help create engaging learning experiences, empower technical and scientific discovery and, most important, bring people closer together.

The technology helped monitor telemetry, send data to team members onsite and in the U.S. and provide for on-the-fly algorithm changes while the vehicles were moving at speeds that could reach 132 kph (82 mph). The technology also monitored and controlled one of the most innovative features of the vehicle: a concentrator system that used a moving series of mirrors to deliver additional solar energy to the cells, effectively boosting the power of the six square meters of cells to the equivalent of 7.2 square meters.

The benefits: reliable, high-speed global connectivity helped the UM Solar Car Team overcome a disastrous beginning to finish strong in the race.
A total of 32 teams began the 2007 World Solar Challenge at 8 a.m. October 21, 2007 in Darwin, Australia. By 8:04 a.m., the UM vehicle had already passed several other cars; by 8:05, it had been cut off by another entrant and crashed. In the words of one team member, "It was so damaged, we couldn't pick the car up off the road." Fortunately, no one was hurt, and after an all-night repair session, the car was ready to race by the start time the next day. Unfortunately, the crash cost 10 hours of racing time.

As the team began to catch up to the rest of the field, the MOTOMESH network proved its worth time and again. One result of the crash was that the mirror-based concentrator system was damaged. Team members in Ann Arbor were able to write a new algorithm to repair the problem and download it directly to team vehicles—while they were in motion—via hot software download over satellite link and the MOTOMESH network. The Ann Arbor team also wrote programs optimizing the car's performance in approaching, climbing and descending hills, and downloaded the programs directly to the solar vehicle.

The team was also able to chat and text message between cars. "We were able to communicate across the world, sending data and chat messages every few minutes," one team member recalled. The team was also able to remotely program car speed to comply with Challenge speed limits, and the network continually updated telemetry data. With the MOTOMESH wireless networks providing in-vehicle diagnostics and helping ensure peak car performance, the team was able to pass 25 other teams. Ultimately, the UM car crossed the finish line third and officially finished seventh, quite remarkable for a team that lost so much racing time.

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