



MLiX Rechargeable Lithium-ion Batteries Power the Winner at World-Famous Hill Climb!

Achieving victory through technology



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Lithium-ion rechargeable batteries play important roles as power sources for Eco Cars and smart grid storage systems, supplementing electricity generated from renewable energy sources. In June 2013, MLiX rechargeable lithium-ion batteries provided by MHI marked an extraordinary feat: A racing car powered by these batteries finished in first place in the Electric Division of the Pikes Peak International Hill Climb (PPIHC), the world's most demanding hill-climb race, held in the U.S. state of Colorado. We spoke with Project Manager Naoya Yamasaki, a central figure in this accomplishment.

Tackling a brutal hill-climb race to the 4,301m peak

The PPIHC is a grueling hill-climb race to the 4,301m summit, covering a course elevation difference of about 1,500m. The race environment is severe with rapidly changing weather conditions, and as the race progresses, the thinner air at higher altitudes takes its toll on combustion engines of gasoline-powered cars.

On June 30, 2013, an astonishing new race record of 9 minutes and 46.53 seconds (9:46.53) was set in the Electric Division. This record-setting time by an MLiX-powered racing car was even faster than the 2011 overall winner running a gasoline-powered racing car.

At the moment of victory, MHI's Pikes Peak Project Manager Yamasaki was flooded with indescribable emotions as the faces of everyone who had supported him came to mind. He says he couldn't wait to get the news to the project members and supporters in faraway Japan, a distance his cell phone couldn't bridge.

Yamasaki first became involved with this race in February 2012, when he met Nobuhiro Tajima, Chairman and CEO of Tajima Motor Corporation. Nicknamed "Monster," Tajima is a world-famous rally racer with a past record of six consecutive overall wins in the PPIHC Unlimited Division. In love with the MLiX's capabilities, Tajima was determined to race in an electric vehicle (EV) instead of a gasoline-powered car. Yamasaki, who has worked exclusively on rechargeable lithium-ion batteries since joining the company, became Tajima's contact at MHI.

When they first met, the race was a mere four months away. MHI had never equipped a racing car with a battery before, and the development, testing and successful mounting in such a short time frame was a real challenge. However, the PPIHC was a very visible stage, and the perfect opportunity to raise the name value of MHI batteries.

Conquering heat buildup, weight reduction and other major challenges

The MLiX P140 series is composed of mass-produced

batteries for industrial vehicles and large storage systems. Yamasaki's project team made further improvements to the P140 to adapt it for the race up the steep slopes of Pikes Peak, doubling its output performance over that of competing products.

The 156 curves over the course of the hill-climb race call for abrupt accelerations and decelerations, and make the batteries susceptible to heat buildup. Other teams coped with this by adding gaps or fans, which greatly affected the cars' aerodynamics. In contrast, the P140 has very little internal resistance and does not readily retain heat. The team managed to completely enclose the battery, doing away with many of the car design limitations. Of course, racing up the hill exposes the cars to harsh conditions, including rain, snow, hail and dust. Under these circumstances, the advantages of a completely enclosed battery were incalculable, and the other teams and the media were astonished.

According to Yamasaki, the rapid string of accomplishments was possible only because of the team's many years of accumulated skill. "Afterwards, someone involved with the race told us that many competing teams and media representatives had said, 'They'll never manage it on that schedule!' However, the Tajima Corporation engineers and our project members and related personnel came together to tackle the challenge, and so we managed to finish in time for the race."

Unfortunately, a non-battery-related issue with the drive system forced Tajima to retire from his first attempt. The project members, however, kept insisting that they wanted to try again the following year. Likewise, MHI considered its batteries unrivaled and was disappointed at having missed the chance to prove it, and as a result, the company was strongly committed to participating again in 2013. The company also expanded its car development scope by working on simulations over the course of the entire race.

"When racing an EV to the goal at top speed, weight reduction is critical to improving cornering and other performance factors. The Tajima Corporation engineers and MHI project members thoroughly reviewed everything, down to individual bolts, and managed to reduce the weight of the entire car by nearly 200 kg. We ran repeated simulations of the battery capacity that the car would need to get to the goal within the target time, and set the minimum number of batteries to allow an



MHI engineers' involvement was focused on mounting the battery. With its high output and capacity for being completely enclosed, the P140 realized a convincing victory.

approximately 1,000-horsepower EV to run at top speed. This was made possible by the fact that these high-performance batteries can be used until nearly drained."

As different technical problems cropped up, technicians at the MHI R&D centers all around the country were mustered to field them. Each time, every problem was resolved in just a few days, something that Yamasaki says made him better appreciate MHI's vast potential.

With even greater trust and brand strength, MLiX heads to the next stage

At the end of a year-long struggle, the day of the 2013 race finally arrived. Just before the Electric Division was slated to begin racing, the clear sky abruptly changed with dark clouds converging over the mountain and rain beginning to fall. As every team struggled to select appropriate tires, Tajima chose slick tires into which his engineers had hand-cut grooves. The difficult road conditions sent driver after driver off the course, but Tajima finished the race in style, even beating his earlier 2011 record. After the race, the Electric Division winner heaped praise on MLiX, saying, "The awe-inspiring power of MHI's lithium-ion batteries and the MHI project members' tenacious efforts made a huge contribution to this win."

Any battery capable of powering the winning car in a demanding race such as this must really be something, and as word of the victory spread, Yamasaki was flooded with domestic and foreign inquiries about MLiX. They had surpassed all other battery manufacturers to win at PPIHC. The result of this bold challenge has been the creation of a product brand of solid strength. "During the project, we had crisis after crisis. However, I think we achieved the results we did because we believed in our technical capabilities and in the strength of the product. We pushed our way through." Even as he reminisces, Yamasaki keeps his eyes firmly fixed on future developments.

As environmental projects become more prevalent in Japan and abroad, the situation that surrounds MLiX is evolving. MHI has positioned energy and environment-related business as one of its focal areas for the 21st century. With added impetus from the success of the Pikes Peak Project, the fields of activity for MHI's rechargeable lithium-ion batteries are bound to expand.

*A next-generation power grid that optimizes the flow of electricity by controlling both supply and demand sides. Renewable energy, whose supply is unstable, is stored in storage batteries, contributing to peak shifts in electricity demands.



MHI is also participating in a joint electric bus development project in Manitoba, Canada.