April 19, 2004

Overhauling Lance Armstrong

By JOHN MARKOFF

EAVERTON, Ore., April 14 — Lance Armstrong's fate in the 2004 Tour de France may hinge on work now being done by clothing designers here on Nike's sprawling campus.

Nike is a member of an unusual alliance of companies named F-One that last year quietly banded together to redesign Armstrong's equipment and clothing radically in preparation for this year's 20-stage, 2,110-mile race in July.

Despite the Tour's length, margins of victory can be razor thin, and aerodynamic streamlining is playing an increasing factor in cycling, track and field, swimming, speed skating and skiing.

In 1989, Greg Lemond won the Tour by only eight seconds. Armstrong won last year's Tour by just a minute and one second after almost 84 hours of racing. During the team time trial, Armstrong's United States Postal Service team picked up a crucial 43 seconds.

Armstrong will be trying for his sixth consecutive victory in the Tour, a feat that has not been accomplished during the 101 years of the race. Armstrong's sponsors are trying to ensure that he retains a technological edge this year.

"Little interaction effects and race equipment can lead to big gains or losses," said Bart Knaggs, president of the Postal Service racing team.

The effort began with experiments in November in a wind tunnel at the University of Washington. On April 22, Armstrong plans to race with his new equipment for the first time this year in the United States during the time trial stage of the Tour of Georgia.

Knaggs said that immediately after the 2003 Tour, he brought all of Armstrong's sponsors together in Austin, Tex., Arsmtrong's American home base.

Knaggs acknowledged that the Postal Service team's obsessive focus on refining cycling technology and the advantage it gave the team last year is almost certain to touch off a response from the other teams in the Tour, which is expected to draw 15 million spectators and be broadcast to 170 countries.

But little is known about the plans of the other 20 teams entered in this year's Tour, and stealthy efforts may be under way from competitors like Team Telekom, which is backed by Adidas, one of Nike's rivals.

"I'm amazed that I haven't heard anything about the other efforts," said Lennard Zinn, a technology writer at Velonews, a weekly bicycle racing newspaper. "The only thing last year that was significant and new was the Nike Swift Spin suit, and I would think it would have touched off work from other people."

The fear that any technological advantage the Postal Service team held in 2003 might be quickly erased led to the new, broader effort.

"We brought all the key suppliers together and made them understand there has to be a holistic connection between Lance and his equipment," Knaggs said. "The body and the bike have to be thought of as one."

In that equation, he said, the body is clearly the dominant factor.

Nike's Project Swift designers said that the rider's body accounted for as much as two-thirds of the total air resistance created by a bicycle racer. The other third comes from the bike itself.

Total resistance is a combination of air resistance and mechanical resistance from tires, gears and bearings.

"With the sort of speeds that Lance will be riding at in a time trial, 90 percent of the resistance will be caused by the air," said Len Brownlie, an expert in aerodynamics at Aerosports Research, who is consulting for the F-One project and for Nike. "That's significant."

Brownlie said that although the original aerodynamic research on bicycle racing was done for the United States Olympic team in 1984, progress could still be made.

"People assume everything that can be done has been done," Brownlie said, "and that's not necessarily true."

Nike designed more than 33 prototype suits and experimented with 60 different fabrics in designing this year's Swift Spin suit for Armstrong.

Ultimately, a polyester microfiber spandex fabric that the company came across in its research for its Swift Swim suit showed strong results as a bicycle racing material as well.

Depending on the area of the body, the Swift Spin designers used different materials to alter airflow subtly with the idea of limiting low-pressure areas directly behind the rider's body.

For example, the shoulders and arms of the Swift Spin suit are finely dimpled, but the body of the suit is extremely smooth.

Fit has also become a crucial aspect of the design process. According to Jordan Wand, global director of Nike's Advanced Innovation Team, the company's pattern makers have fashioned increasingly tight and wrinkle-free designs. Moreover, as Armstrong loses weight while he gains conditioning during the racing season, new form-fitting suits will be made regularly.

This year, with the help of the new Postal Service team sponsor AMD, the Silicon Valley computer-chip maker, Armstrong was outfitted with a system in a wind tunnel that made it possible for him to see instantly how changes in position affected his aerodynamic drag and the power he could exert.

As a result of the wind-tunnel testing, Armstrong's position on his time trial bike will be more compact and lower than in 2003. Early results from training in California with his redesigned bike were significant. At a Postal Service team training camp in Solvang, Calif., Armstrong flew past his teammates, who were riding in a pace line.

The Nike designers acknowledged that equipment is only one piece of the puzzle in winning the Tour de France. Last year, in one painful time trial stage, Armstrong allowed himself to become dehydrated, losing 90 seconds to his main rival, Jan Ullrich.

It is possible for the Nike Swift suit to trim as much as 90 seconds in a 34-mile time trial, said Rick MacDonald, one of the Swift Spin designers, but he admitted there were pitfalls.

"This is a mathematical model," he said, noting that other factors affect performance. "A rider could have a bad breakfast."

Retaining the Technological Edge

Changes made to Lance Armstrong's equipment and clothing in preparation for this year's Tour de France.

Handle Bars A bonded carbon aluminum bar is being fabricated, to put Armstrong in a slightly lower, more compact position.

Helmet Redesigned because of changes in international bicycle racing rules that require stronger helmets in time trial events.

Suit Composed of three materials and designed to move seams out of the path of the air flowing around the cyclist. Virtually no creases or wrinkles, to affect airflow.

Frame A time-trial frame molded from carbon fiber. Can be changed depending on course conditions. The frame, seat post and front fork are shaped like an aircraft wing to cut through air more effectively.

Computers Used in the wind tunnel, making it possible to adjust rider's position, while getting immediate feedback on changes in aerodynamic efficiency and riding power.

Brakes Aerodynamic design. Also, a front chain ring with fewer holes to disturb air flow.

Shoes Covered with a seamless silver fabric to ensure smooth airflow.

Wheels Altered depending on road and wind conditions. A solid rear wheel might be used in a tail wind to create a kite effect, and wheels with spokes might be used in an uphill time trial.