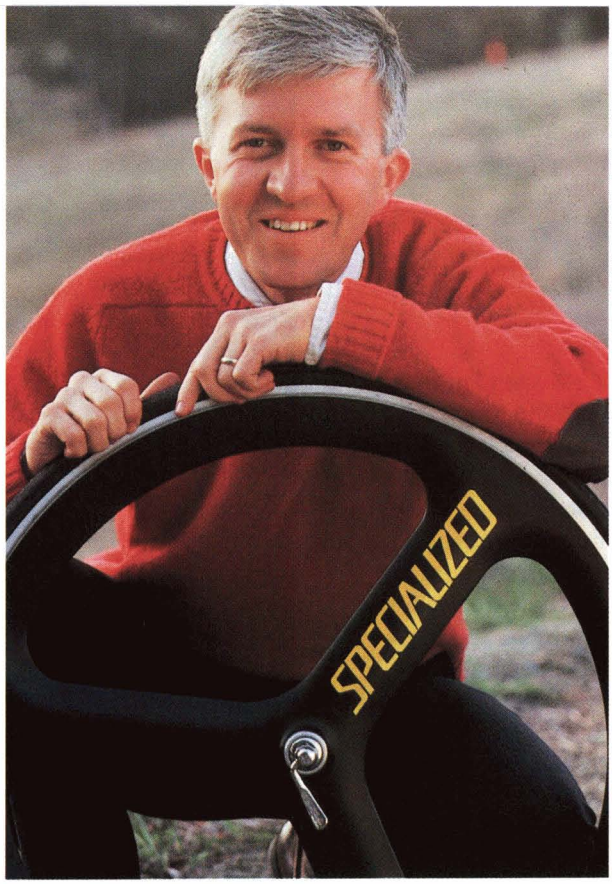
Bicycle Wheel



At right, Mark W. Hopkins displays the new aerodynamic wheel for racing bicycles he designed with colleague Frank S. Principe. Both engineers are members of a "Wheel Team" organized by the Advanced Composites Division of E. I. duPont de Nemours and Company, Wilmington, Delaware. The team developed the wheel in conjunction with Specialized Bicycle Components, Inc., Morgan Hill, California, employing duPont composites technology with NASA aerodynamic and computer modeling technology.

At racing speeds (25-35 miles per hour), multispoked wire wheels create considerable speed-trimming drag. Newer disc wheels offer less but still significant drag and their large surface areas make them difficult to control in crosswinds. To obtain even lower aerodynamic drag, Principe and Hopkins decided that the design should be as thin as possible and should have the fewest spokes that would support the loads the wheel would encounter. The design effort was a complicated task because the thinner the wheel and spokes, the more difficult it becomes to obtain adequate lateral stiffness.

The duPont engineers conducted extensive research on the latest data available relative to drag coefficients for NASA airfoils and determined an optimum profile to balance aerodynamic and structural needs. The basic design they selected is a three spoke wheel, each spoke in effect an airfoil, with a blunt leading edge and a thin trailing edge to maximize aerodynamic efficiency as the spoke moves through the air like a helicopter's rotary wing. To get the requisite stiffness, they employed a composite material of epoxy resin reinforced by fibers of carbon, glass and Kevlar®.

After establishing the basic geometry, the team used sophisticated computer modeling techniques to engineer the material to the target weight and stiffness. Modeling was accomplished by use of PATRAN® and MSC/NASTRAN® computer programs (NASTRAN is an acronym for NASA Structural Analysis; MSC/NASTRAN is an enhanced proprietary version by MacNeal-Schwendler Corporation).

The final product met its targeted performance goals and has a retail price of $750. Introduced in the spring of 1990, the wheel is manufactured by duPont's Pencader Composite Part Fabrication Plant, Newark, Delaware. Specialized Bicycle Components handles promotion and marketing.

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