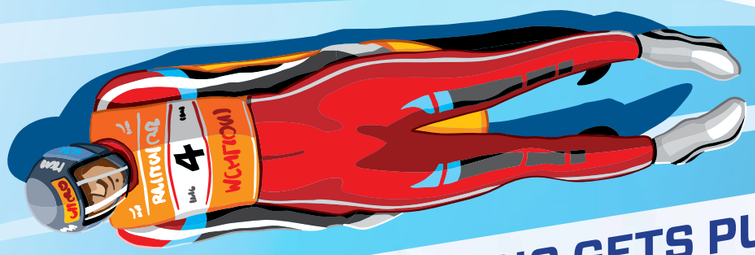
NEED FOR SPEED

BY DEBORAH LEE ROSE



EXTREME ENGINEERING GETS PUT TO THE TEST ON THE OLYMPIC LUGE TRACK.

Olympic athletes compete for medals based on hairsbreadth margins of performance. Nowhere is the quest for Olympic speed—and the engineering advances that enable thousandths-of-a-second wins—more apparent than on the luge track.

Luge athletes, or "sliders," hurtle down the steep, icy chute on open, fiberglass sleds or "pods," pulling an average of 3Gs in a minute-long run. That's about the same gravitational force as astronauts experience during liftoff. Everything, from the athletes' prone positioning, skintight suits, and pointy-toed booties to the lightweight materials and sleek aerodynamic shape of the sled, is designed to minimize friction and maximize speed. That's a tall order at the Beijing Winter Olympics; the Yanqing National Sliding Centre features 16 curves, including the world's first 360-degree twist.

To prepare for the 2022 luge singles, doubles, and team relay races, athletes worked in close collaboration with engineers, whose advanced research and expertise in manufacturing technologies from computational fluid dynamics to 3D printing led to the creation of the fastest, strongest, and most efficient sleds in the sport's 58-year Olympic history.

Among those leading the race to reduce drag force and boost safety and performance is a team made up of Clarkson University mechanical and aeronautical engineering professors Doug Bohl and Brian Helenbrook, as well as Colby Mazzuca of AeroWorks Engineering. Funded by the National Science Foundation, the team is optimizing the aerodynamics of luge sleds used by US athletes in national and international competitions.

LUGE FACTS AND FIGURES

FIRST OLYMPIC LUGE COMPETITION:
1964

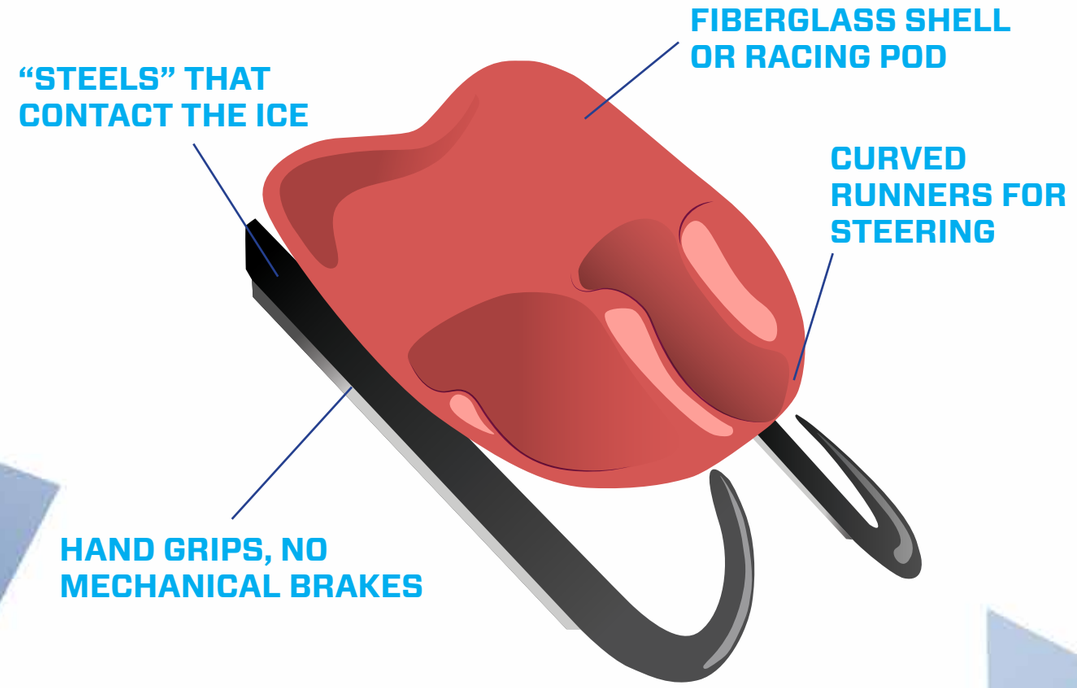
FIRST US DOUBLES MEDAL:
1998

FIRST OLYMPIC USE OF A REFRIGERATED TRACK:
1980

FIRST US WOMEN'S SINGLES MEDAL:
2014

FIRST US MEN'S SINGLES MEDAL:
2018

SLED COMPONENTS



DESIGN BY TONI RIGOLOSI

2022 OLYMPICS

TRACK GRADIENT

18°

VERTICAL DROP:

117 M (384 FEET)

TOTAL CURVES:

16

NICKNAME:

FLYING SNOW DRAGON

RACING TRACK SURFACE:

ICE

SLED FORCE

5Gs (ON BANKED TURNS)

SLED SPEED

145KM (90 MPH)

Clarkson University graduate student Phillip Buck puts a model through wind-tunnel tests.

Image courtesy of Clarkson University

For Bohl, an expert in fluid dynamics, the challenge is professional and personal—both he and his son are sliders, though not in the Olympics. Where luge athletes once hand-shaped their own sleds by instinct, experience, and feel, luge engineers now have an expanding toolbox of advanced technologies. These include laser scanning of athletes' bodies, computer models of sleds with sliders on them, and wind-tunnel tests of both standalone sleds and athletes in racing position. With these tools, plus 3D printing to quickly make molds for specialized sled components, engineers and luge team athletes hope they can further slash race times and propel more US sliders to the Olympic podium.

Beyond the world of sports, engineering knowledge gleaned from luge twists and turns "allows us to make engineering and design advances that can be applied broadly across many technologies," explains Bohl, whose team is investigating how to use advanced computational simulations and experiments to automate the aerodynamic design of a complex system. For example, their process could be applied to design car shapes of the future, reducing aerodynamic drag and increasing fuel efficiency to help lower environmental impact. In addition, says Bohl, "there is a 'fun factor' of speed and Olympic dreams in this project. We get to help current athletes achieve their personal dreams by working to provide advanced equipment." The luge project "also allows us to connect younger students, who will become the next generation of engineers, to STEM in a unique way. The fun factor draws them in, excites them, and shows them that STEM is also fun and exciting. That makes this project doubly rewarding to us."

Deborah Lee Rose is an award-winning author and STEM writer. Her latest book for young readers is ASTRONAUTS ZOOM!, *about the International Space Station.*