General Information

Source: NBC Learn
Creator: Lester Holt
Event Date: 12/08/2009
Air/Publish Date: 12/08/2009

Resource Type: Video Science Explainer
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Copyright Date: 2009
Clip Length: 00:04:20

Description

Ski-jumping--hurtling down a ramp at speeds of 60 mph, then soaring through the air--is an excellent illustration of the aerodynamic forces of lift and drag. NSF-funded scientists Paul Doherty, of The Exploratorium in San Francisco, and physicist George Tuthill of Plymouth State University, explain, along with U.S. ski team members Todd Lodwick and Bill Demong.

Keywords

Citation

MLA

APA

CHICAGO MANUAL OF STYLE

Transcript
Air Lift: Ski Jump
LESTER HOLT, anchor:
This year, the U.S. team is a serious medal contender in Nordic Combined, a sport that combines ski jumping with cross-country skiing. U.S. hopefuls Todd Lodwick and Bill Demong, along with George Tuthill, a physicist funded by the National Science Foundation, explain the principles of physics behind the long, soaring jumps.

Hurtling down a snow-covered ramp at speeds well over 60 miles an hour, jumping off the edge, and launching into the air, then landing two football fields away from where you started. Ski jumping looks pretty simple, right? In fact, each step of a jump, from takeoff to landing, requires a complex manipulation of forces: gravity, drag, lift.

TODD LODWICK (U.S. Ski Team - Nordic Combined): If you can think of an airplane trying to land on a runway, we're pretty much doing the exact same thing.

HOLT: Todd Lodwick is planning to compete in his fifth Winter Olympics with the U.S. Nordic Combined team. For the aerial portion of the event, Lodwick knows that controlling his body position will mean the difference between a gold medal and disaster.

LODWICK: I think the number one thing in ski jumping is actually flexibility. You have to be very flexible, so that you can get into a position you feel comfortable and powerful enough to get out of.

HOLT: During his jump, a ski jumper has to put his body in two completely different positions: one for coming down the ramp, another for gliding through the air.

Dr. GEORGE TUTHILL (Plymouth State University): They have two contradictory missions. The first is on the end run, and just before the takeoff, is to gain the maximum amount of speed. In the air, they are trying to maximize the effect of the air on them. Maximize the lift that's produced by their body and the skis.
HOLT: As the ski jumper comes down the ramp, or “in-run”, the air around him creates resistance, also known as drag. To minimize drag, the skier will streamline his posture.

TUTHILL: That involves, the chest parallel to the snow as much as possible, the head down. And the arms behind them.

HOLT: But when the skier reaches the “takeoff,” he has to dramatically re-adjust his body, leaping forward and upward, simultaneously, all in a tenth of a second.

Dr. PAUL DOHERTY (The Exploratorium): When they’re coming down the ramp, they have to minimize the air drag. They want the highest speed possible. But after they leave, they need lift. They want to fly like a bird through the air.

HOLT: Once in the air, the skier re-positions his body, to take advantage of “lift,” the upward force that helps him glide through the air.

TUTHILL: The lift that a ski jumper gets, is more like the lift your hand would get if you held it out the window of your car and angled the fingers up a little bit, holding your palm flat. You would feel a very strong push, of the air, that would force your arm upward.

HOLT: Catching the air has been made easier by holding skis in the "V" formation.

LODWICK: The biggest change in ski jumping over the last 20 years, definitely has to be the “V” style.

BILL DEMONG (U.S. Ski Team, Nordic Combined): When you see videos of old-school ski-jumping, they often have their skis parallel and underneath them. And originally that was what was considered stylish. But what we learned in the late 80s and early 90s is that by separating the skis into a “V” shape, you were able to get 30 percent more lift.

HOLT: That’s because higher-pressure air under the skier, pushing upward, has a wider surface area on which to act.

TUTHILL: And it’s the force of the air on the base of the skis and the chest that really provides the lift.

HOLT: It’s hard to believe, but the first skiers to use the “V” formation actually had points taken off by the Olympic judges.

But this year, whichever skier uses it to best advantage will come home with the gold, and the memory that, at least for a few seconds, he came as close as a human being can get to flying.