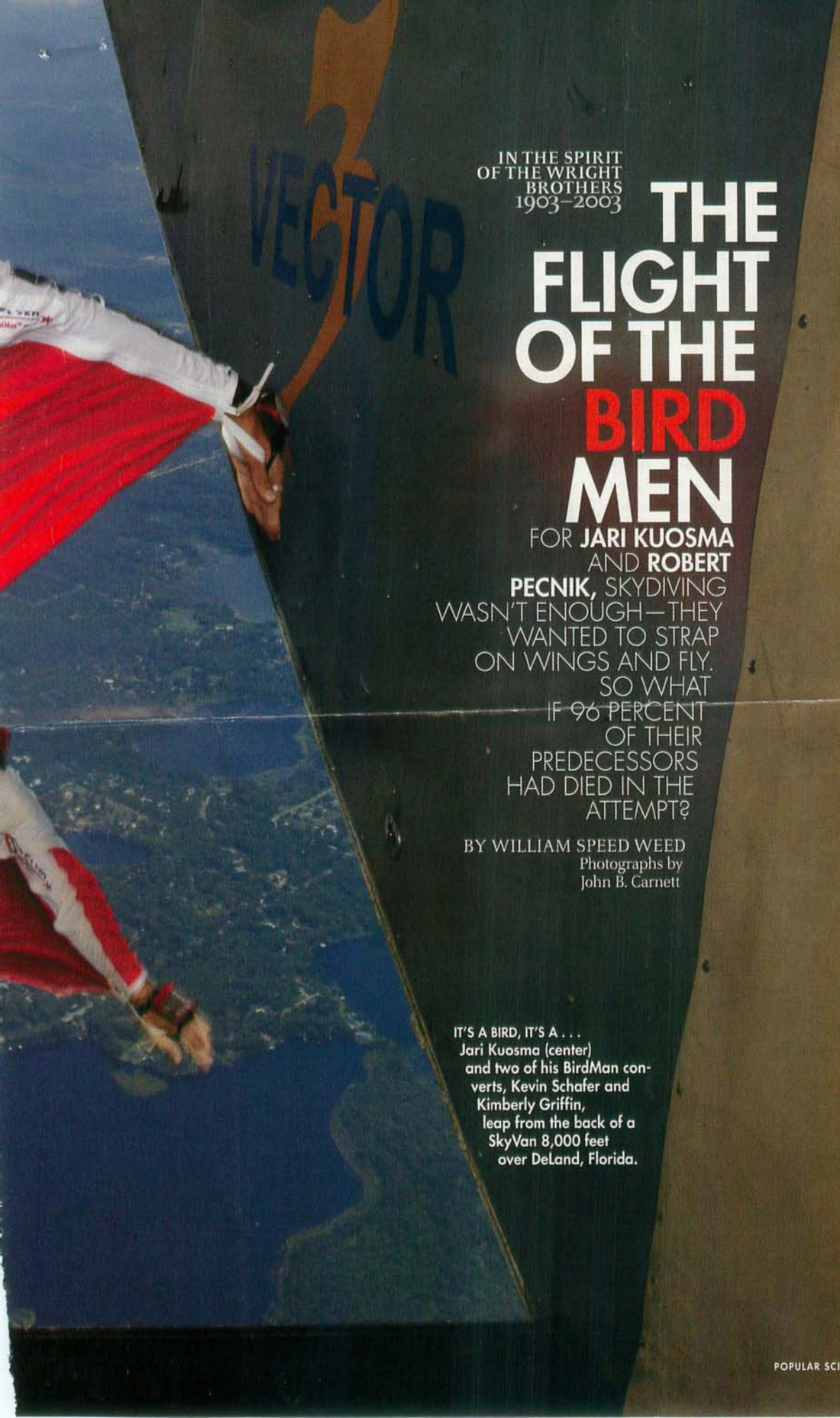


IN THE SPIRIT OF THE WRIGHT BROTHERS 1903–2003

THE FLIGHT OF THE BIRD MEN

FOR **JARI KUOSMA** AND **ROBERT PECNIK,** SKYDIVING WASN'T ENOUGH—THEY WANTED TO STRAP ON WINGS AND FLY. SO WHAT IF 96 PERCENT OF THEIR PREDECESSORS HAD DIED IN THE ATTEMPT?

BY WILLIAM SPEED WEED
Photographs by John B. Carnett

IT'S A BIRD, IT'S A . . . Jari Kuosma (center) and two of his BirdMan converts, Kevin Schafer and Kimberly Griffin, leap from the back of a SkyVan 8,000 feet over DeLand, Florida.

Waiting on the ground for the Twin Otter that'll take them up, Blossom DeRego and Jari Kuosma look like a pair of avant-garde performance artists posing as flamingos, with bizarre flaps of scarlet flowing from their armpits and between their legs. The other skydivers, milling about in skintight ninja suits, look like superheroes. Once aloft at 13,500 feet, though, they all pour from the plane's side door, and suddenly there's no doubt who the superheroes are. DeRego and Kuosma's scarlet flaps transform into wings, and the dynamic duo swerve and swoop through the sky like they're heading for the Hall of Justice.

Poor ninjas. They just drop like cannonballs.

DeRego, a personal trainer from Hawaii, recently moved to DeLand, Florida, to live in the skydiving capital of the world. With 593 jumps, she's a veteran cannonballer. But this, her first flight in a BirdMan suit, is something entirely new. The moment she's out the door, she feels as if she's flying two miles above Earth. *She* is flying—her body alone, unaided by plane or glider. She zings from cloud top to cloud top, screaming with glee. The suit's three wings (the flaps under each arm and between the legs) increase her body's surface area by 100 percent, cut her fall's terminal velocity by two-thirds, and propel her forward to whoosh about the sky. Kuosma, for his part, holds down the other end of the experience spectrum. He and his Croatian partner, Robert Pecnik, invented these wing suits. Kuosma's terminal velocity in the suit is a mere 35 mph—as opposed to 120 mph for a ninja-suit jumper—and with his 80 mph horizontal top speed, he can almost outpace the Twin Otter.

Kuosma and DeRego cannot gain or maintain altitude, so, technically, they aren't flying. But because even beginners can swoop two miles horizontally for every mile they drop, it sure feels like flight. After the jump, DeRego's eyes look as if they're on fire. "*Wow!*" she says, and then, clearly at a loss, she just repeats herself—"Wow...Wow!"—over and over. Finally, she breaks into a huge smile and speaks words that humans have dreamed of speaking at least since Daedalus built wings of feather and wax: "I was flying!" she says.

IN AUGUST 1998, just days after meeting for the first time, Jari Kuosma and Robert Pecnik drove from Slovenia to Arco, Italy, to leap off a 3,000-foot cliff. For Kuosma, this was not an entirely novel activity. He'd begun throwing himself from tall earthbound structures—BASE jumping (the acronym stands for Building, Antenna, Span, Earth)—the previous year, and had maybe a dozen jumps to his credit. In Pecnik, he had instantly sensed a kindred spirit. As a boy Pecnik had strapped homemade parachutes to hamsters and tossed them (without harm) from his sixth-story bedroom window; by the time he joined the Croatian national team he was making his own jumpsuits. Somehow, though, he had yet to do any BASE jumping, a deficiency Kuosma decided to address immediately.

Normal jumpers can free-fall for 11 seconds off the Arco cliff before they need to pull their chutes. But as they stood looking out over the Dolomites, Kuosma and Pecnik had a more ambitious model in mind. They were thinking of Patrick de Gayardon, who, wearing a winged jumpsuit of his own design, had in 1997 flown for a record 27 seconds off Arco. "A BASE jump is an incredible thing," Kuosma says. "But to fly off a cliff like this, now that's something!"

This dream—to fly, utterly on one's own power—is of course an ancient one, a human urge that was barely scratched by the advent of the parachute in the 1780s, the hang glider in the 1880s, the airplane in 1903. These are all still mediated experiences: It's the parachute or plane that's flying; the human's just along for the ride. Then, in 1914, Georgia "Tiny" Broadwick, who a year earlier became the first woman to parachute from an airplane, made the first-ever free-fall jump, plummeting for several seconds before pulling her chute. At last the human body was tumbling free high above Earth.

Still, you could hardly call it flying. Next step: wings. The first wings to arrive on the skydiving scene were actually designed not so much to fly as to make it safer to fall. Before Broadwick's jump, people assumed free-fall would kill you—how could one breathe while moving at 120 miles per hour? The idea that you could control your body under such extraordinary conditions seemed so absurd that no one even tried. People just tumbled out of planes, spinning chaotically and counting seconds until they opened their parachutes. If they pulled while in a warped, upside-down position that snagged the chute, they would "Roman candle" into the earth. The main goal of early birdman wings was to flatten out the tumble.

In the 1940s, Frenchman Leo Valentin solved the free-fall problem without wings. In a few short years, he invented the techniques of advanced free-fall that skydivers still use today: the stable belly-down frog position, the shooting forward arrow position, turns, barrel rolls, and, most important, the life-saving moves used to recover from spins.

Valentin's discoveries, though, did nothing to squelch the urge to fly. In fact, Valentin himself was a master birdman, who worked on dozens of wings throughout his adult life. He even wrote a book (called, naturally enough, *Bird Man*) about his efforts. Kuosma and Pecnik later took the "BirdMan" name for their suits and company to honor him. Valentin's greatest design was a pair of rigid wings so large that he needed a cargo plane to carry him to altitude. In 1956, the huge wings pulled him back into the plane's ramp as he exited during a jump over England. He knocked his head and fell into a tight spin, the massive wings overpowering his well-practiced attempts to recover stability. When he pulled, the wings' rigid structure entangled both his main and reserve parachutes. He tumbled to his death in a snarl of wings and cords and parachutes.

Valentin's fate was hardly an anomaly. From 1930 to the early 1960s, out of 75 actively experimenting birdmen, 72 were killed in the pursuit. The problem was, the technology of the time wasn't a whole lot better than Daedalus's wax and feathers. Before the invention of strong synthetic materials, fabric wings had to be reinforced by wood or metal stays, which tended to cause one of two exigencies: Either the wings would fly too well, overpowering the birdman and dumping him into a terminal spin, or his parachute cords would get tangled in the stays and not deploy properly.

It wasn't until the mid-1990s that a truly modern wing suit emerged, and it was Patrick de Gayardon who wore it. De Gayardon's wings, made of a double layer of parachute material, required no wood or metal stays. Instead, air inflated the wings and held them rigid as he flew. For years, skydivers stood in awe. "He was a daredevil," says Norman Kent, a professional skydiving photographer and an old friend of de Gayardon. Kent


Jari
Performance Designs Inc
BirdMan

recalls the gasps of onlookers when de Gayardon flew into the Grand Canyon or past the glaciers in Chamonix, France. "It was just like watching this wacko do something no one else could do," Kent recalls. To the skydiving world, de Gayardon became *the* birdman, the only mortal the gods permitted to fly.

Then, in April 1998, while testing an upgraded suit on a jump over Hawaii, de Gayardon's parachute cords got snarled, sending him plummeting at 120 mph to his death.

Standing atop the Arco cliff just four months later, Kuosma and Pecnik knew about all this—de Gayardon's recent death, the sport's 96 percent fatality rate. Nevertheless, they resolved in that moment not only to design their own wing suits but to do something even crazier: to build a business around selling them to other skydivers.

Then they leapt off the cliff.

AS DEREGO RUSHES OFF to tell her friends about her flight, Kuosma strips off his flamingo suit, repacks his parachute for another day, and heads to the drop zone bar for a pint of Australian lager. He's wearing neon orange pants and a blue T-shirt

BUILDING A NONLETHAL WINGSUIT

Early-generation wingsuits were death machines, killing 72 out of 75 pioneers. But the BirdMan is safe enough to be sanctioned for sale by the United States Parachute Association—largely thanks to these innovative bail-out and control features.

Arm Release
Once he's opened his main parachute, a birdman must raise his arms above his head to control it. He pulls on these zippers first, detaching the wings and giving him range of motion.

Halfway Harness
The parachute harness is integrated into the suit. Shoulder straps are outside, while the leg straps wrap around the upper thighs under the suit, where they won't interfere with the wings.

Emergency Cutaway
These handles attach to a cable that runs up the side of the diver's body. The cable comes free with a yank, quickly releasing the wings in case of emergency.

Wing Support
Mesh-covered air inlets below the armpits and crotch inflate the three wings. The inflated wings create a three-dimensional shape much like an airplane's, increasing lift.

Leg Release
Zippers also run from the foot to the thigh. A diver opens these once he has opened the parachute so he can run during landing.

with a Superman insignia on it, except the S has been replaced by an icon of a BirdMan skyflier. Kuosma sports rakishly tousled hair and a mischievous grin; he looks like Loki, the Norse god of trickery, posing as Clark Kent.

Beer in hand, Kuosma sits at an outdoor table among a small group of skydiving acolytes and recounts the tale of how he and Pecnik managed to design wings that would not only work but be safe enough for the masses. They started by trying to get technical specs from de Gayardon's estate but were rebuffed. "We had to reinvent it," Kuosma says.

The basics were easy: Put a double layer of parachute material between each arm and the torso, and between the legs. Give each wing a vent—in the armpits and in the groin—so that it can fill with air. Design the wings so that when they become rigid with air, they assume the classic wing profile, a shape that creates lift by redirecting the flow of air downward as it passes over the wing.

A critical determination was the angle the wing made between the torso and the arm. The larger that angle—the higher the arms can extend—the more the birdman's surface area increases and the greater the lift. At the same time, though, the larger the wing, the more strength needed to control it. At a certain point, it will get too large and overpower him in flight. Over the course of several generations of suits, Kuosma and Pecnik ultimately settled on an angle of 78 degrees for the arm wings (the arms are slightly lower than straight out to the side), and 35 degrees for the legs.

With no hard stays in the suit, Kuosma says, "everything you need to do to save your life, you can do with the wings on." A jumper can reach his main chute at the small of his back as well as the reserve chute handle on his chest. But if history taught one lesson, it was the importance of shedding the wings immediately in an emergency. So they designed two wing-cutaway systems. The first is a zipper that runs the length of each arm and frees it from the wing. During normal operations, skyfliers undo these zippers after they've pulled the parachute so they can reach overhead and steer with their toggles.

As a backup, Pecnik designed a novel secondary cutaway that works faster than a zipper. Interdigitated loops of strong nylon, alternately connected to the suit body and the wing, attach the wings to the torso. Running through those loops is a yellow cord, which ends in a small pillow on the side of the thigh. By yanking that pillow, the skyflier pulls out the cord and detaches the wing from the suit's body. "This system was the revolution that allowed us to market the wing suit," Kuosma says. "Because no matter what happens, you can cut away the wings and become just a regular jumper."

Of course, that's an assurance born of 1,300 wingsuit flights. On his very first flight in January 1999, Kuosma wasn't so confident. After five months of planning, drawing and sewing, Pecnik brought prototypes to DeLand, one for himself, one for Kuosma and one for Kuosma's then-girlfriend, a member of the Norwegian national skydiving team. Their mission: to test-pilot their own bodies from 13,500 feet.

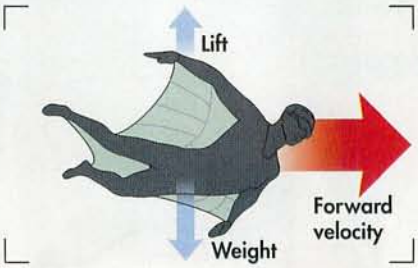
What are your thoughts as the Twin Otter gains altitude and you're about to leap out wearing the sort of suit that has killed almost all of your predecessors? You wish you could test it somewhere safe. Vertical wind tunnels do exist, but they're only a few yards across; a birdman will bang into the walls. You have no choice but to test it from a plane—the higher the better because you'll have more time to react if something goes wrong. "I thought of the history," Kuosma says. "Of how Patrick—the god of this sport with 14,000 jumps—had died doing it. You're stepping into the complete unknown. You have to commit everything you ever knew or cared for. I gave myself a 50-50 chance."

All three jumped at the same time. Their fears vanished instantly. "Right from the door we were flying," Kuosma says. "It was an incredible experience. You pick a spot, a canyon between two clouds, and you fly there. You can play with your own shadow against the cloud. When we landed, it was like a big lightning: This is what I want to do, I thought, and this is what I want every skydiver to experience."

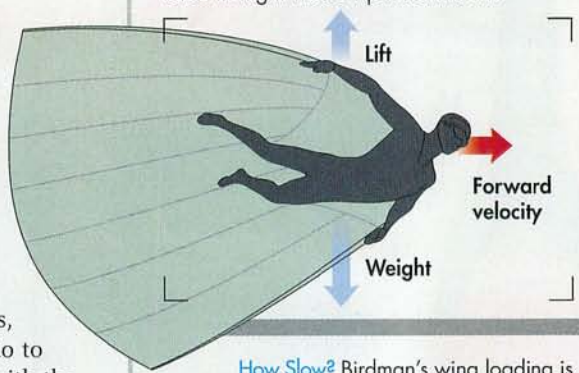
A WING AND A PRAYER

Kuosma and others want to land safely, sans parachute. But without bigger wings, the laws of physics are a bit of an impediment.

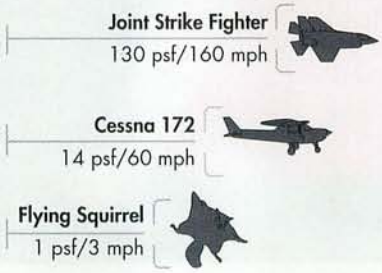
The Basics. Both velocity and wing loading—the ratio of weight to wing area—determine lift. The more weight and the smaller the wings, the faster a flying object must move to stay aloft.



BirdMan's Dilemma. With small "wings," BirdMan must move fast to maintain lift. Large wings—12 feet long—would allow for reasonably slow landings. Yet the added force in flight would rip his arms off.



How Slow? Birdman's wing loading is 90 pounds per square foot (psf), his minimum speed 90 mph. Compare to other high flyers:



JASON LEE

"THE ULTIMATE GOAL," HE SAYS, "IS TO FLY TO THE GROUND AND LAND WITHOUT A PARACHUTE."

BY LATE SPRING of that year, Pecnik had made 85 suits in a factory in Croatia. Kuosma threw them into the trunk of his car and showed them off all over Europe. In August, a year to the day after they had first jumped together at Arco, the two rendezvoused at the cliff in full BirdMan regalia. Both flew for 27 seconds, matching de Gayardon.

In the spring of 2000, they broke a distance record with a demonstration flight in Holland. Dropped at 16,000 feet over the offshore island of Texel, Pecnik, Kuosma and four others flew their BirdMan suits three miles over the Strait of Marsdiep, then opened their parachutes and landed on the mainland. The stunt got noticed, and BirdMan suits started selling.

Three years later, they've sold more than a thousand. Design modifications have extended the length of the wings without increasing the angles, and have tweaked the flier's profile to better approximate a classic wing shape. Recently, in a fourth-generation suit, Pecnik flew for more than a minute off Arco before pulling his chute.

Tens of thousands of skyflights are made each year. So far, only one skydiver has died wearing a BirdMan suit—but it was one he'd borrowed, violating Kuosma's training-is-essential ethic. He won't sell a suit to anyone with fewer than 200 jumps—experienced skydivers, he says, handle emergencies more calmly—and anyone with fewer than 500 jumps must take a safety course. Curiously, the course doesn't emphasize how to fly. "I don't have any technique to teach you," Kuosma told DeRego. "You know how to do it already. Just think about where to go and you'll turn."

What Kuosma does teach DeRego is to keep her arms symmetrical; an imbalance could spill her into a spin. If you feel the wings overpowering you, he says, pull your arms and legs in, reducing surface area. If it gets really bad, just cut the wings away. Above all, if it ever feels scary, pull your parachute. Kuosma learned that lesson in February 2000 while testing Pecnik's latest design. "Robert thinks I am his hamster now," Kuosma says with a laugh. "These wings were much longer and larger than we'd ever tried." The suit performed so well that it overpowered his shoulder muscles. "Super fast, I knew this flight was no longer under my control," he says. "I instantly remembered why all those early birdmen died, so I pulled my parachute, before the forces grew so big that I could not open it."

All in all, though, dangerous spins are a rarity among skyfliers. A bigger concern, Kuosma says, is the tendency to focus too much on the fun and not enough on the ground. "Sometimes people are flying too low before they open their parachute," he says. "It's such an amazing feeling that you think you can take it all the way down."

AND WHY NOT? As twilight and the last of the day's parachutes descend on DeLand, Kuosma, now on his second pint, grins around the table at the other skydivers. "Maybe we have to add a little engine to the back for thrust," he says. "And we definitely need to improve the overall profile of the flier. But the ultimate goal is to fly to the ground and land without the parachute."

Kuosma's scheme inspires enthusiastic nods among the other skydivers, but not everyone is so supportive. "They're deluding themselves," says MIT Professor of Aeronautics R. John Hansman. The problem, he says, is a number called wing loading, the ratio of an airplane's weight to its wing surface area. A light sailplane has a wing loading of about six pounds per square foot of wing, which allows it to land at very slow speeds. A fighter jet, with a wing loading of 100 pounds per square foot, requires landing speeds of 120 to 150 miles per hour. Since our own strength limits how big our wings can be, human beings, with our dense bones and muscles, will always have a wing loading in the fighter plane range, and we'll have to land at similar speeds. "The problem isn't the landing," quips Hansman. "It's the landing gear. Our legs won't run fast enough."

Kuosma, though, does not blench at the arguments of skeptics. "All our inventing so far has been a back-of-the-envelope thing, just two guys with a tiny budget," he says, conveying the implicit "and look at what we've done!" through his grin. He and Pecnik dream of corporate sponsorship—"a few million dollars and the right precision measuring technologies to see where we can improve the suit."

As for the landing gear problem, well, Kuosma has thought about that too. "We'll have to land in foam, maybe, to absorb that speed," he says. "Or on a ski slope like a ski jumper." Blind hubris? Maybe. But it would be his own hamster body that Kuosma would be putting at risk. And can you blame him for trying to be the first to take the ancient dream of flight all the way to a safe landing? ■

The birdmen who didn't survive: **www.popsci.com/exclusive**

William Speed Weed jumped from an airplane for the first time while reporting this story. He writes regularly for National Geographic Adventure *and* The New York Times Magazine.