The Balloon

Solo Challenger prepa
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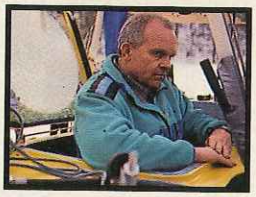


Four balloons are vying to be the first to circle the globe. But only one is flying solo.

e Great n Race

By Robert Gannon

JOHN B. CARNETT (4)

THE ASSEMBLY TOOK ALL NIGHT. Now, just before dawn on January 8, 1996, bathed in the glow of construction floodlights, a 15-story balloon, shedding frost, gently lifts a little yellow gondola from the snow. Inside, dressed in Arctic clothing, warmed by a mobile-home heater that might or might not work, suffering from a cold, squeezed onto a sleeping bench surrounded by camping-trip supplies and electronic gear is Steve Fossett, 51, who got his balloon license less than three years ago. His aim: to circle the globe.

Scarcely two days later, the flight of *Solo Challenger* ended. The shredded balloon wound up lying in a Canadian hay field, its gondola ingloriously on its side, the exhausted man it sheltered wondering if he finally met a challenge he couldn't best.

The trip was short, plagued by equipment failure, and nearly disastrous. It began in the Stratobowl, a 1,000-foot-wide, pine-lined hole sunk 500 feet into South Dakota's Black Hills. The bowl provides protection from the wind, an inflating balloon's most deadly threat. Off to the side sits the crew's workshop, a trailer-size cabin heated inadequately by a roaring propane heater.

For those steeped in balloon history, the Stratobowl is holy ground. *Explorer II* lifted from here in 1935 to carry the first human beings into the stratosphere, with 21,000 onlookers "cheering themselves into a frenzy," according to a local paper.

Fossett's team has gathered here to make history too. And not a moment too soon. Elsewhere are three other teams preparing balloons and capsules in hopes of circling the globe first.

A British team headed by Virgin Records owner Richard Branson plans to insert the *Virgin Challenger*—a balloon large enough to contain five Boeing 747s—into the jet stream and whisk around the world at speeds up to 250 mph. Branson hopes to launch from Morocco later this year.

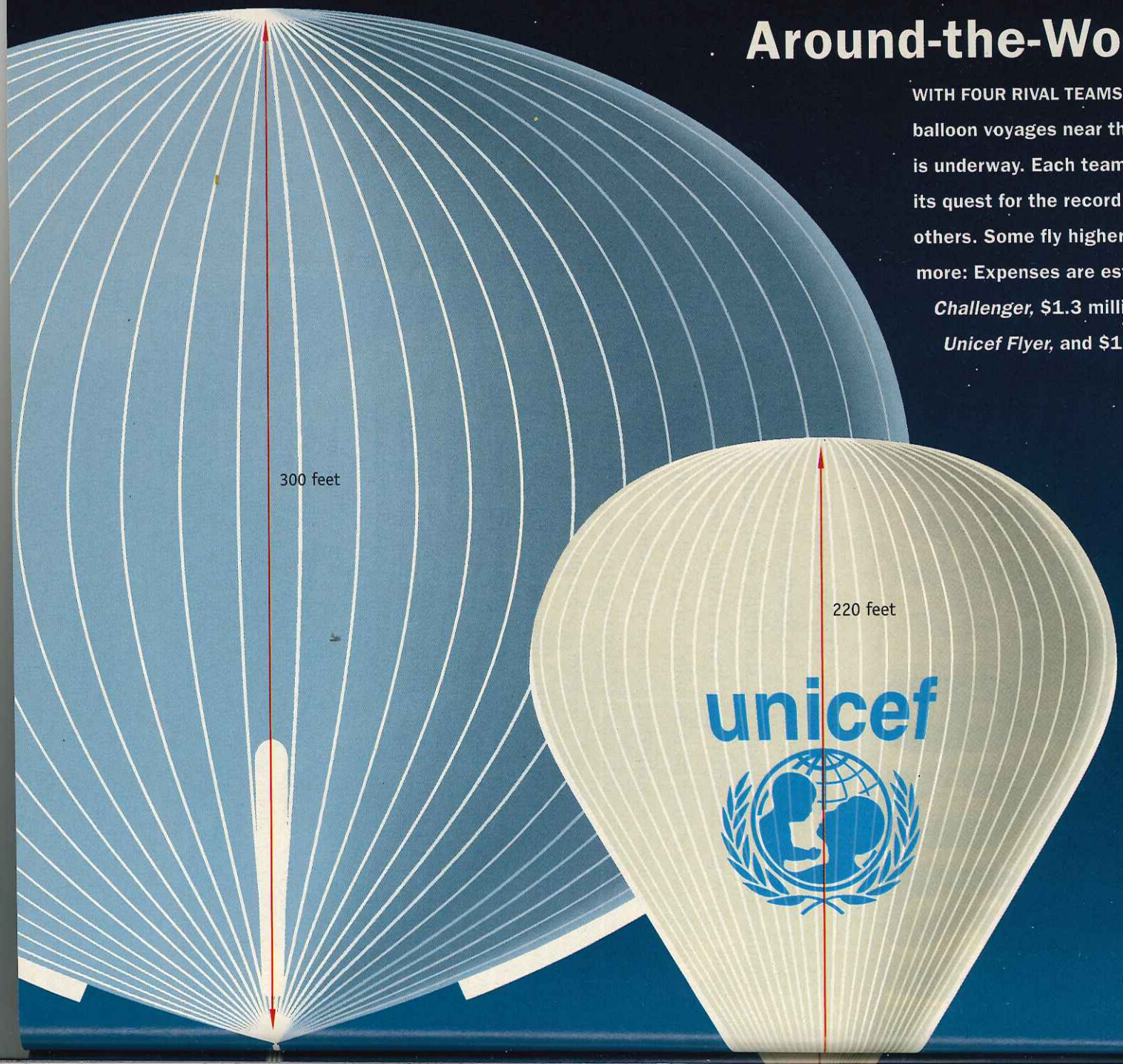
Meanwhile, a Dutch team headed by helicopter pilot and long-distance balloonist Henk Brink plans to launch its 220-foot-high, 800,000-cubic-foot *Unicef Flyer* from the Netherlands. Like the British team, the Dutch crew expects to ride the jet stream in a pressurized cabin. But mechanical and weather problems have temporarily grounded the Dutchmen.

A third team hopes to fly even higher. In December, Americans led by Bob Martin plan to launch the

INFOGRAPHICS BY JOHN GRIMWADE

Around-the-World Balloons

WITH FOUR RIVAL TEAMS planning to launch globe-circling balloon voyages near the end of the year, a race of sorts is underway. Each team is using a different strategy in its quest for the record. Some balloons are larger than others. Some fly higher than others. And some cost more: Expenses are estimated at $360,000 for *Solo Challenger,* $1.3 million for *Odyssey,* $3.5 million for *Unicef Flyer,* and $10 million for *Virgin Challenger.*



Unicef Flyer

Flown by a two- or three-man Dutch team, it will hitch a ride in the jet stream, about seven miles up, zipping around the world at speeds between 100 and 250 mph. The crew plans to launch from the Netherlands sometime this winter.

Virgin Challenger

A British crew of three will also fly in the jet stream. They could experience dramatic G-forces when their balloon first hits the fast-moving air. Sponsors planned a February launch in Morocco, but the jet stream didn't cooperate. They'll try again between October and February.

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Odyssey

The largest of the four balloons when fully inflated, it will fly about 24 miles above Earth in the stratosphere, drifting along at 50 to 60 mph. In an emergency, a parachute could lower the three-man American crew to safety. They plan to launch from Australia in December.

Parachute

60 feet

Conventional hot-air balloon to same scale as balloon drawings.

10 20 30 40 50
FEET

Solar panels

Viewing bubble

Hatch

Bunk

Control console

Virgin

170 feet

Viewing bubble

Flight deck

Bunk

Top hatch

Bunk

Main hatch

All capsules are shown at the same scale.

1 2 3 4 5 6
FEET

150 feet

Solar panel

Control console

Viewing bubble and hatch

Bunk

Solo Challenger

Flying alone, Steve Fossett cruises 4½ miles above the ground at a leisurely pace of about 50 mph. He flies high enough to require oxygen for breathing in his unpressurized gondola—the only one with a viewing bubble that can be opened. But he flies low enough to worry about storms and heat-seeking missiles. Fossett made his first attempt in January; he plans to be ready again by this November.

Odyssey from Alice Springs in central Australia, and ascend into the stratosphere. If they are successful, their gondola will become a tiny spaceship for the trip around the world.

Fossett's quest differs from the other three in major ways. First, he is going solo. The others are not. Going alone is less complicated and more heroic. (Nobody remembers those crews who flew the Atlantic before Lindbergh.) And second, Fossett is flying on a budget—as these things go, a shoestring. Funding for the mission is coming out of his own pocket, with no commercial sponsorship. The total cost is around $360,000. Fossett's competitors are spending between $1.3 million and $10 million apiece.

The record-seeking mission began, in a sense, some 10 years ago. That's when Fossett decided that there's more to life than generating millions as a Chicago commodities trader. That's when he swam the English Channel. A little later, he competed in the 1,100-mile Iditarod dog-sled race. And just last September, he broke a 110-year-old sailing record by skitting his trimaran from Yokohama, Japan, to San Francisco in 17 days.

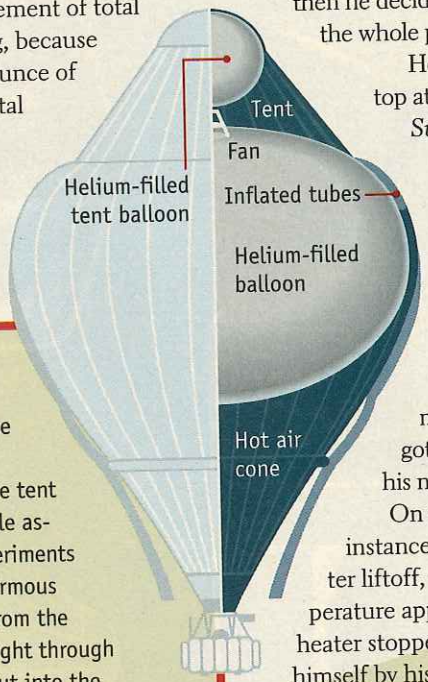
He liked it—liked the challenge, the pitting of himself against the elements, the requirement of total focus. Good thing, because he'd need every ounce of physical and mental strength in his attempt to be the first around the world in a balloon. "Flying around the world solo is the top ballooning milestone," Fossett said a few days before takeoff. "The classic. It's the greatest unachieved goal in aviation."

A year earlier, there had been *two* unachieved goals. The other was the solo crossing of the Pacific by balloon. Then in February 1995 the understated, soft-spoken stockbroker climbed inside his plastic gondola and floated 5,436 miles from Seoul, Korea to Saskatchewan, and right then he decided to waft around the whole planet.

He doesn't look like a top athlete. As the *Chicago Sun-Times* once wrote, "He doesn't pump iron, has thinning hair and carries a bit of a paunch." But don't let that fool you; he's got the concentration, got the drive, and maybe most important, got the ability to suppress his need for bodily comfort. On the Pacific flight, for instance, only three hours after liftoff, with an outside temperature approaching -40°C, his heater stopped. He started to warm himself by his generator, but soon that stalled too. Inside the gondola, where the temperature dipped to -20°C, his drinking water froze. He needed that water to soothe his throat, which was parched by the dry oxygen he was required to breathe because his capsule was unpressurized. He had to place his water cans next to his bare skin to thaw them.

Fossett's team toiled more or less independently during 1995 to overcome problems that nearly turned the Pacific flight into disaster. By early December, they had assembled at the Stratobowl to begin integrating their revamped systems.

Equipment that worked well on the six-day Pacific flight had been recycled for the round-the-world trip, expected to take two to three weeks. The pod would be the same: long enough so Fossett can almost stretch out on its



The Roziere Hybrid Balloon

THE PROBLEM with a helium balloon is the daily cycle of heating and cooling. The balloon shrinks at night, losing up to 10 percent of its lift. To halt a disastrous descent into the sea, the pilot must toss ballast (usually sand) overboard. With the sun's return comes the opposite problem: The balloon expands so much that it must be vented to prevent bursting.

Steve Fossett's Roziere balloon, designed and fabricated by Cameron Balloons of Bristol, England, solves the problem by using hot air as well as helium: The main body consists of a 200,000-cubic-foot helium-filled balloon resting inside a 260,000-cubic-foot hot-air balloon. The air inside the larger balloon is heated by a propane burner.

In daylight, the objective is to keep things cool. Cameron accomplishes this by covering the whole system in a shroud of aluminized Mylar. To achieve a double-glazing effect, the Mylar is held about six inches away from the gas cells by two dozen air-filled plastic sausages.

To conserve the burner's heat at night, a protective tent sits atop the whole assembly. "Our experiments show that an enormous amount of heat from the propane passes right through the helium and out into the blackness of space," says Alan Noble, a Cameron designer.

What supports the tent? "We thought of erecting tent poles," says Noble. But since the designers are balloonists, they decided to support it with a balloon. So above the whole works floats a second helium-filled balloon, this one 6,000 cubic feet. Like the larger helium balloon below, it's flaccid at ground level but expands at altitude to lift the tent. A tiny, solar-powered fan automatically turns on in the sunshine to exhaust any daytime heat accumulating in the tent.

The balloon-suspended tent, the air-filled sausages, and the fan are innovations never before tried on a full-scale model.—*R.G.*

sleeping bench, and tall enough so he can sit without bumping his head. The capsule has no windows, but it's equipped with a topside plastic bubble. When Fossett throws back the bubble, and stands up to straighten his knees, his torso pokes into space. At some 4½ miles up—the expected cruising altitude—the view is breathtaking. But so is the temperature, hovering between -32°C and -48°C.

The $315,000 balloon, a 15-story-high model designed and fabricated by Britain's Cameron Balloons, is new. It uses a proven concept, but the design is untested. The balloon is called a Roziere (pronounced Rosy-a), after the first free-flight balloonist, who floated over Paris in 1783.

A balloon lifted strictly by hot air would require too much fuel for a globe-circling trip, and a helium-only balloon would call for too much ballast—at best it could last about four days. To make longer trips possible, Roziere balloons use both helium and hot air.

Fossett's balloon is designed to achieve relative equilibrium during the day. He turns on his burner only to change altitude. But at night, as the gas cools, he must blast the burner every few minutes or less.

How can he sleep? He relies on the world's only balloon autopilot—a shoebox-size device dubbed "Vegematic II." It was designed by lanky, quick-to-smile Bruce Comstock, 52, a world-champion hot-air balloonist and an essential member of Fossett's team.

Comstock's first version of the autopilot sailed with Fossett across the Pacific, and it worked almost flawlessly. But it drifted from its setting an average of 11 feet a minute. And so the new, improved version.

In concept, the autopilot is simple. A microcomputer inside tracks the balloon's altitude and rate of climb, then calculates the optimum time to blast a shot of hot air or to set off an alarm to warn Fossett that something is wrong.

The air for lift is heated using a fuel mixture of propane and ethane. Pure propane is the conventional fuel of hot-air balloonists. But when British team member Andy Elson—probably the most experienced high-altitude hot-air balloonist in history (he once flew over Mt. Everest)—tested equipment for Fossett before the Pacific venture, he ran into trouble with pure propane. "Below -42°C ," he says, "it's quite happy to remain a liquid." Three days before the Seoul liftoff, the team was still trying to find something to add for increased volatility. The answer: ethane, which vaporizes down to -88°C. A 70/30 mixture is good to at least -55°C, the lowest temperature Fossett is likely to encounter.

The freezing cabin was the biggest problem on the Pacific flight. Even though Fossett was sheathed in his Iditarod outfit, he was miserable—or as he puts it in his understated way, "It was very disconcerting."

The trouble, Elson learned later, was simply that the cabin heaters were designed to be used at sea level. "The mixture in thin air is just too rich," he says. "There's not enough available air flowing in, and they choke themselves out." After Elson increased the size of the air intakes, the heaters worked fine during a test flight to 26,000 feet.

A more difficult problem was the generator motor—a 90-ampere automobile alternator charging a 12-volt system. It failed three days into the Pacific flight, and to conserve power, Fossett was forced to break off contact with the world.

The problem here, Elson determined, was a faulty sensor and, as with the heater, air jets that were too small. Elson rewired the sensor to turn on a warning light instead of shutting the unit down, and installed three different jets to be used at different altitudes. But time ran out before it could be tested, so the alternator is limited to nighttime and backup use.

Taking its place as the primary generator is something never before tried as a balloon's main electrical supply: solar cells. Brought in to fashion the system was Bill Yerkes, a balding, fatherly, ex-Boeing solar maven who has been working with photovoltaic cells for 26 years. He is the only team member who is not a balloonist.

"And that's good," he says. "These guys think in terms of what they have onboard, what they're familiar with. *Of course* they use a gas engine to generate electricity. They're *surrounded* by gas." But up in the intense sunlight, a solar array should be ideal.

The solar cells Yerkes chose are old Westinghouse units—lightweight and cheap—originally designed to run water pumps in the world's deserts. He laid out the cells on his dining room table, taped them together with aircraft tape, and assembled a 10-pound array of 15 panels that would dangle beneath the gondola. The idea was that when Fossett got stabilized, he would unfold the array like a Venetian blind. At trip's end, he'd pull it up again. To track the sun, a tiny sensor would activate a small, array-swivelling motor geared down enough to crack off any ice that had accumulated.

In December, Yerkes toted the assembly to South Dakota for its first tryout. The array, now a yard wide and 13 feet long, was carefully unfolded over the end of a Colorado School of Mines stadium bleacher. The tracking mechanism worked beautifully. The Venetian-blind idea, unfortunately, did not; the array stuck halfway open.

Over dinner that night at Rapid City's Firehouse Restaurant, the team brainstormed fixes: A weight at the bottom of the panel? A slippery folding cord? A long stick to poke the panels down? The solution was to discard the idea of in-air deployment. Instead, at takeoff, someone on the ground would unfold the panels as the gondola rose.

But between that December conference and the January liftoff, the whole Venetian blind idea was scrapped. Recasting it was 62-year-old launch director Nick Saum—wiry, holder of dozens of balloon records, team grumpus. Working in the Stratobowl's little shack, he reassembled the panels to make the whole thing rigid. At takeoff, two helpers hung it in place as the gondola lifted. And fold-up at journey's end? "Forget it," Saum told Fossett. "When you come down you're gonna trash the sucker."

That was one worry less. What continued to worry everyone, of course, was the weather. The objective on such a flight is to wait until the polar jet stream is overhead, then snug up underneath it and hope it will haul you along, far enough north to avoid hostile countries, yet not so far north as to invalidate the flight. (Edge too close to the pole, and the trip doesn't count.)

Trouble is, the jet isn't continuous. It often meanders widely, and if you are caught in what balloonists call "loops," you might end up sailing round and round while your supplies diminish and frustrations soar.

To call the weather shots, Fossett tapped Lou Billones, a retired Air Force weatherman, a professor at Omaha's College of Saint Mary, and a professional balloon meteorologist. Enjoying the full cooperation of the armed forces, NASA, and NOAA, he uses satellites and mapping techniques never before employed for balloon trips. Fossett's weather station is the den of his Omaha home.

Billones is confident of predicting the polar jet three days in advance, he tells Fossett over breakfast, and is "fairly comfortable" with his 10-day model. Beyond that, he only shrugs. His main worry is thunderstorms. A storm could rip a balloon apart—sucking it up into its innards, bombarding it with fist-size hail, wringing off the envelope with tornado-force winds, spitting out the gondola like a cherry pit. You want to steer clear of storms.

You do that by changing altitudes, by grabbing a current veering away from a gathering system, or, if the storm is small, by sailing above it. Billones, back in his Omaha den, would send weather forecasts and instructions to Fossett's onboard computer by e-mail. (The other three round-the-world teams, in their comfortable pressurized cabins, expect to float far above any violent weather.)

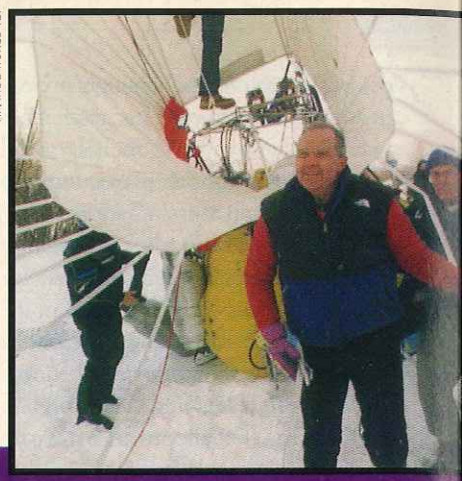
Aside from storms and his nagging cold, as launch day approached, what else was Fossett worrying about?

• Mid-air collisions? Hardly. The atmosphere is big, and his aluminized skin looks like a ball of fire to a plane's radar.

• Rupture? Possible, but unlikely to happen in the calm of mid-flight. The only threat—and it's real—is on take-off and landing.

• Fire? He's surrounded by gases—propane, ethane, oxygen—and much to his crew's dismay, he insists on carrying along a camp stove to heat his military dinners.

AP/WIDE WORLD (2)



Fossett was amazed, he said later, at how much could go wrong on such a short trip.

He's had trouble with fire before. The first night of his Pacific flight, he was awakened when "Vegematic I" announced an abrupt change in altitude—an acceleration downward, he noticed, toward the sea.

He popped open his canopy, reached upward into the night to relight his dead burner, and in his haste, slopped fuel everywhere. He lit the burner, and a fireball as well—but with no great damage. Said Fossett later: "I suppose that was the most exciting moment of the flight."

• Equipment failure? Most certainly. So much is new, so much untested, failures are likely. But most of Fossett's gear is backed up by a second set or an alternative.

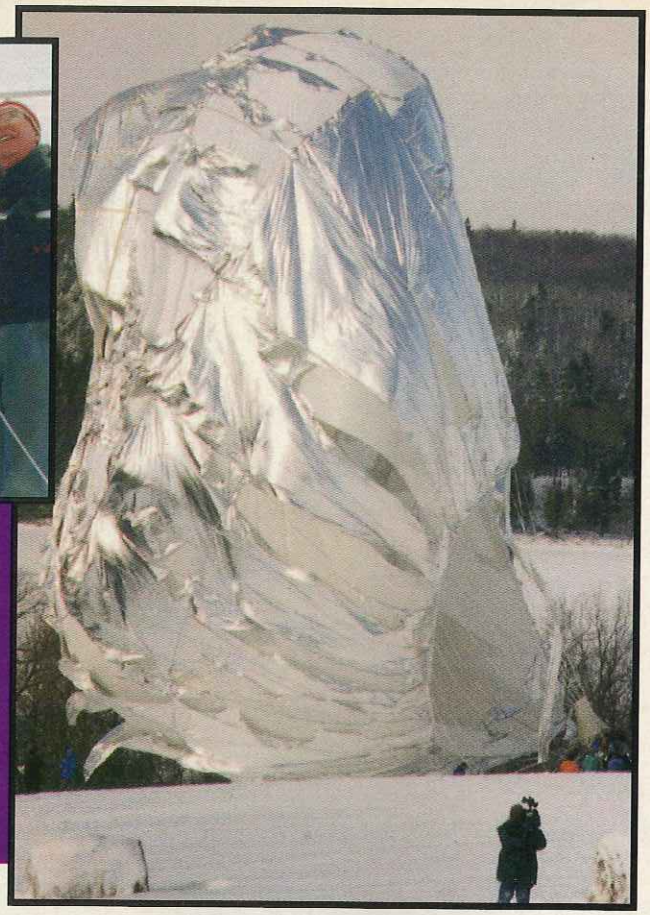
• Icing? Probably no problem. Ice crystals lurking around 27,000 feet might sublime onto the Mylar sheath and build up. The extra weight would lower the balloon into warmer air, where the ice would melt off. "But it's an interesting unknown," says high-altitude expert Elson. "It could shorten the flight by using up fuel or it could damage the balloon."

• Fossett's throat? Because the capsule isn't pressurized, he must wear an oxygen mask. The gas is drier than the Sahara, and his throat can quickly become raw. He bubbles his oxygen through water to pick up moisture.

He's also trying out another plan: acclimatization. For two weeks before the flight, he spent as much time as possible in a little ranger cabin 11,000 feet up in the Colorado Rockies, while his blood generated additional red cells, adapting to thin air.

• General discomfort? That's guaranteed. Boredom during long periods of uneventful floating, yearning for a pressurized cabin so breathing isn't labored, wishing to stand up without the equivalent of a bucket of ice water in the face. As high-altitude expert Elson says from his own extensive experience: "It's hard work, it's cold, it's miserable. You get tired, you suffer from sleep deprivation, you never really get comfortable, and you desperately want a shower—you'd kill for a shower and a night's deep sleep."

• Unfriendly countries? Fossett's biggest worry by far, he says, is not mechanical or physiological, but geopolitical. His flight path could potentially cross 44 countries, and some of them don't welcome air-space incursions. No



Tired and cold, Steve Fossett (in center of photo at far left) inspects his damaged balloon after landing in a Canadian hay field on January 10.

balloonist will ever forget the unprovoked shooting down of a trans-Eurasia balloon by the Belarus military last September 12. (The other contestants float too high for worry. "Heat-seeking missiles go up to only about 37,000 feet," says Virgin's Branson. "If we have to, we'll go to 40,000.")

As it turned out, hostile military gunfire was the least of Fossett's problems. Instead, almost every major piece of equipment aboard the *Solo Challenger* failed. Fossett was amazed, he said later, at how much could go wrong on such a relatively short trip.

The first problem was a launch delay of four hours, caused by minor assembly details. The delay affected the balloon's trajectory, but after meteorologist Billones worked out the details, the new route seemed almost as good as the original.

The first sign of real trouble came two hours into the flight when Saum, taking photos from a plane, noticed rips in the Mylar. Two hours later, another plane reported the Mylar torn along every gore. Just why remains a mystery. The launch was gentle, and Fossett experienced no wind shear.

The balloon's designers speculate that when the craft rose to its initial 17,000-foot altitude, the helium balloon and air-filled sausages expanded more than expected, turning a few insignificant punctures into major rips. With the Mylar ruined, preventing precious nighttime heat from escaping was difficult. At 3 a.m. on the second day, over Ohio, the heater stopped. Unable to light it, Fossett considered aborting. Suddenly it started again—only to continue to behave unpredictably. But by sunset that day, as Fossett crossed the Chesapeake Bay, things looked better; he was even ahead of schedule.

Then the autopilot and its backup quit—probably because the generator broke down, which allowed the batteries, with no nighttime solar input, to discharge. By 2 a.m. on the third day, the power was so low that communications ceased. Fossett couldn't radio his altitude, Billones couldn't send instructions, and back in Omaha, a houseful of meteorologists couldn't figure out why Fossett was off track.

The lack of power was only one cause of poor communications. At times when Billones tried to send critical altitude instructions, CompuServe, America Online, and even the National Weather Service system failed to carry the message. The reason: Fossett was unlucky enough to be airborne at the height of a January blizzard. Everyone was home—overloading the Internet.

By 3 a.m. that day, the burners were cutting out, because there wasn't enough electrical power for the microcomputer controlling them. Even when the burners were working, the ripped outer sheath allowed so much heat to escape that at one point, 200 miles or so east of New York, the balloon dropped some 15,000 feet. Billones was radioing Fossett to climb to 18,000 feet, to get to those currents that could still carry him to North Africa. But by then *Solo Challenger* was grazing the Atlantic wave tops, "kissing the surface of the water," as Fossett put it later.

And all this on only three hours sleep since liftoff two days earlier.

That's when Fossett decided to call it quits. At 6:16 a.m., he sent out a Mayday. To answer came a Canadian Coast Guard cutter, a C-130 Hercules airplane, and two helicopters. The C-130 reported seeing flotsam, including a piece of shiny metal with an American flag on it. That was Yerkes' solar array.

About then is when Fossett took advantage of a little miracle that was occurring in the form of an unforecast low-pressure system centered over Massachusetts, its counterclockwise winds sweeping northwest. He settled into a snow shower that swept him up the Bay of Fundy. His final descent was over a frozen lake near Hampton, New Brunswick. He gently arched up the shore and plopped down in a hay field.

One thing the crew ponders: Had Fossett launched a few hours earlier, as planned, his course would have taken him far out over the Atlantic, far from the front—almost certainly to a crash landing at sea.

Despite that chilling realization, Fossett will try again, probably this winter. "All of us are ready to dig our heels in hard and make this project work," says Comstock. They'll use simpler, off-the-shelf equipment for the next attempt. Although Fossett plans to stick with the Roziere design, the balloon itself will require extensive repairs.

Fossett has lost his early lead in the race around the world. But even if another team gets off the ground before the *Solo Challenger*, one thing won't change: Fossett remains as determined as ever to be the first balloonist to fly around the world alone.