

SHOW 305

Episode Open

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EPISODE OPEN

NARRATION Take a ride on the wild side with these black-footed ferrets, the last of their kind. They're headed back to the prairie on Scientific American Frontiers. Also, can surgeons save this man's failing heart. Watch an astonishing new technique. An Olympic star and his racing kayak help solve the mystery of a lost Alaskan boat. And disabled kids stand tall when confidence goes on sale. All coming up on Scientific American Frontiers. GTE brings you more than the power of telecommunications products and services. A grant from GTE also brings you the power of a new world in Scientific American Frontiers. At GTE, the power is on.

WOODIE FLOWERS Hi, I'm Woody Flowers and welcome to Scientific American Frontiers. We have some terrific stuff for you this time. You're going to find out if the black footed ferret can make it back from the edge of extinction. And you're going to see an amazing new kind of heart surgery. Now, some of you may find parts of these first two stories quite intense. After all, heart surgery's pretty dramatic and although ferrets are cute, they're also predators. So there are some graphic scenes coming. Now these scenes are there because we're showing science as it is, and we've only included footage that's essential to tell the story. So please hang in there. I think you'll be glad you watched.

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RESTORING THE FERRET

You have to come all the way to the badlands in South Dakota to see one of the last thriving prairie dog towns in the country. Once a signature of the West, dog towns are now confined to parks and occasional patches of open land. That's bad news for the prairie dogs, but it's even worse for prairie dog predators. In fact, there's one predator that you just can't find anywhere. Unless you come to a place like this, an animal hospice run by the Wyoming Game & Fish Dept. The only home this black footed ferret has ever known.

Six years ago, wildlife agents rounded up the last 18 ferrets still alive and bred them here under strict sterile conditions. Now, biologists and veterinarians are working out a daring new scheme at the forefront of species reintroduction. This

little kit is one of 450 ferrets raised in captivity. With this kind of breeding success, the program is ready for the final challenge. In a few months, 90 ferret kits will try to reclaim their rightful home on the prairie. While biologists here are devising new techniques to prepare ferrets for the wild, biologists in the field are searching for a place for them to live.

Patrick Millica is surveying a prairie dog town outside of Medicine Bow, looking for the perfect home. A dog town with a lot of healthy prairie dogs to eat. He can't count every burrow, so he just counts the ones that fall under the bar of his surveying wheel and uses them to estimate the town's population. With a compass and the horizon as his guides, Patrick walks several lines through the town to obtain his sample. This looks like a good home for ferrets, but there's competition for this land.

There's Casey Smith on a horse called Bird, number 9.. oh, Smith, come on Smitty, yeah, rank him son, go for it now, buddy. Roll (inaud) bareback rides tonight. Rodeos keep alive the skills and traditions that tamed the West. One of those traditions is raising cattle. The wide open spaces that prairie dogs and ferrets depend on, ranchers like Wayne White use to feed their cattle.

WAYNE WHITE The endangered species act tied to the black footed ferret reintroduction, thee won't be the control on the prairie dogs and if we can't control the prairie dogs on our private land, where there's ferrets, who would want to buy it or, can't make a living off it with prairie dogs on it, and it's definitely going to make an impact on us. No prairie dogs means no ferrets. But as far as many ranchers are concerned, the only good prairie dog is a dead one.

NARRATION He's dead. And ranchers aren't the only ones responsible for the ferret's predicament. Ironically, the same government agencies that are trying to save the ferret killed prairie dogs by the thousands in the 1930s and 40s. As prairie dogs died, their territory was taken over for grazing, so the ferret was left homeless and starving. Today, the very existence of the species rests on the fate of these kits. So, biologists on the reintroduction team are doing their best to prepare the ferrets for life in the wild. The problem is, no one really knows how to do that, so this team is testing some dramatic new methods. One of their goals, sharpen the ferret's hunting instincts. The kits are raised on a mixture of mink chow and ground rabbit. Later on, they get prairie dog meat to develop a taste for their prey. Finally, late a night when they're most active, some kits are confronted with the real thing: live prairie dogs. At first, the ferret is baffled. But eventually, instinct teaches it the rules of this deadly game. It's hard to watch, even for a dedicated biologist like Astrid Vargas, but to improve the ferret's chances of survival, Astrid has an even bolder idea. She's helped to build a mock prairie dog town, where kits grow up in a simulated natural environment, complete with live prairie dogs. If kits raised here do better in the wild than kits raised indoors, mock

environments may become standard in future reintroduction projects. With a night scope, you can see that the ferrets are enjoying their surroundings. Of course, building a whole environment is a lot of work, but biologists think it's worth it.

ASTRID Blackfoot ferrets have gone extinct because of human encroachment, what we've done to their habitat and to their prey base, so from both an aesthetic point of view, because it's a gorgeous animal and from a spiritual point of view, because it's our own fault that they've gone extinct, we are trying to put the ferrets back where they belong. Frequency is .656...

NARRATION To find out whether their innovations make any difference, the team will use radio collars to track the ferrets after release. While sedated, the kits are marked with dye to distinguish this year's release group from future groups and from generations born in the wild. The ferrets are ready for launching into their new world. This prairie dog town near Medicine Bow has everything that ferrets need, and local ranchers, with some reluctance, have been persuaded to cooperate with reintroduction efforts. Ferret shipments are arriving at the site daily. For the indoor kits, this is their first taste of the prairie. For mocktown kits, it's graduate school. They all spend about a week in a cage on the site to give them time to acclimate. Patrick leaves them fresh prairie dog meat to keep their hunting instinct on edge. Ten nights later, it's time to cut the apron strings. The release team has done everything it can to prepare the kits for this moment. Now, they're on their own. From a lonely outpost, US Fish and Wildlife agents are eavesdropping on the ferrets.

AGENT It's moving right below station 6.

NARRATION They know when kits make a break for it by tracking the radio collar signals. If a ferret gets into trouble, they'll try to locate it. Dean Biggens is worried about ferret #27, who hasn't moved in days. Each ferret is both a rare animal and a storehouse of information about species reintroduction, so every animal is important, and losing even one is a blow.

DEAN BIGGENS Well, there it is, lost collar.

NARRATION The ferret may still be alive, but this is bittersweet news, because they lose all data on the animal.

DEAN BIGGENS Yeah, you guys can scratch off number 27 from the animal list. We found the collar just lying on top of the ground here, it evidently came off the animal. 10-4.

NARRATION One month later, at least 17 ferrets are still alive. Twelve percent of the indoor kits are known to have survived. Of the mocktown kits, at least 43%

are still alive. The results are preliminary, but kits raised outdoors seem to fare better. If they survive the winter and reproduce, we will have saved the blackfooted ferret, and we'll have learned how to give other endangered species a second chance.

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BACK BEAT: HEART SURGERY NARRATION This is the most critical kind of medical emergency, racing against the clock to the hospital, but our passenger is not a patient, it's a live human heart, resting on ice inside that box. A few miles from here, there's a 49 year old man with advanced heart disease. He's been waiting more than a year for a donor heart like this. Now there's just 4 hours to get to the hospital and perform that miracle of modern surgery, a heart transplant. Right now, it's the only hope for people whose own hearts are beyond recovery, but our next story's about a startling new kind of surgery, one that may bring an alternative to many patients who are waiting, hoping for their donor hearts to arrive.

NARRATION This 60 year old man's heart is failing. He has just a few months to live, and he can't get a transplant because of a shortage of donor hearts. John Roble's only hope is a bold new experiment in surgery.

JOHN Think there can either be a cardiac trip on this (mature?) and looked at the wall, and I'd rather go through this way and try it, because I really believe in it.

NARRATION In a daring operation, doctors will provide extra pumping power from the patient's own body. They will remove a back muscle and wrap it around the worn out heart. A special pacemaker will stimulate the muscle to squeeze every other beat. There's no wait for a donor and no risk of rejection by the immune system. The only drawback: John must go through a series of rigorous tests to qualify. If his heart's too sick the back muscle won't provide enough power to help. Here at Allegheny General Hospital in Pittsburgh, two out of the 3 candidates are turned down. An echocardiogram using sound waves will reveal John's heart. He's the victim of a viral infection. The damage is similar to that caused by a heart attack. On the left, a normal heart. On the right is John's. His heart chambers have swelled like a balloon. John's enlarged heart is dangerously inefficient. In his final test, a pressure sensor is guided through a vein towards the heart. With his heart like a balloon, the higher the pressure, the worse shape he's in.

DOCTOR We're going to go on and measure the pressure in the right ventricle.

NARRATION John is far worse than they imagined. His pressure, way above normal.

JOHN What's in the back of your mind is that you have a feeling that you may be weak in one area and that you won't be accepted for the test, so you sort of hope and pray that everything works out right and they just point in your favor.

SURGEON JAMES McGOVERN I've had a look at all your tests that you had repeated since you've come back here and this is what, 3 months or so. It's 3-1/2 months since your last... In, consistent with what you relate about your getting tired and such, your tests are worse now than they were 3 months ago, and pretty much across the board...

NARRATION Without surgery, it's a certain death sentence. With surgery, his chances may be no better.

SURGEON JAMES McGOVERN If we don't do something here, it's going to continue to worsen, so we need to intervene in this at this point, so I think that you're still a candidate for the operation but barely so.

NARRATION Though John's glad to be accepted, he must come to terms with a tremendous risk.

SURGEON JAMES McGOVERN I figure this way, even if something should happen along the way, I'd feel like, what they can learn something from me, and if it can help one person coming after me it's worth everything.

WOODIE FLOWERS For Dr. McGovern and his team, John will be only their 29th patient. Behind them, 8 years of research trying to perfect the procedure. Ahead, hours of grueling surgery. The first step. They delicately remove the back muscle, careful not to disrupt its nerve or blood supply.

SURGEON JAMES McGOVERN It's reasonably healthy. It's not as big as...

WOODIE FLOWERS Dr. McGovern holds in his hands a human back muscle.

SURGEON JAMES McGOVERN Which is good.. So now we just need to put the leads in, right. NARRATION The next step is to attach wire leads and apply an electrical stimulus.

SURGEON JAMES McGOVERN All right, let's test the contraction here.

NARRATION If all is well, the muscle should contract. But all is not well. The black one is to the stimulating lead, correct?

NARRATION If they can't fix the problem, they may have to crap the operation. They try another wire lead.

SURGEON JAMES McGOVERN Go up slowly from one...

NARRATION And it works.

SURGEON JAMES McGOVERN Ok, 1.3 is the first twitch, I think.

NARRATION Removed from his back, John muscle twitches at their command.

SURGEON JAMES McGOVERN What's the heart rate here.

NARRATION But the surgeons are facing a deadlier challenge.

SURGEON JAMES McGOVERN Any way you can raise that up.

NARRATION? John's vital signs are weak. With the most dangerous part of the operation ahead, Dr. McGovern considers stopping.

SURGEON JAMES McGOVERN He's clearly sort of wobbling here.

NARRATION But they manage to stabilize John's condition and decide to press on. They turn John over and open his chest to expose the beating heart. The doctor will reach in and pull through the back muscle.

SURGEON JAMES McGOVERN Ok, well let's retrieve this muscle out here first.

WOODIE FLOWERS John's heart is too big for the muscle.

SURGEON JAMES McGOVERN That's not even close here, his heart is gigantic. It's never going to reach.

NARRATION So Dr. McGovern must improvise. The material he uses is dacron.

SURGEON JAMES McGOVERN Sew that on there like that, then we'll... put another one here. Okay. All right, there it is, the longest muscle in the world. If it needs to be longer than that, we're in trouble. Big trouble. All right, suture.

NARRATION Finally, they can wrap John's back muscle around his heart. Even with the extension, it's a tight fit.

SURGEON JAMES McGOVERN It's just going to barely make it.

NARRATION After 6 hours, all that's left is to insert the pacemaker that will sense the heartbeat and stimulate the back muscle to contract at the same time. Though they install it now, they won't be able to turn it on until John's sutures have healed. For his wife Jane, the hardest part appears over.

JANE We just talked to Dr. McGovern and they just got him out of surgery. They said everything went well. They just said he was a little bit worse than they anticipated and they almost didn't do the surgery, so we got very lucky.

NARRATION John is anything but lucky. In the two weeks after the operation, he has kidney failure, pneumonia, a blood infection and three cardiac arrests. All life support comes from tubes. Doctors say there is little chance he'll pull through. With John heavily sedated, Dr. Ignatio Chrislie will turn on the pacemaker for the first time.

DR. CHRISLIE Here's the side fistulator under this (inaud)

NARRATION It will take 10 weeks to bring the back muscle up to full strength. Today, Dr. Chrislie programs the pacemaker to deliver just a small stimulus. Ever so slightly, John's back muscle now beats with his heart. Proof is on the EKG. This is John's heartbeat. When they turn on the pacemaker, its electrical signal creates a new spike on every other beat. Two weeks later, the muscle is ready for more. They give it a stronger stimulus that shows up as two spikes, and they'll keep boosting the stimulus every two weeks. Meanwhile, John struggles to survive. Five... six... seven... Eight weeks later, John has made a miraculous turnaround.

JOHN I don't remember the last two months. It's just a blank. But they said maybe it's better that way too. You know, because all my scars were healed already. I didn't have any pain that I knew of. Today, it's the last big boost in the pacemaker program. John's back muscle will finally beat strongly enough to help his tired heart. With the stimulus turned up high, the pacemaker signal creates five spikes on the EKG, so his heart is getting better. But what about his back?

DR. CHRISLIE The Good Lord just put that muscle in our back because some day at this point we could use it for this particular purpose. It doesn't have much use. It helps in some of the movements, it helps if you're going to row a boat, it helps if you're going to swim backstroke, it helps if you're a fireman or you have to climb a rope or something, which is Ö none of our patients is going to do it anyway. We'll see how you do with this higher step a couple times, and then if its.... This operation is still experimental. It will take years of study to determine how well it works, and whether it should be offered to the thousands of patients

with failing hearts. For John, the only thing that's certain is a long and difficult road ahead. Take a break againÖ How do you feel.

JOHN Tired.

NARRATION Surprise! But after 3 months in the hospital, he's well enough to go home. This is a welcome home party! A place he never thought he'd see again.

JOHN Actually, the folks saved my life, really. I really appreciate it. And saying thank you means so little to me, but I hope it means a lot to you. Thank you

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COLLIDING GALAXIES: ART OF SCIENCE

NARRATION Galaxies in collision. It sounds like a science fiction movie, but today's it's serious science for astronomers Lars Hernquist and John Barnes. Ironically, it turns out that a key part of their research is a movie, a simulation they produced at the Pittsburgh super computing center. In the film, disk-shaped galaxies, flat circles like our own Milky Way, collide, merge and give birth to football shaped galaxies that have been observed elsewhere in the universe. Now, that's just one of Barnes' and Hernquist's discoveries but thanks to their research, we can sit back and enjoy some truly cosmic animation.

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REBUILDING THE LEGENDARY BAIDARKA

NARRATION You know, a canoe is a really nice boat. It's lightweight, efficient, easy to paddle, but where did the canoe come from? I don't mean who manufactured it, but where did the design come from. The answer is, we really don't know. It's the same with kayaks, although nowadays we mass produce boats like this, canoe and kayak design were developed by native Americans so long ago, many thousands of years, that their origins have been completely lost. This great boat building tradition flourished all across the continent, but we're just discovering that one place it was most refined was on the remote Aleutian Islands, halfway to Siberia, a piece of American 1,000 miles from the mainland. And make the memory to be eternal... These Aleut people are bringing their ancestors home. Amen. Holy god, holy mighty, holy mortal, have mercy on us... The dead are 700 years old, but their remains were discovered just a year ago. Since then, they've been studied by anthropologists on the mainland. The Aleuts approved the investigation because the aim was so vital to help honor their own history. Anthropologist Bill Laughlin has worked alongside the people here for 50 years. These 1948 home movies show one of Laughlin's earliest digs at the site

of an ancient Aleut village. His discoveries have revealed a way of life that has thrived here for 9,000 years. The key to this achievement was not on the land, it was out at sea.

LAUGHLIN This is an especially good place to see the historical panorama of the interaction between the Aleut hunters and collectors and the sea from which all their resources came. Everything they needed came out of the ocean, and the biggest challenge of course was just to go out on the open sea and harpoon a sea lion or a whale.

NARRATION The treeless tundra of these islands holds little that sustains life. While the surrounding ocean is rich in whales, seals and fish of many kinds. But to hunt and travel required an ocean going vessel that could stand up to the roughest waters and worst weather in the world. The Aleuts developed a sophisticated boat design that would meet these challenges for thousands of years. Their invention was an ocean kayak named the badarka by Russian explorers. Fast, seaworthy, it was the crowning achievement of the Aleut hunters. Boat builder George Dyson is out to learn the mysteries of badarka design and performance. Accounts by early Russian colonists describe an extremely fast boat, but none survive. To recreate how the high speed bakarka worked, George's only guide is this tantalizing sketch, two centuries old, of an odd looking craft.

GEORGE DYSON From the sketches, and from what is being discovered in burial caves and so on, archeological evidence, how do we reconstruct the, really the dynamics of boat building of that time from what really is only fragmentary evidence. And the only way to do that is by reconstructing the vessels themselves.

NARRATION The original frames were made of pieces of driftwood, a scarce and precious building material. In his workshop north of Seattle, George Dyson has other choices. He's trying out aluminum tubing. While colleague Joe Lubishur experiments with the same design made from wood. The badarka has some perplexing features. A bow like an open jaw. Was it functional or purely decorative? The stern ends not in a point but in a square. Why? Inset in places, bone bearings where the parts rubbed together. The ancient boat builders obviously didn't want a rigid structure. They used loose lashings as well. The result is a very flexible frame. Aleut Mike Micanof sews on a nylon covering. It's a substitute for the sea lion hide his ancestors used. A flexible skeleton, wrapped in soft skin, just like the sea mammals the Aleuts hunted. For the first test, they've chosen a freshwater lake where it will be easy to measure speeds on a quarter mile run. Greg Barton, an Olympic gold medallist, has been recruited to paddle. He'll run the course first in his facing kayak. Greg's strength roughly matches a

typical Aleut hunter who, like Greg, kayaked every day. But his kayak is radically different from the Aleut badarka.

GREG BARTON This kayak is designed specifically for racing on calm water in a straight line. It's very narrow. The main difference between this kayak and the others is that this is much skinnier, has much less resistance in the water.

NARRATION Resistance is created when a boat pushes water aside, forming waves at the bow and stern. The faster it goes, the larger these waves grow. The paddler has to climb up his own waves, so when a boat makes big waves, it reaches a sort of natural speed limit that's tough to beat. Greg's racing boat is more streamlined than the average kayak. You can see the small waves it's creating. Full out, he hits 10 miles an hour, Olympic class sprint speed. Now, the badarka. With its larger hull, it's bound to be slower, but how much slower. No one knows. Greg gives it all he has and hits 9 miles an hour, as fast as the best ocean kayaks on the market today. But the two-piece bow seems to be doing little. It's right out of the water. In fact, what's happening is, the boat is planing, skimming the surface. It's a way to beat the speed limit of its own waves, a trick well known to modern boat designers, but it looks like the Aleuts got there first. The trials were revealing, but not realistic. Badarkas were meant for different conditions.

GREG BARTON If you took the same boats and put them in some 6 ft swells, I'd be swimming to shore with my raceboat and I'll still be on the other boats. And then also the speeds may vary. The other boats probably wouldn't slow down nearly as much, whereas the race boat would be floundering, and you'd be spending a lot of time just trying to keep the boat upright. So for the ultimate test, Frontiers has arranged to bring the badarka back to its roots in the Aleutian Islands. It's summer here, but the weather is still cool, and the waves are ominously large. We're going back to the village of Nikolsky, ancient center of traditional Aleut boat building. They still spend on the sea for their livelihood, but no one's hunted in a badarka for 80 years. George Dyson and Bill Laughlin are on hand for the Badarkas' arrival. The boats are coming 3,000 miles from Seattle, first by commercial jet to the nearest fishing port, then 3 days at sea onboard a 50 ft trawler. Finally, they're transferred to small boats out in the bay, and then the badarka is home at last. For the Aleuts, it's a time of rediscovery. That's marvelous. I think that's the first time now since 1910 that real Badarkas have been brought ashore here. It's a historic moment. The young people have never seen a badarka before, but for the older men, the memories come flooding back. They had piece of sea line height about this wide and about 5 ft long that they put in there and that's where they sat. They used grass for putting under their behinds. Did they carry a lot of stuff in the old time badarkas. Yeah, they did carry quite a bit of stuff, they carried the provisions, you know, stuff to eat and then

sometimes 2 or 3 badarka, you know, a group were tied together to spend the night on a open sea, when they were hunting sea otters.

NARRATION For George, it's the moment of truth. The water is 40 degrees, and it's going to be rough out there. Dangerous waters for the boat's first ocean test. But he's a skilled kayaker and this, after all, is where the boat belongs. As it works its way onto the open sea, the mysteries of the badarka's strange design will be mysteries no longer. The open jaw bow has an obvious function. The lower section pierces the surface, providing clean entry into the water. The wide upper bow gives the boat lift as it crashes into swells. Without it, the badarka would nosedive into the waves. The ancient designers managed to combine different qualities in a single craft, high speed during the hunt, safety and comfort cruising in big seas.

GEORGE DYSON Feels real nice in the rough water, feels like it was made for rough water. The fact that it could achieve significant times on a flat water racecourse, and also cut into this sloppy water as cleanly as it does definitely shows the real virtues of a versatile design.

NARRATION Another virtue is the flexible frame. Working in rough conditions every day, a rigid boat would wear out quickly, but with a shock absorbing hull, the badarka can bend with the waves instead of straining against them. The Aleut designers could also turn the dangerous surf to their advantage, the wide square stern catches the energy from following waves, pushing the boat on its way.

GEORGE DYSON They would surf like crazy if you had the power to get on top of these waves.

NARRATION With an experienced kayaker like George making it look simple, it isn't long before everyone wants a go at it.

GEORGE DYSON Let's go try it out, huh. I'd like to try it out.

NARRATION Larry Pletnikof has never gone kayaking before, and remember, this is an expert level boat, it's very tippy. But even a tumble into the frigid bay doesn't phase the brave at heart. It was great! I couldn't believe he stayed up as long as he did. I wouldn't put anybody who'd never been in a kayak before stay up that long. I did it today! In the hands of its inventors, the badarka is back in home waters.

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SAILING THERAPY IN FRANCE

Lydie Poppasee is paralyzed from the waist down. She is on her way to her daily physical therapy session at this rehabilitation center. Two months ago, an as-yet undiagnosed nerve disorder struck her legs. Now, she has to make the attempt to relearn the basics, to bend her knees, or just to stay balanced for a few seconds.

Hugh lost his right leg in a road accident. Now he has to learn to walk again, with an artificial leg. Bathroom scales help him see if he's putting his weight onto the new leg. He's trying to put a maximum of weight on his right side, you see, because the tendency is to put all the weight on the wood one. For Hugh, as for Lydie, this is grim and hard work. No fun at all.

Raphael, another road accident victim, has irreversible brain damage, but still loves to talk. Raphael finally gets through. Raphael has a daily routine as well, which therapist Bruno takes him through. 20 years ago, patients like Raphael would not have received this kind of aggressive therapy, but now the body's remarkable hidden reserves have been recognized. Progress may be slow, but it's real. It's an exchange between the two of us, exactly like a dance. I have an action, he reacts, and that produces another action on my part. It's a learning process we go through together.

The rehabilitation center happens to be located on a beautiful section of France's Atlantic coast. A few years ago, the staff here had a seemingly crazy idea. This morning, Hugh, Lydie and Raphael are not heading for their regular therapy sessions. They're going for a sail. Like Bruno, many of the staff here are keen recreational sailors. They wondered, why shouldn't the patients take advantage of the area as well. They tried out the idea with borrowed private boats, and it worked so well, that 4 years ago, they persuaded a local bank to donate the center's own boat. Now, every day, weather permitting, a group of patients heads out to sea.

As they leave the harbor, it soon becomes clear that Raphael and his companions are not just along for the ride. It's the first time he'll have tried to steer on his artificial leg. It's going to be very hard. Meanwhile, the others have work to do. Without thinking about it, they're doing the same tasks they do in their therapy sessions. Only now, it's natural. They're motivated. There's a job to do. Even someone as severely disabled as Raphael can join in. And it's not just the physical work that's important. Every day we see the boat on the sea and we can't go, and imagine, and today we can go on this boat and it is very good.

For Bruno, it's the very act of getting away from the center to broader horizons that brings the greatest benefits. I think that when someone has had an accident, his personal horizon becomes really limited. To show him a new horizon, it's a psychological symbol. It has real psychological impact on his rehabilitation. As the day unfolds, everyone gets a chance to work and to have a little fun. I put

progress to second time from this work, it's very, very good. Procedures on the boat are not quite as casual as they might seem. Bruno is familiar with every patient's case history, so with Lydie, he concentrates on her right knee, which shows particular weakness. Once they've avoided running the boat onto the rocks, they can return to the real business of the day.

As they head back in at the end of the day, there's one last opportunity that Bruno exploits. As boats enter the harbor, the square panel, silhouetted against the roof, must be lined up. That puts the boat within a safe channel. It's a perfect exercise in visual perception, something Raphael has to relearn. Until that it, it's time to save the boat again. This time, from colliding with a fishing trawler. Although by now, the locals are getting used to the somewhat unpredictable boat from the center. In fact, not only have the neighbors gotten used to the center's sailboat, they think it's a great idea.

So in what's become an annual event, boaters from miles around have gathered at the center. In the crowd, 130 patients, men and women, boys and girls. At the dock, amateur yachtsmen, fishermen, coast guard, even the local fireman, all here to make the center's special sailing weekend a success. There's even a piper on hand, to play the Farewell to Departing Sailors that's traditional to the area. It's one big party for all concerned, but for the patients, it's more than that. It confirms what their own boat has taught them, that reaching for the horizon is something they can do.

That's it, until next time on Scientific American Frontiers. Please come on back and watch.

NARRATION GTE brings you more than the power of telecommunications products and services. A grant from GTE also brings you the power of a new world in Scientific American Frontiers. At GTE, the power is on.

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