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Rush in *Cyclops 1* at OceanGate's headquarters in Everett, Wash. PHOTOGRAPHER: BALAZS GARDI FOR BLOOMBERG BUSINESSWEEK

It's Brutal to Get to the Ocean's Depths. This Minisub Will Take You There

Only four vessels can reach 3,000 meters, and they're all owned by governments. Stockton Rush is building a private minisub with modified PlayStation controllers and cockpit tablets straight out of *Star Trek*.

By Josh Dean

For years upon years, Stockton Rush dreamed of leaving this earthly plane. "I wanted to be an astronaut," says the man with the satin pilot's jacket and the lustrous silvery mane, speaking at New York City's Explorers Club, one of the few places where a guest might really encounter someone who's exited our planet's atmosphere. Rush learned to fly as a teenager specifically for that purpose, but he became disillusioned with the narrow scope of manned space exploration. He wanted to go far and find new worlds. "I eventually realized I wasn't going to get to Jupiter or Mars," he says. Which was OK, because Rush found a new and even more mysterious universe to explore. "I realized that all the cool stuff I thought was out there is actually underwater," he says,

then begins clicking through slides of creatures from the extreme deep. These are the fish of nightmares and sci-fi films: They have huge eyes or no eyes, spiny protuberances, enormous teeth, exoskeletons. “Here’s the creature from Alien,” he says, showing a slide from the film, and then, click—something in our oceans that looks a heckuva lot like the creature from Alien. Click. “Here’s the goblin shark.” Click. “And the barrel-eyed fish, one of my favorites. It was brought up in nets over the years, but until someone saw it underwater, we didn’t know that its eyes rotate up inside its gelatinous skull.”

There’s no better place to pitch audacity than the Explorers Club, and Rush has come to New York to raise awareness of his quest to reignite curiosity about the abyss. The 55-year-old Seattle native has spent much of the past decade drumming up support for deep-sea exploration, and he’s found people mostly uninterested—or at least wary. Rush longs to shine lights into the dark realms of the ocean, to 3D-map ancient wrecks, to study the bizarre ecosystem of hydrothermal vents, and to see the barrel-eyed fish in its element, but he keeps running into the same problem: There’s no good way to get down there and do any of that.

Small, robust, deep-diving submarines known as submersibles are the spaceships of the deep, and they’re in preciously short supply. “I didn’t understand why there were only a few submersibles in the world that could go to the average depth of the ocean,” Rush says. That’s about 3,800 meters (12,500 feet)—or so we think. The ocean floor is only crudely mapped. We know it less well than we know the surface of the moon.

Approximately half of the ocean is at least 3,000 meters deep, and there are four active vessels capable of getting there, each owned and operated by a national government and not available to the private sector: France’s Nautile(which can dive to 6,000 meters), Japan’s Shinkai (6,500 meters), China’s Jiaolong (the newest and deepest diving, capable of 7,500 meters), and the U.S.’s Alvin (4,500 meters and best known for helping to find the wreck of the RMS Titanic). “A couple of years ago, Alvincelebrated his 50th birthday,” Rush says with a smirk, as an image of the rotund, almost cartoonish little sub pops up among the slides. “There are not many pieces of high-tech equipment that celebrate 50th birthdays.” Alvin has been “massively upgraded,” he says, “but it is an interesting statement on how much money has been invested, or not invested, in submersibles.”

Rush earned his money “the old-fashioned way,” he says. “I was born into it and then grew it.” His grandfather was an oil and gas magnate who made a fortune in Indonesia. Rush has been investing in startup companies most of his adult life while also working in aviation. He was a commercial jet transport pilot at 19 and later a flight-test engineer for McDonnell Douglas Corp. When he has time, he still flies the Glasair III experimental airplane he built from a kit, but since he acquired his first submarine in 2003, his focus has been on exploring underwater. That sub, a crude, two-person tube based on plans once sold in the back of Popular Science, looks like a steampunk sculpture that puttered out of Burning Man or a giant propane tank that fell on its side. (“I hate when people say that,” Rush says.)

“Humans are naturally terrified of going underwater, but that’s where the coolest stuff is”

He bought the sub partially assembled out of a dusty hangar in California and finished the job himself. He loved that little sub, even though it could dive to only 100 meters and required him to lie face down staring out a window in the floor—and terrified anyone he took for a ride. These faults were superfluous; what mattered was that the sub gave Rush a chance to begin exploring the vast realm beyond the capability of scuba equipment.

And that sealed it. He decided this would be his calling, to reignite man’s fire for the deep.

In 2009, Rush founded OceanGate Inc., a company promising “manned submersible solutions” for the deep ocean, and began a crash course in submarine design. He and a partner, Guillermo Söhnlein (who’s since left the operation and is now only a small shareholder), bought and modified two larger subs as steps toward the real goal—a multiperson submersible that can dive to 4,000 meters and beyond.

That sub, Cyclops 2, should be ready for sea testing by yearend, leaving just enough time to complete safety certification for the thing Rush is most eager to promote in New York: a 2018 trip to the wreck of the Titanic, which lies 3,800 meters beneath the surface of the North Atlantic, nearly 400 miles off the coast of Newfoundland. In April, OceanGate sold the last of the 54 spots available for the first year, at $105,129 per person. That’s the inflation-adjusted price of a first-class ticket in the Vanderbilt suite on the Titanic’s first and only voyage.

Rush assumes that once the sub is out in the wild and ferrying billionaires into the deep, commercial clients of all sorts will beat a path to his door. But—at least now—he cares far more about what it will mean as a symbol for the forgotten ocean. “It didn’t take off like space did. It doesn’t have the visuals,” he tells the Explorers. “Had I known what was there and had it been popularized by movies like Star Trek. … Humans are naturally terrified of going underwater, but that’s where the coolest stuff is.”

David Lochridge, OceanGate's director of marine operations, pilots Cyclops 1 during a test dive. PHOTOGRAPHER: BALAZS GARDI FOR BLOOMBERG BUSINESSWEEK

Rush didn't set out to take people to the Titanic. It had already been done. Starting in 2005, Deep Ocean Expeditions LLC, owned by an eccentric Australian adventurer and entrepreneur named Mike McDowell, shuttled 197 tourists to the famous luxury liner using two Soviet-era Mir submersibles chartered from the Russian Academy of Sciences during a difficult economic period in which Russia was also selling seats on rockets. The last of those trips took place in 2012, the 100th anniversary of the Titanic's sinking. Rush assumed that meant the market was exhausted. Then he talked to Rob McCallum, the British-born adventurer who led the trips. McCallum told Rush that the only reason the trips had stopped was that the Russians quit renting out the Mirs, which have since been mothballed. "There was never an end in sight to our market," McCallum says. "We just didn't have the machines."

Up to that point, Rush had been thinking about unexplored wrecks, hydrothermal vents, and bizarro sea creatures, not to mention the many ways a capable sub could be leased out to an oil and gas company to service undersea wells and oil platforms, or to a research institution to do surveys of sea cucumbers, or to the CIA/NSA/DIA to do whatever it is that spooks do on the floor of the ocean. He still thinks that's where the company's future lies. But what the market wanted then and there, Rush finally recognized, was more Titanic.

"Even I didn't appreciate how big the Titanic was until we offered it," he says over a plate of pasta a few weeks after the Explorers Club lecture. He's a cheerful, charismatic man whose boyish enthusiasm for adventure makes for easy comparisons to adventure-chasing bon vivants such as Richard Branson and Elon Musk. "For a number of people, it's the most important thing they're ever going to do."

“There’s big stuff out there”

Rush won’t disclose the cost of developing the Cyclops 2, beyond saying it’s “in the tens of millions.” So far, he’s been able to fund OceanGate with his own money, plus seed capital from friends and family. At various points, especially in the early days, Rush solicited venture capital money, but he got only polite rejections. He received similar treatment from oil and gas companies. Everyone, he says, just wanted to wait and see.

None of which slowed his progress or damped his enthusiasm. “People used to ask me, ‘How do you think you can do this if nobody else can?’ I like to point out that the two deepest-diving subs on the planet are the Chinese Jiaolong and James Cameron’s sub”—the DSV Deepsea Challenger, which in 2012 carried the Titanic director to Challenger Deep, the ocean’s deepest point, and is now retired. “They were both built by amateurs who had never built subs before. The sub is not the challenge. The challenge is the business model and the logistics.”

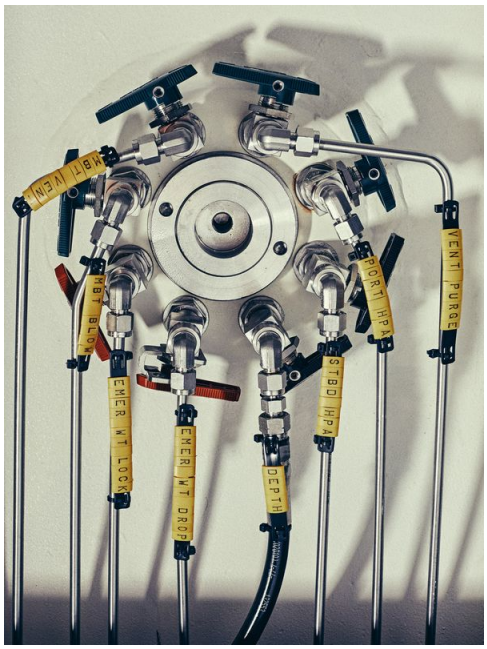
Rush is certain he’ll have the Cyclops 2 ready to dive to the Titanic next May, or he’s at least good at acting certain. He hasn’t made it easy on himself. Since the American naturalist William Beebe first closed the hatch on his so-called bathysphere and plummeted 845 feet under the Atlantic in 1930, every deep-diving submersible has had a hull made of metal—typically steel and occasionally titanium. Rush told his engineers he wanted to save weight by using carbon fiber and also that the hull had to be safe to 6,000 meters. He’s still waiting for the arrival of the hull, which is curing in an oven at a composites company in central California, as we walk through a large garage bay and into the hangar that serves as OceanGate’s base in the port of Everett, Wash., 45 minutes north of Seattle. He’s also waiting for the titanium dome that will be attached to the hull’s end, which is being milled in Pennsylvania.

One reason Rush is so confident of meeting the Titanicdeadline is that about 80 percent of Cyclops 2 will be identical to Cyclops 1, one of the submersibles he bought when he founded OceanGate. (It’s been modified so thoroughly that it looks like a new design.) Cyclops 1, a “working prototype” rated to 500 meters, has been in use for the past few years, including last summer, when Rush took a small group of clients to the wreck of the Andrea Doria, the Italian ocean liner that sank in 1956 off the coast of Nantucket in Massachusetts.

The two subs will share an exterior frame, thrusters, sonar, life support (96 hours’ worth), and control systems, including the modified Sony PlayStation controller that pilots use to “fly” the subs. Rush is proud of this detail. He wanted the operation to be familiar and simple, so a pilot can pick it up easily, and asked engineers at the University of Washington’s Applied Physics Laboratory, who also contributed to the hull design, to match the controls on the submersibles—forward, backward, sideways, pivot, hold—to the buttons of an actual toy.

Cyclops 2 will have numerous differences, too. A major focus is what Rush calls the “user experience.” He wants ambient LEDs inside the cockpit and tablets displaying feeds from the external cameras. Both will help make up for the fact that, unlike Cyclops 1, which has an enormous clear dome at one end, Cyclops 2 will have only a single

small window at the front. It's an unfortunate requirement of the extreme pressures found below 5,000 meters.



Detail shot of Cyclops 1.PHOTOGRAPHER: BALAZS GARDI FOR BLOOMBERG

There's a full-size model of the Cyclops 2 interior in the shop, where OceanGate's engineers can practice the arrangement and installation of components. "What I'd like is for it to be like a holodeck, so the whole inside is a screen," Rush says, running a hand along the perforated aluminum that currently serves as an interior surface. "We can put images on it, and if somebody gets nervous, we give them a beach scene."

Rush has talked to the Scripps Institution of Oceanography about a program in development that's like Shazam, the song-naming app, for sea life. It's probably a few years away, but the concept is compelling. The program takes an image, scans the contents, compares whatever is there to known life forms, and then returns species names in real time. Imagine looking at a live feed of the sea outside as identifying names and information pop up alongside every plant or animal that appears. And then there's the possibility of virtual-reality headsets to make a passenger feel as if she's outside the sub, in the water—a concept in development at the Advanced Visualization Lab at Woods Hole, the famous oceanographic institute in Massachusetts.

"But none of that's really relevant right now," Rush says. "The most important thing is building something that actually gets there and back."

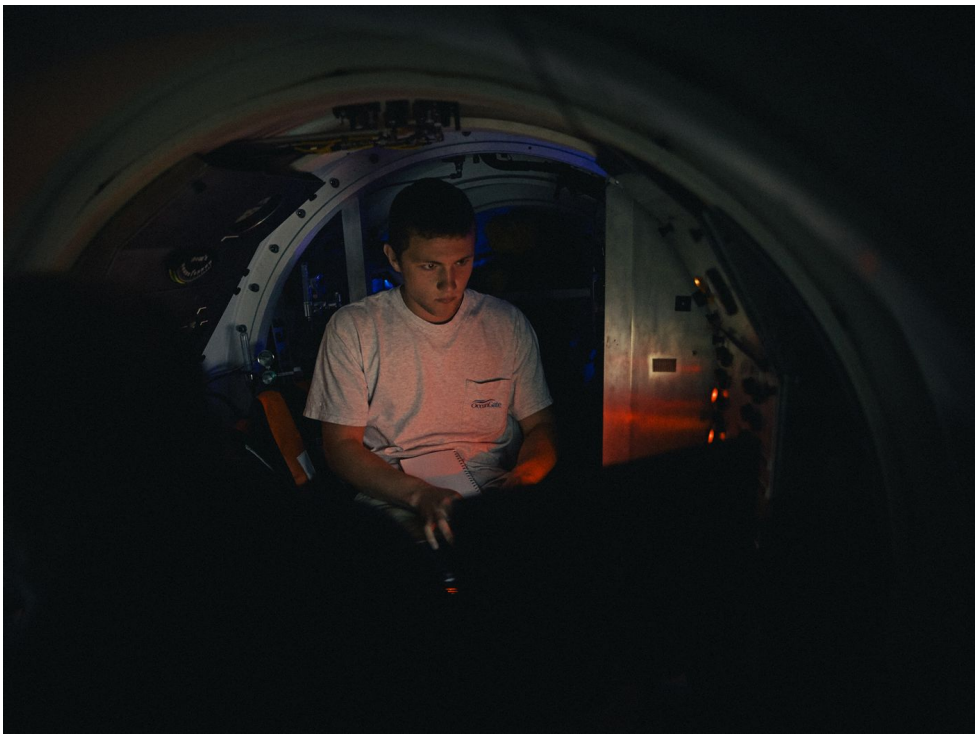
He still can't believe he has to sell the ocean so hard. "I started the business thinking that it's all about proving I can do it," Rush says, sitting at a conference table in the small warren of offices where OceanGate's non-engineers work. And certainly that's been part of it. But the bigger challenge has been proving to people—especially investors—that the ocean matters. "I thought they'd look at it the way I did," he says. Meaning, with slack-jawed, wide-eyed wonder.

Rush continues to be a major investor and has stepped in to write emergency checks when funds have run low. Finally, over the past year, capital has gotten "substantially easier" to raise, he says—deposits for the Titanic trip gave him both money and credibility. "I mean, I'm not quite where SpaceX is," he says, "but it's nice to have some income as opposed to running around just trying to get meetings."

There are other intriguing elements beyond the sub. Rush spent years studying the world of submersibles in search of inefficiencies and realized that the biggest limitation wasn't the submarine; it was the ship required for launch and recovery. All of the world's deep-diving manned submersibles have to be paired with a large ship that

can carry them to a site, then lift them up and over the side into the water for launch. The process of moving a heavy sub overboard and then getting humans into its small hatch is precarious even in calm conditions. When the sea gets agitated, boarding is almost impossible.

Rush realized that if he could simplify the launch and recovery, he could significantly cut logistics costs and make his sub that much more marketable, because it would in theory be easier to move around the world and be useful on more days. There's an old saying in naval operations that he likes to quote: "Your ship is always in the wrong ocean."



Engineering technician Daniel Doran aboard Cyclops 1.PHOTOGRAPHER: BALAZS GARDI FOR BLOOMBERG BUSINESSWEEK

Having a carbon-fiber sub will help. It will be lighter and easier to transport. But Rush's secret weapon is the 35-foot-long flat metal barge on which Cyclops 1 sits. Ms. Lars (an acronym for mobile subsea launch and recovery system) is in her third iteration, with a fourth and hopefully final version on the way. Last summer, for the Andrea Doria excursion, OceanGate just put Cyclops 1 and its barge on a truck to Boston. The barge was pulled to the wreck site behind a run-of-the-mill harbor craft.

OceanGate planned to go back to the Andrea Doria this summer to work on a 3D scan with the sub's newer, better sonar, but Rush decided in early June to scrap that and "conserve manpower to ensure that Cyclops 2remains on track." Instead, Cyclops 1 stayed in Everett to serve as a test mule for its deeper-diving successor until October, when it will be moved to the Bahamas to participate in research at the Cape Eleuthera Institute. "We're going to explore the band between what's scuba-dive-able and the real deep," Rush says. Little is known about that zone—from 200 feet to 1,500 feet, more or

less—and the Cape Eleuthera scientists are keen to study how surface sharks interact with sharks that operate primarily in the deep.

What if the Cyclops 2 isn't ready in time or fails a sea test and requires a significant redesign? OceanGate is both a submersible manufacturer and a tour operator, so it's a question that does come up. In the case of a major delay that would cause Rush to miss the May 2018 window for reaching the Titanic, he'd probably push everything back a year. "I mean, we can do it," he says. "Virgin Galactic's been doing that for, what, seven years?" And people are still putting down deposits for space.

Rush's hope—really, his expectation—is that none of this matters in the end—that the experience of spending a day zooming around a realm very few humans have seen will be so transformative that the product will sell itself and some significant percentage of his clients will become regulars. He even considered a membership model, such as NetJets Inc.'s.

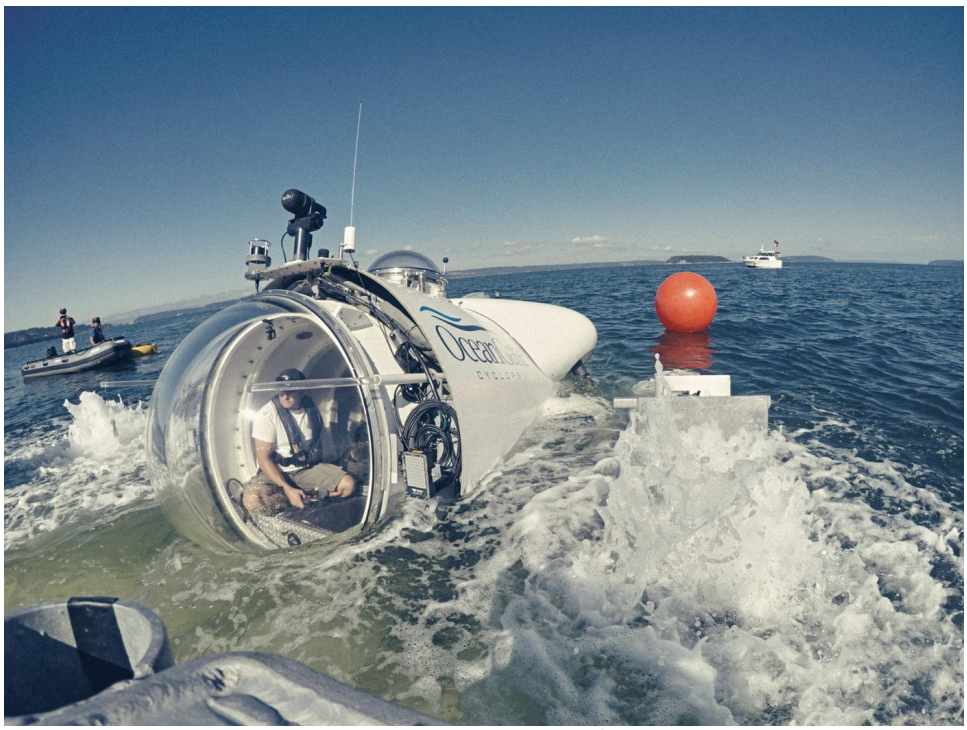
Rush fantasizes about so many dives: a Roman trireme lying several thousand meters under the Mediterranean, World War II fighter planes rusting away in the relatively shallow waters off of Croatia, and the spectacular ecosystems around hydrothermal vents, which support life forms that have evolved without needing sunlight. "There are tons of targets," he says. "The question is, can I get 20 people who say, 'I want to go see this.' "

Rush is an unabashed optimist. It's one of his best qualities as a person and an entrepreneur. And he's also not alone in feeling bullish about the deep ocean in 2017.

Maybe no one has more experience in the deep ocean than Alfred McLaren, a former U.S. Navy nuclear submarine captain, electrical engineer, and president emeritus of the Explorers Club. He says he's spent "close to five and three-quarters" of his years "completely submerged." McLaren led U.S. nuclear submarines in some of the first missions under the Arctic ice, and as an expedition leader for McCallum aboard the Mir subs, he's one of the few people to have visited both the Titanic and the Bismarck, which is 1,000 meters deeper.

McLaren rolls off a half-dozen sites he'd like to visit. A mobile, deep-diving manned sub could go to the Black Sea to look for 10,000-plus-year-old ships preserved in its hypoxic waters, into the mysterious depths of the Great Lakes, or under Arctic and Antarctic sea ice. A nimble sub could even take people into Loch Ness to look for its monster.

The memory that most stands out from McLaren's many dives is a "barracuda-shaped" fish that he and a BBC producer saw while descending through 4,500 meters on the way to the Bismarck. It was more than 20 feet long and had big eyes, huge scales, and a long jaw with jagged teeth. "There are two of us alive who have seen this," he says. "There's big stuff out there."



Lochridge embarks on a dive to test systems designed for Cyclops 2. PHOTOGRAPHER: BALAZS GARDI FOR BLOOMBERG BUSINESSWEEK

Only three humans have been to Challenger Deep, more than 10,900 meters down in the Pacific Ocean. The first two, French inventor Jacques Piccard and Navy Lieutenant Don Walsh, did it in 1960, inside the Italian-built, U.S. Navy-operated Trieste. The third was James Cameron, who commissioned the one-man DSV Deepsea Challenger for the sole purpose of making the trip. The Challenger was plagued with problems, forcing Cameron to cut his time in the trench from six hours to two, but it completed the one job that mattered; it got its pilot to the bottom of the sea and back to the surface safely. Later damaged in a truck accident, it's now retired.

Rush is skeptical of the idea that anyone would want to endure that trip, which would require many hours of ascent and descent in tight surroundings doing basically nothing. ("You're just Spam in a can," he says.) McCallum, who consults for two other deep-sea submersible projects, both in stealth mode, disagrees. He's certain he could sell it: "I imagine there are people in the world who might spend $1 million to get there—to be among the first 10 people to do that is a big deal."

McCallum consulted for OceanGate in the early days, before departing the project for various reasons, including some concern with the way Rush was doing things. He worries that Rush is moving too fast and promising too much. "I know Stockton well and think the world needs more Stocktons prepared to take a chance," he says. "But he's a full-speed-ahead, damn-the-torpedoes kind of guy, and in the submersible industry, extreme depth is all about precision and control. Nothing can be left to chance."

On the other hand, that worry is the same thing that makes McCallum root for Rush and OceanGate. "In Stockton's view, all things are achievable," he says. "If we don't have the technology to develop this, let's develop it. I love that."