

Pioneering the next space tourism option

Joby's attempt could set precedents

Why startups should protect their tech

AEROSPACE

★ ★ ★ AMERICA ★ ★ ★

Jet fuel

from thin air

Meet the technology that could bring air travel to net-zero **PAGE 24**



ANALYSIS
From Apollo to Starship

PAGE 38

TABER MACCALLUM

POSITIONS: Since 2019, co-founder, co-CEO and chief technology officer of Space Perspective. Co-founder, chief technology officer and board member of World View Enterprises, 2012-2018. Co-founder and chief technology officer of Paragon Space Development Corp., 1993-2014. Analytical systems lead for Biosphere 2, 1984-1993.

NOTABLE: Holds multiple technology patents, including for a hazardous water diving suit for the U.S. Navy and the atmospheric monitoring system used in the Biosphere. At Paragon, he and Poynter led the 2014 StratEx project that launched then-Google executive Alan Eustace to an altitude of 41 kilometers via helium balloon for his record-breaking skydive. Explorers Club fellow since 1991.

AGE: 59

RESIDES: Cocoa Beach, Florida

EDUCATION: Left university to work for NASA on self-sustaining habitat experiments on the International Space Station.



JANE POYNTER

POSITIONS: Since 2019, co-founder, co-CEO and chief experience officer of Space Perspective. Co-founder, CEO and board member of World View Enterprises, 2012-2018. Co-founder and president of Paragon Space Development Corp., 1993-2014. Food production systems lead for Biosphere 2, 1984-1993.

NOTABLE: Besides co-founding multiple companies, she has authored two books and delivered a TED Talk on global sustainability that has been viewed over 1 million times. She also helped develop the first carbon credit rating program using mangroves in partnership with the United Nations and World Bank. Holds a patent for the world's first self-sustaining habitat used in multiple space programs. Explorers Club fellow since 1994.

AGE: 60

RESIDES: Cocoa Beach, Florida

EDUCATION: Left university to work for NASA on self-sustaining habitat experiments on the International Space Station.

Space balloon entrepreneurs

Married couple and tech visionaries Taber MacCallum and Jane Poynter are entering a critical period in their bid to create “the world’s first luxury spaceflight experience.” Customers would be lofted into the stratosphere inside a pressurized capsule with windows suspended from a hydrogen balloon providing views of the curvature of the Earth and the blackness of space. But first, MacCallum and Poynter must prove the safety of their design, and they plan to do that in 2023 through a series of uncrewed flight tests from Cape Canaveral in Florida, followed by a flight with a company crew and then the first customers in 2024. They are not alone in the market, having left World View Enterprises, another aspiring balloon company they founded in 2018, to create Space Perspective, for which they have raised \$48 million. I reached them via video call in their Florida offices to discuss their confidence in stratospheric balloon tourism. Here is our conversation, compressed and lightly edited. — *Paul Brinkmann*

Q: Crowds gather to watch rocket launches, and people are paying millions to ride on them, so why do you believe tourists will pay for a long, slow balloon ride?

Jane Poynter: Taber and I have been working together for over 30 years on ways to make space accessible for as many people as possible. So yes, when we think of space travel, we normally think of high g's and training and special equipment like spacesuits. Very exciting, but not for everyone. So we developed this way of taking people above 99% of the atmosphere using a space balloon, which allows this incredibly gentle, comfortable, seamless experience.

Sticklers might note that the 30-kilometer altitude is only one-third of the way to the Karman line, the international definition for the start of space. MacCallum and Poynter feel confident in the term “space” balloons because customers will see the Earth against the blackness of space and stars. — *PB*

We go up on the balloon and down on the balloon — very safe. It's also environmentally sustainable because it's an emissions-free vehicle. So when we talk to people, we are getting a hugely positive response. And since we've shown the design for our capsule's space lounge, people are just blown away because it completely changes our perception of what it means to go to space.

Taber MacCallum: We're also talking to people who want to do both, a rocket and a balloon. They liked the rocket ride, that was a cool experience, but the balloon would be something new and exciting. I get a lot of people who just don't want the rocket ride, but they want that quintessential astronaut experience of looking out the window in space. So it's an accessible alternative.

Q: Why do you want to work in stratospheric tourism like this, and why do it with a balloon?

MacCallum: When we talk with astronauts about some of the quintessential experiences they had and what they got out of it, it was really close to our experience in the Biosphere.

He's referring to Biosphere 2, a greenhouse, habitat and research laboratory north of Tucson, Arizona, built in the late 1980s to demonstrate the viability of closed ecological systems to support and maintain human life in outer space. MacCallum and Poynter spent two years living in relative isolation inside the structure as part of an experiment. — *PB*

We had our world, which we could see, and it was three and a half acres. And when they're in space, they see our world, and you can see sort of the whole thing and understand how big it is and how small it is. And we think that is a really important and valuable experience for people to have. And so the question was, how do you make that experience accessible and not take two years living in a biosphere?

Poynter: On a personal level, and for the company, it's incredibly important that we behave like we are, in fact, crew members on this spaceship Earth. So our capsule, Spaceship Neptune, is essentially zero emissions, and we operate the company as a carbon-neutral company.

Q: Ticket sales opened last summer at \$125,000 per seat, so how many have you sold, and what can you tell us about who's buying them?

Poynter: We've sold out our entire first year and most of our second year, so that is about 600 tickets and 80 flights. It's a broad demographic — people who are saving up to go and people who have bought two capsules, eight seats

“We go up attached to the balloon and back down attached to the balloon. So obviously, that eliminates all the complexities involved with dropping away from the balloon or transferring to another form of flight.”

— Jane Poynter

“I get a lot of people who just don’t want the rocket ride, but they want that quintessential astronaut experience of looking out the window in space. So it’s an accessible alternative.”

— Taber McCallum



per capsule because they want to go with their friends, family or colleagues. About 40% of sales are buying out the entire capsule. Unlike some rocket trips that last only 10 minutes, this is a social experience lasting over six hours with a bar, restroom and music if wanted. We expect people to get married on some trips, for example. And we’ve arranged the seating such that it emphasizes both the incredible view but also the interaction among our explorers.

Q: You describe this as a gentler, more leisurely trip than on a rocket, but are there limitations on age or physical condition for passengers?

MacCallum: It’s a broad demographic that have bought tickets, but it turns out to be part of our licensing with the FAA that the issue of age is coming up. The first reaction from FAA is that you have to be 18 years old in order to sign the paperwork to do the flight. But then we said, “Well, you know, 16-year-olds can get a pilot’s license, and 14-year-olds can fly.” So we’re working with the FAA, and we’re trying to bring that age limit down. Lowering the age limit won’t be in the cards for a while, but we certainly would like to make it younger.

Poynter: With human spaceflight, we generally think about the compartment that holds the people at some point during the flight separating from its primary flight system. But we are able to have the entire flight without having to transfer to another system. We go up attached to the balloon and back down attached to the balloon. So obviously, that eliminates all the complexities involved with dropping away from the balloon or transferring to another form of flight. And that boosts our safety factor and makes this more accessible.

Q: Blue Origin is making a point of flying celebrities and expanding the age range of people who go to space, so how will you choose your first few crews?

Poynter: I don’t think we’ve decided yet who will be on our first flight, but we are really focused on making this broadly accessible. We’ll also be looking for people who can communicate about the experience in different ways — artists and musicians and leaders of all kinds, students, researchers. I mean, when William Shatner came back from his Blue Origin flight, he was very articulate about his experience, and that’s incredibly important.

▲ Space Perspective employees prepare a balloon and weighted test article for a June 2021 test flight near NASA’s Kennedy Space Center in Florida. The balloon and article stayed aloft for almost seven hours before splashing down in the Gulf of Mexico about 80 kilometers off Florida’s west coast.

Space Perspective



Q: You flew a weighted test article, not a capsule, suspended from a test balloon from Kennedy Space Center to about 30 kilometers and then a splash-down in the Gulf of Mexico last June. Where do things stand in testing and production now?

MacCallum: Yes, that test was very successful in terms of how we forecast the flight trajectory, how we manage the recovery ship and to go through the whole concept of operations. That success allowed us to dive into a big design and engineering cycle without having to run that test again. The capsule's interior design is a big part of that design cycle because we needed to lock down the configuration, ensuring we had the right size. Now we are engineering the capsule to the next level and run load analyses. We are in the process of building our first capsule, and we aim to reveal it later this year ahead of our test flight around the end of the year. We anticipate being in balloon and parachute production within a few months. So we'll see a lot of testing in 2023.

Q: As a balloon flight, there is no steering or navigation control, so why do you need a ninth person on board as a pilot?

MacCallum: You need somebody who's going to make sure that everyone feels comfortable. I think it's a bit unnerving not to have an expert there. Also there is a range of things that we'd like to have manual override on, just as a third or fourth level of safety — for example, with the life support system. When you go through the safety analysis, we've found a large benefit in having an expert on board, even just to ensure people are properly buckled in at the right times for example.

Q: I've read that your balloon is a standard design for stratospheric balloons, but tell me more about the hardware and the balloon materials.

MacCallum: It's a classic NASA balloon design: polyethylene filled with high-strength fibers to give it the tensile strength it needs. We're putting some formulation twists on it for added safety for human flight in a routine sense. Fundamentally, it's the same balloon that NASA has done 1,000-odd flights with for weather and other types of research. The person who leads our balloon team is Mitzi Giles, whose balloon designs hold records for mass above 100,000 feet. And she has made a huge number of NASA balloons. So we're really building on NASA's experience with balloons. We have a back-up parachute system, similar to



▲ Space Perspective's stratospheric balloons will travel about 19 kilometers per hour, a gentler ride than the one experienced on vehicles such as Blue Origin's New Shepard capsule. During the company's passenger flight in March, the capsule was accelerated to a top speed of 3,600 kph within minutes.

Blue Origin

parachutes you see bringing a capsule back for SpaceX or Blue Origin. The capsule is made of carbon fiber composite, and the capsule design team is led by Ryon Warren, who formerly worked as a contractor with Virgin Galactic.

Q: What will passengers experience during and after splashdown?

MacCallum: Our team of meteorologists will be forecasting where the splashdown will occur, the right time to begin the descent and the right rate of descent, so that is where our guidance, navigation and control will be. It's just not as complicated as the trajectory of a rocket. During the big test that we did in June, the ship was exactly where we wanted it, between half a kilometer and a kilometer away from the splashdown location, downwind. It was actually 800 meters or eight-tenths of a kilometer away from the splash location. Our recovery team is led by Ryan Nascimento, who developed splashdown recovery for SpaceX and did every recovery through their Inspiration4 splashdown in September. So he's the only person on the planet who has developed capsule recovery and actually done human capsule recovery since Apollo.

Poynter: This will be a truly bespoke experience, meaning it can be tailored to fit the customer expectations. For example, at the end of the flight, you can envision some people saying they've got to go, and we take them straight ashore and off they go. Other people might want to continue the incredible experience of our planet and get on a yacht and sail away or motor away. We're already having discussions about that.

Q: Since this is a hydrogen-filled balloon, how do you address questions about flammability, and do people ask you about the Hindenburg disaster?

MacCallum: Airships like the Hindenburg simply are not meant to have hydrogen as a lift gas. The Hindenburg was designed for helium and only had hydrogen because U.S. law at the time prevented sale of helium to Germany. That was 85 years ago in a vehicle that was not designed for hydrogen. Balloons are significantly different in that it's a single layer, so if any hydrogen leaks out, it just leaks into the air. There have been gas balloon flights dating back all the way to the 1700s, and there has never in the history of gas ballooning been an accident attributed to the use of hydrogen.



Poynter: It's also important to note that helium is non-renewable, and it's in very scarce supply, so much so that the National Weather Service has moved to hydrogen for its balloons. And if you use helium, you're in competition with hospitals and the medical world, which uses helium in MRI machines. We're now seeing hydrogen increasingly used as a fuel. Sadly, the tragedy of the Hindenburg is seared in everyone's memory but frankly is completely irrelevant to what we're doing.

Q: How are you testing the capsule and balloon? Will you be testing to failure, exploding balloons, like Starship tests?

Poynter: No, we're not exploding balloons. We all love to watch that, but we don't need to do that.

MacCallum: I'm sure we'll have the odd hiccup and something that doesn't go right. That's why you're testing. But no big explosions. We'll have a very thorough uncrewed test program before we get into a crewed test program. And that's really where the rubber hits the road. You can do a lot in ground testing and materials testing, and we have an extraordinary materials testing lead to do just that. But in the end, it's got to be flight testing. You just can't simulate those environments on the ground.

Q: What will training be like for passengers?

Poynter: It will be a little more than an airline flight. We'll be asking people to show up three days before their flight, partly due to weather prediction. We want to get people comfortable with the capsule, where everything is, how everything works. There will be a safety briefing to make sure they know how to be buckled into a seatbelt for the first 15 to 20 minutes and at the end of the flight also. Other than that, we want people to give us their drink menus.

Q: What's the biggest challenge Space Perspective is facing now?

MacCallum: The big challenge is getting to routine safe flight. You can do one-offs. We did the StratEx flight in 2014 when we were with Paragon, where we set the world record for human flight under a balloon, but doing flights routinely day in and day out — that means the system has to be absolutely as robust and simple as possible. So separating from the balloon, destroying the balloon, inflating a parachute, flying under a parachute, would add a huge amount of risk and complexity. So it was really Jane's idea to look at splashing down because, you know, you can't miss the ocean. ★

▲ Comfort was the driving force behind the design of the interior of the planned Spaceship Neptune capsule, shown here in a rendering. The reclining lounge chairs and walls of the cabin, which could seat up to eight, would be constructed of dark materials to reduce window glare.

Space Perspective