Strap yourselves in, we're going to Mars. Why the heck should we do this?

12 years ago, I gave a TED talk on 10 ways the world could end suddenly. We are incredibly vulnerable to the whims of our own galaxy. A single, large asteroid could take us out forever. To survive we have to reach beyond the home planet. Think what a tragedy it would be if all that humans have accomplished were suddenly obliterated.

And there's another reason we should go: exploration is in our DNA. Two million years ago humans evolved in Africa and then slowly but surely spread out across the entire planet by reaching into the wilderness that was beyond their horizons. This stuff is inside us. And they prospered doing that. Some of the greatest advances in civilization and technology came because we explored.

Yes, we could do a lot of good with the money it will take to establish a thriving colony on Mars. And yes we should all be taking far better care of our own home planet. And yes, I worry we could screw up Mars the way we've screwed up Earth.

Think for a moment, what we had when John F. Kennedy told us we would put a human on the moon. He excited an entire generation to dream. Think how inspired we will be to see a landing on Mars. Perhaps then we will look back at Earth and see that that is one people instead of many and perhaps then we will look back at Earth, as we struggle to survive on Mars, and realize how precious the home planet is.

So, let me tell you about the extraordinary adventure we're about to undertake, but first, a few fascinating facts about where we're going. Mars is not our sister planet. It's far less than half the size of the Earth, and yet despite the fact that it's smaller, the surface area of Mars that you can stand on is equivalent to the surface area of the Earth that you can stand on, because the Earth is mostly covered by water.

The atmosphere on Mars is really thin -- 100 times thinner than on Earth -- and it's not breathable, it's 96 percent carbon dioxide.

It's really cold there. The average temperature is minus 81 degrees, although there is quite a range of temperature.

A day on Mars is about as long as a day on Earth, plus about 39 minutes. Seasons and years on Mars are twice as long as they are on Earth.

For anybody who wants to strap on some wings and go flying one day, Mars has a lot less gravity than on Earth, and it's the kind of place where you can jump over your car instead of walk around it.

Now, as you can see, Mars isn't exactly Earth-like, but it's by far the most livable other place in our entire solar system.

Here's the problem. Mars is a long way away, a thousand times farther away from us than our own moon. The Moon is 250,000 miles away and it took Apollo astronauts three days to get there. Mars is 250 million miles away and it will take us eight months to get there -- 240 days. That's only if we launch on a very specific day, at a very specific time, once every two years, when Mars and the Earth are aligned just so, so the distance that the rocket would have to travel will be the shortest. 240 days is a long time to spend trapped with your colleagues in a tin can.

And meanwhile, our track record of getting to Mars is lousy. We and the Russians, the Europeans, the Japanese, the Chinese and the Indians, have actually sent 44 rockets there, and the vast majority of them have either missed or crashed. Only about a third of the missions to Mars have been successful.

We don't, at the moment, have a rocket big enough to get there anyway. We once had that rocket, the Saturn V. A couple of Saturn Vs would have gotten us there. It was the most magnificent machine ever built by humans, and it was the rocket that took us to the Moon.  The last Saturn V was used in 1973 to launch the Skylab space station, and we decided to do something called the shuttle instead of continuing on to Mars after we landed on the Moon. The biggest rocket we have now is only half big enough to get us anything to Mars. So, getting to Mars is not going to be easy and that brings up a really interesting question ... how soon will the first humans actually land here?

Now, some pundits (commentators) think if we got there by 2050, that'd be a pretty good achievement. These days, NASA seems to be saying that it can get humans to Mars by 2040. Maybe they can. I believe that they can get human beings into Mars orbit by 2035. But frankly, I don't think they're going to bother in 2035 to send a rocket to Mars, because we will already be there.

We're going to land on Mars in 2027. And the reason is this man is determined to make that happen. His name is Elon Musk, he's the CEO of Tesla Motors and SpaceX. Now, he actually told me that we would land on Mars by 2025, but Elon Musk is more optimistic than I am, so I'm giving him a couple of years of slack. Still ... you've got to ask yourself, can this guy really do this by 2025 or 2027?

Well, let's put a decade with Elon Musk into a little perspective.  In 2005, a lot of people in the automobile industry were saying, we would not have a decent electric car for 50 years. 10 years ago, SpaceX had not launched anything, or fired a rocket to anywhere. So I think it's a pretty good bet that the person who is revolutionizing the automobile industry in less than 10 years and the person who created an entire rocket company in less than 10 years will get us to Mars by 2027.

Now, you need to know this: governments and robots no longer control this game. Private companies are leaping into space and they will be happy to take you to Mars. That raises a really big question. Can we actually live there? Now, NASA may not be able to get us there until 2040, or we may get there a long time before NASA, but NASA has taken a huge responsibility in figuring out how we can live on Mars.

Let's look at the problem this way. Here's what you need to live on Earth: food, water, shelter and clothing. And here's what you need to live on Mars: all of the above, plus oxygen.

So let's look at the most important thing on this list first. Water is the basis of all life as we know it, and it's far too heavy for us to carry water from the Earth to Mars to live, so we have to find water if our life is going to succeed on Mars. And if you look at Mars, it looks really dry, it looks like the entire planet is a desert. But it turns out that it's not. The soil alone on Mars contains up to 60 percent water. And a number of orbiters that we still have flying around Mars have shown us -- and by the way, that's a real photograph -- that lots of craters on Mars have a sheet of water ice in them. It's not a bad place to start a colony.

Now, here's a view of a little dig the Phoenix Lander did in 2008, showing that just below the surface of the soil is ice -- that white stuff is ice. In the second picture, which is four days later than the first picture, you can see that some of it is evaporating.

Orbiters also tell us that there are huge amounts of underground water on Mars as well as glaciers. In fact, if only the water ice at the poles on Mars melted, most of the planet would be under 30 feet of water. So there's plenty of water there, but most of it's ice, most of it's underground, it takes a lot of energy to get it and a lot of human labor.

This is a device cooked up at the University of Washington back in 1998. It's basically a low-tech dehumidifier. And it turns out the Mars atmosphere is often 100 percent humid. So this device can extract all the water that humans will need simply from the atmosphere on Mars.

Next we have to worry about what we will breathe. Frankly, I was really shocked to find out that NASA has this problem worked out. A scientist at MIT named Michael Hecht developed a reverse fuel cell, essentially, that sucks in the Martian atmosphere and pumps out oxygen.  You have to remember that CO2 -- carbon dioxide, which is 96 percent of Mars' atmosphere -- CO2 is basically 78 percent oxygen.

Now, the next big rover that NASA sends to Mars in 2020 is going to have one of these devices aboard, and it will be able to produce enough oxygen to keep one person alive indefinitely. But the secret to this -- and that's just for testing -- the secret to this is that this thing was designed from the get-go to be scalable by a factor of 100.

Next, what will we eat? Well, we'll use hydroponics to grow food, but we're not going to be able to grow more than 15 to 20 percent of our food there, at least not until water is running on the surface of Mars and we actually have the probability and the capability of planting crops. In the meantime, most of our food will arrive from Earth, and it will be dried.

And then we need some shelter. At first we can use inflatable, pressurized buildings as well as the landers themselves, but this really only works during the daytime. There is too much solar radiation and too much radiation from cosmic rays. So we really have to go underground.

Now, it turns out that the soil on Mars, by and large, is perfect for making bricks. NASA has figured this one out, too. They're going to throw some polymer plastic into the bricks, shove them in a microwave oven, and then you will be able to build buildings with really thick walls. Or we may choose to live underground in caves or in lava tubes, of which there are plenty.

Fnally there's clothing. On Earth we have miles of atmosphere piled up on us, which creates 15 pounds of pressure on our bodies at all times, and we're constantly pushing out against that. On Mars there's hardly any atmospheric pressure, so Dava Newman, a scientist at MIT, has created a sleek space suit. It will keep us together, block radiation and keep us warm.

So, let's think about this for a minute. Food, shelter, clothing, water, oxygen ... we can do this. We really can, but it's still a little complicated and a little difficult.

So, that leads to the next big -- really big step -- in living the good life on Mars. That's terra-forming the planet: making it more like Earth, re-engineering an entire planet That sounds like a lot of hubris, but the truth is that the technology to do everything I'm about to tell you already exists. First we've got to warm it up. Mars is incredibly cold because it has a very thin atmosphere. The answer lies here, at the south pole and at the north pole of Mars, both of which are covered with an incredible amount of frozen carbon dioxide -- dry ice. If we heat it up, it sublimes directly into the atmosphere and thickens the atmosphere the same way it does on Earth.

And as we know, CO2 is an incredibly potent greenhouse gas. Now, my favorite way of doing this is to erect a very, very large solar sail and focus it -- it essentially serves as a mirror -- and focus it on the south pole of Mars at first. As the planet spins, it will heat up all that dry ice, sublime it, and it will go into the atmosphere. It actually won't take long for the temperature on Mars to start rising, probably less than 20 years.

Right now, on a perfect day at the equator, in the middle of summer on Mars, temperatures can actually reach 70 degrees, but then they go down to minus 100 at night.

What we're shooting for is a runaway greenhouse effect: enough temperature rise to see a lot of that ice on Mars -- especially the ice in the ground -- melt. Then we get some real magic. As the atmosphere gets thicker, everything gets better. We get more protection from radiation, more atmosphere makes us warmer, makes the planet warmer, so we get running water and that makes crops possible. Then more water vapor goes into the air, forming yet another potent greenhouse gas. It will rain and it will snow on Mars. A thicker atmosphere will create enough pressure so that we can throw away those space suits. We only need about five pounds of pressure to survive. Eventually, Mars will be made to feel a lot like British Columbia.

We'll still be left with the complicated problem of making the atmosphere breathable, and frankly, that could take 1,000 years to accomplish, but humans are amazingly smart and incredibly adaptable.

There is no telling what our future technology will be able to accomplish and no telling what we can do with our own bodies. In biology right now, we are on the very verge of being able to control our own genetics, what the genes in our own bodies are doing, and certainly, eventually, our own evolution. We could end up with a species of human being on Earth that is slightly different from the species of human beings on Mars.

What would you do there? How would you live? It's going to be the same as it is on Earth. Somebody's going to start a restaurant, somebody's going to build an iron foundry. Someone will make documentary movies of Mars and sell them on Earth. Some idiot will start a reality TV show. There will be software companies, there will be hotels, and there will be bars.

This much is certain: it will be the most disruptive event in our lifetimes, and I think it will be the most inspiring. Ask any 10-year-old girl if she wants to go to Mars. Children who are now in elementary school are going to choose to live there.

Remember when we landed humans on the Moon? When that happened, people looked at each other and said, "*If we can do this, we can do anything*." What are they going to think when we actually form a colony on Mars?

Most importantly, it will make us a space-faring species. That means humans will survive no matter what happens on Earth. We will never be the last of our kind.