Now, just in case you are sitting there feeling smug, I am afraid the results in the USA are really not looking much better. Only 4 percent of U.S. adults when asked could name a living scientist who they would nominate as a science role model, although at the same time, 96 percent, a stunning 96 percent of U.S. adults think that it is important for the U.S. to be a leader in science education.

So it all sounds rather gloomy, but there is hope, as I found out when I went on a worldwide school's lecture tour with a talk, surfing the solar system. It is about the sort of concepts of astronomy and theoretical physics that we set out to cover in our book.

I have probably spoken, and we estimate, to about 20,000 kids worldwide, and what I discovered was an enormous appetite and enthusiasm for science, and there are so many questions that we have to write another book in order to be able to answer them. And they are great questions like can you skateboard on Jupiter, and my personal favorite is what does happen if you get to the edge of the universe.

Now, you could say that we are just lucky, that

we have got the science at our disposal, and without a doubt, I can tell you that black holes presented by Stephen Hawking explained simply for kids is a winner. We have them. We had them with us all the way.

But more seriously, some research at universities in the U.K. shows that a significant percentage of students studying sciences -- and I mean across the board, this isn't just physics -- report that their interest in science was sparked by exactly these topics. They went on to become scientists because of an early interest in astronomy and the exotic phenomena of theoretical physics, but space has the power to capture children's imagination and engage their curiosity. There seems absolutely no doubt, and we have never needed to do this more urgently.

Of course, it is not just what we say to kids. It is what we show them. The images sent back by NASA's Hubble play such a huge part in capturing kids' attention in an ever increasingly crowded world with many, many demands on them. This means we can show kids something of the cosmic environment that surrounds them, from Saturn's rings to getting them to think about what would it be like to see a sunset on Mars.

Now, manned space flight is a topic which kids never tire of, and because of NASA, they can read about it, they can hear about it, watch documentaries, look at photographs, and visit space centers. NASA runs a huge number of educational programs both in and outside schools.

This means that kids' space dreams aren't limited to science fiction, and with exciting new missions planned back to the Moon and onwards to Mars, it means that there may be kids now who will grow up wanting to be astronauts, as excited about it as a whole generation of astronauts today are, the ones who watched the Apollo Moon landings in their pajamas with their parents and decided they were going to grow up to be an astronaut, and that is certainly an awful lot more aspirational than wanting to grow up to appear on a reality TV show or become a pop star.

Because of NASA, we can also show kids what our planet, what the Earth looks like from space. They can see what a beautiful planet we live on, but how vulnerable it is, how fragile it is, and we can really make it clear to them that they need to look after it.

When we look around us in space, we see all sorts of other fascinating, extraordinary, exciting worlds, but

we don't see another planet nearby exactly like the Earth, and that is a very strong message to kids to say, "You live on a beautiful planet after. You need to look after it."

So we are not saying that all children need to grow up and go into space, but we are saying that the work done by NASA has a profound and lasting impact on the way that children view their life on Earth, their cosmic environment. It can influence the choices they make in the future and their careers.

I would like to close with a fan letter we had from Ben, age 6. His mother had told us he wasn't a confident child, but that he loved reading about space so much that it has changed his life. He wrote to us to say, "Now that I know I am good at space, I have decided to become a scientist when I grow up."

Thank you. Thank you for listening.

[Applause.]

DR. HAWKING: What will we find when we go into space? Is there alien life out there, or are we alone in the universe?

We believe that life arose spontaneously on the Earth. So it must be possible for life to appear on other

suitable planets, of which there seem to be a large number in the galaxy.

But we don't know how life first appeared. The probability of something as complicated as a DNA molecule being formed by random collisions of atoms in ocean is incredibly small. However, there might have been some simpler macro molecule which can build up the DNA or some other macro molecule capable of reproducing itself. Still, even if the probability of life appearing on a suitable planet is very small, since the universe is infinite, life would have appeared somewhere. If the probability is very low, the distance between two independent occurrences of life would be very large.

However, there is a possibility known as panspermia that life could spread from planet to planet or from stellar system to stellar system carried on meteors. We know that Earth has been hit by meteors that came from Mars, and others may have come from further afield. We have no evidence that any meteors carried life, but it remains a possibility.

An important feature of life spread by panspermia is that it would have the same basis which would be DNA for

life in the neighborhood of the Earth.

On the other hand, an independent occurrence of life would be extremely unlikely to be DNA based. So watch out if you meet an alien. You could be infected with a disease against which you have no resistance.

One piece of observational evidence on the probability of life appearing is that we have fossils from 3.5 billion years ago. The Earth was formed 4.6 billion years ago and was probably too hot for about the first half billion years. So life appeared on Earth within half-a-billion years of it being possible, which is short compared to the 10-billion-year lifetime of an Earth-like planet.

This would suggest either panspermia or that the probability of life appearing independently is reasonably high. If it was very low, one would have expected it to take most of the 10 billion years available. If it is panspermia, any life in the solar system or in nearby stellar systems will also be DNA based.

While there may be primitive life in another region of the galaxy, there don't seem to be any advanced intelligent beings. We don't appear to have been visited

by aliens. I am discounting reports of UFOs. Why would they appear only to cranks and weirdos?

[Laughter.]

DR. HAWKING: If there is a government conspiracy to suppress the reports and keep for itself the scientific knowledge the aliens bring, it seems to have been a singularly ineffective policy so far.

Furthermore, despite an extensive search by the SETI project, we haven't heard any alien television quiz shows. This probably indicates that there are no alien civilizations at our stage of development within the radius of a few hundred lightyears. Issuing an insurance policy against abduction by aliens seems a pretty safe bet.

Why haven't we heard from anyone out there? One view is expressed in this Calvin cartoon. The caption reads: "Sometimes I think that the surest sign that intelligent life exists elsewhere in the universe is that none of it has tried to contact us."

More seriously, there could be three possible explanations of why we haven't heard from aliens. First, it may be that the probability of primitive life appearing on a suitable planet is very low.

Second, the probability of primitive life appearing may be reasonably high, but the probability of that life developing intelligence like ours may be very low. Just because evolution led to intelligence in our case, we shouldn't assume that intelligence is an inevitable consequence of Darwinian natural selection.

It is not clear that intelligence confers a long-term survival advantage. Bacteria and insects will survive quite happily even if our so-called intelligence leads us to destroy ourselves.

This is the third possibility. Life appears and in some cases develops into intelligent beings, but when it reaches a stage of sending radio signals, it will also have the technology to make nuclear bombs and other weapons of mass destruction. It will, therefore, be in danger of destroying itself before long.

Let's hope this is not the reason we have not heard from anyone. Personally, I favor the second possibility that primitive life is relatively common, but that intelligent life is very rare. Some would say it has yet to occur on Earth.

[Laughter.]

DR. HAWKING: Can we exist for a long time away from the Earth? Our experience with the ISS, the International Space Station, shows that it is possible for human beings to survive for many months away from Planet Earth. However, the zero gravity aboard it causes a number of undesirable physiological changes and weakening of the bones, as well as creating practical problems with liquids, et cetera.

One would, therefore, want any long-term base for human beings to be on a planet or moon. By digging into the surface, one would get thermal insulation and protection from meteors and cosmic rays. The planet or moon could also serve as a source of the raw materials that would be needed if the extraterrestrial community was to be self-sustaining independently of Earth.

What are the possible sites of a human colony in the solar system? The most obvious is the Moon. It is close by and relatively easy to reach. We have already landed on it and driven across it in a buggy.

On the other hand, the Moon is small and without atmosphere or a magnetic field to deflect the solar radiation particles, like on Earth. There is no liquid

water, but there may be ice in the craters at the north and south poles. A colony on the Moon could use this as a source of oxygen with power provided by nuclear energy or solar panels. The Moon could be a base for travel to the rest of the solar system.

Mars is the obvious next target. It is half as far, again, as the Earth from the Sun and so receives half the warmth. It once had a magnetic field, but it decayed 4 billion years ago, leaving Mars without protection from solar radiation. It stripped Mars of most of its atmosphere, leaving it with only 1 percent of the pressure of the Earth's atmosphere.

However, the pressure must have been higher in the past because we see what appear to be runoff channels and dried-up lakes. Liquid water cannot exist on Mars now. It would vaporize in the near-vacuum. This suggests that Mars had a warm wet period during which life might have appeared either spontaneously or through panspermia. There is no sign of life on Mars now, but if we found evidence that life had once existed, it would indicate that the probability of life developing on a suitable planet was fairly high.

NASA has sent a large number of spacecraft to Mars, starting with Mariner 4 in 1964. It has surveyed the planet with a number of orbiters, the latest being the Mars Reconnaissance Orbiter. These orbiters have revealed deep gullies and the highest mountains in the solar system.

NASA has also landed a number of probes on the surface of Mars, most recently the two Mars Rovers. These have sent back pictures of a dry desert landscape. However, there is a large quantity of water in the form of ice in the polar regions. A colony on Mars could use this as a source of oxygen.

There has been volcanic activity on Mars. This would have brought minerals and metals to the surface which a colony could use.

The Moon and Mars are the most suitable sites for space colonies in the solar system. Mercury and Venus are too hot, while Jupiter and Saturn are gas giants with no solid surface.

The moons of Mars are very small and have no advantages over Mars itself.

Some of the moons of Jupiter and Saturn might be possible. In particular, Titan, a moon of Saturn, is

larger and more massive than other moons and has a dense atmosphere.

The Cassini-Huygens Mission of NASA and ESA has landed a probe on Titan which has sent back pictures of the surface. However, it is very cold, being so far from the sun, and I wouldn't fancy living next to a lake of liquid methane.

What about beyond the solar system? Our observations indicate that a significant fraction of stars have planets around them. So far, we can detect only giant planets like Jupiter and Saturn, but it is reasonable to assume that they will be accompanied by smaller Earth-like planets. Some of these will lay in the [inaudible] zone where the distance from the stars is the right range for liquid water to exist on their surface.

There are around a thousand stars within 30 lightyears of Earth. If 1 percent of each had Earth-size planets in the [inaudible] zone, we would have 10 candidate new worlds. We can revisit it with current technology, but we should make interstellar a long-term aim. By long term, I mean over the next 200 to 500 years. The human race has existed as a separate species for about 2 million years.

Civilization began about 10,000 years ago, and the rate of development has been steadily increasing.

If the human race is to continue for another million years, we will have to boldly go where no one has gone before.

Thank you for listening.

[Standing ovation.]

MODERATOR: Thank you, Professor Hawking, for that series of insights and a challenge to us all.

I believe now for those of you who wanted to do flash photography, it would be okay for a few moments, and I invite you all to head upstairs for a very nice reception, courtesy of our sponsor, Lockheed Martin.

Thank you all.

[Applause.]

DR. HAWKING: Thank you for listening.

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