

Science and space travel – Part four

Audience member: “Did Mars have water on it?”

Joe Edwards: “It did – at one time we think it did have liquid water. The question was, ‘Does Mars have water on it?’ Yes, in the form of ice and we believe that at one time it had liquid water.

Audience member: “Just to do with the dark side of the Moon, is that something you can explore, any of that?”

Edwards: “Well, there really is no dark side of the Moon. There’s a far side of the Moon. The Moon spins on its axis, just like the Earth. It spins at the identical rate as the Earth itself so no matter where you live on the Earth, you only see one side of it.

“But yes, one of the more interesting things that can be done on the far side of the Moon is to establish an observatory. Get a place at which we can build a very large structure, much more powerful than the Hubble Space Telescope.

“And it could be a vehicle, it could be an instrument which we use to look at a variety of wavelengths of energy around the universe and be able to service the thing and keep it going for decades.

“Interestingly enough, it would also be on a planetary body that is no longer geologically active, so there are no earthquakes or earth tremors or things like that upsetting its delicate scientific balance.

“Would it be too cold? The colder the better because the space telescope sensors utilise liquid oxygen to cool them down as close as we can get to absolute zero and it’s pretty darn cold, you know? Certainly for one half of a lunar day it would be very cold, minus 240 degrees or something.”

Audience member: “You know the docking stations that you have at the moment? Could they be transported over towards where the Moon’s orbit is, as opposed to, say, building new ones?”

Edwards: “We will actually build a new spacecraft to go to the Moon, and this is the reason why. Because every ounce of a spacecraft, we have to send that thing 240,000 miles away, and it’s much cheaper and much more efficient to design a very light vehicle that is purpose designed to go to the Moon and return. That’s why we wouldn’t take the space shuttle. That darn thing weighs 240,000 pounds and you don’t need wings, or a rudder, or a variety of equipment that’s on the space shuttle to go back to the Moon.”

Enright: “Somebody asked a question about why they didn’t send robots. Well, let’s talk a little bit about that and let’s talk about these babies. These are real robots. These are the Mars exploration rovers, Spirit and Opportunity, and they’re already working on the surface.”

Edwards: “And have been for about three years.”

Enright: “This is a hugely successful effort by the United States, with a lot of European involvement. The instrument package at the front of this rover is supplied by the Max Planck Institute in Germany which has been absolutely central to what they have been doing to study the rocks.

“There’s a European Rover planned for launch in 2012, landing in 2013, which is called Brigit. Brigit will be landed on Mars in 2013 to search for evidence of life.

“To finish up, I thought we’d talk a little bit about Mars, since this is, ultimately, the stated objective of the American space programme and of the European space programme under the Aurora programme which has been adopted by the European Council of Ministers.

“Ireland isn’t a direct contributor to the Aurora programme. It’s in keeping with our tradition of really just being basic members of the European Space Agency. We’re there but not with knobs on. Most of our partners in Europe, however, are contributing significant funds towards exploring Mars.

“So I thought what we’d do is just, while we’re talking, take a look at some pictures that have come back, literally in the last couple of weeks. There are two (European) Rovers on the surface of Mars. One is called Spirit and the other is called Opportunity.

“This first sequence shows where Spirit landed. It’s a vast crater called Gusev Crater, about the size of Munster, and the Rover has made some astonishing discoveries of rocks which have been affected by water – they’ve been changed by water a very long time ago.

“The hills in the distance are called the Columbia Hills, rather sad of course, because they’re named after your late colleagues, friends and colleagues, who died aboard the Columbia space shuttle accident in 2003.

“Now this is a crater of a different kind. This is the Spirit Rover on the other side of Mars and it has arrived at a place called Victoria Crater. And this, I think, is just one of the most stunning places I have ever seen anywhere.

“As I say, these pictures came down just in the last few days, and they show us a place – when we talk about exploring Mars and about going to distant planets, it’s often very difficult to work out or to think: ‘What is this place?’ And this is our first real opportunity to get a sense of place

in the way, of course, that is so familiar to Irish poets among others. As I say, this is Victoria Crater. The Spirit Rover has been exploring that crater for about 12 months.

“But both rovers have been very quiet for the last best part of a year because of a huge dust storm on Mars, but fortunately they’ve survived it. They’ve lived to tell the tale and send back these extraordinary pictures which I think are just absolutely stunning. It is possible to imagine that some day a young man or woman will step out onto that surface. Could they be here today, that person, the first person to step on Mars?”

Edwards: “Yes, it’s certainly possible. The question that goes through our mind in NASA is: ‘As you walk along the surface of Mars, what are you going to find?’ Was there enough liquid water in the past that you might actually find a fossil? Even if it’s a fossil of microbial life. So it’ll be a pretty exciting day.

“When I first went to NASA my wife made me promise her one thing and it was: ‘You won’t go to Mars’. Because it’s a one and a half to three year trip. ‘So you have to promise me you won’t go to Mars.’ And I said: ‘OK honey, I won’t’, knowing of course, in a heartbeat, you know?”

Enright: “How soon is it going to happen? Is it possible that the young people here today could be the right age when the mission to Mars...”

Edwards: “I think so. Maybe 2030, 2040. I really hope that we make it to Mars in our lifetime. We’ll just have to see. It’s not that hard to get to Mars actually. We have much of the technology today. It’s more willpower, just to spend the money and go do it.”

Enright: “How many people here would like to go to Mars? OK! Alright!”

Edwards: “It seems to be only the younger folks in the crowd.”

Enright: “OK, let’s open it out a little bit.”

Audience member: “Joe, two questions. The first question is while it is the stated goal to get to Mars, how realistic is that? And do you think that goal will survive George Bush leaving office? And sorry, the second question is more general: how do you think the space community and people working in space should actually reach out? There’s a lot of children here tonight but I’m sure you could have filled this place three times over.”

Edwards: “The first question – the effort to go to Mars will outlast anyone that is currently in politics anywhere around the world. Because we’re talking 2030 or 2040. It will be an iterative approach. We at the international Space Station will go on to the Moon and then we’ll find a way to get to Mars.

“And I think as we go back to the Moon and establish this permanent human presence there we’ll find, as a country and as a species, that actually it’s a little bit easier to do than it was thought at first.

“The second half of your question was what?”

Audience member: “[Unclear]...talking about people actually feeling connected to the space programme.”

Edwards: “Oh yes. I can’t tell you the number of times I’ve had someone come up to me and go: ‘Joe, I love the space stuff, but NASA has to do a better job of marketing.’ You know, NASA is an engineering organisation. It’s a science organisation. By and large, we don’t have people going to get their MBAs and taking a marketing course.

“Almost as a consequence of the good work the European Space Agency does, the Canadian space agency, Japan, Russia, the United States; almost a consequence of that is a lack of money, a lack of time to spend on marketing itself. So what I’ve always told NASA is: ‘Don’t worry about marketing, the best marketing that a space agency can do, regardless of its nationality, is to have successes. You know, the worst marketing that you have is to have failures.’

“It’s a risky business. It’s a business that’s very difficult to do. It will never be perfect. What I espouse is: ‘Let’s just try and do our jobs well. Leave the marketing to Madison Avenue or wherever.’

Audience member: “I just have two questions that I wanted to ask. The first question is: you were saying that you were a naval aircraft pilot and you were travelling at 600 miles per hour, about 10 miles per minute, 0.6 of a mile per second. Then you said in the space shuttle lower orbit you were travelling at 17,300 miles per hour, which is 300 miles per minute or five miles per second.

“For manned human interplanetary travel and manned human inter-solar system travel, like for instance travelling to Alpha Centauri or exploring space, what speed would be required per second for maximum efficiency?

“And what speed can we achieve now, in 2007? And the second question I had for you was: you mentioned an asteroid storm on the Moon, did that form 10% of the craters formed or 90% that we see today?”

Edwards: “OK, let me answer the first question first. The fastest that we’ve ever had an object go at with a human being in it is 35,000 miles per hour. Other than in science fiction, we do not have a propulsion system that effectively allows us to leave the solar system and travel to other parts of the galaxy, much less to other galaxies themselves.

“But in space exploration, you know we’ve only been doing this for 40 or 50 years, it’s very much at an embryonic stage. Yes, we have made great gains. But imagine if it were several thousand years ago and we had been sailing. Someone had figured out how to make a sail for a boat, and now it was 50 years later. There were thousands of years of human progress that allowed us to go from square-rigged ships, to sloops, to catamarans, to heavier-than-air craft and those kinds of things. So we don’t have the answer right now.

“Right now, to go to a place like Mars requires a tremendous personal sacrifice – one and a half to three years out of your life, with perhaps a permanent effect on your body and your bone mass and those kinds of things.

“But think back to the early explorers like Captain Cook, Magellan or Amerigo Vaspuci. Those early explorers endured tremendous hardships themselves, perhaps being at sea for two, even three, years, and the effects of debilitating diseases such as scurvy and other kinds of things.

“So we don’t see space flight as something that’s easy. We see it as something that’s very hard and it requires tremendous personal sacrifice. But we are willing to take that risk because we believe that it’s very important and that as a species, as human beings, it’s worth the risk and we’ll be better off for it.”

Enright: “I’ll answer the lunar cratering question. It’s entirely dependent on how you date the Serenitatis event, which is controversial, and I recommend Bill Hartman’s paper on the subject from 2002.”

Audience member: “I have two questions. The first one, it’s just on the poles of Mars. Do you believe that there is actually liquid water under them, like liquid ocean?”

Edwards: “On Mars, no. What we actually have proven to ourselves with the two Rovers that are on the surface today, is that there is ice in the permafrost and that there are various geological features on the planet that lead us to believe that in the distant past that ice was actually liquid.”

Enright: “There is some new information which is quite exciting, it’s still controversial, but the European Mars Express Mission – a team using data from its radar sounder which penetrates deep into the Martian surface – they published in Science magazine, I think it was, last Thursday, a report claiming to have discovered a very large amount of frozen ice at the equator of Mars in a region that has always been puzzling because of the features on it.

“That would be incredibly exciting. That would add another third, 30% more water, frozen water, to what we already know exists on Mars, which is very exciting.”

Edwards: “I probably should choose my words carefully. I’m not saying that there couldn’t be liquid water somewhere under the surface, but right now we don’t see any evidence for it.”

Enright: “We should emphasise as well – I think you clearly from your question realise this – that sometimes people talk about looking for water on Mars, there’s plenty of water on Mars as Joe has said several times. The issue is: is there any liquid water? Would it perhaps be the way to allow organisms to thrive? Next question.”

Audience member: “Hello Joe. First of all, welcome to Ireland. I’m afraid I have a bit of a meteor strike of questions for you. First of all, as you know George Bush is planning to put the space shuttle out of action by 2010. As an experienced pilot, how do you feel on the X-38 space plane programme? You know, we need something that’s convenient, reusable and [unclear] Richard Branson’s...”

Edwards: “There was a programme that didn’t last very long where we tried to develop a new, reusable spacecraft with the capabilities of the space shuttle Orbiter. But it’s not really George Bush that’s cancelling the programme. €17billion may be less than we spend on carry-out pizza but it’s still a lot of money and we don’t feel like we can afford to keep both programmes running at the same time. It’s time to move on from this vehicle that has served us very well and go on this next exploration, the next exploratory effort.”

Audience member: “Secondly, you were just mentioning Arthur C. Clarke at the beginning. It’s funny; he apparently worked with NASA. He came up with, famously, in ‘2001: A Space Odyssey’ the idea of Velcro shoes, or slippers if you will, to stick to the floor, to simulate gravity. When we think of artificial gravity we think of clumsy men out in boots or stations that circle themselves, but if it’s convenient and less expensive, why not try it?”

Edwards: “Well, you could certainly do something like that. But with artificial gravity, the downside to it is that one of the reasons that you’re going into space to begin with is to take advantage of the lack of gravity to study physical forces in the universe, inter-stitial forces between atoms and grains of sand, you know, and things like that.

“So primarily, you would like to have the benefits of not having gravity, or micro gravity which is when your lower Earth orbit is 1×10^{-6} Gs. But the real reason that you’d like to have gravity is so that you could perhaps expose the crew to it periodically to reduce the debilitating effects of long-term space flight, and that’s a much more difficult problem that we do not have the answer to yet.”

Audience member: “This is the final one, don’t worry. As a pilot for a space shuttle, as all of us are aware the missions specialists certainly get to go on the extra vehicular activity, if you call them excursions. Is it possible for a space tourist or a space pilot to go on them? I don’t know about either of those. I’ve never met Destito but as far as I’m aware he’s never held the record for flying the closest to a space shuttle.”

Edwards: “Well, can pilots do spacewalks? That’s basically what you’re asking. We used to joke around the astronaut office that we couldn’t get into the union; the mission specialists did it all. The fact is that walking in space, extra vehicular activity, is a very highly honed skill and it requires months and years of practice. In particular in training for a particular mission, you train for months in the pool to be able to go and do those tasks that look so easy to do in video that’s down-linked here to Earth.

“At the same time the pilots are engaged in the same kind of rigorous training but in the operation and flying of the vehicle itself, and there’s just not enough time in the day for you to train for both of them. And that’s the real reason why mission specialists do it and we do the flying.”

Enright: “OK, I think we have a question down the back again.”

Audience member: “For those who spend time in space, is there any long-term physiological effect?”

Edwards: “The long-term physiological effects in space? One is dramatic hair loss, which is the most severe of all of them. I’m kidding of course. Anyway, long-term space flight, what happens to you? Within three days of being on orbit your blood, your body has poured 10% of your blood plasma overboard in your urine.

“And very soon after that, your brain figures out that you don’t need all this bone mass that you’ve built up so that you can work against the force of gravity, and it begins actually decreasing your bone mass. One reason you can’t be an astronaut if you’ve ever had a kidney stone is because of that very thing.

“There’s a lot of calcium in your urine. You’ll start losing bone mass in your pelvis which is the biggest, most densest bone in your body. Then your brain moves on to your femurs and starts getting rid of that bone mass as well because you don’t need your legs to stand up any more. The human body’s a pretty remarkable thing.”