

Question 1:

Dear Cheap Astronomy_ Is a Lagrange point a good place to keep a record of the history of Earth?

This question is based on the premise that humankind – and presumably a large proportion of other megafauna on Earth – might be wiped out one day, perhaps by an asteroid impact. So, given the risk we face, wouldn't it be a good idea to store a record of the history of humanity somewhere – somewhere that's out of harm's way.

Well, if we really put our minds to it, we might soon develop the technology to defend Earth from an asteroid impact. So perhaps our best plan is to try and stay alive, rather than diverting resources towards creating a lasting momento of ourselves.

Of course, there are cynics who will suggest the best thing we can do is create a distant and unassailable storehouse of all the useful knowledge and technology we have developed so far, since we will probably soon die a self-inflicted mass extinction event, long before an asteroid comes along.

By this way of thinking, the proposed storehouse of all knowledge and wisdom is not so much for the benefit of passing aliens, but for whatever evolved beings come next. Hopefully, the ecological niche we vacate will get filled by a species less prone to running about in mobs and firing guns in the air.

But... nah, sod that way of thinking. The survival of our species – and probably the survival of any species this planet is ever likely to produce – will always come down to a few, generally nameless, individuals who decide to do something sensible. There will always be an equal number of nameless individuals who decide to do something stupid or mean. But since you are probably listening to this on a smart phone, rather than in a post-apocalyptic bunker, it seems that the sensible people do generally win out – at least on average, over long time periods.

Anyway, putting all the rights and wrongs of humanity to one side, let's get on with answering your question. Exactly what we might put in a storehouse of all knowledge and wisdom is a bit beyond the range of this podcast, although it must be said that some mathematical proofs, a few ground-breaking architectural designs and perhaps some gene-splicing techniques are going to be a lot more useful than Chuck Berry and whale songs.

As we previously covered in Cheap Astronomy episode 76, the Sun-Earth Lagrange points L4 or L5 would be the best spots to park our Earth storehouse. Objects at Lagrange points L1, L2 or L3 can sustain a station-keeping solar orbit with the Earth, but those points aren't stable – the spacecraft we currently have parked at L1 and L2 still need to fire their rockets now and again to stay in position.

L4 and L5 are much more stable and could potentially harbour an Earth storehouse for a million years or so – although, over these time scales, the faint gravitational whisper of passing planets can still perturb something put there. So an automated once-in-a-hundred-millennia correction burn will still be required.

This might prompt you to wonder why we don't park more spacecraft at L4 and L5, instead of L1 and L2. The problem is that L4 and L5 are both about 20 million kilometres from Earth

(which is over 1 light minute) while L1 and 2 are just 1.5 million kilometres from Earth (which is only about 5 light seconds).

So, not only do you need more fuel needed to get to L4 and 5, but once you are there, the lengthy communication delay back to Earth creates its own problems.

Mind you, if we just want to park a record of Earth's history out there, the communication delay isn't such a problem. But before we do that, we really, really should establish an Earth-asteroid defence system – because if it's not there when it matters, we will be history.

Question 2:

Dear Cheap Astronomy -Was Einstein just a science-fiction killjoy for having ruled out warp speed and time travel.

Humans are story-tellers, it's how we make sense of the world. Our stories are generally based on whatever we know at the time, with a little imaginative elaboration mixed in. Older styles of fiction, generally involve people or animals with exaggerated physical abilities or even magical abilities. Modern science fiction takes a similar approach to story-telling, but draws in plot devices from science and technology.

So, in by-gone days, Zod the Defiant flew over the mountain range on his winged chariot to avenge the sons of Vetrab by spewing down fire upon the evil city of Otraybin. These days, Luke Skywalker, a Rebel Alliance sympathiser, uses the Force to fire two proton torpedos down the exhaust port of the Death Star, thereby thwarting the evil Empire's plans – at least until the next movie.

But because astronomical scales are yet to become part of our daily lives, our modern stories are still told as though they were taking place on Earth, or at least within Earth-like dimensions.

Luke is first seen operating within the Earth-like dimensions of Tatooine, which has an Earth-equivalent atmosphere and an Earth-equivalent gravity field. To allow Luke Skywalker to cross light years from his home planet to the scene of a battle with the Empire, the story employs a magical plot device, warp drive – which is about as plausible as flying over a mountain range on a winged chariot.

After the scene-changing warp-drive, Luke is then seen within the Moon-like dimensions of the Death Star, in which he mostly runs around in corridors. Then there's another scene change to the fourth moon of Yavin, where the rebel base is, and which also happens to have an Earth-equivalent atmosphere and an Earth-equivalent gravity field. And finally it's back to the Death Star again to torpedo that exhaust port.

This is how we are used to telling stories on Earth – a bunch of stuff happened here and then a bunch of stuff happened there. How the protagonists got from here to there isn't worth dwelling on.

As for time travel... well, warp-drive is time travel. If you are going to get up, have breakfast, then cross 100 light years to foil the evil Empire schemes – before re-crossing that 100 light

year distance to get back home for dinner, then you just time-travelled – you just did in a day what should have taken 200 hundred years.

The Star Wars story is actually full of time travel. For the plot to make sense, Luke Skywalker first has to receive information, from 100 light years away, almost immediately so that he knows to cross that one hundred light years in order to deal with what's happening there. Furthermore, having warp-driven across 100 light years to blow up the Death Star and then return home for dinner, Luke would be able to look through a very powerful telescope one hundred years after his return and watch himself blowing up the Death Star, as the light from that distant event finally arrived at his home.

Back in the real world, we are slowly becoming used to the idea of story-telling across astronomical distances. All of us space mission fans hold a big celebration at a spacecraft launch, after which we all get on with our lives until six months later when we hold another big celebration as that spacecraft approaches its destination – and we all watch with bated breath to see if the latest technique for a Mars soft-landing actually works.

With the Voyager missions these disconnected episodes have come to span decades. Voyager 2 flew by Jupiter in 1979 and finally flew by Neptune in 1989. Then it just kept on going. In the next year or two it will finally leave the heliosphere. Lots of people who weren't born when it launched will be able to celebrate this event.

Once you start dealing with events that happen across astronomical distances you need a new kind of story-telling that can deal with a very slow progression of the plot. So maybe it was Luke's great-grandfather that set off to investigate rumours that someone was setting up an Empire, a journey which eventually delivered grandson Luke there, so Luke could destroy the Death Star and then it was Luke's great grandson who returned home to tell everyone the news.

But, wait... even that can't be right – there was all that business with Luke's father. Hmm... maybe the truth is stranger than fiction.