Implausible Engineering – Episode 1a: The Relativity Vault

We're all going to die. But let's say you're going to die from some incurable disease – or even just from ageing – and you've got some time to plan ahead. One option is to assume that future science could save you. A common strategy to access this option is to get yourself frozen – or even just get your head frozen –until medical science can find a cure for whatever ails you.

However freezing yourself or you brain isn't that great an option, since the act of freezing – where all the liquid water in your body expands and crystallizes would irreversibly rupture the cellular integrity of your body and your brain before the clock even starts ticking. So, all future medical science could do could only thaw you into an organic mush.

But there is an alternative and one that suits the context of a space science podcast. Rather than freezing yourself, why not take advantage of relativistic time dilation. So rather than freeze your brain you could pack it up your still-living self into a spacecraft able to move at over 99% of the speed of light with life support systems to keep it going for a few years on board by which time thousands of years may have passed on Earth.

Of course, there are a number of substantial technological hurdles to overcome first. For the sake of brevity, let's just wave a magic wand to create a spacecraft, propulsion system and adequate fuel to able to achieve and sustain 99% of the speed of light. You'll need life support to keep you going for a few yearsa few years since you need to time accelerate up and then decelerate back down from 99% light speed without the acceleration turning your brain into organic mush. This much is achievable at just one G of acceleration you'd be approaching light speed in just over a year and at say 3g, which should still be tolerable, you could do it in a bit under 4 months.

A bigger problem is colliding dust grains at those speeds which could not only damage the ship, but cause shock forces which might well exceed 1 or 3 G and turn you mushy and of course those impacts are going to slow the spacecraft down, indeed they are likely to prevent it from ever reaching time dilation speed. So a time dilation machine might better involve a capsule spun on an arm or a tether around a tight circle within an evacuated chamber. There would be some extraordinary technology required to spin something at that speed and some extraordinary lubrication and cooling systems operating at the axle of the spinning structure to make it possible, but again let's just magic wand that part.

The biggest problem of all is how you keep all this going and get the help you'll need at the other end. So for example, do you just set a timer and plan to be a thousand years ahead when the machine slows down? Or is better to have an automated system some kind of signal from the outside world that they have the technology to cure you – so that then you slow down. And either way, what kind of guarantee is there that anyone at the other end is really going to give a bleep. If you are stupendously rich and the only person to have ever done this, then there might be a certain interest factor, but if you've done, then it's likely others would have done it, so the future civilization ends up with multiple almost corpses to reanimate and educate and socialize into however future society may work. And those future people

will be thinking should they put their energy into bringing up their kids or look after these anachronistic and primitively-educated bleeps who couldn't accept their time was up.

So you have to be vastly rich with some kind of resource that retains its value over thousands of years – and you'd probably need generations of descendants motivated enough to keep the whole thing going – or you hold some secret that no one else knows about and there's an understanding your revival back to good health is the only way to get that secret – so the whole world becomes as invested as you are in your recovery.

So, there you go folks a weird &%$# idea. The physics of it might be plausible, the engineering design probably isn't – though maybe you could make the diameter of rotation utterly huge so the spin at the axle wasn't so intense, although then the evacuated chamber would also have to be huge. And even then, the biggest problems in making this happen are what they always are – people, money and motive. If you think there's a way to make this idea work, let us know at cheapastro@gmail.com.

Implausible Engineering – Episode 1b: The welcome note

One solution to Fermi's paradox – about why there's a universe of potentially habitable worlds out there, but no-one's talking - is that we are the first, or at least one of the first technology-exploiting species. After all, it's unlikely much could have happened when the early Universe full of hydrogen, helium and a few trace elements – you need stellar nucleosynthesis to build more complex elements and supernovae to spread those elements out. Indeed, from our own experience you need several generations of stars and a substantial degree of universal expansion to create a quiet corner of a galaxy where a stable G-type star with a complex chemical protoplanetary disk can persist for the billions of years required for evolution to do its thing.

So, the point of today IA is to pose the question of what, if any, responsibilities we may choose to exercise as one of the first emerging technological species in the Universe. Should we put out an information broadcast telling others how to advance - something like Douglas Adam's *the secret is to bang the rocks together guys* or maybe put out some fantastic physics formulas. Trouble is, a broadcast radiating out spherically to cover the greatest area, would rapidly attenuate in accordance with the inverse square law – so you are better off beaming a signal in a straight line, which will still eventually attenuate, but it will cross much a greater distance before it does so. In the absence of knowing where anyone is, all you can do point your signal at a few likely candidate regions and hope for the best. Our attempts to date have been pretty lackluster – for example, Frank Drake's Arecibo message and a Beatle's song from the Deep Space Network, both technology demonstrations to impress other humans, rather than serious attempts to communicate with aliens.

The Arecibo message contains an inordinate amount of content describing a generic DNA molecule and then the form of a human being. While making more sense than a Beatles' song, it still seems a bit self-indulgent as do the Pioneer and Voyager messages-in-a-bottle, the former being a plaque with a waving Caucasian naked couple, the latter a golden record containing songs by humans and whales as well as

other music and images. What both do have – which might be genuinely useful to aliens is a pulsar map. The idea was that pulsars have distinctive pulse timings, so by sending a layout of distinctive pulsars and their relative distances from Earth, an alien could figure out where Earth is. At least that's what everyone thought back in the seventies, when the Voyagers were launched and we'd only discovered pulsars 10 years earlier, thanks to Jocelyn Bell-Burnell. Today, we know pulsar rate do actually vary over time – and also we can only see pulsars when they are beaming one of their polar jets in our direction. So, if they are not beaming in your direction you can't see the pulse at all – they just look like a plain old neutron star – which is after all what they are.

So, where we are going with all this is that putting out a message for the aliens isn't as easy as it sounds. There's two problems to deal with – one being how to send the message, the other being what to put in it.

A readily detectable message could be established with stellar-level engineering. After all stars are visible from all directions for thousands of light years – so if you could shadow one with giant screens distributed in some kind Dyson swarm you would produce a 'hey look over here' beacon. perhaps using something like Morse code to provide coordinates for aliens to focus in on. At that focus point, would be an electromagnetic radiation transmitter with a lot more information carrying capacity but something easily missed from a wide-sweep scan.

Whatever information you send, you need to consider that different aliens will tune in at different times, so you need a repeating message – with some translation tips at the start – so if someone tunes in half way through, the message loops back to the start before too long. As to the contents of the message. If the aliens are like us, they may genuinely want to know what we look like and how we spend our days, but more pragmatic ones looking for more practical information might welcome a map of our observable Universe, not to know where we are as much as to know which parts they can't see from their location. They might welcome some practical engineering and chemistry tips too. For example, Imagine how getting advice on building an efficient fusion energy generator might transform our lives.

The question then is why we or anyone else might put the not-inconsiderable effort into establishing such a communication. The chances of it becoming a two-way conversation are minimal given we would likely be tens or hundreds of light years apart so there's little immediate benefit for us beyond hoping we might be paying it forward – that is, if we assume benevolence is a universal feature of technological species we'd undertake a selfless effort on the assumption we should receive someone else's message at some point. But given our own example maybe universal benevolence isn't something to hold out a lot of hope for.