

## The Naked Pioneers

*'Ad astra per aspera' – 'Through difficulties to the stars'*

Carl Sagan

Two space probes called Voyager 1 and Voyager 2 were sent to the outer planets in the late 1970s to beam back lots of lovely images and data of the gas giants and their moons. Primary mission complete, and with no way of being controlled, the probes were doomed to drift forever in the unimaginable void of interstellar space.

With this gloomy-sounding outcome in mind, NASA decided to do something very optimistic. They would send with them a message, on the very slim chance that they would one day be recovered by some little green chap. The message took the form of a metal record. A record designed to convey something about our origins, our civilisation, our art, through sounds, images and music. *CliffsNotes to Earthlings*.

To tell the story of this record, its creators and the people who chose that moment to fall in love, we need to begin by backing up a little. You see, *Voyager Golden Record* is a sequel. It's the more ambitious, bigger-budget sequel to *Pioneer Plaque*. Five years before Voyager, the Pioneer probes became the first man-made objects destined to reach interstellar space, to cast off the gravitational cloak of our solar system and head out into it forever. While this was known to everyone involved in the mission, it took an outsider looking in – a writer for *Christian Science Monitor* – to draw attention to the magnitude of this fact. Pioneer 10 and 11 were to be humankind's first emissaries to the stars. Here was a first-time opportunity to send a message, a greeting to any intelligent beings who might chance upon them.

Armed with enthusiasm and a deadline of just three weeks, a three-strong team, comprising an artist, an astronomer and

an astrophysicist, thrashed out a design for a modest metal plaque, complete with star map and naked human figures. However, one of the strangest aspects of the Pioneer plaques – the first of which was hurled towards Jupiter in March 1972 – was the absence of vulva.

The last-minute sanitising of the female figure, for fear of offending a domestic audience, captures an essence of the environment in which the Pioneer plaques were forged. These are not only messages to some imagined future alien interaction, they are also time capsules, snapshots of when they left Earth. The removal of the vulva is a lens through which we can view America nearly 50 years ago. Despite the swinging sixties, despite mass movements, protests, social reforms and upheavals, despite convention-busting cinema coming out of the American New Wave, America in 1972 remained a conservative environment. NASA was in the glare of the public gaze, at the mercy of popular opinion. It was funded by American tax dollars, and everyone knew it. And to tell the story of the missing vulva, we need to back up just a little bit further.

In 1964 a graduate student working at NASA's Jet Propulsion Laboratory\* noticed something important. His name was Gary Flandro. He had finished school in 1957, just before Sputnik, perfectly timing his arrival at JPL with the start of the space race. The first of the Pioneer missions took place the following year, when a probe designed to achieve moon orbit, failed some 73.6 seconds after launch. A steady stream continued to punch holes in the atmosphere. Some were lost at launch, others failed to reach their

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\* The Jet Propulsion Laboratory (JPL) began life in the mid-1930s as an isolated haven at the foot of the San Gabriel Mountains where California Institute of Technology (Caltech) students could blow stuff up without hurting anybody. During the Second World War it was commandeered by the Army. Then, after Sputnik signalled Russia's round-one victory in the space race, it was where America set about designing and building their counterpunch: Explorer 1, America's first satellite.

desired orbit, others did very well. A personal favourite is Pioneer 5 from March 1960 – a spherical probe sent to measure magnetic forces in the space between the orbits of Earth and Venus – that looks very similar to the intimidating black ball that approaches Princess Leia in *Star Wars: A New Hope*.

Flandro had been investigating the knotty problem of how an object might be sent further, towards the outer planets. The general consensus at the time was that this was virtually impossible without something called gravity assist. Jupiter held the keys to the outer planets. Without Jupiter's gravity, any object sent in that direction would eventually fall back to Earth's orbit. But with Jupiter there, an object could fly past, pick up an enormous boost of energy, and then be hurled out towards Saturn. Then, in theory, it could do the same thing at Saturn, and head off further towards Uranus, Neptune and so on.

While working on trajectories, Flandro realised something mind-blowing: that by the late 1970s all the outer planets would be on the same side of the Sun. This alignment of Jupiter, Saturn, Uranus and Neptune could enable a single craft to visit all four outer planets by using gravity assists in what would be dubbed the 'Grand Tour'. This wasn't quite a single one-time option – there were various possible iterations and trajectories – but such an advantageous planetary arrangement would not occur again for another 175 years. Flandro had uncovered a chance to explore a number of planets in one go, at a fraction of the cost. Suddenly NASA had been given the mother of all deadlines.

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To plan for a planetary Grand Tour, NASA needed Pioneers 10 and 11 to dip their toes in the waters of the outer solar system, to see if such an endeavour was even possible. The idea to include a message with the Pioneers came relatively late in the day. Eric Burgess, an English freelancer, had been writing about space missions since 1957. He's the one who

held up his hand in class and pointed out to the world that NASA was about to throw something further than anything had ever been thrown. And during conversations with writers Richard Hoagland and Don Bane the idea for attaching some kind of physical message to the craft was forged. Burgess was unsure about pitching direct to NASA, so instead he approached Carl Sagan, whose eyes lit up.

Sagan was already a well-known astronomer, with a growing public profile, but he was not yet the household name he would become. He was a coal-face scientist, with acknowledged achievements, enthusiasms and specialisations under his belt. He would study the greenhouse effect on Venus, seasonal dust patterns on Mars, the environment of Saturn's moon Titan. He would play a medal-winning role in NASA's Mariner 9 mission, and contribute to the Viking, Voyager and Galileo missions.

In early December 1971, astronomers and astrophysicists descended on San Juan, Puerto Rico, for the 136th meeting of the American Astronomical Society. During a coffee break Sagan began talking to his friend and colleague Frank Drake about the idea for a message aimed at extraterrestrials. He was preaching to the converted – Frank had been thinking about communicating with aliens for years.\*

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\* In 1959 a paper had appeared in *Nature* under the heading 'Searching for Interstellar Communications'. This was the cosmic equivalent of pioneering jazz guitarist Charlie Christian's 'Guitarman, Wake Up and Pluck!' article, printed some 20 years before. Much as Christian had inspired a generation of players to electrify and amplify their instruments, so the *Nature* paper put forward a realistic strategy for searching for extraterrestrial intelligence. It pointed out that scientists now had equipment within their grasp that could scan for radio signals from any alien civilisation with comparable technology. Written by Giuseppe Cocconi and Philip Morrison, the paper ends: 'The probability of success is difficult to estimate; but if we never search, the chance of success is zero.' And Frank Drake became the first radio astronomer to do exactly that, with an experiment named 'Project Ozma' in 1960.

Writing in ‘The Foundations of the Voyager Record’ in 1978, Drake recalled that many of the parameters for the Pioneer plaques were pinned down during that frantic coffee break in Puerto Rico. Before the end of recess, Sagan and Drake had decided they wanted to convey where, when and who the craft came from, without using written language.

To begin with, Sagan suggested a map showing binary stars and constellations, but Drake had a more elegant solution. He suggested a map showing Earth in relation to certain pulsars – spinning neutron stars that emit regular beams of radiation. He reasoned that, as the frequencies of the pulses shift slowly over time, it should be possible for some future being to calculate – from the difference in the frequency of those pulses as recorded on the plaque, compared to the pulses at that future time – the approximate date when the ship’s plaque was designed.

Sagan had the connections and influence within NASA, but it wasn’t an easy sell. Even the smallest addition of weight to Pioneer 10 would throw off NASA’s calculations. To enable Sagan’s project to proceed, NASA would have to unclench, let go the reins, and okay its engineers to re-compute the figures. After weeks of delays and bureaucratic wrangling, Sagan had his green light. But with the launch fast approaching, it was a green light with a strict deadline of just three weeks.

Drake set to work on his pulsar map, while Sagan drew up a second diagram showing the solar system and Pioneer’s trajectory. They had covered the when and the where. Now they needed to tackle the who. Step forwards the third collaborator: artist Linda Salzman Sagan, who had been married to Carl since April 1968.

Salzman began working on simple line drawings of human figures, expressly designed to carry physical characteristics that crossed racial boundaries. The team ruled out giving the humans clothes, discounted diagrams showing veins, muscles, lungs or organs, and abandoned an early idea of showing them holding hands – the viewer might interpret the image

as being of a single organism.\* The final design shows a man and woman drawn to scale before a schematic of the Pioneer spacecraft. The man is slightly taller than the woman, his arm raised in greeting. And they're both naked.

Robert Kraemer, Director of Planetary Programmes at NASA, was at the meeting called in January 1972 to approve the designs. He recalled feeling nervous about the images. He could see Linda had done a good job, yet he feared a public reaction to the nudity. His boss, John Naugle, shared some but not all of his anxiety, okaying the design with the proviso that they erase the short line that indicated the vulva.

The plaque was rubber-stamped. The design was engraved on a six-by-nine-inch gold anodised aluminium plate and bolted to Pioneer 10 in a place that would protect it from the worst of the interstellar dust. It was ready to go.

The existence of the plaque was revealed to the public in February 1972. Both Sagan and Drake fielded press interviews, posed for pictures and talked before cameras<sup>†</sup> next to the soon-to-be-launched vessel. There was plenty of enthusiasm and excitement, but there were several strands of negativity and derision, most of it aimed squarely at Salzman's human figures. Some objected to a skewed gender

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\* A NASA post-mission report, penned by our three collaborators, took a cautious tone: 'It is not clear how much evolutionary or anthropological information can be deduced from such a sketch drawing ... It seems likely, if the interceptor society has not had previous contact with organisms similar to human beings, that many of the body characteristics shown will prove deeply mysterious.'

<sup>†</sup> Frank recalls: 'I had to go on a talk show in Toronto. I was on for maybe five minutes or something. I thought, "Oh, this went very well." I thought I was articulate, I didn't mumble. And all I got was this horrified look from people. They were in shock, they were speechless. "What is it? What happened? What's wrong?" I asked. And they said it was the first time a naked human had ever been shown on Canadian television. "We're all going to be fired!" Luckily nothing happened.'

bias, others to the figures' racial make-up. That only three people worked on the message also caused disquiet in some quarters. But the vast majority were simply scandalised by the nakedness. What was NASA doing, spending our taxes to send this filth out into the universe? Cartoonists had a field day, lampooning NASA as interstellar pornographers. Even those covering the story had to tread carefully. The *Chicago Sun-Times* editors avoided trouble by airbrushing out the 'sexual' parts of the image, removing more and more through subsequent editions of the day. The *Philadelphia Inquirer* upheld standards by covering the woman's nipples and man's genitals. When the *Los Angeles Times* showed the design in all its naked glory, it attracted letters of complaint. There was even one voice who felt that the male figure was performing a Nazi salute.

Pioneer 10 left this clamour far behind, launching from Cape Canaveral, Florida on 2 March 1972. The mission was to be a barnstorming success. The bare facts are these: between July 1972 and February 1973 it became the first spacecraft to traverse the asteroid belt – itself seen as a significant achievement. The first of around 500 photographs of Jupiter was beamed back in November 1973. The closest approach (132,252km) took place in December 1973, by which time it was being followed by its equally successful sister, Pioneer 11, which launched in April 1973 and became the first craft to visit Saturn. Primary missions complete, both headed off into space, their instruments taking the environmental pulse of the far reaches of the solar system and the heliosphere.

Radio communications with Pioneer 10 were finally lost in 2003 – electric power was by then too weak for Earth's receivers to pick up any transmission. At that point the probe was some 12 billion km, or around 80 Astronomical Units, from Earth. For many years it held the gold medal for the most remote Earth-made object, until it was surpassed in February 1998 by the faster Voyager 1. And as I write, Pioneer 10 is heading towards the constellation Taurus at a speed (relative to the Sun) of about 12km a second.

Back on Earth, the plaque's three-strong creative team were left to ruminate over their bruising encounter. There had been bemused surprise and some alarm at the public reaction, but they came to view the majority of the criticisms as unfounded, and were also pleased that it had provoked such interest. Drake wrote in 'Foundations' that the experience had taught them humility in their approach to the future Voyager enterprise.

Today you can quickly find digital threads and articles discussing the absent vulva, still picking over the size and stance of the female figure in relation to the male. It's certainly possible to see how the image can be interpreted as being of a docile woman standing beside the active man. Look at the way her head is turned slightly towards him, while he manfully stares directly at the viewer. He seems to be saying: 'Stand back, darling, let me handle the important business of waving.' It's all rather 1972. When *The Spokesman-Review* newspaper ran with the story, it appeared next to a one-paragraph news item titled 'Women Get In', reporting that Oxford University's Sporting Club was about to admit women for the first time in 109 years ('albeit for a trial period on Saturday nights only') and directly above a quarter-page advertisement for the Preliminary Miss USA Pageant.

Given the timescale, the fact that no plaque to represent all humankind could ever please *all* humankind, the state of racial and gender politics in 1972, and the gender stereotypes being published in books, magazines and advertisements of the era, it could have been a good deal worse had it not been handled by such a brilliant, committed, well-meaning, humble and thoughtful trio. And the upside is this: the removal of the vulva will remain an illustrative sign of the times in the several-million-year lifespan of the Pioneer plaques.

The team's post-match report, stamped in the NASA archives April 1973, ends: 'It is nevertheless clear that the message can be improved upon; and we hope that future spacecraft launched beyond the solar system will carry such improved messages.'



In the film version of this story, the camera now scans across the Pioneer plaque one last time, the footage slowly fades to black, a needle hits vinyl and through static pops we hear the guitar intro from 'Johnny B. Goode'. Fade up to some archive footage of Carl Sagan striding purposefully. Time for Interstellar Handshake 2.0.