The Human Core

Human Core is a **time capsule** made with the technology of today t**o tell extraterrestrial life about humankind and planet Earth**.

Using blocks of **high-temperature quartz glass** protected by a metal cover, the **information is engraved** into a **three-dimensional cubic structure**, which ensures that the **information can be retrieved even in millions of years**. An **intuitive instructions** manual ensures that foreign intelligent life forms are able to retrieve and understand the contents of the Human Core.

Providing **8 GB of data storage** that will **stand the test of time**, it enables the transfer of human knowledge about the foundations of mathematics and physics, as well as pictures and audio recordings capturing the **essence of our existence**.

Detailed project description:
Technology has advanced a lot since the launch of the Voyager missions (that included the Golden Record), especially the means to store information electronically.

However, space is a hostile environment to electronics, and they will fail eventually. A time capsule that can survive thousands or even millions of years therefore must follow a fundamentally different approach.
Our solution, **The Human Core**, uses a **3D matrix as a physical structure to store data in binary code**.

While the Golden Record was a good solution at the time of its conception, the data storage worked 2-dimensionally. Human Core provides a much higher data density, resulting in a 50x increased storage capacity compared to the original record.

The data matrix holds **8 GB of information** and is generated inside a transparent **10 cm • 10 cm • 15 cm quartz glass block** that is able to withstand strong thermal shocks.
The matrix, **a cubic segment of side length 8 cm**, is formed of selective **10 *µ*m big micro cracks** ("bubbles") in a grid of width 20 *µ*m using a technique called **"Sub-Surface Laser Engraving"**. The total amount of grid points is **4096^3 = 69 billion**. The matrix can hold **2700 greyscale images** @ 3 Megapixels (1536 px • 2048 px, 8 bit), **910 color images** @ 3 Megapixels, or **16.5 hours of sound recordings** (mono, 48 kHz, 24 bit), or any blend of the above.
Next to the data matrix is a depiction of **two humans**, one man and one woman, using the same 3D engraving technique. Besides them, the Human Core contains **a series of 3D figures with increasing detail, describing the exact position of earth in the galaxy at the time of probe launch**.
Furthermore, a **trail of spheres** of decreasing size indicates the **starting point and direction to read the data** in the matrix. It starts with a **hollow semicircle** at the edge of the Core, which provides **further haptic cues** to **spacefaring civilisations whose optical senses might not be able to make out** the structure inside the quartz.
To **protect the data storage** from **micrometeorite** bombardment, several countermeasures are in action.

Redundancy is introduced by adding **three identical Human Cores in one protective compartment, positioned strategically** so that a **single micrometeorite penetrating the compartment may only damage two Cores at max**.
The protective compartment is made of **gold plated aluminum**. And additional **socket layer of graphite foam** acts as a **heat insulator and shock absorber**, forming the only connection the Human Core has with the compartment.
The cover of the round compartment contains **instructions** to retrieve the first layer of data from the matrix: An image, containing information about the deciphering process for the rest of the data.
To enable the retrieving civilisation to verify their readout, and to ensure proper image dimensions and ratio to be used, the first image is also etched into the cover sheet.
Instructions about how to retrieve the data is furthermore **engraved into each Human Core**, in case the cover of the compartment became illegible over the course of time.
To **determine the age of the probe**, should it be found, **an ultra pure sample of Uranium-238** is placed prominently upon the cover. Using **radiometric dating methods**, the launch date of the probe can still reliably be determined millions of years later.
The f**irst image is held in black in white**. Utilising only **one bit per pixe**l, this allows the picture to have the **unique property to be visible from visual inspection** (or with a microscope) of the Human Core, forming the **resulting image as the outest 2D layer of the data matrix**.
It holds information about basic mathematical operations, the number system, and physical constants, as well as the read order and the format of the remaining image data.

Furthermore, it provides the wavelengths for the red, the blue and the green channel of color images.
The remaining data is separated into image data, which is a mixture of greyscale and color images, and audio recordings. The last of the images will provide the receiver with information about how the audio portion of the matrix is formatted, and how to play it back.

The image portion of the data matrix contains information about the following topics:

-Mathematical and physical proofs and theories. Due to the nature of mathematics to be "universal", this is an offering to the civilisation which finds the probe that might be of use to them.
- Chemistry: The composition of earth and its atmosphere, the sun, the planets of the solar system, and the nearest stars, information about the building blocks and structure of our DNA.
- Biology: Cells, cellular reproduction, the human body, especially about the structure of the human brain and the human sensory organs.

Furthermore, it should contain pictures delineating the following:
- Faces of humans, to depict our diversity and emotions
- Humans around the world, in different situations, to give a broad picture about human everyday life
- Houses, cities, villages
- Animals and plants
- History and culture (including human art, music, and architecture)
- Technological advances (the ISS, the moon landing)
- A star map that includes further spectral information for each star in our neighborhood, for now and for times in the future.

The audio portion includes the following information:
- Human speech, intonation and emotions (including e.g. the cry of a baby)
- Sounds of animals
- Natural sounds
- Technological sounds (e.g. Modem, vacuum cleaners)
- Music

Even if the probe is not found by extraterrestrial lifeforms in our lifetime, the Human Core will probably continue to exist long after us and will serve as a memory of those who once lived on this beautiful planet.