



SETI INSTITUTE

Mission 2 A Message from Earth

Description of the *Voyager* Record

How to Play the Record

The cover of the *Voyager* record has instructions (in pictures) on how to play the record. In the upper left the picture shows that the enclosed needle should be placed on the outside of the record at the beginning of play. To describe how fast the record should turn scientists have written the time, 3.6 seconds, in binary notation around the edge of the record. Because the discoverers would not define time in seconds, the creators of the record described the time in terms of the fundamental transition of hydrogen (70 billionths of a second). Hydrogen is the most abundant element in the universe, so it is thought that if the discoverers had the technology to encounter *Voyager* they would be able to interpret this information on the record cover. Just below this there is a picture of the record and needle as viewed from the side. Below that is the binary representation of the time it takes to play the whole record (1-1/2 hours).

How to See the Images

The etchings on the right side of the cover show how to convert the information on the record into images. The typical signal of the beginning of a picture is depicted at the top followed by the time period for one image line. Each picture is made up of 512 vertical lines of information. The first image, a circle, is displayed to show the discoverers the correct height and width ratios of the images, and to reassure them that they have decoded the pictures correctly. If the extraterrestrial engineers had made a mistake, their image would look like an ellipse, rather than a circle.

Pulsars

The starlike image at the lower left is a map of nearby pulsars, giving their rotation periods in binary notation. Lines going off from these pulsars from the Earth are identified with labels that should provide an unambiguous description of our location. What is a pulsar? (*A pulsar is the shrunk corpse of a large star that burned all its fuel and then blew up in a gigantic explosion called a supernova.*) The pulsar, which is all that's left of the star, is so small it would fit in downtown New York City! But pulsars spin very rapidly, sometimes as much as a thousand times every second, and like lighthouse beacons, they broadcast light and radio waves into space. These broadcasts sound like the ticking of a clock, except that the ticks can be very fast (even a thousand ticks a second). There is only one location in space (Earth) from which the pulsars that "tick" at the rates shown can be seen by looking in the directions shown.

The Hydrogen Atom

The pair of circles describes the fundamental transition of hydrogen. The little dash between the circles indicates the unit time for deciphering the record, its images, and the pulsar map. It represents the time it takes for the hydrogen atom to switch between its two lowest energy states. This same cartoon can also represent a fundamental unit of length: 21 cm. This is the wavelength of the radio waves given off when the hydrogen atom makes this energy switch.

Radioactive Dating

Finally, the record cover contains a small disk of ultra-pure uranium 238 with very low radioactivity. This enables the discoverers to conduct radioactive decay analysis and determine the date that *Voyager* was launched. This date can also be cross-checked using the pulsar map. Because the period of a pulsar slows down slightly in time, there is only one time in history when the 14 pulsars would have had precisely the periods depicted in the map.

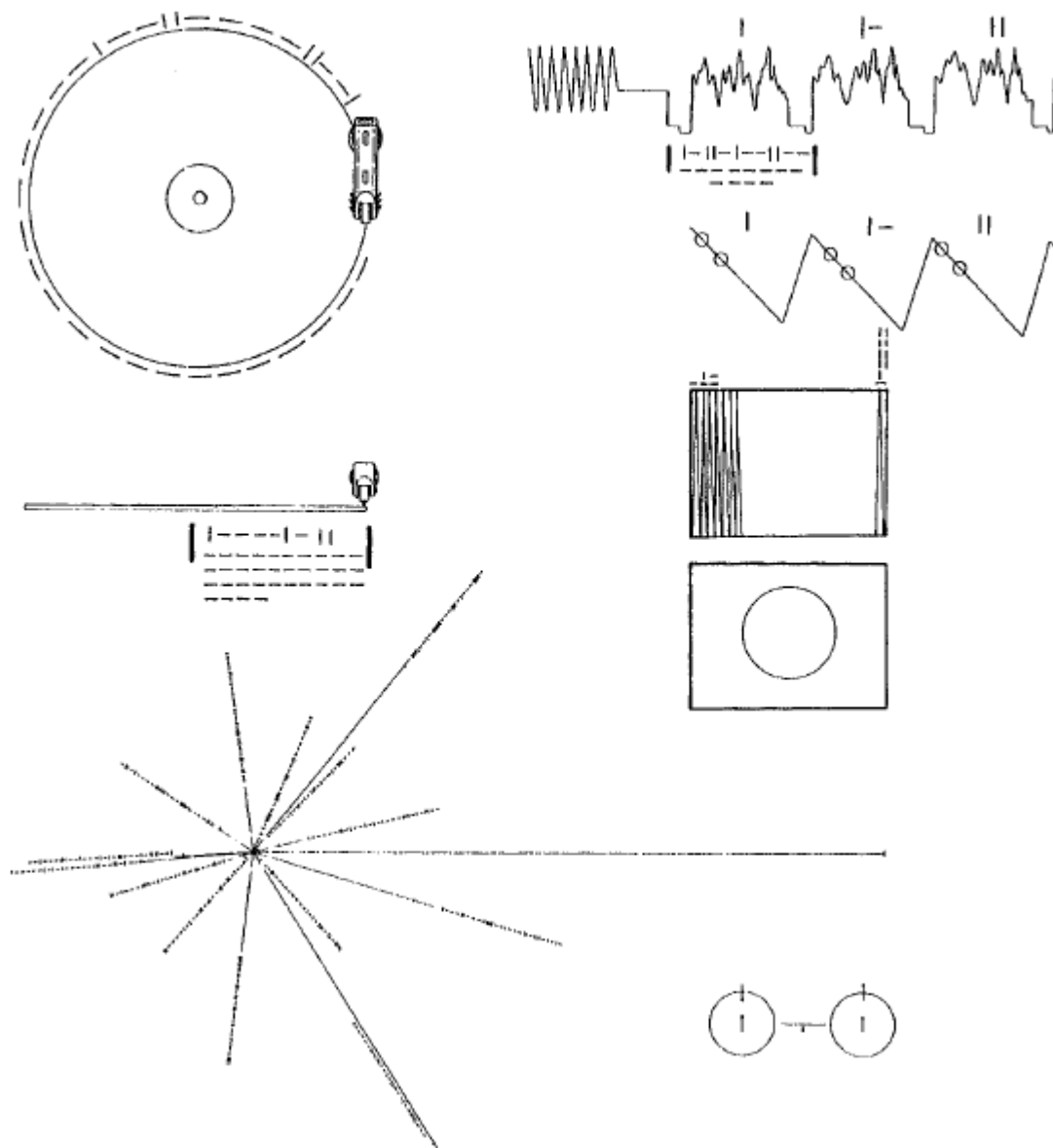


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Diagram of the *Voyager* Record

Figure 2.1.





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Sending a Message to the Unknown

Name: _____ Date: _____

1. In what ways do you think our ancestors have tried to leave their "I was here" message for future generations to know what their lives were like?
2. How are we, who live today, leaving our "I was here" message for future generations?
3. In what years were the *Voyager* spacecraft launched? _____
4. In what years did the *Voyager* spacecraft finish their survey of the outer planets?

5. What was the principal job of the *Voyager* spacecraft?
6. What was attached to the two *Voyager* spacecraft that would tell any intelligent life-forms that found it what life was like on Earth prior to 1977?
7. In the space provided below, write a paragraph that states what the message that you made with your group tries to convey, and how you think an extraterrestrial intelligence would interpret it. One person from your group needs to write this paragraph down on a separate sheet of notebook paper for use on the next class day.



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Did You Get Our Message?

Name: _____ Date: _____

1. Open a picture-message that was created by another group and study it for a few minutes. Do not open the sealed written message yet. In the space below, write down what you think the team was trying to say.

2. Now break open the sealed message and read the other team's description of what they were trying to say with their set of pictures. How does what you wrote compare with what they were trying to convey with their pictures?

3. How could a clearer message be sent? What could be done to improve the chances of communicating with an extraterrestrial intelligence?



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Mission 2 **A Message from Earth**

Who Speaks for Earth?

Name: _____ Date: _____

1. Do you think that the *Voyager* scientists accurately portrayed what Earth was like prior to 1977? Why or why not?

2. There were only a small handful of persons who selected what was going to be put on the *Voyager* spacecraft. Do you feel that the *Voyager* message represented all peoples of the world? Did it speak for all cultures, all races, all religions, and all nationalities? Is this even possible?

3. Who should speak for Earth when a project like this is done? In other words, if another *Voyager* craft were being sent out into the solar system and beyond today, who do you think should be chosen to put the pictures and music on it?

4. If you could choose one photo and one piece of music that could have been included on the record that was placed on the *Voyager* spacecraft, what would they have been? Why?

5. If you could remove one photo and one piece of music from those that were included on the record that was placed on the *Voyager* spacecraft, what would they be? Why?