

Feature Science and Technology

Scientists Propose the Ultimate 'Message in a Bottle'

by Nicola Cole and Daniel Nelson

An attempt to pass a message to intelligent life elsewhere in the solar system — if any exists — may be made with a forthcoming space shot. The space scientists proposing the idea are inviting suggestions as to what the message should say.

WHEN the Cassini probe shot takes off for a seven-year voyage in 1997, its cargo may include a message disc from planet Earth — designed to be read by space explorers from elsewhere in the galaxy.

Beings who receive the message, explains Carolyn Porco of the University of Arizona's lunar and planetary department, "might be our distant human descendants, future explorers from another part of the galaxy or, perhaps in the very distant future, indigenous intelligent life that evolves on Titan". Titan, largest moon of the planet Saturn, is Cassini's destination.

The message-in-a-rocket idea is proposed by Porco, space artist Jon Lomborg and University of California radio astronomer Gregory Benford.

Their proposal is due to come up for discussion by Cassini's \$3.2 billion backers — the United States and European Space Agencies — in May.

The current plan is to inscribe a message consisting of line drawings, symbols and text on a diamond. It could be done by electron-beam lithography, which can inscribe extraordinarily tiny details — at a tenth of a micrometer resolu-

tion (a micrometer is one-millionth of a metre).

It has to be as tough as a diamond because the centimetre-thick, 2 centimetre-diameter disc will have to survive Titan's minus 290 degrees Fahrenheit environment, which scientists suspect might be similar to that of Earth 4.5 billion years ago, before life began pumping oxygen into the atmosphere. Titan's atmosphere contains nitrogen, methane and hydrogen, and there are believed to be lakes and seas on the surface.

It is not the technology for the disc that is giving the headache, but deciding what to say in the message.

Planetary scientist Porco says the message is intended to answer questions likely to be raised by whoever discovers

the spacecraft or the probe which will touch down on Titan: Who built these vehicles and why? When did they live? What were they like? Where did they come from?

To answer such questions the message should convey the anatomical, intellectual and cultural nature of our species, the state of our technology, the nature and location of Earth, and the purpose and timing of the Cassini mission.

For Cassini, Benford favours a greeting from the countries participating in the space shot plus a map of our solar system: "If anyone has any more ideas they would be much appreciated."

Commenting on the proposal, Britain's *New Scientist* magazine said in an editorial that leaving or sending mes-

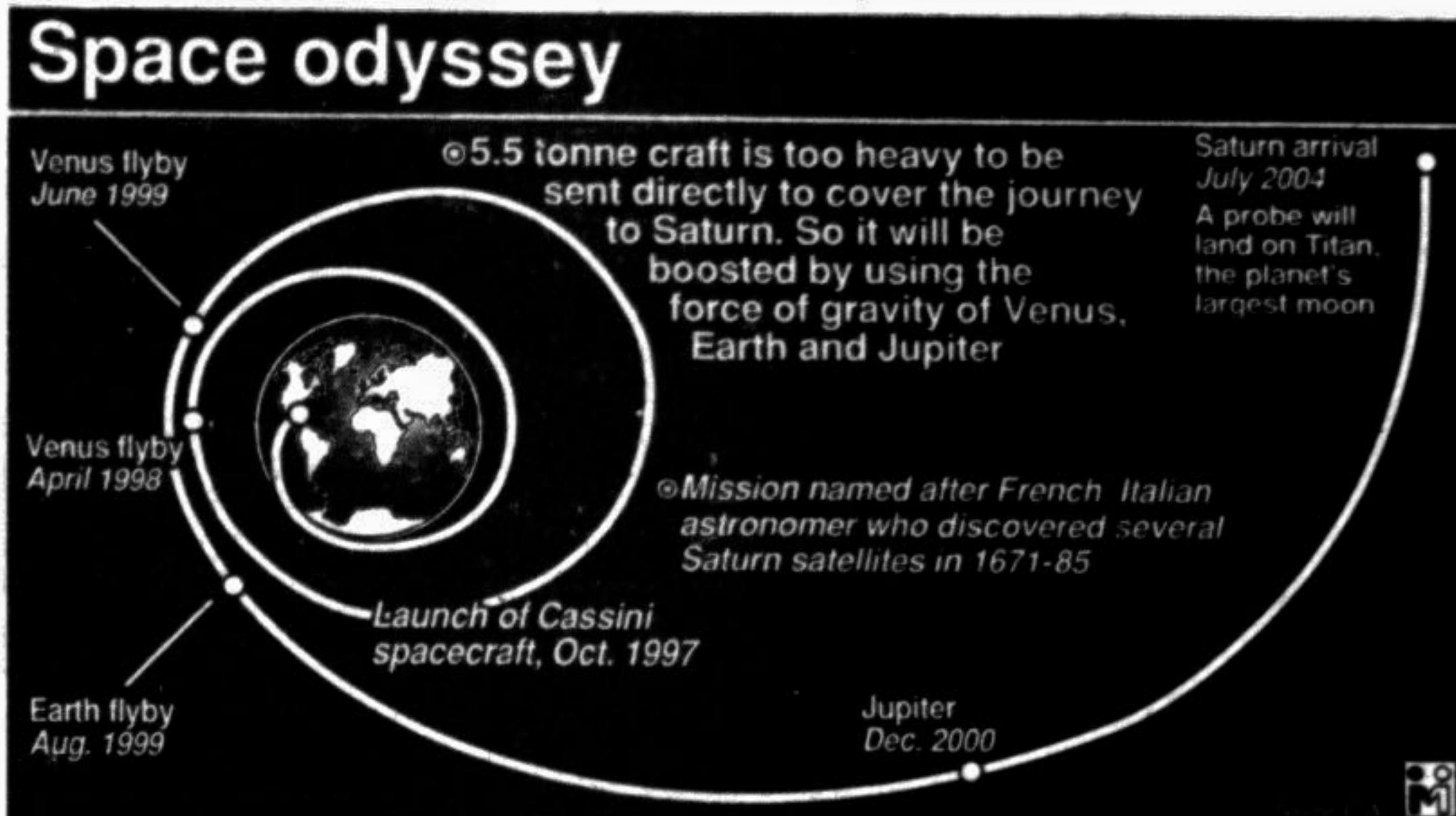
sages to future generations implies faith that "there will indeed be a future with people to read it. Paradoxically, there never has been a time when the people of this planet stood in greater need of reassurance about the future."

"Perhaps that's why, in the

late 20th century, some people feel the curious compulsion to establish a one-way communication with the future."

Lomborg and Porco took their inspiration from messages carried by earlier spacecraft and by the computer videotape planned for the next Russian Space Agency mission to Mars.

The US spacecraft Pioneer 10, the first man-made object to leave the solar system, is now journeying through space



Remote Sensor Aids Cancer Detection

by Xu Yihe

The method will become one of the safest, simplest, cheapest and surest ways for early detection of lung cancer

WHILE Western scientists use remote sensing devices to find out more about planet Earth, doctors in China have begun using them to explore further the human body.

A pocket size sensor called the 'human body energy metabolism detector' is the brainchild of Zhao Si, 40, a scientist with the China Nuclear Corporation. It is used to detect abnormalities deep in the body.

The device detects tiny changes in the temperature of visceral organs and in the equilibrium of the Jingluo (channels and collaterals) system of the human body, which Mr Zhao believes indicate pathological changes inside. Heat is a carrier of the human body's biological information, he says.

The principle is that when pathological changes occur in visceral organs, body heat changes, too.

Mr Zhao says some energy is transferred directly or indirectly into body heat during the energy metabolism process. "Once we can test minor changes of the heat of visceral organs, say, 0.2 to 0.5 degrees higher or lower than normal, we can surely find out general and specific rules of bodily functions," he said.

He says that although there are many ways of testing temperatures on specific parts of the human body, existing devices can only do so by touching the skin. Remote sensing, currently used extensively to gather and record information concerning the earth's surface, involves techniques that do not involve actual contact with the object or area under study.

Clinical thermometer readings of patients cannot always be precise because of vagaries of the environment where temperatures are taken, the state of clothing and other factors.

What is novel about Mr Zhao's sensor is that it can be used 10 inches away from the clothed body — unlike a conventional thermometer which must, at least, touch the skin. It works through an infrared remote sensor and the registered temperature shows on a digital display.

Both laboratory and clinical experiments show that the device has an accuracy of within one-hundredth of a degree. Mr

Zhao says that, as an aid to diagnosis, the device has been very successful in detecting human ailments at their earliest stages.

Feng Lida, professor at the General Naval Hospital in Beijing, says this is significant because the device can detect internal illnesses before the abnormality takes on any physical shape or causes density changes in tissue, as in the case of cancer.

Over the past three years, the device has been used on 10,000 people for blind cancer monitoring in 15 hospitals across the country. The accuracy rate is 92 per cent. It was also used on 5,000 known cancer patients in order to collect data. More than 94 per cent of Mr Zhao's conclusions confirmed the doctors' diagnoses.

Doctors at the Suzhou Medical College, using the instrument to diagnose primary liver cancer, found that the infrared radiation energy from a point on the liver of a cancer patient, reflected in temperature readings, is much higher than that of acute hepatitis patients or healthy people.

The Sino-Japanese Friendship Hospital in Beijing discovered that infrared radiation energy from the lungs of lung-cancer patients is obviously higher than that of patients without the disease.

The method will become one of the safest, simplest, cheapest and probably the surest way for diagnosing lung cancer at its early stages, says Li Ye, a professor with the Sino-Japanese hospital.

Scientists at the physiological department of Suzhou Medical College also use the instrument to experiment on the asymmetry of the two cerebral hemispheres, a basic medical research field.

Results show that the energy on the non-writing hand cerebral hemisphere is much higher than that on the writing hand side. It also indicates that the level of asymmetry has nothing to do with age or sex. However, the cerebral metabolic energy of the male appears to be higher than that of the female.

In the past, similar experiments usually required a surgical operation, mostly on animals, says Duanmu Zhaoxia, a professor with the physiological department of Suzhou Medical College. "But the test using the detector is painless, easy and safe," he says.

The sensor, first exhibited in Beijing in 1990, has been granted patent rights by the China State Patent Bureau. Applications for patents have been filed in the United States, Germany and Japan.

— *Depthnews Asia*

Talking to alien intelligence

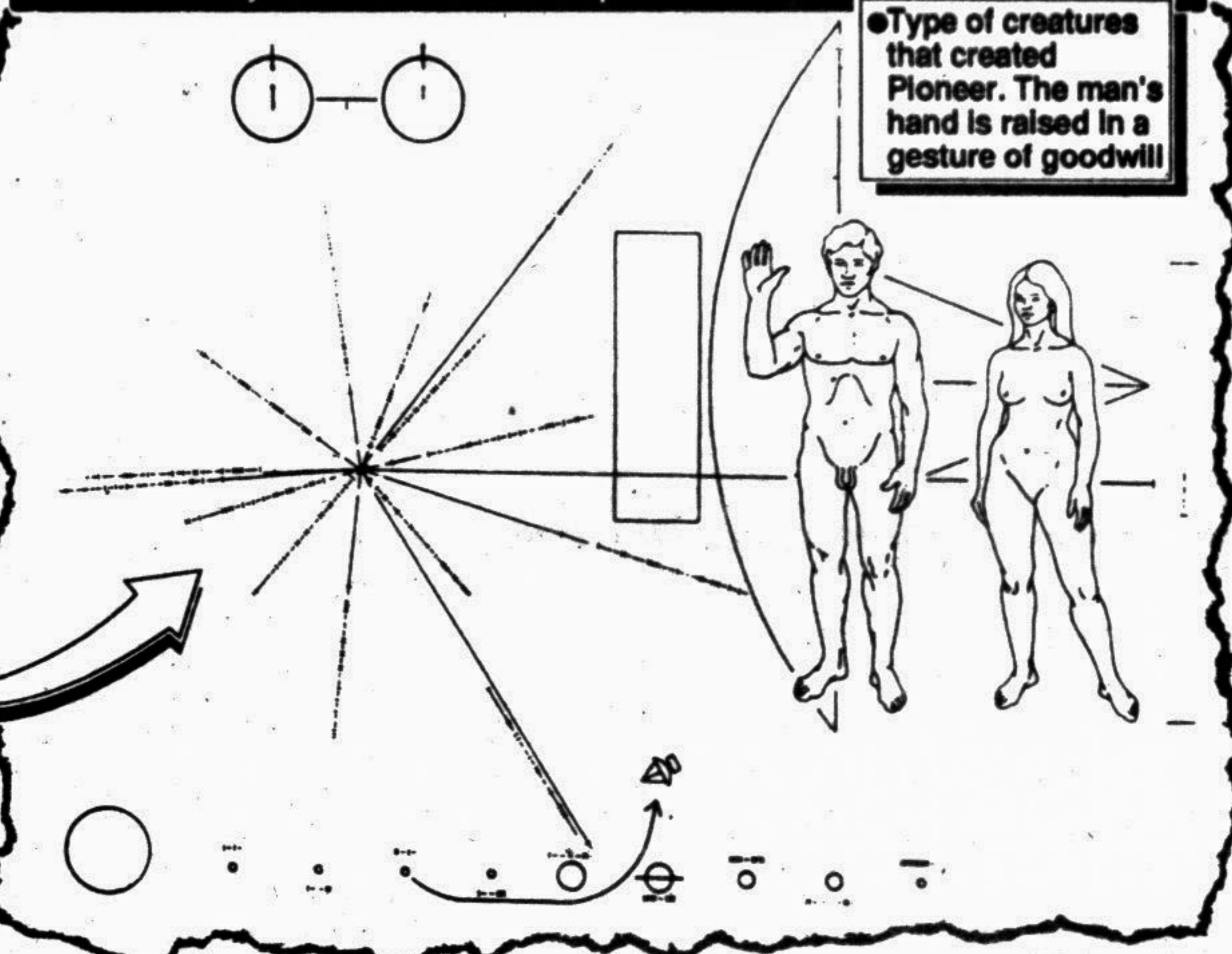
Binary numbers at end of lines represent frequency of pulsars at time of launch, relative to that of the hydrogen atom (upper left). Hydrogen atom is used as a "universal clock"; the regular decrease in pulsar's frequencies will enable another civilisation to determine time elapsed since Pioneer's launch. Also used as yardstick for sizing the drawings. Hydrogen wavelength, about 8 inches, multiplied by the binary number representing "8" shown next to the woman, gives her height - 64 inches

Representation of the positions of 14 pulsars (comic sources of radio energy) arranged to show our Sun as the home star of the launching civilisation

Planets with the spacecraft's trajectory arching away from Earth, passing Mars and swinging by Jupiter

Source: NASA

Pictorial plaque carried by spacecraft Pioneer - the first artificial object to escape from the solar system into inter-stellar space



carrying a plaque bearing an illustration of a man and a woman, plus other information.

The US National Aeronautics and Space Administration says "it is designed to show scientifically educated inhabitants of some other star systems — who might intercept it millions of years from now — when Pioneer was launched, from where, and by what kind of beings."

Most systematic attempts to search for extra-terrestrial life — most notably Project Phoenix launched by the US space agency in 1992 but taken over by private funding after US government cutbacks — use radio telescopes targeted on distant star systems in the hope of detecting radio signals of artificial origin.

In his new book, *Are We Alone?* (published by Penguin books) Paul Davies rates the chances of success of Project Phoenix as "slim" but adds: "Nevertheless, if we don't try we will never know whether alien signals are being beamed as us. Even with such a slender possibility of success, the effort seems worth it, given the momentous nature of the discovery of an alien civilisation."

"In the words of Frank Drake (a US astronomer): 'Our needle in the haystack is elusive, but many of us feel that searching for it is one of the greatest quests our species can undertake.'"

— *Gemini News*.

Accountability of the Scientific Community

Scientific Freedom without Responsibility?

by Md Lutfur Rahman

Fire was perhaps the first scientific discovery to benefit mankind. But is science today playing with fire in its attempts to control nature, the universe and our lives? As the gap between the the public and the scientific community widens, scientists are called to be more accountable to us, the general public, to take responsibility for the results of their work and to regain our trust.

SCIENTIFIC Progress is two sided: it gives power to improve our lives and power to destruct our lives.

There is, in addition, a growing gap between scientific community and the public. Science today is seen, to a great extent, as playing with fire, and increasingly dangerous in the public eye.

The scientific community is often urged to explain its work, and its possible consequences, so that the man or woman in the street can understand (at least to some extent) what is going on. This would reduce public anxiety in the face of natural or technological complexities. Explanation is a good thing. But scientists cannot explain to somebody who is not trained in science how a nuclear power station works. Although they can explain at least the estimated risks that we must accept in order to benefit from scientific progress, or the disadvantages in not accepting technological advances, such as the increase of CO₂ from fossil fuels weighed against the dangers of nuclear power. However, if people feel that the scientists are seeking a particular reaction, then they become suspicious of their explanations. Scientists should put much more effort into activities that display science as an important part of human culture.

Science has such a tremendous impact on daily life that we often forget that the use-

fulness of scientific results is not the only reason for doing research. Human beings are curious; we want to understand our world better. Why does the universe consist of something rather than nothing? What makes particles, atoms and molecules cling together and create objects of the familiar world? How do objects attract other objects at a distance — nuclei, electrons, stars and planets?

This search for a deeper insight is part of our nature. It is a cultural activity similar to the way in which artists portray their understanding of the world. Scientists play down this aspect of science. Normally they justify their demands for money by discussing the benefits of their results to society.

Scientists who make great discoveries tend to explain their results mostly as facts, without saying much about the way in which they were achieved, thus hiding the human adventure involved in all research activities. But perhaps they should try to convey much more of this adventure to the public. Public trust in science and scientists has diminished significantly over the years. Political leaders want to base their decisions more and more on reports by experts, often scientists. But too often politicians want support for their personal opinion, and experts are selected accordingly.

The scientific statements on the Chernobyl catastrophe frankly contradicted each

other. However, it was not a case of experts simply lying — it is possible to misinform by omitting important facts. The diminishing confidence of the public in science and scientists, is at least partially, caused by such a dishonest approach.

Many scientists absolutely refuse to assume any responsibility for the consequences of their results, claiming them to be consequences which they did not want and which they could not influence. All accountability cannot be denied in this way. Though there may not be any legal case to answer, there are other responsibilities to be considered. For example, nobody could say Otto Hahn and Fritz Strassmann were responsible for the atomic bomb. But Otto Hahn could not deny that his discovery led to such terrible consequences as Hiroshima — and in fact he did blame himself in some deeper moral sense.

This kind of accountability should be maintained — the responsibility which scientists could and should feel for the consequences of their research. Often scientists remain silent when they see undesirable tendencies in applications of their field of expertise, because they are reluctant to get into conflict with the people who fund their research. Responsibility is both desirable and possible, but what we need is an atmosphere that encourages scientists to practice it.

WIND power has yet to become a widespread source of energy for lighting homes and running factories. But proponents say this oft-bellied form of renewable energy now deserves a second look.

Projects to study, harness and use wind resources are under way in different parts of the world, ranging from wind farms in China and India, the United States and Europe.

The United States, which has three large wind sites with 1,000 wind turbines each, is the largest commercial user of wind energy. The power firm South California Edison buys 965 megawatts in wind-supplied power. The United States plans to produce 10,000 megawatts from wind power projects by the year 2000.

"It is generally accepted that wind power technology is mature, financially viable and no longer in the realm of research and development," says Dennis Elliott and Steve Drouilhet of the US National Renewable Energy Laboratory (NREL). Both were in Manila recently to address a wind power conference.

Projects to assess wind resources in areas where potential for using wind power is good have been undertaken in Mexico, Brazil, Argentina, Indonesia, the Caribbean and Eastern Europe.

This year, India is installing more wind turbines, which consist of a set of rotor blades mounted on a tower, attached to a gearbox and generator. Wind power is a big draw for private investors in India because of the tax incentives being offered by the government to develop it as a clean and cheap alternative to thermal power that still meets the bulk of India's commercial energy needs.

The South Asian country already has a wind energy capacity of 180 mw, of which 131 mw is in the southern coastal state of Tamil Nadu. China, which has 11 wind farms, is working on developing its own wind turbines and aims to have an installed ca-

Watts in the Wind

The idea of harnessing the wind for energy is no longer hot air.

by Johanna Son and Mahesh Uniyal

capacity of 650 megawatts by the year 2000.

Developing countries and some international agencies are increasingly interested in renewable forms of energy given rising concern about pollution from the heavy use of fossil fuel. Energy demand in developing countries is also growing at seven times the rate of industrialised nations.

Wind power advocates concede that energy source's track record in the past has been had and marked with technical and commercial failures, making it lag way behind other renewable forms of energy like gas and hydroelectric power.

Some critics view using wind, like solar energy, as an elusive and futile quest.

But advocates argue that wind power, though not seen to become as widely-used as

conventional sources, may yet add to the respect given renewable energy. The last 10 years have yielded large improvements in measuring wind resources and boosting technical and economic performance of turbines, they say.

Wind-powered systems in some cases already compete with coal- or oil-fired ones in terms of costs. California turbines produce electricity for 4.5 to 4.8 US cents per kilowatt-hour. Some estimates say next-generation wind turbines may reduce cost to four cents or less per kwh by 2000.

Wind proponents say US\$1 million investment is needed to produce one megawatt through conventional oil, coal or geothermal plants. The figure is lower for hydro and wind because there are no fuel costs.

For many developing coun-

tries, uses of wind energy lie not just in supplying existing power grids, but in its potential for supplying power to remote places, islands or dispersed communities for purposes like pumping water or running small appliances.

Many of the two billion people in the developing world who are without electricity live in remote villages, far from existing grids.

Energy experts say countries like archipelagic Philippines could find wind power useful, especially since half of rural households are without electricity and many remote islands rely on more expensive diesel generator sets for power.

The Philippines, whose earlier wind projects failed, is measuring wind resources and testing wind turbines and aims to have 50 mw installed by

1997. Five potential commercial wind sites have been identified and a 10-kilowatt pilot wind turbine project for 20 homes will start this year on a remote island.

Rodrigo Paras of the National Power Corporation says the larger goal is to pinpoint where small-scale wind systems can supplement diesel-based generation on small islands.

Despite strides made in wind energy in past years, there remain problems that the industry says it is seeking to address.

Elliott and Drouilhet say a lot of factors can affect wind projects, among others a systemic study of wind resources and fund availability. Other problems include the need for large land for wind farms containing wind turbines, noise problems, visual impact, electromagnetic interference and hazards to birds.

There have been cases of residents petitioning against wind towers they find unsightly. The United States' NREL is designing towers that are a less attractive perch for birds after many were killed by blades. Southern California Edison says it still has problems with equipment failure.

Still, wind proponents add that firms looking for investment opportunities in oil or coal in Asia are also considering wind power projects, which augurs well for wind energy.

Alberto Dalusung of Winrock International's renewable energy project, argues wind power is the form of renewable energy with the best potential for applications on a utility scale.

With solar energy unlikely to have utility-scale applications, Dalusung says: "The only renewable technology with a chance (for such uses) is geothermal, hydroelectric power and wind."

He added: "Of those three, geothermal and hydro power are proven. Wind is not yet proven — but in the last 10 years technology has been developed to a point where it is competitive to be used to supply grids."

— *IPS*

