

THE TORONTO STAR Sunday, August 5, 2001

Alien hunters scan sky for extraterrestrial life

Scientist says signs of life found in Martian soil

BY GEORGE JOHNSON
NEW YORK TIMES

For so tribal and xenophobic a species, *Homo sapiens* devotes a surprising amount of energy to hunting down extraterrestrials. Whether scanning the skies for distant civilizations, or scrutinizing asteroids for signs left by alien microbes, humans are forever seeking proof of other signs of life.

Undaunted by a cosmos that has remained stubbornly silent, the U.S.-based SETI project (Search for Extraterrestrial Intelligence) continues to comb through radiotelescope data for electromagnetic drumbeats that could mean someone is trying to get in touch.

But it is not just sentient life that is betrayed by its throbbing. It was a simpler, chemical rhythm that moved a scientist to declare last week, at the International Society of Optical Engineering's annual meeting, that Martian soil samples showed signs of harbouring microscopic creatures.

Though primarily concerned with more mundane matters like medical imaging or fiber-optic communication, the society also maintains an interest in astrobiology — using remote sensing devices to ferret out hints of extraterrestrial life. The meeting, held in San Diego, was a natural place to report two of the latest finds.

Reanalyzing data beamed back a quarter century ago by the Viking lander, Dr. Joseph Miller of the University of Southern California concluded that gases from the soil were emitted in a cyclical manner resembling the circadian "day-night" rhythms of living creatures on Earth — adjusted for the length of the Martian day, 24.66 hours. Something in the soil, he believes, was breathing.

Other experts are dubious of Martian microbes and have long dismissed the gases as the byproduct of lifeless chemical reactions. The rhythms, they say, are probably artifacts, produced by temperature changes or some other kind of fluctuations in the Martian atmosphere, or even within the spacecraft itself.

Other evidence presented at the meeting indicated that microbes are raining down from space. An international team of scientists lofted bal-

loons into the upper atmosphere and found bacteria — about 40 kilometres up — that they say most likely dropped in from another world.

For all the caveats, there hasn't been so much excitement about the possibility of "space bugs," as some call them, since 1996, when NASA announced that a Martian meteorite carried wormlike structures and various chemical combinations that could be microscopic fossils.

Excitement over the possibility that extraterrestrial bacteria exists has never been more intense and new research projects are gearing up to tackle the subject. Although the U.S. government stopped funding for SETI in 1993, philanthropists have taken up the slack.

The search for intelligent cohorts will really take off in several years, when the Allen Telescope Array, a \$26 million (U.S.) complex of radiotelescopes named for its chief benefactor, Paul Allen, co-founder of Microsoft, goes on line in the Cascade Mountains of California.

Another SETI project, announced last month, will focus on a different kind of pattern: distant laser pulses that some far-off outpost may be flashing to attract attention.

NATIONAL POST, THURSDAY, APRIL 25, 2002

BRITISH COLUMBIA

Universe 13B years old, younger than previous estimates

VANCOUVER • The universe is about 13 billion years old, slightly younger than previously believed, say scientists who measured the cooling rate of ancient dying stars called white dwarfs. Astronomers led by Dr. Harvey Richer of the University of British Columbia found the stars in a cluster about 7,000 light years away, using the Hubble Space Telescope.

NATIONAL POST, MONDAY, MARCH 11, 2002

ALBERTA

Newly discovered comet can be seen in western sky

EDMONTON • A newly discovered comet that is exciting astronomers and amateur star-gazers from all over the world has been spotted in the western sky over the Edmonton area and is likely to brighten in the next few weeks. Over the past week, Comet Ikeya-Zhang has doubled in brightness so that it can now be seen with the naked eye.

No big asteroid threat for centuries

Ever since scientists confirmed that an asteroid about 10 kilometres across smashed into the Earth 65 million years ago and caused the extinction of the dinosaurs, astronomers have been scanning the skies for other rogue space rocks that could collide with our planet.

So far, the searches have identified all the 10-kilometre-class asteroids, the so-called global-extinction objects, and none of them will come close to the Earth for the next few hundred years at least.

"What we worry about are the smaller ones, one to two kilometres in diameter, that we haven't identified yet," said asteroid expert Brian Marsden of Harvard University. Marsden was speaking at a recent conference on space objects that threaten the Earth held in Washington D.C.

He noted that about half of the estimated 1,200 one-kilometre-or-larger asteroids that come near enough to Earth to be potentially dangerous have been identified so far. He expects that 90 per cent of them will be found and tracked by the end of the decade.

The explosion from the impact of an asteroid one kilometre wide would be powerful enough to incinerate a city

The Universe

TERENCE DICKINSON

the size of Toronto and to do severe damage over a much broader area. That's why astronomers want to identify all of these objects as soon as possible.

And then there are the thousands of smaller asteroids out there. Just last month, for instance, a "small" asteroid 100 metres across whizzed midway between the Earth and the moon. It's the largest space boulder ever recorded that close to Earth. The disturbing aspect of that incident is that the asteroid, now designated 2002MN, was not discovered until three days after it passed its closest point to Earth. This is because it approached us from an astronomical blind spot in the same general direction as the sun.

On a cosmic scale, the Earth is a very small target. But from time to time renegade chunks from the asteroid belt do score a direct hit. It happened on June 30, 1908, when a 30-metre asteroid (about the size of a 10-storey building) plunged into the atmosphere over central Siberia, broke

apart and exploded before reaching the ground. Known as the Tunguska event, the explosion had the force of a 10-megaton nuclear blast and levelled more than one million hectares of Siberian forest.

Statistically, a Tunguska-class object hits the Earth about once every 200 years. An asteroid one or two kilometres wide clobbers us every few hundred thousand years. Nothing to lose sleep over. But for astronomers it's an ongoing challenge to figure out how to close the net and learn about these objects before they get here.

THE TORONTO STAR Sunday, July 21, 2002

METRO TODAY
MONDAY, JUNE 24, 2002

Scotland world capital of . . . UFO sightings

LONDON Want to see a flying saucer? Then come to Scotland.

The country - better known as the home of the legendary Loch Ness monster - has the highest concentration of UFO sightings on the planet, according to figures released early today.

Around 300 Unidentified Flying Objects are spotted in Scotland each year, the most per square kilometre and per head of population of anywhere in the world, figures compiled by Scotland's official tourist body found.

VisitScotland said 0.004 UFOs were spotted for every square kilometre of Scotland - a rate four times as high as in France or Italy, this planet's other UFO hotspots. The 2,000 UFOs are spotted every year in the United States represent just 0.0002 sightings per square kilometre.

There was one UFO sighting per 17,000 inhabitants in Scotland compared to one per 61,200 in Canada, and one per 136,450 in the United States.

"Traditionally, Scotland has had a lot of odd incidents, right through history, from ghosts and poltergeists to supernatural beings and the Loch Ness monster. So, Scotland is well-known as a place where strange things happen," said Ron Halliday, author of UFO Scotland.

Others had a less dramatic explanation. "UFOs tend to be attracted to regions that are fairly remote. Plus if you have a remote area, look out for airbases; Scotland is littered with them," Graham Birdsall, editor of UFO magazine, said. "In 90 per cent of UFO reports a bit of diligent research will produce a simple explanation."

Reuters

METRO TODAY FRIDAY, MARCH 8, 2002

Cam focuses on old galaxies

SPACE Astronauts from the space shuttle Columbia added a new camera the size of a phone booth to the Hubble Space Telescope's array of scientific instruments yesterday, potentially extending the telescope's optical reach to the ends of the universe.

Since it takes billions of years for light from distant galaxies to reach Hubble, the telescope pho-

tographs faraway sights as they existed eons ago.

Garth Illingworth, a Hubble astronomer from California State University at Santa Cruz, said Hubble's new camera should take scientists back to the first billion years or so after the Big Bang, when the first stars and galaxies were formed.

Reuters

TUESDAY, JUNE 18, 2002 METRO TODAY

Team teleports light ray

Scientists in Australia have successfully teleported a laser beam of light from one spot to another.

Physicists at the Australian National University in Canberra announced yesterday they had disembodied a laser beam in one location and rebuilt it about one metre away in the blink of an eye.

The idea is if quantum particles like ions and atoms have the same

properties, they are essentially the same. So if the properties of quantum particles making up an object are reproduced in another particle group, there would be a duplication of the object, so only information about the particles' properties need be transmitted.

The breakthrough opens up possibilities for super-fast and secure communications systems.

Reuters

Kilometre-wide asteroid targets Earth

BY MARGARET MUNRO

The world as we know it could end on March 16, 2880. An asteroid a kilometre wide and packing more punch than all the nuclear bombs on the planet is on course to slam into Earth that day.

The chance of a hit is about one in 300, which is unusually high, according to scientists who detail the risk in the journal *Science* today. Not only is it the longest-term asteroid impact forecast ever made, it is, perhaps unfortunately, also the most precise.

THURSDAY, JUNE 13, 2002

Asteroids could spill galactic secret

SPACE A newly-discovered cluster of asteroids formed 5.8 million years ago could provide clues about the origins of the solar system, scientists said yesterday.

Scientists at the Southwest Research Institute in Boulder, Colo., discovered the family of 39 asteroids in the asteroid belt between Mars and Jupiter and for the first time used a computer model to date when they were formed.

The cluster, formed when a 24-km asteroid was struck by a smaller object, could help answer questions about what happens when asteroids break up and whether one on course for a collision with Earth could be diverted.

FRIDAY, MAY 31, 2002

Sensors to take inside look at Mars

SPACE British scientists started building tiny "Marsquake" sensors yesterday that will be able to detect underground water supplies and could help in the search for life on the red planet.

The 2007 NetLander mission will land four sets of instruments near the Martian equator to examine the planet's weather and geological structure. The quake sensors will be the first to look deep inside the planet, the team responsible for their construction said.

"We will look at how the vibrations from Marsquakes travel through the planet and work out what is going on deep inside," said Imperial College London researcher Dr. Tom Pike. "If these vibrations hit liquid water under the landing sites, we should see a distinctive signature. That is when the search for life on Mars will move underground."

Reuters

Asteroid scheduled to hit Earth on March 16, 2880

sail spacecraft mission that ends by collapsing the sail around the asteroid," says Jon Giorgini, of NASA's Jet Propulsion Laboratory and lead author of the *Science* paper. "These things would all change the way it reflects light and radiates heat and are sufficient to divert it from an impact."

The asteroid, known as 1950 DA, is 1.1 kilometre in diameter. It was first detected in 1950 and then slipped from sight only to reappear on New Year's Eve, 2000.

The fact observations span 50 years, plus some unusual quirks in its orbit make 1950 DA unique, in that its future can be predicted for hundreds of years, say Giorgini and his colleagues from several major U.S. observatories.

Their detailed analysis reveals a 20-minute interval on March 16

2880 when there is a "non-negligible probability" of the giant space rock colliding with Earth.

If the asteroid hits Earth, scientists say it would release about 100,000 megatonnes of energy. That is more explosive power than "all the nuclear weapons in the world, piled together and set off at the same time," Brown says. "It's big enough to cause a full-scale nuclear winter scenario, throwing dust in the atmosphere, decreasing the temperature of Earth, destroying the growing seasons."

Earth has been hit by bigger space rocks such as the 10-to-20-kilometre-wide asteroid that is believed to have wiped out the dinosaurs 65 million years ago. "1950 DA would be messy but much smaller," Giorgini says.

He and his colleagues took everything from the solar wind to planetary alignments into consideration in making their predictions. But there are wild cards. Things such as the so-called the Yarkovsky effect — based on the way physical properties of an asteroid reflects light. As the asteroid tumbles through space, some sunlight is reflected off its surface. This can cause a slight and uneven acceleration of the asteroid and, over time, can significantly change an asteroid's orbit.

Joseph Spitale, of the University of Arizona-Tucson, says in a second report in *Science* today the Yarkovsky effect could be used to divert the asteroid, given enough lead time. He says dumping dirt on it or shattering the upper few centimetres with explosives, could change the course of some space rocks.

Brown says using nuclear explosives on 1950 DA would not be a good idea as the rock could break into pieces, all of which might slam into Earth.

National Post

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TORONTO

THURSDAY, JANUARY 17, 2002

METRO TODAY

Life on Mars gets boost from Toronto researchers

OTTAWA The odds of life on Mars are better after the discovery by Toronto researchers of microbes that manage to thrive under harsh Mars-like conditions in Antarctic soils. The surprise discovery, done on a shoestring budget, is expected to spur more microbe-hunting expeditions to Antarctic regions most like the frozen and dry parts of Mars, the nearest planetary neighbour to Earth.

Scientists said the discovery should also help pinpoint the best landing site for a robotic space explorer tentatively scheduled to seek answers by digging into the Mars surface before the end of the decade.

The colonies of fungi were found in Antarctic samples collected by Bill Mahaney, a world-renowned soil scientist at York University, and identified by fungi specialist David Malloch at the University of Toronto.

"We're not saying this shows there is life on Mars," said Victor Baker, a University of Arizona geologist who was part of the international team. "We're saying that life occurs on Earth in what is a Mars-like environment. Scientists need to start asking different questions."

Torstar News Service

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Asteroid armageddon coming, or maybe not

'RISK FELL TO ZERO'

BY DAVID DERBYSHIRE

LONDON • Scientists had good news on Wednesday for people concerned about how long their pensions will last. The world could quite possibly end anyway on Feb. 1, 2019.

Astronomers say a huge asteroid is scheduled to crash into the Earth at 11:47 a.m. on that day.

If it does, it would wipe out an entire continent, plunge the world into a nuclear winter and take humanity to the brink of extinction.

However, as seasoned asteroid story watchers will have realized, there is a catch. The odds that the world will end in 17 years' time, were last night estimated to be one in 75,000 and lengthening.

That compares with the one in 10,000 chances of a person being killed in a car crash in any one year, and the one in 100,000 chance of being murdered.

The odds of winning the national lottery jackpot are one in 14 million.

With astronomers taking an increased interest in the threat of near-Earth objects, doomsday asteroids are cropping up with alarming regularity.

In February, astronomers discovered another potential threat called 2002 CU11.

Initially, the chances of it hitting the Earth in 2049 were put at a disturbing one in 9,000. But as more observations were made

over the following weeks, the risk of a collision fell to zero.

The latest armageddon rock is called 2002 NT7 and is likely to suffer the same fate.

It was first seen on July 9 by NASA and the US Airforce's Linear Observatory in New Mexico. Since then, scientists at NASA and Pisa University in Italy have carried out orbit calculations every day.

They now believe it orbits the Sun every 837 days, travels in a tilted orbit between Mars and Earth and is between one and four kilometres across.

Preliminary calculations suggest it will come close to the Earth in 2019. If it collides, its impact velocity on the Earth would be 18 miles a second — enough to wipe out a continent and throw up

'[A STRIKE] WOULD REDUCE US TO DARK AGE CONDITIONS'

enough dust to block out the Sun, bringing devastation to the world's food supply.

Dr. Alan Fitzsimmons, of Queen's University in Belfast and a scientist with the National Space Centre, said its orbit needs to be clarified.

"The orbit has been calculated every day, but we need another few weeks before we can get a precise orbit."

On Wednesday morning, the probability that it would collide

with the Earth was one in 60,000. But by the end of the day, when a new set of observations had come in, the odds against a collision had risen to one in 75,000.

Dr. Simon Mitton, an astronomer at Cambridge University, said it is often the case that as more calculations are performed, the danger of a collision declines.

"A pattern is developing with these in that sometimes the initial observations of a new object appear to indicate that it is on a collision course with the Earth.

"But subsequent observations allow the orbit to be more carefully refined and we usually then find that the asteroid is not a threat," he said.

"The likelihood is that NT7 will turn out to be one that misses the Earth by quite a large margin."

Objects the size of NT7 only hit the Earth every one or two million years.

Dr. Benny Peiser, an anthropologist at Liverpool's John Moores University who has written about the influence of asteroids on human evolution, said he was confident that the risk of doomsday is low.

"In the worst-case scenario, a disaster of this size would be global in its extent, would create a meltdown of our economic and social life, and would reduce us to Dark Age conditions," he said.

The dangers of NT7 have yet to be reviewed by the International Astronomical Union, the main international body responsible for announcing such risks.

Dr. Peiser said NT7 would continue to be monitored by space experts across the world.

"In all likelihood, in a couple of months additional observations will eliminate this object from the list of potential impacts," Dr. Peiser said.

"I am very confident that additional observations over time will show that it is actually not on a collision course with Earth."

The Daily Telegraph

Astronomers monitoring asteroid threat

LONDON (AP-Reuters) — Astronomers are carefully monitoring a 2-kilometre-wide asteroid — big enough to destroy a continent — to determine if it's on a collision course with Earth.

Initial calculations indicate there is a chance asteroid 2002 NT7 will hit the Earth on Feb. 1, 2019. But scientists said yesterday the calculations are preliminary and the risk to the planet is low.

"The threat is very minimal," Donald Yeomans, of NASA's Jet Propulsion Laboratory in Pasadena, Calif., told British Broadcasting Corp. radio. "An object of this size would be expected to hit the Earth every few million years and, as we get additional data, I think this threat will go away."

The Lincoln Near Earth Asteroid Research Project in New Mexico detected the object July 9. It orbits the sun every 837 days.

Last month, an asteroid the size of a soccer field missed Earth by 120,000 kilometres — less than a third of the distance to the moon and one of the closest known approaches by objects its size. Had it hit a populated area, it would have released as much energy as a large nuclear weapon.

OBITUARY - On May 25/02, David Prockter, age 49, co-editor of Britain's Interplanetary News, died of a sudden heart attack. Edward Harris will now be the editor.

The Milky Way galaxy has been caught in the act of shredding an ancient star cluster and leaving a tell-tale trail of stellar debris smeared across the sky, astronomers reported yesterday.

A camera on a telescope at Apache Point Observatory, southeast of Albuquerque, N.M., captured a track of scattered stars that appears to stretch the same distance as a lineup of 20 full moons.

"This is the first time that we

have managed to actually catch the Milky Way in the act of disrupting a globular cluster," said Eva Grebel of the Max Planck Institute of Astronomy in Heidelberg, Germany.

Globular clusters are clumps of thousands of stars that are thought to be billions of years old. The one in question — known to astronomers as Palomar 5 — is a relatively small, old cluster, per-

haps 12 billion years old and containing 10,000 stars.

The same gravity and centrifugal force involving the Sun and the Moon that produce ocean tides on Earth pull material from Palomar 5 toward the centre of the galaxy and push it away, but they don't do it smoothly.

The irregular push-and-pull creates clumps of stars in the debris trails, said Michael Odenkirchen of the Planck Institute.

Reuters

FAST FACTS/THE MILKY WAY GALAXY

- Diameter: 120,000 light years. Thickness: About 7,000 light years.
- Closest galaxy: Andromeda Galaxy.
- Number of stars in the Milky Way: 200 billion.

A light year is about 9.6 trillion km, the distance light travels in a year.

Source: www.fix.net/wreil/ccas/cosmic_facts.htm

Earth-piercing 'missiles' coming from space

Twin events in 1993 may be first evidence of strangelets

BY ROBERT MATTHEWS

LONDON • Forget the danger from giant meteors: Earth is facing another threat from outer space. Scientists have come to the conclusion that two mysterious explosions in the 1990s were caused by bizarre cosmic missiles.

The two objects were picked up by earthquake detectors as they tore through Earth at up to 1.5 mil-

lion km/h. According to scientists, the most plausible explanation is that they were "strangelets," clumps of matter that have so far defied detection but whose existence was posited 20 years ago.

Formed in the Big Bang and inside extremely dense stars, strangelets are thought to be made from quarks — the subatomic particles found inside protons and neutrons. Unlike ordinary matter, however, they also contain "strange quarks," particles normally seen only in high-energy accelerators.

Strangelets — sometimes also called strange-quark nuggets — are predicted to have many unusual properties, including a density 10

trillion times greater than lead. Just a single pollen-size fragment is believed to weigh several tons.

A team of U.S. scientists believes it may have found the first hard evidence for the existence of strangelets after scouring earthquake records for signs of their impact with Earth. The team, from Southern Methodist University in Texas, analyzed more than a million earthquake reports looking for the tell-tale signal of strangelets hitting Earth.

While their very high speed gives strangelets a huge amount of energy, their tiny size suggests that any effect might be extremely localized, and there is unlikely to be a blast

big enough to have widespread effects on the surface.

The scientists looked for events producing two sharp signals, one as it entered Earth, the other as it emerged again. They found two such events, both in 1993. The first was on the morning of Oct. 22. Seismometers in Turkey and Bolivia recorded a violent event in Antarctica that packed the punch of several thousand tons of TNT. The disturbance then ripped through Earth on a route that ended with it exiting through the floor of the Indian Ocean off Sri Lanka 26 seconds later — implying a speed of 1.5 million km/h.

The second event took place on

Nov. 24, when sensors in Australia and Bolivia picked up an explosion starting in the Pacific south of Pitcairn Island and travelling through Earth to appear in Antarctica 19 seconds later.

According to the scientists, both events are consistent with an impact with strangelets at cosmic speeds. In a report about to be submitted to the Seismological Society of America, the team of geologists and physicists concludes: "The only explanation for such events of which we are aware is passage through the Earth of ton-sized strange-quark nuggets."

Professor Eugene Herrin, a member of the team, said two strangelets one-tenth the breadth of a hair would account for the observations. "These things are extremely dense and travel at 40 times the speed of sound straight through the Earth — they'd hardly slow down as they went through."

The good news is that, despite their force, the impact of strangelets on an inhabited area would probably be less violent than that of a meteor. "It's very hard to determine what the effect would be," Mr. Herrin said.

Scientists say the discovery of strangelets would be a significant breakthrough, solving several long-standing mysteries. These include the nature of "dark matter," which astronomers say makes up more than 90% of our galaxy. With their high density and stability, strangelets may account for much of this invisible matter.

The Sunday Telegraph

TUESDAY, MAY 28, 2002

Underground ice may lie on Mars

SPACE NASA's Mars Odyssey spacecraft has reportedly detected water ice under the surface of the planet, scientific papers say, in a finding that could be a giant step in the exploration of Mars.

Many astronomers believe Mars used to have quantities of liquid water on its surface, but they have never agreed on where the water went. Research to be published in this week's edition of the journal *Science* may help answer that question.

Liquid water is seen as a prerequisite for Earth-type life on a planet. Underground water ice could be a key to understanding how Mars developed and could inform exploratory missions.

WEDNESDAY, JULY 17, 2002

Telescope to delve deep into alien hunt

SPACE Technological advances have opened the way for scientists to probe millions of previously unknown star systems, increasing the chances of finding intelligent life in outer space in the next 25 years, an extraterrestrial agency believes.

The Search for Extraterrestrial Intelligence Institute in Mountain View, Calif., reports it is developing a giant, \$26-million telescope to start operating in 2005 that can search the stars for signals at least 100 times faster.

Since it was founded in 1984, the institute has monitored radio signals, hoping to pick up a transmission from outer space.

MetroToday news services

THURSDAY, JUNE 20, 2002

'X-files' team probes weird animal deaths

ARGENTINA The government is sending its own "X-Files" scientists to probe strange deaths of farm animals found dissected, mutilated and drained of blood on remote Pampa plains, killings some have blamed on aliens.

At least 70 animals were reported killed in recent weeks, some with their genitals and tongues pulled out with surgical precision, surrounded by charred grass with no signs of blood stains. One horse's hoof had a circle drawn into it.

Frightened farmers said there have been no signs the animals had been attacked by wild boars — and were quick to highlight the meat of the animals had been untouched in a land where hunger is widespread and cattle theft is growing.

MONDAY, MARCH 18, 2002

METRO TODAY

Comet swinging by after 341 years

ASTRONOMY A comet that hasn't been seen from Earth since 1661 will be visible for the next few weeks, CBC.ca reports. Astronomers have calculated that comet Ikeya-Zhang last passed by Earth 341 years ago.

Some astronomers are calling the comet the best one visible in the Northern Hemisphere since Hale-Bopp in 1997. Ikeya-Zhang is barely visible with the naked eye, but its tail of gas and dust is visible through binoculars.

The comet can be seen just after the Sun sets, near where the Sun used to be. In early April, the comet will swing around the Sun and be visible before sunrise.

Most comets are now found by computer, instead of visually, so Ikeya-Zhang's appearance in the inner Solar System is considered a bit of a surprise.

NASA hopes probe will solve mysteries of solar system's oldest objects

BY BROWARD LISTON

CAPE CANAVERAL, FLA. • Seeking to shed light on some of the solar system's abiding mysteries, NASA launched a satellite yesterday on a mission intended to take it within 100 kilometres of a comet.

The satellite, named Contour, for Comet Nucleus Tour, was launched in early morning darkness aboard a Boeing Delta 2 rocket from the Cape Canaveral Air Force Station in Florida. Two hours later, NASA reported it was in its proper orbit and working well.

"It appears the mission is right on the mark. We're happy here," launch director Chuck Duvall said.

Contour will orbit Earth until Aug. 15, when onboard rockets will send it toward an encounter with Comet Encke on Nov. 12, 2003, and Comet Schwassmann-Wachmann 3 on June 19, 2006.

NASA hopes that by analyzing the hearts of two comets close up, Contour will reveal the secrets of the hydrogen-rich celestial bodies, which may be the source of the Earth's water and could become mobile gas stations for future interplanetary explorations.

Comets are common in the solar system — there may be trillions altogether — but most remain far beyond the orbit of Pluto, the outermost planet, and beyond the reach of scientists.

Scientists are interested because they believe each has a nucleus frozen 4.6 billion years ago, at the time the planets were forming, and may yield information about key events in the history of the solar system.

Comets figure in theories on a range of subjects, from the extinction of the dinosaurs to the beginning of life on Earth, yet little is known about them.

"Comets are the solar system's smallest bodies, but among its

biggest mysteries," said Joseph Ververka of Cornell University in Ithaca, N.Y., and Contour's principal investigator.

"We believe they hold the most primitive materials in the solar system and that they played a role in shaping some of the planets, but we really have more ideas about comets than facts."

Contour's science teams hope there will be less mystery and more knowledge after the spacecraft encounters its comet targets.

"I'd expect to find that the ideas and the theories we have right now will be somewhat off-base," said project scientist Michael Belton, an astronomer with the Kitt Peak National Observatory in Arizona.

"I think we have a fair chance of overturning the current paradigm and replacing it with honest truth."

Contour is equipped with a special debris shield so it can navigate closer to the comets and survive bombardment from the minute particles of dust and frozen water that form a comet's most distinctive feature, the tail.

The shield includes a layer of Kevlar, the material used in bulletproof vests, to help vaporize particles striking Contour with the force of .22-calibre bullets.

Contour will spend most of its operational life in hibernation mode to hold down costs on the US\$158-million program.

During each of its near-comet passes, its four science instruments will work for about six minutes, collecting hundreds of photographs and about two gigabytes of data.

Encke was chosen as a target because it has been studied in some detail and could provide a frame of reference for the new data.

The father of comet science, Fred Whipple, used Encke 50 years ago to develop his "dirty snowball" model for comets. At age 95, he is a project scientist on Contour.

Schwassmann-Wachmann 3 was of less interest to scientists until the mid-1990s, when it split into three parts.

Contour will return to Earth's orbit after studying the two comets and can be sent out again if a good opportunity presents itself.

Reuters

ASTRONOMY

Scientists urge Pluto mission for clues to life's beginnings on Earth

how life came to exist on Earth. This is the latest salvo in a two-year tussle over funding for a mission to Pluto, the only planet in the solar system that has never been directly observed by a robotic probe.

Many scientists believe the Kuiper Belt is a kind of comet and asteroid breeding ground, and comets and asteroids may have carried water and the building blocks of life when they smashed into Earth in its infancy. "They are the only mechanism we know to bring water and biological materials to a sterile Earth," said Michael Belton, who chaired the committee that prepared the council's report. Dr. Belton, who is president of

Pluto takes 248 years to make one trip around the sun.

The report outlined objectives for NASA that could be launched between 2003 and 2013, including learning how life developed on Earth and whether life exists beyond Earth.

The report said NASA needs to send a series of robotic spacecraft, ranging from relatively small ones that would cost less than US\$325-million to mid-size ones costing up to US\$650-million, with launches at least every 18 months.

NASA has shown wavering enthusiasm for a Pluto-Kuiper Belt mission. In September, 2000, the National Aeronautics and Space Administration stopped work on

Belton Space Exploration Initiatives in Tucson, Ariz., said the recommended mission would be a robotic reconnaissance of the "diverse properties of Kuiper Belt objects." "It's not a Pluto-centric mission," Dr. Belton said in a telephone interview.

"Pluto is included in that because Pluto is the largest member of that group. It's strange, and it turns out that all these other Kuiper Belt objects have unexpected properties too."

Pluto is the most distant planet from the sun, and in recent years some have even questioned whether it qualifies as a planet because of its small size and eccentric orbit. Discovered in 1930,

NASA withdrew funding for robotic exploration.

WASHINGTON • Pluto and its oddball neighbourhood should be NASA's top priority in solar system exploration, scientists said yesterday, even though the latest federal budget eliminated funding for such a mission. The National Research Council urged an exploration of Pluto and the Kuiper Belt in which it lies because this region of unusual cosmic objects might yield clues to

a robotic mission, saying it needed to be "rethought and re-planned" to cut costs.

Funding was restored in November, 2001, and then eliminated this April, along with funding for a mission to Jupiter's moon Europa, another mission recommended by the research council.

This raised hackles at the California-based Planetary Society, which has launched an online petition drive at www.planetary.org to send a mission to Pluto and Europa.

"If the Pluto-Kuiper Belt mission is cancelled now, the best opportunity for exploration of this frontier planet will be lost for decades," the non-governmental space-boasting society said in a statement to Congress.

Delaying the mission would risk a probe arriving at Pluto after its tenuous atmosphere freezes with the onset of a winter lasting more than 100 years.

Reuters