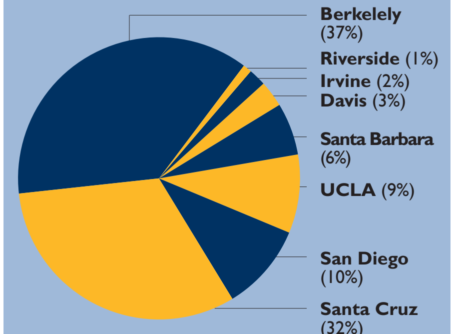
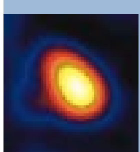
UC earns major research awards from NASA

NASA research funding to UC by campus, FY2002

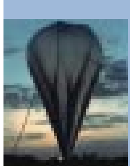


Source: UCOP contracts and grants database



- The RHESSI satellite is helping researchers at UC Berkeley's Space Sciences Laboratory understand solar flares: pages 4-5

- At UC Santa Barbara, two geographers are using satellite images to document the degradation of Amazônia: page 3
- UC Santa Cruz astrobiologist Dave Deamer is exploring cell membranes and the origin of life: page 2



- UC Riverside physicist Allen Zych is searching for the sources of high-energy gamma rays in deep space: page 6
- UCSF psychiatrist Nick Kanas is studying how humans adapt to the rigors of living in space: page 7

NASA has awarded the University of California $108.5 million in research grants for fiscal year 2002. NASA is tapping UC's unparalleled research and education facilities to help fulfill the agency's new missions.

Under recently appointed Chief Administrator Sean O'Keefe, NASA is striving not only to understand the cosmos, but also to protect our planet and inspire the next generation of space explorers.

UC researchers study solar flares and monitor the sources of gamma rays in deep space. UC's NASA-funded research on the Earth spans the scale from modeling the origin of organic molecules necessary for life, to documenting the degradation of the Amazon rainforest.

NASA relies on UC researchers to help determine whether astronauts could withstand the psychological rigors of a trip to Mars. Meanwhile, UC educators are reaching out to students to teach them about the science behind NASA missions.

UC maintains several outstanding research centers that attract NASA funding, including UC Berkeley's Space Science Laboratory and the Lick and Keck observatories.

UC and NASA also benefit from the proximity of UC campuses and NASA research centers. In northern California, NASA Ames in Mountain View is just a short drive from the Santa Cruz, San Francisco and Berkeley campuses, while in southern California, UCLA and the campuses at Santa Barbara, Riverside and Irvine are not far from NASA's Jet Propulsion Laboratory in Pasadena.

In recent years, NASA research funding to UC has tended to fluctuate between $50 and $100 million annually, depending upon the timing of large, multi-year grants. FY02 was a stellar year, with NASA awarding two major grants – $33 million to UC Santa Cruz for collaborative research with NASA Ames on the evolution of new stars and $15 million to UC Berkeley's Space Sciences Laboratory for studies of the solar wind.

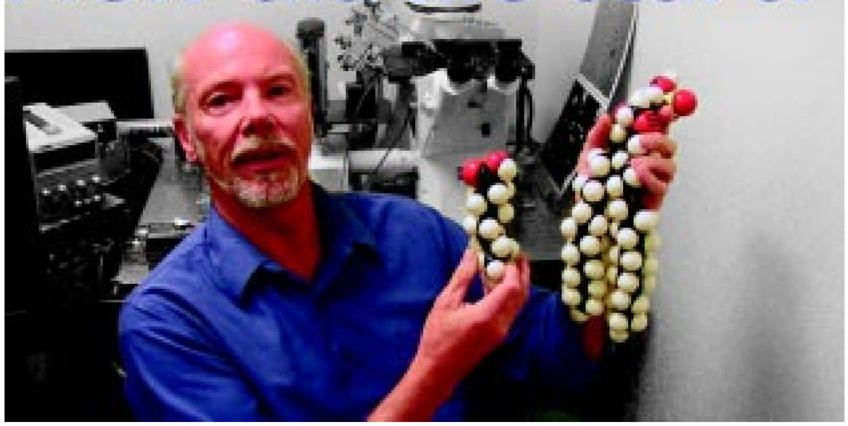
> *These are exciting times. We are on the threshold of discovery and we hope to take you on that journey into the future.*
>
> NASA Administrator
> Sean O'Keefe

Between them, these two campuses garnered 69 percent of NASA's research funding to UC, with $39.5 million flowing to UC Berkeley and $34.9 million to UC Santa Cruz.

UC San Diego captured over $11 million, or 10 percent of the total NASA research funding to UC. UCLA earned $9.5 million, for nine percent of the funding.

The remaining UC campuses earned from $1.2 million to $6.4 million each, with the exception of UC San Francisco, the only UC campus solely dedicated to the health sciences, which earned about $400,000 for NASA-related medical research.

How did life start?



UC Santa Cruz astrobiologist Dave Deamer holds a model of a simple organic molecule in one hand, and a more complex amphiphilic lipid molecule in the other. The simple molecule may have formed in space and fallen to prebiotic earth. The more complex molecule is necessary for cellular membranes.

Even the earliest forms of life had to be picky. All organisms must have some way to isolate themselves from chemicals they don't need, and yet absorb nutrients they do need. For early life to evolve, there first had to be membranes.

UC Santa Cruz chemist and astrobiologist Dave Deamer is exploring how nature could have formed membranes during Earth's prebiotic period, membranes that became the basis of cellular life. In the process he is developing an alternative theory of the origin of life, and he is building research tools for today's biotechnology industry.

Although the solar system formed approximately 4.6 billion years ago, the first 700 million years were rough on our planet – the moon and the early Earth were bombarded by comets and asteroid-sized objects until about 3.9 billion years ago. The energy released by the largest impacts probably vaporized the oceans and destroyed any existing life on the Earth's surface. The first microfossils appear in sedimentary deposits about 3.5 billion years ago, suggesting that cellular life with a complete genetic system existed at that time. That leaves a window of 400 million years during which early life began.

The origin of life on the prebiotic earth required three essential conditions – liquid water, a source of organic (carbon-based) compounds, and a source of free energy. Bathed in sunlight, the Earth had plenty of free energy. Water became abundant once Earth cooled enough for water vapor to precipitate from the atmosphere. Simple organic compounds were formed both on Earth and in space, where they collected in meteorites and comets. When meteorites impacted Earth, or when our planet passed through the tail of a comet, these organic compounds literally fell from the sky, adding to those formed on Earth itself.

Biologists have considered the Earth's oceans as a likely candidate for life's origin, but there are several alternatives. Possibilities include thermal regions below the earth's surface or on the ocean floor, where high temperatures and reactive chemicals could have formed the basis of life. At the other extreme, the melting and refreezing of ice fields could have concentrated organic compounds, and low temperatures could have preserved them.

Deamer's research has suggested yet another possibility, one that is causing a stir among astrobiology researchers. "If you look at the chemistry of organic membranes," says Deamer, "it's pretty clear the most logical place for life to have evolved is in fresh water at moderate temperatures."

To illustrate his point, Deamer cites the soap bubble. "A soap bubble is an example of a self-assembled membrane. It is easy to calculate that a single soap bubble could never be produced by chance in the lifetime of the universe, yet bubbles are a common occurrence, at least when soap is mixed with fresh water," Deamer says. In salt water, or even in hard water with high levels of dissolved minerals, the presence of sodium, calcium and other ions causes the soap molecules to clump together, preventing the self-assembly that brings about the bubble.

Soaps are chemically related to organic compounds called lipids, the class of molecules that includes oils, fats and waxes. Deamer is most interested in amphiphilic lipids. Molecules of amphiphilic lipids have one end that tends to interact with water molecules, and another end that is far less interactive with water. The nature of amphiphilic lipids allows them to form orderly layers or structures when mixed with water, and makes them important components of cell membranes.

Deamer is exploring the chemical reactions on prebiotic Earth that would have allowed the creation of membranes of amphiphilic lipids. There are two things that need to be explained. First, how did the simpler organic molecules, either seeded on earth from meteor and comet dust or springing from terrestrial sources, combine to form more complex amphiphilic lipids? Second, when did directed assembly (assembly based on DNA or its precursors) begin to happen?

While exploring these far-reaching questions, Deamer has hit upon an application with practical uses. He has learned to create nanopore membranes – membranes with holes small enough for a single strand of DNA to pass through. Subtle changes in the electrical state of a nanopore membrane distinguish between the base pairs of DNA. The nanopore membrane is a high-speed, inexpensive device for sequencing DNA. Deamer and UC jointly hold patents on this technology and he is working with biotechnology companies to commercialize the research.

Says Deamer, "Studying membranes provides not only general knowledge of the emergence of life on our planet, it also provides very specific knowledge about people today and paves the way for therapies based on individual genetic information."

Documenting Amazônia

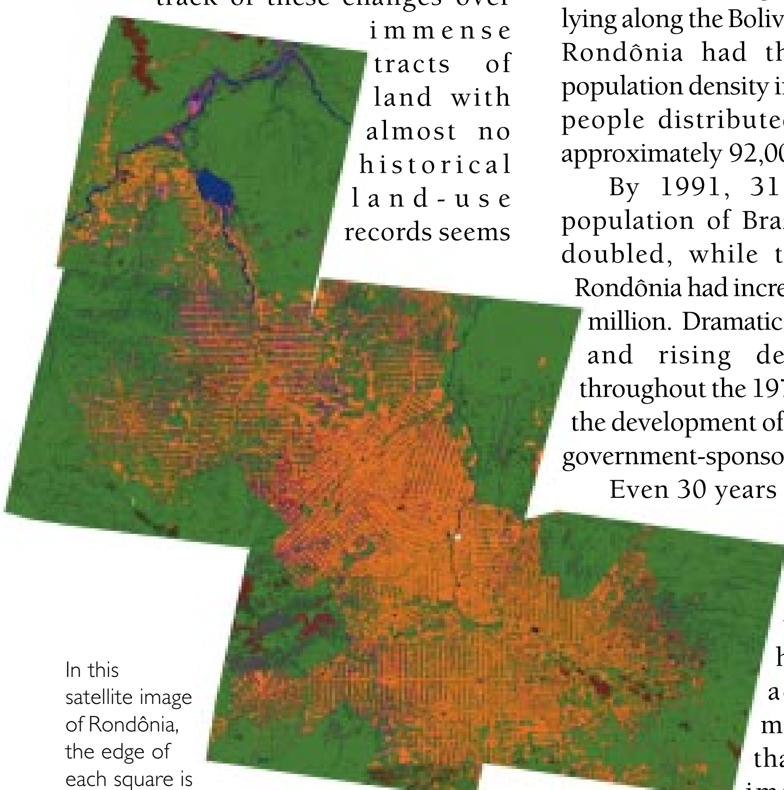
Burned rainforest in the Brazilian state of Rondônia. *Photo courtesy of Lee Clockman*

UC Santa Barbara geologists Oliver Chadwick and Dar Roberts are using satellite imaging and NASA grants to understand one of the most vexing problems affecting Earth's environment – the degradation of the Amazon basin.

Tropical forests that once covered its 2.7 million square miles are succumbing to fires, ranching and urbanization. As the Amazon's biomass is burned and destroyed, carbon passes back into the atmosphere, increasing the risk of global warming.

"It may appear that changes in Amazonian land use are an either/or proposition," says Roberts. "There is either old growth forest, or deforested pastureland and cities. But the reality is not so simple."

Some old growth forest is being degraded by selective logging that leaves many trees standing but destroys up to half of the forest biomass. In other areas, pasture is being reclaimed by second-growth forest. "Keeping track of these changes over immense tracts of land with almost no historical land-use records seems like an impossible task," adds Chadwick, "yet to understand the Earth's carbon and nutrient balance, we must document what is happening to Amazônia."



In this satellite image of Rondônia, the edge of each square is about 115 miles. Old-growth forest is green, pasture is orange, second-growth is purple, and urban areas are black.

The work of Chadwick and Roberts focuses on land use in Rondônia, a Brazilian state roughly the size of Oregon lying along the Bolivian border. In 1960, Rondônia had the second lowest population density in Brazil, with 70,000 people distributed over an area of approximately 92,000 square miles.

By 1991, 31 years later, the population of Brazil had more than doubled, while the population of Rondônia had increased 16-fold, to 1.13 million. Dramatic population increases and rising deforestation rates throughout the 1970s and 80s followed the development of improved roads and government-sponsored colonization.

Even 30 years ago, the forest was still relatively untouched. Most of the development in Amazônia has come since the advent of land-mapping satellites that can take digital images in several wavelengths of visible and near-infrared light.

For Chadwick and Roberts, the hard work is not finding images of the Amazon, but linking the spectral characteristics of the satellite images – the intensity of reflected visible and near-infrared light – to characteristics of the actual landscape. This involves both old-fashioned fieldwork and the latest computer algorithms.

Chadwick and Roberts have visited Amazônia often to take detailed measurements of leaves and the soils. "To use remote sensing for mapping vegetation, we had to understand the spectral changes that come with leaf aging," says Roberts. "We examined leaves for changes in reflectance, transmittance and absorption."

The next task was to determine exactly what the digital satellite images of Amazônia revealed. First, the pure types of land cover – old-growth forest, second-growth forest, pasture, bare soil – had to be identified by their spectral characteristics. Old-growth rainforest appears darker then a second-growth forest because of the shadows cast by multiple canopies – different types of mature trees reach different heights, casting shadows on the canopy of shorter trees. By comparison, second-growth forest is of uniform height, so there are very few shadows.

(continued on last page)

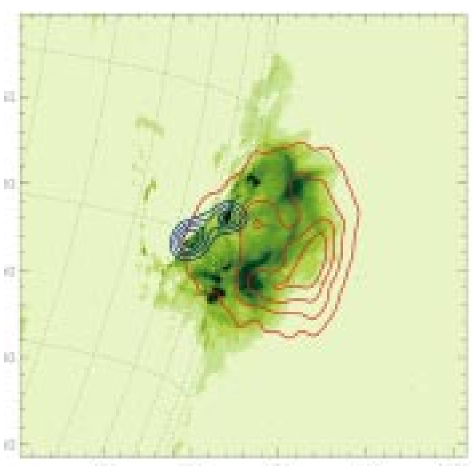
In March of 1989, an odd glow illuminated the northern horizon of the night sky, while during the day, small black dots appeared on the sun. In ancient times these strange events would have been taken as omens – and they were.

That month, a huge power blackout plunged Canada's Quebec province into darkness. Six million people lived without electricity for several hours. In June of that year, 500 people were killed when a gas pine line running along the trans-Siberian railroad exploded.

The culprit was not some mystical demon, but a huge disturbance on the sun's surface – a coronal mass ejection – that sent billions of tons of charged particles racing toward Earth at speeds of up to 1,200 miles per second. The charged particles funneled to Earth's magnetic poles, interacting with atmospheric gases and causing the aurora to glow.

As the particles approached, they pushed and pulled at the Earth's magnetic field. Just as a rapidly moving magnet can induce electrical current in a nearby wire, the rapid movement of our planet's magnetic field generated currents along high-tension wires in Quebec, overloading transformers and bringing down the electric grid. The shifting of Earth's magnetic field also induced currents in metal objects at higher latitudes, creating rapid galvanic corrosion in older, unprotected pipelines. The resulting gas leaks caused the explosion in Siberia.

This coronal mass ejection contained sub-atomic particles (electrons, protons and heavier ions) accelerated to high energies. Fortunately, no astronauts were outside their spacecraft during this event – the energetic particles streaming toward Earth could have killed them. The bombardment temporarily distorted the Earth's upper atmosphere, degrading the orbits of low-altitude satellites, and interfering with satellite communications.

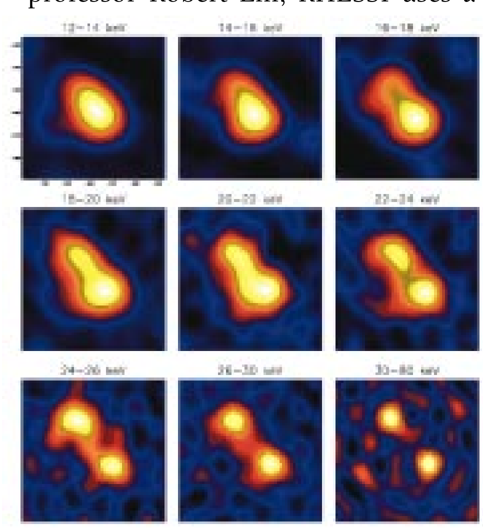


The edge of the sun is outlined on the left. Superimposed over a solar flare are contour lines that show the X-rays generated by the flare.

In this illustration the RHESSI X-ray telescope flies at 373 miles above Earth, using the Earth's magnetic field to align itself with the sun. RHESSI rotates about its axis once every four seconds and uses this rotation as part of an ingenious imaging system to capture X-ray images of solar flares.

To our eyes, the sun is a big ball of energy, a steadily burning fusion power plant in the sky. But in reality, the sun is a place of violent storms – in addition to coronal mass ejections, intense flares of extremely powerful X-ray and gamma ray energy burst off the sun's surface over an 11-year cycle. The sun's fluctuating magnetic field is the likely culprit behind the cycle of sunspots and solar storms, but no one knows for sure.

As humans venture more and more out into space, and as we become more reliant on satellites for communication, we'll need to know more about the sun's behavior and the threat it can pose. At UC Berkeley's Space Sciences Laboratory, researchers are watching the sun through a unique set of eyes. The RHESSI (Ramaty High Energy Solar Spectroscopic Imager) satellite is a solar telescope orbiting 373 miles above the Earth's surface. Under the direction of physics professor Robert Lin, RHESSI uses a


A top view of a solar flare in several different portions of the X-ray spectrum. The flare bursts off the sun's surface in a loop. The base of the loop generates the most energetic X-rays.

unique imaging system to take pictures with the X-rays and gamma rays produced by accelerated subatomic particles during solar flares.

Conventional telescopes cannot take a snapshot of the sun's X-ray and gamma ray bursts. Powerful X-rays shoot right through their lenses and mirrors. But certain materials will block the rays, just as your bones and teeth block X-rays in a doctor's office. So even if X-rays can't be focused, they will cast shadows.

RHESSI uses an ingenious application of this principle to take X-ray pictures of the sun. Just as venetian blinds cast shadows on a carpet, solar flares cast shadows through a system of fine and course grids onto RHESSI's X-ray detectors. The RHESSI satellite rotates at 15 revolutions per minute, and the pattern of light and dark falling on the detectors during a solar flare is recorded in digital memory. This information is sent back to Earth, where sophisticated computer software reconstructs the X-ray image of the sun.

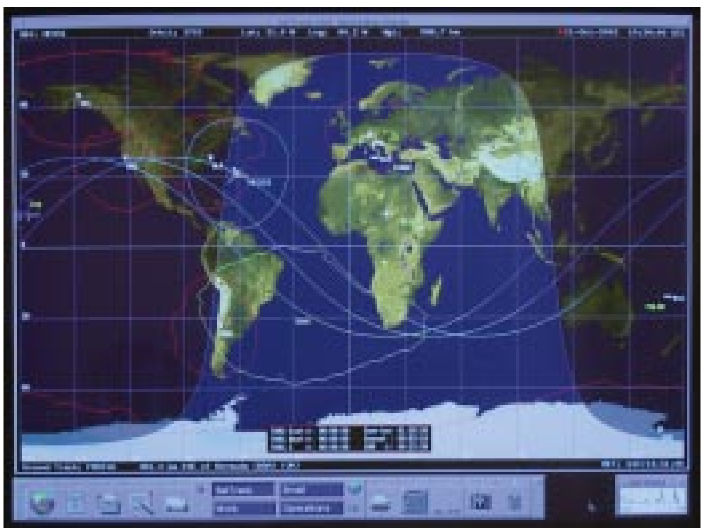
RHESSI flies in a circular orbit inclined at 38 degrees to the equator, and orbits the earth every 96 minutes. Since Berkeley is at 38 degrees N. latitude, the satellite regularly passes overhead.

The Berkeley space sciences lab is the primary ground station for the satellite. The laboratory's 36-foot diameter antenna (see photo in box on right) can download data from RHESSI at four megabits per second, the speed of a good Internet connection. If the sun is unusually active, RHESSI's memory can fill up quickly, so as a backup, ground stations in Virginia, Chile and Germany can also be called into action.

RHESSI almost never made it into space. It was originally scheduled to be launched on July 4, 2000, in time for peak activity in the 11-year solar cycle. But during a pre-launch vibration test, the vibration table malfunctioned, and the satellite was shaken at 20 Gs instead of two Gs. This violent motion broke the solar panels and cracked the main support structure.

RHESSI was repaired and finally launched on Feb. 5, 2002. In the meantime, Reuven Ramaty, NASA solar scientist and long-time supporter of the project, died before he could see the satellite launched. The satellite, renamed the Ramaty High Energy Solar Spectroscopic Imager, launched from a rocket that was carried to an altitude of 40,000 ft. by a Lockheed L-1011 aircraft. Early fears that RHESSI was launched too late in the 11-year solar cycle quickly proved to be false – the sun has remained active through 2002, and RHESSI has already met its scientific goals for documenting a wide selection of solar flares.

"By observing the unique spectral characteristics of solar flares," says Lin, "we learn about the acceleration of subatomic particles on the sun and their interactions. The sun is the most powerful particle accelerator in the solar system, and RHESSI is teaching us exactly what sort of interactions are taking place there."



Satellite tracking software shows the path RHESSI traces over the Earth during its 96-minute orbit. As sunrise approaches the East coast of the U.S., RHESSI flies over Bermuda. About 15 minutes later, RHESSI will fly over Berkeley, where it will transmit its images to the SSL ground station. If RHESSI is flying within the red circle surrounding Berkeley, the satellite is above the horizon there and transmission can occur.

Berkeley's Space Sciences Laboratory

The Space Sciences Laboratory at UC Berkeley began operating in January 1960. Advocates for the lab recognized the need for a facility to harness the emerging technologies of rockets and satellites for scientific exploration. A corner of the old Leuschner Observatory on the main campus was the laboratory's first home.

A grant for the laboratory's current building was awarded by NASA in 1962, and the new laboratory was dedicated in 1966. It is located in a wooded site high in the Berkeley hills, overlooking the Lawrence Hall of Science and the San Francisco Bay.

The Space Sciences Laboratory is involved in dozens of space exploration missions, including its latest, the Cosmic Hot Interstellar Plasma Spectrometer (CHIPS), a satellite designed to monitor a cloud of hot gas in space that may be a remnant of a supernova. The lab is also home to the Center for Science Education, where the multidisciplinary staff develops innovative programs to serve educators, students and science museums.

Researchers Manfred Bester and Nahide Craig of the UC Berkeley Space Sciences Laboratory are dwarfed by the antenna used to track RHESSI and other satellites.

TIGRE

TIGRE will be launched below a NASA scientific balloon capable of carrying an 8,000 pound payload to altitudes over 120,000 feet.

Using simple telescopes, Galileo and other early astronomers discovered the moons of Jupiter and described the laws that governed the motions of planets. Today, researchers like UC Riverside astrophysicist Allen Zych are looking at the universe with very different kinds of instruments, and what they are finding is as wondrous and as full of surprises as the discoveries of Galileo.

The early astronomers were limited to looking at the cosmos in the range of visible light. Astronomers today can look across the whole electromagnetic spectrum – from radio frequencies to infrared, through visible light, to ultraviolet, X-rays and gamma rays. Zych and colleagues at UC Riverside have been developing telescopes for gamma ray astronomy since the early 1970s. Zych and collaborators at NASA's Jet Propulsion Laboratory and other universities are working together on a new gamma ray telescope called TIGRE, or Tracking and Imaging Gamma Ray Experiment.

Zych will use TIGRE to look for new pulsars – rotating neutron stars that radiate most of their power as gamma rays. He will also look for gamma ray bursts. These intense blasts of gamma ray energy are so powerful that they defy our understanding of physics. The most likely source is matter that accumulates around black holes just before being sucked into these super-dense collapsed stars. TIGRE will be sensitive enough to detect the gamma ray signature of radioactive Aluminum-26, an isotope whose presence marks a supernova explosion.

The hunt for these unique phenomena requires a unique instrument. Unlike visible light, X- and gamma rays cannot be focused by mirror and lenses. X-rays can be imaged by clever techniques because they can be blocked by matter (see pp. 4-5 for an example of this). But high-energy gamma rays shoot right through matter. They can be detected only by the subatomic fingerprints they leave behind.

Inside TIGRE, gamma rays impacts produce positrons that are tracked through several detector layers to determine their direction.

TIGRE detects gamma rays with several 16-inch by 16-inch square panels of silicon detectors. These panels are stacked 64 layers thick to form a rough cube. When gamma rays penetrate TIGRE's detector, their high energy knocks loose subatomic particles – mostly electrons and positrons (the anti-matter twins of electrons).

The TIGRE detector tracks the path of the particles and uses this information to calculate the direction and energy level of the gamma rays that broke the particles loose. This feat is similar to watching a group of billiard balls being hit by a cue ball and trying to infer the original direction and energy of the cue ball from how the balls bounce. TIGRE will make these calculations with far greater accuracy than existing instruments.

In 2004, TIGRE is scheduled to fly to an altitude of approximately 120,000 feet, tethered to a NASA scientific balloon. On the ground, the balloon is loosely filled with helium, forming a slender column over 500 feet tall. At its maximum altitude of over 120,000 feet, the balloon expands to a flattened sphere with a diameter of about 470 feet, large enough to contain two Boeing 747s placed end-to-end.

After 24 hours, a radio command will separate TIGRE from the balloon for a 45-minute parachute ride back to Earth. The balloon will be tracked and discarded, but TIGRE will survive the impact to fly again. Still in the planning stages is a 100-day mission below a NASA ultra-long duration balloon, to be launched from Alice Springs, Australia.

"TIGRE is a significant advancement over previous gamma ray telescopes," says Zych. "Our hope is that TIGRE will eventually be launched into orbit so it can provide continuous observations for several years."

SPACE PSYCHOLOGY

Working in outer space is about precision and predictability. Orbits are planned, equipment refined, the thrust of rockets calculated. Yet at the core of this enterprise is a multipurpose device whose behavior is difficult to model or predict – the astronaut.

How do men and women hold up to the rigors of working and living in space? What sorts of limitations are dictated by the frailties of the human mind? Could a human stand the tedium of traveling to Mars or beyond? NASA has turned to UC San Francisco psychiatrist Nick Kanas to answer these questions.

"I was one of those kids who grew up reading science fiction and dreaming about going into space," says Kanas. A graduate of UCLA medical school, Kanas chose an internship at the University of Texas, Galveston, near NASA's Johnson Space Center. There, in 1971, he coauthored a seminal paper for NASA on the psychological demands of living in space.

After a two-year stint in the Air Force, Kanas began his current job as a UCSF psychiatry professor and a staff psychiatrist at the San Francisco Veteran's Administration hospital at Ft. Miley. Kanas treats patients and conducts research on how U.S. astronauts and Russian cosmonauts adapt to life in space.

The record for living in space was set by physician cosmonaut Valeri Polyakov, who lived aboard the Russian Mir space station for 14 months, from January 1994, until March 1995. Upon returning to Earth, Polyakov was so weak he had to be carried from his spacecraft.

UCSF psychiatrist Nick Kanas with a model of the space station. Above right, one of Kanas's many NASA mission patches.

To study the psychological stresses of living in space, Kanas has astronauts, cosmonauts and their ground crews fill out detailed questionnaires about their reactions, perceptions and moods during missions. He compares these to results from earthbound work settings. So far, the research shows that humans adapt well to working in space.

However, when Kanas studied the Shuttle/Mir missions, he found consistent evidence of *displacement*, a psychological term that means negative emotions are shifted onto others. Kanas observed that the crews in space scapegoated the ground crews on earth. Meanwhile, ground crews were found to displace their negative emotions to management.

"This displacement can lead to troublesome in-group/out-group distortions in communication," says Kanas. "Both crew members and mission control personnel need to learn to recognize and deal with the effects of displacement before such communication problems emerge." Kanas recommends preflight countermeasures, including both formal lectures and team-building exercises.

Physiological changes due to zero gravity can also have psychological consequences. After several weeks in space, an astronaut's face gets puffy and red due to changes in blood circulation. This may give them a chronic angry look that makes facial expressions harder to interpret.

Crews aboard the space station have been limited mostly to Russians and Americans, but Kanas is looking forward to truly international crews aboard the space station. "I'll be interested to see how cultural interactions play themselves out in space," he says.

Kanas also ponders whether humans could survive the psychological stresses of a trip to Mars. "No one in the history of mankind has ever seen Earth as an insignificant dot in the sky," say Kanas. "There are no good models for space travel this far from Earth." A round-trip Mars mission would take three years. Mars and Earth are far enough apart that conversation between mission control and a Martian lander would be difficult – the lag time between a question and an answer would be eight to 20 minutes. In case of a medical emergency like appendicitis, astronauts would be on their own.

Kanas sees the space station as a psychological test bed for a Martian mission. Crews with astronauts of different genders and nationalities could be brought together and trained in an environment very similar to that of a spaceship traveling to Mars.

Even if a mission to Mars never materializes, the information on how people from several different countries interact in confined, stressful working conditions will have benefits on Earth. "In a funny way," says Kanas, "space is a microcosm of Earth. If different people can learn how to get along in space, maybe we can do it on Earth, too."

Amazônia

(continued from page 3)

The final task was to write computer algorithms that determine the proportion of each type of land cover in each digital image pixel. In a typical Landsat satellite image covering an area of 115 by 115 miles, one pixel covers an area of about 100 by 100 feet. In that area, more than one pure type of land cover could occur – a mixture of second-growth forest and pasture, or a mix of old-growth forest and bare ground.

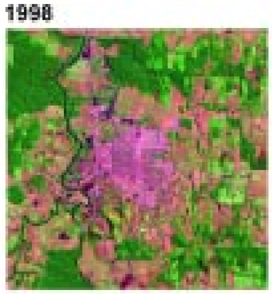
Computer algorithms can take the spectral characteristics of these mixed pixels and reconstruct the percentage of pure land cover types in each. "The trick," says Roberts, "is knowing which pure land cover types to use as your benchmarks. This is still as much art as it is science."

Chadwick and Roberts are striving for better estimates of forest degradation – partial damage to forests that falls short of total destruction. While complete deforestation in Amazônia is mapped in detailed annual reports, the extent of partial forest degradation is unknown. The total area of degraded forest, estimated from field surveys, is far larger than the area de-forested each year. Annual deforestation rates range between 4,000 to 11,000 square miles, while it has been estimated that up to 6,000 square miles are selectively logged, 30,000 square miles are damaged by burning, and 15,000 square miles are fragmented each year. "Better information on forest degradation would enhance the effectiveness of planning development, commercial activities, and conservation activities, as well as improve local and global ecological models and carbon budget estimates," Chadwick says.

1975

1984

1998



These images trace the growth of the Rondônian city of Ariquemes from 1975 to 1998. The edge of each image covers 9.5 miles.

With the price of Landsat image data falling dramatically in recent years, the raw data is now affordable for small organizations struggling to monitor the health of the Amazon rainforest. What's lacking is the expertise to interpret the information.

The UC Santa Barbara geographers are working to systematize and streamline their techniques so that they can be taught to local environmental groups and other non-governmental organizations in the Amazon. Chadwick and Roberts also share their data with other NASA researchers who are using the information to build more accurate climate-prediction models.

We all have a stake in the health of the Amazon basin, conclude Chadwick and Roberts. They hope their work there will lead to better understanding of the transformation of Amazônia.

Former NASA chief scientist named UC Riverside chancellor

France Córdova

France Córdova, a nationally recognized astrophysicist and former NASA chief scientist, was named chancellor of the University of California Riverside in April, 2002.

From 1993 to 1996, she was chief scientist at NASA, serving as the primary scientific advisor to the NASA administrator and the principal interface between NASA headquarters and the broader scientific community.

At the time of her appointment as UC Riverside's chancellor, Córdova served as professor of physics and vice chancellor for research at UC Santa Barbara. As vice chancellor, in addition to her regular duties, she initiated a program to encourage and fund research across disciplines. She also spearheaded a campus-wide effort to increase opportunities for students to engage in research.

The scientific contributions of Córdova's career have been in the areas of observational and experimental astrophysics, multi-spectral research on X-ray and gamma ray sources, and space-borne instrumentation. She has published more than 130 scientific papers.

Córdova is the winner of NASA's highest honor, the Distinguished Service Medal. In 2002, the National Research Council named her a National Associate of the National Academies in recognition of extraordinary service.

UC Riverside is one of the fastest-growing campuses in the UC system. Cordova replaced Raymond Orbach, who now heads the Department of Energy's Office of Science.

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