

Rice University
**Department of Space Physics &
Astronomy**

1963 – 1988

**25th Anniversary
Scrapbook**



Rice Gets \$200,000 To Launch Rocket Probes

Rice University has received a \$200,000 grant from the National Aeronautics and Space Administration to study airglow and aurorae with four rocket probes into space.

Dr Kenneth S. Pitzer, Rice president, said the probes will be called "Sammy I, II, III and IV," after the university's mascot, Sammy the owl.

Dr Brian J. O'Brien, professor of space science at the university, intends to measure light and particle energy in both airglow and aurorae.

HE HOPES TO determine if airglow is really a weak permanent aurorae, or an entirely different space phenomenon.

The first rocket probe will be launched 100 miles into space about the middle of December from Wallops Island, Va.

The probes will be the first by a university in the Southwest.

They will also be the first to obtain simultaneous definitive measurements of light and particle energy in airglow, Dr Alexander Dessler, chairman of the space science department, said.

THE LAST THREE of the space probes will be fired into aurorae from Fort Churchill, Canada, in January or February.

The instrumented probes are being designed, constructed and tested in the satellite techniques laboratory at Rice.

They will be launched by Nike Apache rockets.

The NASA grant will provide the one-year program with some

ground equipment that can be used in later space experiments.

MOST OF THE money will be used in gathering scientific evidence on aurorae and the sources of airglow.

Besides gathering scientific information, "sammy" will provide an education tool for the development of space research scientists and satellite engineers, Dr Pitzer said.

The project will assist Dr O'Brien, Dr Dessler and Curtis D. Laughlin, head of the laboratory, in building a team of faculty, staff and students with experience in rocket work for later projects.



DR BRIAN J. O'BRIEN
Leads Space Program

the HOUSTON POST
November 10, 1963

Curt Michel: professor to astronaut and back

(Continued from Page 1)

"And they sort of frown upon you if you aren't around every day, if you aren't one of the boys."

Terming it "classic" to fly once and then get out, Michel added to his reasons for leaving the space program:

"I was dissatisfied with the amount of time this thing was taking," he said, "and I wasn't being allowed to keep up my work."

A "certain suggestion of hazard" worried his wife, said Michel. "No sooner had I joined the program than there were five accidental deaths, and then the Apollo fire."

Are his two children impressed with their astronaut-father? "I don't think they even think about it," Michel said.

Dividing his time between teaching, research, and chairing the Rice Self-Study Committee, the professor who is a member of two departments finds it hard to define his status:

"I teach a physics class, but the Space Science Department pays me. I guess I 'belong' to the department that hands out the money."

What Michel is doing, specifically, is studying the radio stars called pulsars. Used as "space clocks" because of their extremely regular fluctuations, the stars have been Michel's pet project for about three years.

Getting interested in pulsars in a "backward" way, Michel was studying solar phenomena when pulsars were first discovered.

What now for NASA

Turning from his own work to the space program again, Michel discussed his feelings about the direction in which NASA is headed.

"I think the decision to go with the shuttle aircraft was unfortunate," he said. "It's an engineering development, which is NASA's forte, but it's not a goal in itself."

Manned shuttle rockets will begin taking satellites aloft about 1973. The idea, said Michel, was one of economics: stage rockets cost a lot of money.

"They want to get the cost of putting a satellite in orbit from, say, ten thousand dollars a pound to \$100 a pound. But something else they need to take into consideration is that the major cost lies in the satellite itself, not in the

launching vehicle," he explained.

"Maybe I'm a little cynical, but I think they're being overly optimistic about the better economic standpoint."

One of the most touted advantages of a manned rocket would be that satellites damaged in take-off could be repaired. Michel expressed doubt about that advantage as well: "The satellites are built so compactly that there's no way you can get in there with a wrench and fix what's wrong," he said.

"Satellites will have to be redesigned to be repairable, and that may cost as much as sending two non-repairable satellites up."

Michel said that the economics of the situation are "slippery" and that there is no simple answer.

Exploration worthwhile

Noting that he was a science-fiction fan, the ex-astronaut said that he believes in the value of space exploration and said that life on other planets was sure to be discovered eventually.

"We have to catch other civilizations after their primitive states and before they become too efficient to waste energy."

"If they're as sloppy with electromagnetic energy as we are, we'll find them," Michel added.

Within our own solar system, Jupiter is tapped as most likely to contain life, says Michel, because of the amount of activity both on the surface and inside the planet. However, he said that it was not likely to be intelligent life.

"Intelligent life comes from uncomfortable life," Michel said. "Intelligence evolves where mere survival is a battle."

It took four years and a high degree of concentration
for a Rice undergraduate researcher
to travel the long road

From Unskilled Labor To The Space Shuttle

By TOM RICH

THIS IS THE STORY of my personal involvement in research, an involvement that has turned out to be one of the most instructive and satisfying things I've done in my five years at Rice. As you read, keep in mind that this is an article written by an engineer; given a choice, I'd prefer writing in FORTRAN—a language of computers—to writing in English any day.

The research project that has occupied most of my spare time since my sophomore year is called SIDE (for Supra-thermal Ion Detector Experiment). Three SIDE instruments are on the moon today, continuously sending data to the earth, and eventually to Rice. The SIDEs were carried to the moon by Apollos 12, 14, and 15, and were set up on the lunar surface by the Apollo astronauts during their "moon walks." Explained simply, the SIDE is a particle detector which observes gases at the lunar surface. The SIDEs have "seen" the solar wind (gases boiled off from the sun), gases released by lunar seismic events, traces of noble gases in the lunar atmosphere, and traces of what *could* be water vapor appearing naturally in the moon's crust.

SIDE was conceived by and was developed under the leadership of two Rice scientists, John W. Freeman, Jr., professor of space physics and astronomy, and H. Kent Hills, senior research associate, at the start of the Apollo program in the late 1960s. A tribute to the design effort that went into the SIDE is that the oldest SIDE (carried to the moon in November 1969) is still sending back useful data; that's an operational lifetime, so far, of almost five years, while the design goal was only three

years. The three SIDEs have so far amassed a total of eleven years of data among them. These data are recorded on about 5,000 magnetic tapes stored by the SIDE group at several places in the Rice space physics building.

My association with SIDE began four years ago while my father and I were driving past an Oklahoma refinery. He asked me if such plants were what I, as a chemical engineer, would be working on some day. His question

prompted me to think long and seriously about the type of work I really wanted to do. Soon afterward I abandoned chemical engineering for space science. Still unsure, I studied the Rice catalog and started talking to professors, including Richard A. Wolf, professor of space physics and astronomy, who served as undergraduate adviser of what was then the Space Science Department. Thinking that working in the department might aid my selection of a major, I asked Dr. Wolf if he knew of any small jobs in a research project. He checked around, and subsequently I was hired by Dr. Freeman to work with the SIDE group. The job required protracted use of an SDS 910 computer dedicated to SIDE processing, fitting in well with the major I finally chose—

Tom Rich holds bachelor's and master's degrees ('73 and '74) in electrical engineering. A cellist, Rich played with the Rice orchestra for four years and served two years with the University of Houston Symphony. He is a member of the Association for Computing Machinery and the Institute of Electrical and Electronic Engineers. Rich sees a strong link between his music and his affinity for computers. "If you play the cello, you can also perform on a computer," he says. "Both involve discipline and both require long practice to achieve expertise. A good cellist knows his instrument thoroughly and tries to bring out fully every subtlety he can find. A good programmer knows his computer thoroughly. By exploiting all the subtleties of his machine an experienced programmer can greatly enhance the computer's flexibility."

electrical engineering.

The first tasks on the job were, of course, slightly routine, but the thought of being connected with the space program and lunar research kept me interested. I began to use the computer almost daily for magnetic tape manipulations and soon made my initial attempt at programming for the SIDE. Fresh out of Rice's introductory computer course (Engineering 240), I tackled

A central question related to university goals and roles concerns the compatibility of faculty graduate research activities with the faculty's obligations as teachers and advisers of the undergraduate student body. Although few would deny that some mixture of teaching and research is possible and even desirable, agreement as to what mix is optimum is difficult to obtain. The most common argument against

extensive (or expensive) research is that the obligations to the funding agency may take precedence over obligations to the university, resulting in isolated faculty members who contribute little to the undergraduate education of students. Of the many words spoken or written for or against university research, few have been heard from undergraduates who have been associated with such research.

Tom Rich's story tells of the experience of one such student among a number of Rice undergraduates participating in graduate research programs.

PAUL A. CLOUTIER,
Associate Professor of Space
Physics and Astronomy

Professor Freeman examines some of the tapes containing data from his SIDE experiments now on the lunar surface. Some 5,000 tapes of SIDE-based material are stored in several areas of the Space Physics Building.





Photos: Manuel Garcia

After removing a SIDE data tape from its storage area author Rich types in the required instructions to extract the needed information from the tape.

the ten-year-old FORTRAN language on our SDS 910. The rigidity of this FORTRAN system, together with the complexity of SIDE data, made the first program take several confused months to complete. The second year I began to feel more at ease in FORTRAN, but I was increasingly hampered by the limitations of the 910's FORTRAN system. To achieve more flexibility in programming, I started learning assembly language—the elementary language the programmer uses when “talking” directly to the computer. My first attempts were cumbersome and awkward, but there were two very helpful people around, there was unlimited computer time, and I was being paid for all the time I spent learning about the computer.

Toward the end of my third year with the project, I started to develop two programs that were to be my main contribution to SIDE research. The first of these is a multimachine program for data reduction and simplification. The program condenses data from various modes of SIDE operation into a compact, consistent, and easily understandable form on magnetic tape. Copies of the tapes produced by this program will serve as the permanent record of SIDE data at the Goddard Space Science Data Center in Greenbelt, Maryland. The second program dealt with large-scale data plotting and interpretation. Using the monster Benson and Lehner plotter donated by Texaco to the space physics facilities,

this program summarizes a full lunation—approximately 28 days—of SIDE data into a single plot about a yard square. These plots have been valuable tools in helping researchers visualize the complicated activities of the lunar atmosphere. Production runs of both programs began a year ago, and are expected to continue as long as the SIDEs keep sending data from the moon.

Looking back on my years at Rice, I know I received benefits from my association with research that no undergraduate course work could give. To me, most homework and lab problems had a “let’s pretend” quality; research gave me the opportunity to do something real while still in school. I found that I could do very detailed and exhaustive work, knowing that the finished product would be of immediate value.

From the standpoint of a part-time job, this was perfect for a full-time student. The hours were completely unscheduled, and many times I worked on the weekend or late at night. The salary started at a little above minimum wage and jumped to over \$4 an hour after I got my B.S. in 1973.

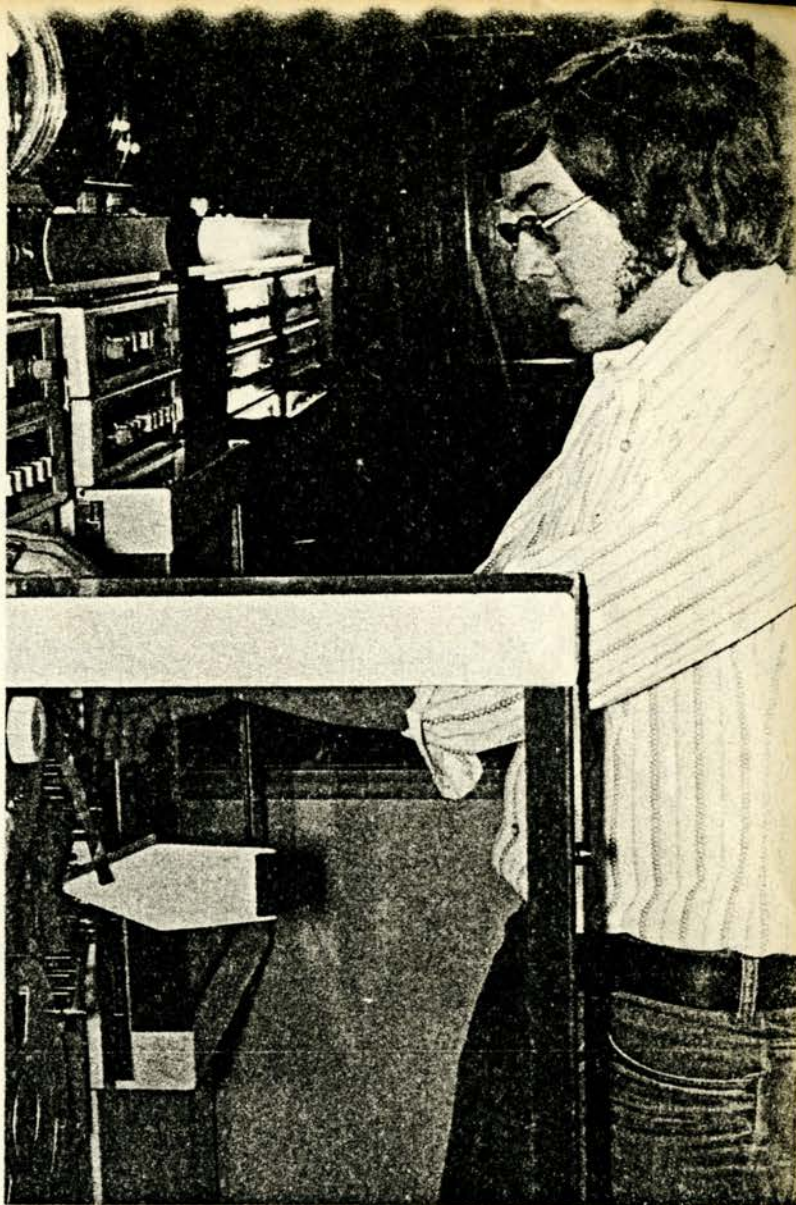
The programming experience has been of great use in my fifth-year courses, and I expect it to prove invaluable later in my career. I have had a “hands on” contact with computers that is rarely available from the very large and expensive computing systems common today. There was plenty of opportunity to learn about

and experiment with many of the subtle and useful features of computer hardware.

My research job put me in early contact with a group of innovative, professional people who assembled a powerful computer facility from a few moderately capable machines and who did so on a limited budget. For example, a computer-to-computer communication link, designed and installed by space physics personnel, now allows three space physics computers to "share" their attached peripheral equipment with each other, expanding the facility's total potential to much more than the simple sum of three computers standing alone. This, after all, is what professional engineering is all about: to do a task the best possible way while keeping within the rigid constraints of available resources and current technology.

Joining the SIDE group as an undergraduate, I observed the research process from several different levels. First, I experienced it as the unskilled worker and saw the great amount of record keeping and data labeling needed in a project of this size. Second, I saw it from the technician's level, working with programs already developed for specific tasks. Finally, I was in a position to design programs of my own. Given an abstract idea for a program, I had to develop practical procedures implementing that idea on the computer equipment at hand.

In short, working on SIDE research provided a good head start for my career. It was a sort of "trial period" in which I sampled the kind of work going on in the space program. I liked what I saw and when the time came for hunting down a permanent job, I knew what to look for. I'm now helping to develop NASA's next program—the space shuttle. The opportunity to do research as an undergraduate made possible an easy transition to this new project. □



Instructions completed, Rich mounts the fully programmed SIDE tape into the computer which is now ready to speed the tape's message toward its ultimate translation.



The SIDE's message from the moon is translated from the computer onto this large Benson-Lehner plotter. The message represents graphically an entire month of lunar atmospheric activity. At left, Dr. Hills points to a bump indicating increased particle concentration as the moon passes through the earth's magnetic sheath, a passage duly recorded by Rice's SIDE equipment on the lunar surface.

Longer Life for Orbiting Satellites At Hand, Easing Launching Needs

By DAVID E. SANGER

Special to The New York Times

WASHINGTON, Oct. 16 — The nation's largest operator of communications satellites said today that it had developed a surprisingly simple technique for greatly prolonging the life of satellites now in orbit, a move that should lessen the acute need for launching vehicles since the space shuttle disaster.

The technique, announced by the Comsat Corporation, chiefly involves a subtle change in the orientation to the earth of certain communications satellites. The change, recently carried out successfully on a Comsat satellite, is expected to cut by up to 90 percent the amount of fuel that satellites burn each year in compensating for forces that cause them to drift out of position.

Lack of fuel frequently cuts short the working life of a satellite, even if its

electronics are in perfect working order.

Comsat's action, variants of which appear to have been used on some military satellites, was quickly hailed by users of commercial satellites, who said it meant that they would probably be able to lengthen intervals between satellite launchings. "We are breathing a little easier," said John D. Hampton, the deputy director general for operations at Intelsat, the 112-nation consortium that operates international communications satellites.

"They've done some neat, effective physics and discovered something that everyone else missed," said Mr. Hampton.

Richard L. McGraw, a spokesman

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the NEW YORK TIMES
October 17, 1986

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for Comsat, said: "It was just one of those 'Eureka!' things."

Engineers cautioned that the Comsat technique did not eliminate what they call the "launching crisis" created by the two-year delay in shuttle flights and the Government's decision to ban most commercial payloads once flights resume. The engineers said loss of battery power and failure of electronic components could still cripple satellites and require launching of replacements.

But the advance announced today appears to reduce a major vulnerability to failure for many of the satellites most critical to telephone, television, and maritime communications.

Since the Jan. 28 Challenger disaster, which killed the shuttlecraft's seven crew members, satellite operators have been afraid that if major equipment failures occurred in satellites, there would be no way to send up replacements. The only available foreign launching service, the Europeans' Ariane rocket, is fully booked, and the United States has yet to develop a private launching industry.

Moreover, communications satellites still planned for launching in the shuttle's payload bay face long delays. For instance, an Intelsat satellite originally scheduled for a 1987 launching is now to be lofted in late 1991.

While Comsat touted its solution as "unique" today, company officials conceded that the technology was not new. They said it could have been executed as long as a decade ago.

But no one believed the satellite's electronic parts, particularly its signal amplifiers, would last much longer than seven years or so, and thus fuel supply was not a problem. And until Comsat satellites began facing increased competition from fiber-optic cable systems for relaying voice and data messages, the company paid little attention to ways of making satellites more economical.

"Now we have discovered that the parts are more reliable than we first thought, and we're in a more competitive situation," said William L. Mayo, the president of the Comsat General Corporation, a Comsat subsidiary. "It has taken 20 years to get around to thinking about it."

In developing the technique, Comsat engineers called into question the basic tenet of geosynchronous orbit: That the satellite has to hover over the same place on the earth at all times.

A Way Around 'Drift'

Once a satellite is in geosynchronous orbit, gravitational forces, chiefly from the moon, cause back and forth "drift" along the earth's north-south axis. If left uncorrected, the satellite's drift can move its antenna's footprint on the ground too far from the ground stations the satellite is communicating with. Thus, all communication with the satellite can be lost.

Satellite operators have corrected for this drift by periodically firing small, remote-controlled fuel jets on the satellite. Such maneuvers expend a fair amount of the several hundred

pounds of fuel, at least 37 pounds a year.

The Comsat technique does not correct the satellite's drift. Instead, it calls for one-time changes in the satellite antenna and in ground stations.

With fuel thrusters, the satellite is tilted precisely so that its antenna "footprint" stays fixed on roughly the same spot on earth. The ground antennas are converted, at a cost of \$15,000 to \$20,000 a piece, to follow the drifting, but predictable, motion of the satellite.

'Suddenly a Light Went On'

A satellite's fuel consumption can thus be reduced to about three pounds a year, perhaps doubling its life, Comsat officials said.

"It's one of those cases where a simple idea emerged because people have been thinking about a problem for years, and suddenly a light went on," said Prof. D. Allan Bromley, who is Henry Ford 2d professor of physics at Yale University. "It's sort of delightful that there can still be some simple physical solutions that eluded everybody, and then had an impact."

According to some experts, elements of the technique announced today have been used in some military satellites. But most advanced military satellites have large, omnidirectional antennas that eliminate the need for the satellite to be in a precise position at any given time.

Comsat officials said they had applied for a patent to the process of tilting the satellite and would license the technique to Intelsat and perhaps even some competitors. But other experts noted that such a simple adjustment might be made by almost any satellite owner, without Comsat's knowledge. "I guess they are depending on everyone's honesty to take out the license," said Professor Bromley.

Limitations Are Cited

At the same time, some Comsat competitors expressed reservations. For instance, at MCI Telecommunications, which owns three communications satellites and operates two more, Michael Lyon, the vice president of space resources, said "there are limitations" to the technique. MCI's network of ground antennas are all fixed to look at a single place in the sky, he said, meaning that using the Comsat technique would require a substantial investment in new equipment and software in the ground network. In addition, he said, data are frequently sent from one satellite to another. "In that case, you have to know exactly where the satellite is," he said. "Drift is not tolerable."

Comsat credited its finding to Dr. Lawrence H. Westerlund, the vice president of engineering and operations for the communications services division. Outside experts said that although the tilting might appear obvious in retrospect, it was understandable why it was not evident from the early days of satellite technology.

"Orbital dynamics is very complex, and not at all intuitive," said Prof. William M. Hollister, a professor at the Massachusetts Institute of Technology. "It's easy to get confused fast, and that's when simple things are missed."

Tiny Diamonds in Space Seen As Clue to Evolution of Stars

NYT 3/12/87 By JOHN NOBLE WILFORD

Microscopic diamonds, older than the Sun and the Earth and perhaps the oldest minerals ever examined, have been found imbedded in meteorites, scientists reported yesterday.

The scientists who made the discovery said the diamond grains were presumably created in the atmosphere of a distant, dying star shortly before it exploded billions of years ago, casting a shower of matter through the heavens. This apparently means that interstellar dust is sprinkled with diamonds, the scientists said.

Because the meteoritic diamonds are so durable, remaining unaltered through time, distance and the inferno out of which the solar system emerged, scientists believe the grains encapsulate pristine traces of many other elements produced by exploding stars, or supernovas, not unlike the one that recently appeared in the skies of the Southern Hemisphere.

The Evolution of Stars

A more detailed examination may give scientists their first glimpse of stellar elements like those that were the source of most of the atoms on Earth and in the bodies of its inhabitants. This analysis of the diamonds was also expected to provide new insights into the evolution of stars and the birth of the solar system.

Moreover, scientists said, the discovery represents the first evidence that diamonds in nature can be formed at

low pressures and is likely to stimulate laboratory research in creating synthetic diamonds for industrial and consumer goods.

The discovery was made by a team of scientists led by Edward Anders and Roy S. Lewis of the University of Chicago. Their description and analysis of the diamonds were reported in the current issue of the British journal *Nature*. The diamonds are so tiny that trillions of them could rest on the head of a

Continued on Page 15, Column 4

Tiny Diamonds in Space Are Seen As Clues to Birth of Solar System

Continued From Page 1

pin. Their distinctive crystalline structure could be determined only through careful observations with electron-scanning microscopes.

John A. Wood, a specialist in meteorites at the Harvard-Smithsonian Center for Astrophysics at Cambridge, Mass., called the discovery surprising because of the assumption that natural diamonds could not be created in the extremely low pressures of stellar atmospheres. On Earth they are formed deep in the ground, where the pressures are 60,000 to 80,000 times the pressure on the surface.

The discovery is also important, Dr. Wood said, because "these little grains were created long before the solar system and had to pass through some rigorous environments before reaching us."

Although the diamonds may be the first unadulterated minerals from outside the solar system, Dr. Wood noted that scientists recently found some calcium aluminum fragments in meteorites that had a "peculiar mineralogy" and therefore might be material from beyond the solar system.

The work leading to the diamond discovery was begun by John F. Wacker, a researcher at the University of Chicago who is now at the Scripps Institution for Oceanography in La Jolla, Calif., and Tang Ming, a graduate student at Chicago. They isolated the residue of minerals by dissolving the surrounding silicate material with acid.

Identity of Diamonds Confirmed

Dr. Lewis, a senior research associate in chemistry at Chicago, and Eric Steel, a chemist at the National Bureau of Standards in Gaithersburg, Md., then confirmed the identity of the diamonds with X-ray and electron analytical instruments.

Tiny diamonds have previously been extracted from meteorites, but they were all determined to have been created by the shock of the objects' impact on the surface of the Earth or with other bodies in the Solar System, such as asteroids. Trapped in the diamonds being examined by the University of Chicago group was xenon gas of an un-

usual composition. Xenon of this type is not found on Earth, so scientists have assumed that it was formed from elements in a stellar explosion.

Dr. Lewis said material from two other meteorites was analyzed. They also had diamonds with xenon.

After ruling out many possible explanations for the diamonds, the researchers concluded in their article in *Nature*, "It seems necessary to invoke an extra-solar origin for the diamond."

The Death of 'Red Giants'

According to Dr. Anders, a professor of chemistry at the University of Chicago and its Enrico Fermi Institute, it is known that large aging stars, called "red giants," begin spewing out prodigious amounts of gas and dust as they reach their final stage of life. Carbon and probably graphite are among the ingredients of the dense shell of dust surrounding the star. Some of the carbon apparently was transformed to diamonds.

When the star finally collapsed and then exploded, gases and other material were ejected at tremendous velocities, sweeping diamonds and other matter from the dust shell. Some of the outbursting gases and particles, including the rare xenon, Dr. Anders said, must have penetrated the diamonds.

"In principle," he said, "an examination of these diamonds should give us an accurate profile of material that comes out of a supernova."

Although supernova remnants were primary components of the planets and smaller objects such as meteorites, almost all of that material was reprocessed beyond recognition in the extreme heat at creation of the solar system, which occurred 4.6 billion years ago. Hence, they largely lost their pre-solar history.

But Dr. Anders said some of the diamonds in the interstellar dust must have penetrated meteorites as they were forming at the beginning of the solar system.

"Carbon is very common in interstellar clouds," Dr. Lewis said. "Most of it is in the form of graphite or amorphous carbon and carbon compounds, but now there is reason to look at the astrophysicists' data again. Some of the interstellar carbon must be diamond."

Astronomers focus on Neptune

Rice professor challenges Voyager watchers

By **Barbara Law**
OF THE HOUSTON POST

Rice University professor Alexander J. Dessler is offering space scientists a rare opportunity to be colossally, publicly wrong.

Dessler, editor of the monthly journal *Geophysical Research Letters*, recently challenged readers to predict the nature of the planet Neptune before the Voyager 2 spacecraft flies close by it Aug. 24, 1989.

Two colleagues already have taken the bait, predicting when Voyager first will detect the radio noise emitted by Neptune's magnetic field. Given the history of planet postulations, both are probably way off the mark.

"Terrible. In one word, terrible," is how Dessler described most predic-

tions in the past.

Before Voyager 2 sped by Uranus in January 1986, about a dozen scientists had predicted its magnetic field would be closely aligned with its rotation as are all other planetary magnetic fields in the solar system. Surprisingly, Voyager showed the magnetic field of Uranus tilts far from the planet's poles.

"Nature can put things together in ways that we just cannot imagine," said Dessler, a professor of space physics and astronomy.

Voyager 2's visit to Neptune 12 years after its launch will complete what is called the "Grand Tour," in which one spacecraft flies past all four large, outer planets in the solar system. Only once every 175 years is the quartet together on the same side of

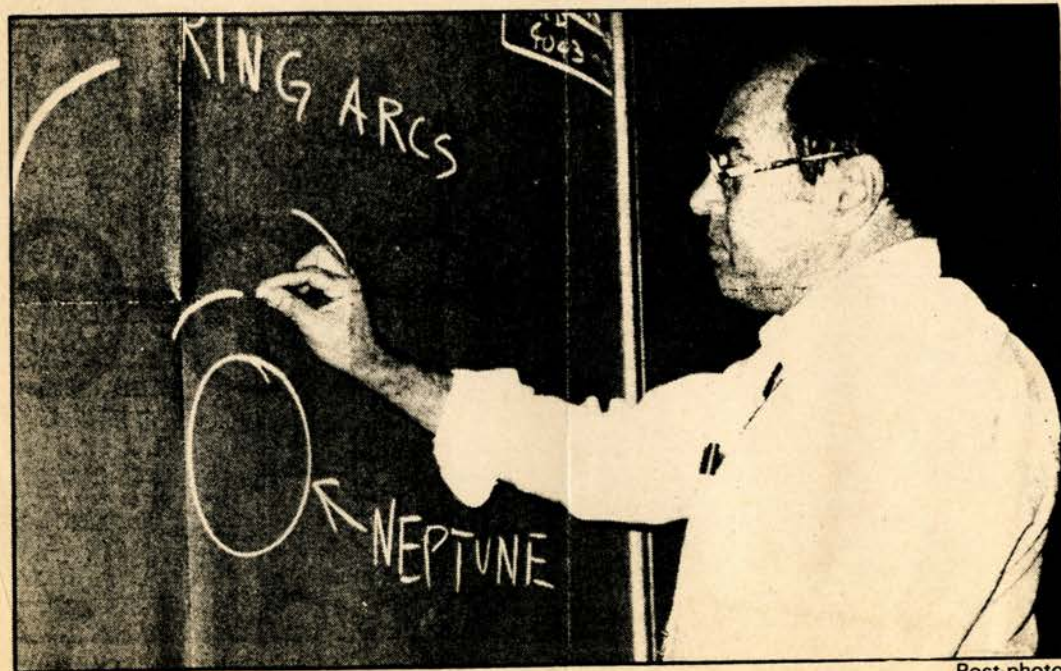
the sun to make it possible.

Neptune will be 2.8 billion miles from Earth when Voyager whizzes over its north pole at 33,000 mph transmitting photographs and data about the planet and one of its two known moons. Transmissions will take about four hours to reach Earth, meaning the spacecraft would pass its prime viewing point before controllers at NASA's Jet Propulsion Laboratory could spot and correct a problem.

"We know almost nothing about Neptune. It'll be fantastic, as good as Uranus," said Stan Peale, a physics professor at the University of California/Santa Barbara.

Dessler himself is cautious. "I'm going to stay out of the prediction business. There are so many possibilities," he said.

★ The Houston Post/Tues., December 15, 1987/ 7E



Post photo

Professor Alexander Dessler illustrates lecture on Neptune at Rice University.



Rice photo

Rice University professor Donald D. Clayton explains his theory on the origin of the universe.

Recent evidence

Star blast theory originated at Rice

By Jerry Laws
OF THE HOUSTON POST

Recent evidence that exploding stars produce all of the heavy chemical elements in the universe is a triumph for Rice University Professor Donald D. Clayton, who published a theory of the process 19 years ago with two associates.

Their work showed the origin of planets, metals and the basic components of life was not one event, but many.

"The Big Bang gave us hydrogen and helium and the stars did all the rest," Clayton said this week. "Mankind's always wondered about his origins, and the fact is that the scientific way of proving it came out of Rice University."

"We are all bits of stardust," he added. "Even the atoms of our own bodies were at one time created in the explosions of countless stars during the pre-solar history of the universe."

Astronomers and astrophysicists agree the heavy elements come from supernovas, dying stars that fuse lighter elements into heavy radioactive nuclei that are ejected when the stars explode.

In a landmark 1969 paper, published when he was just 33, Clayton and two co-authors predicted proof would be found in the detection of gamma rays shed during the natural decay of radioactive cobalt into iron.

One form of radioactive cobalt decays so rapidly that its presence within the expanding gas cloud of a supernova would prove the cobalt was made there, they theorized.

Clayton and his associates knew they might not live to see the theory proved. Not since 1604 had a star exploded near enough to be seen with the naked eye. The gamma rays from more distant supernovas scatter and are lost in the cosmic background.

Supernova 1987A offered proof. First seen Feb. 23 from a Chilean observatory, the closest supernova to Earth since the telescope's invention has created great interest among astronomers.

Last month, cobalt gamma rays from the supernova 170,000 light years away reached detectors on NASA's Solar Maximum satellite and a high-altitude balloon. Clayton will join a panel of scientists to explain those findings next week in Austin at the American Astronomical Society's annual meeting.

Several of the top gamma-ray astronomers planning to attend received graduate training at Rice, he said.

Clayton said Supernova 1987A has produced enough radioactive cobalt to form 70 planets the size of Jupiter, which is 318 times as massive as Earth. Clayton and his co-authors in 1969 expected twice as much cobalt to emerge.

THURSDAY



January 7, 1988

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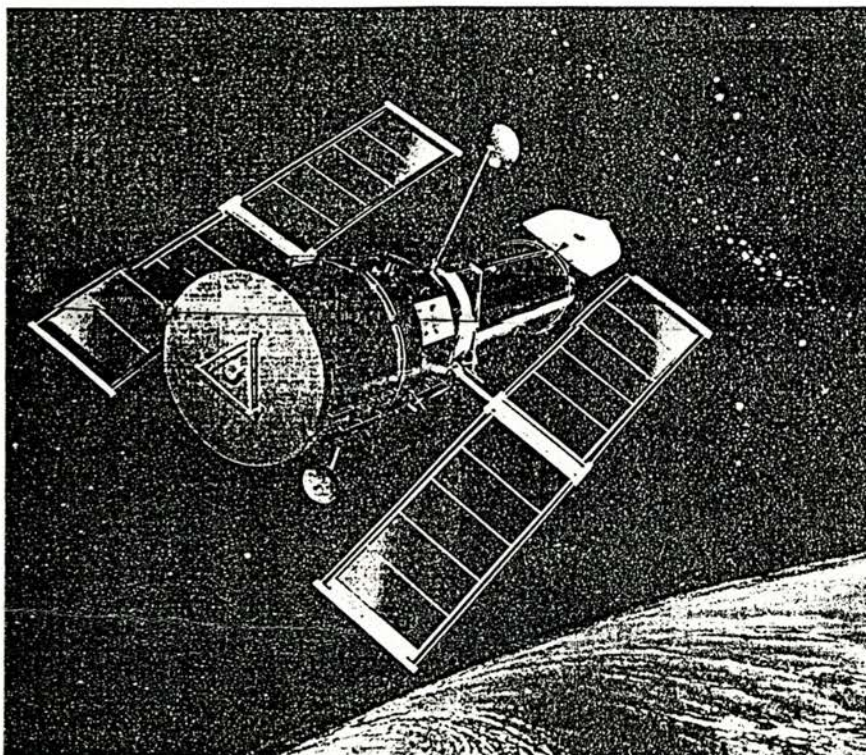
David F. Main / Anglo-Australian Telescope Board



Rosette Nebula in Monoceros Constellation

Hale Observatories

The man behind the telescope



**Project on hold
 as Rice prof keeps
 eyes on heavens**

By CARLOS BYARS
 Houston Chronicle Science Writer

One of these days, Robert O'Dell may make up his mind, then maybe he won't. The question that puzzles the Rice astronomer is, do his many skills and interests make him a Renaissance man or a dabbler?

O'Dell goes his own way as professor of space physics and astronomy, doing a little of this and a little of that. He studies comets, he studies stars, he studies galaxies and the spaces in-between.

He also headed for several crucial years development of one of the world's great scientific instruments, the Hubble Space Telescope. The telescope, once launched, is to be an observatory in space. Far above Earth's obscuring atmosphere, the telescope will be able to see seven times farther into space than any Earth-based instrument. And, being in space, the telescope will be able to use ultraviolet and infrared light that is blocked by the atmosphere.

Unfortunately, the telescope is grounded until space shuttles begin flying again. It is housed at Rockwell Industries' Downey, Calif., facility, where some parts are being modified and upgraded during the delay.

O'Dell, who was selected to accompany the telescope on its ride into space, also has been grounded. The National Aeronautics and Space Administration, which selected him to run the project and then to fly as a payload specialist, has stopped taking civilians into space.

That is a decision that may be reversed, O'Dell said. Mission Specialists Bruce McCandless and Kathy Sullivan have been training on the space telescope for years. O'Dell says they know the huge telescope inside and out and scientists have confidence in their skills.

"They (McCandless and Sullivan) are just the right kind of people for it," he said. "But if they are reassigned we would be flying with somebody that had just read the book."

In that case, O'Dell said, the space agency would get a lot of pressure from scientists to put one of their own back on the flight. And that scientist likely would be himself.

Although O'Dell is no longer the project scientist, he still is a senior adviser on the project. This keeps him involved with key questions that are popping up while the telescope awaits launch.

One of the questions the scientists are wrestling with

See RICE on Page 2.

University astronomer Robert O'Dell, a senior adviser on the Hubble Space Telescope project (above), is studying the spectacular space

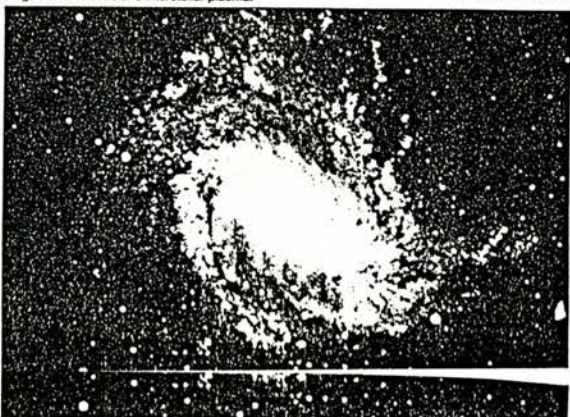
sights on this page. The Helix Nebula in the Aquarius Constellation is being studied for its comets; the Rosette Nebula in Monoceros for

proto-stars; Orion's Great Nebula for star formation; and Hydra's Spiral Galaxy M83 for giant gaseous nebulae and interstellar plasma.



Great Nebula in Orion Constellation

David F. Main / Anglo-Australian Telescope Board



Spiral Galaxy M83 in Hydra Constellation

R. J. Doolittle / Rice University

the HOUSTON CHRONICLE
November, 1963

Trip To Moon Goal Of Rice Professor

HOUSTON (UPI)—Dr. F. C. Michel, a Rice University professor who wants to be a spaceman, said Friday he could gather invaluable information on a trip to the moon.

He said only 450 hours' jet flying keep him from being fully qualified to be an astronaut.

Michel is a member of the Rice Department of Space Sciences. He is 29, holds a doctorate from the California Institute of Technology, and has logged 550 hours in a jet as a captain in the Air Force Reserve.

The requirement for astronauts is 1,000 jet hours.

Michel said he wants to go to the moon and measure its atmosphere, crust composition, possible sedimentary layers,

magnetic field and radiation. "I consider the moon a stepping stone," he said. "No telling what we can find in Mars—it's the best bet in the solar system for having life."

the HOUSTON POST
December, 1963



DR A. J. DESSLER
Receives \$160,000 Grant

Professor At Rice To Study Wave Effects

Rice University has received a grant of \$160,000 from the National Science Foundation to support a three-year study of "The Natural Hydromagnetic Wave Spectrum."

Prof Alexander J. Dessler, chairman of the space science department, will direct the research on the project which will investigate the possible effects of hydromagnetic waves in the magnetosphere. He is the author of several papers on related research.

Rice University will establish a geomagnetic observatory near Houston to conduct the research.

Two research assistants, William Sorenson of 5607 Jackson St and Wade L. Craddock of 1807 Ewing St will assemble, equip and operate the observatory, and reduce the data which they obtain, Dr Dessler said.

The Rice micropulsation observatory will co-operate with a geomagnetic measurement program directed by Dr J. Hertzler at the Lamont Geological Observatory in New York so that detailed local data and the information received from Lamont may be used to establish patterns which will apply over a large geographical area, Dr Dessler said.

Rice professor keeps eyes on heavens while project put on hold

Continued from Page 1.

NASA about now is how high above Earth the telescope should be placed. The original plan called for a circular orbit 300 nautical miles high. Now that doesn't look good enough to the scientists.

ODell says the sun is going through a periodic increase in activity. If the sun becomes very active in the next few years, the atmosphere will warm and expand. This will drag the telescope down, requiring an earlier re-boost from the shuttle.

"A few tens of miles (in orbital altitude) will make a world of difference," he said.

Scientists first sought — and got — an increase to 310 nautical miles. But now some are pressing for a slightly egg-shaped orbit 310 by 340 miles. This will not only stretch the ability of the shuttle but would eliminate any chance for the shuttle to fly alongside while the telescope is tested.

"We want to get as high as we can go. But also we want the ability for Kathy to go crank out the solar array if some \$3,000 motor is holding up the project," ODell said.

Although ODell spends some of his time trying to resolve such problems, most of his work at Rice is related to the study of comets, stars and galaxies.

"The common thread is gas in space," he says.

"At one extreme is comets. I want to address the basic physics, the problem of finding out why they glow, the nature of the nucleus and where they come from. I'm also working on planetary nebula — stars that have blown off their shells and shrunk down to white dwarfs. I'm working on how this collapse begins," he said.

This sampling of ODell's collection of interests is enough to keep whole departments busy for years. But for him, it is not enough. He also wants to know the nature of the gas in dramatic objects like the beautiful Orion nebula, and understand why it glows.

The Orion nebula (visible over Houston on clear winter nights as a fuzzy point of light in the sword of the constellation) has become known in recent years as a place where stars are born. ODell is trying to determine what triggers the process. The gas, and what happens to it, may be a key, he says.

"We know there are real young stars there that have just been formed," he said. "It seems that when a star is created in a region, it heats up the local gas. This creates pres-

sure, which serves as a piston to compress other nearby gas and trigger more star formation."

ODell says that for many years, scientists assumed — mainly because that was the only way to approach the problem — that the pistonlike flow of gas was smooth. But after 10 years of work, he now thinks otherwise.

"We have very many theories based on laminar (smooth) flow. But now we have a lot of data that says, 'Ah, but it's really turbulent,'" he said. (The difference between laminar and turbulent flow is the difference between a quietly flowing faucet and the gush from a wide-open fire hydrant.)

ODell also is intrigued with the big, glowing patches that occur within Orion and other nebulae where stars 10 to 20 times hotter than the sun are found. These are known as H-II (H-two) regions, because they are clouds of hydrogen atoms that have been heated until their electrons have ripped away.

There appears to be a relationship between the size of these regions and the amount of turbulence, ODell says. The more turbulent these regions are, the larger they appear to be. If further study proves this to be correct, ODell will have found a measuring stick that will reach farther than ever into space because these glowing clouds can be detected at distances greater than can be measured by other means.

"If we can measure the turbulence, then we will know the distance," he said.

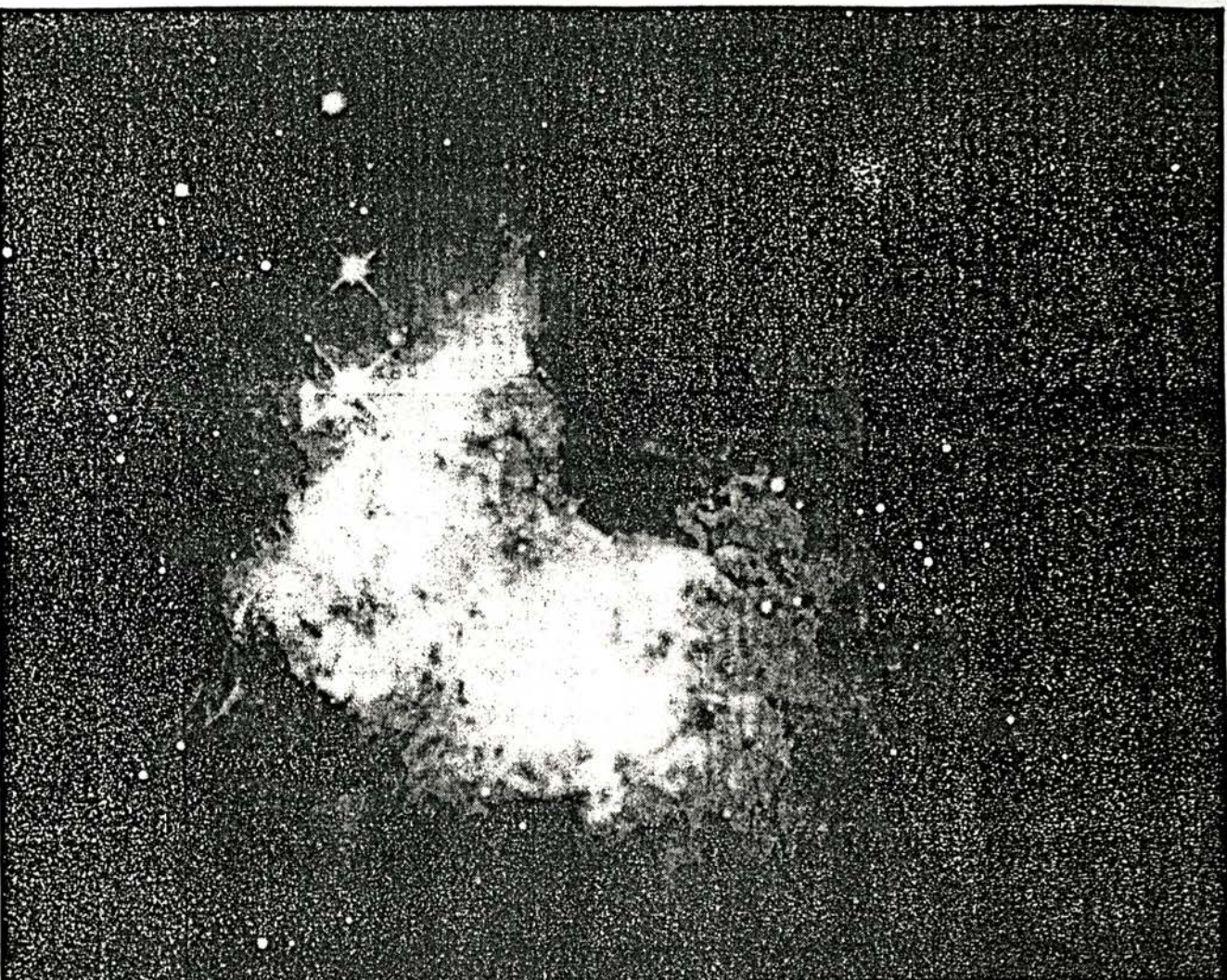
ODell's tendency to dabble in a variety of professional interests is almost matched by his private interests.

His hobby is flying, but having mastered straight and level, he went into aerobatics and flew his own specialized aerobatic bi-plane in competition for 10 years.

Aerobatics in a plane with an engine is one thing. ODell also mastered the art in a sail plane and became a two-time member of the United States team in that sport, flying in international contests.

A student at Illinois State University when the first satellite was launched, he describes himself as one of the first Sputnik people. Now 50, ODell caught the big wave of interest in space, but unlike many in the field, he has never lost interest. Perhaps this is because each of the many balls he juggles has a different challenge, a different fascination.

"I'm one of the older ones at this point," he said. But he gives no hint that he is willing to let any of the balls hit the ground.



Lock Observatory

Orion's Great Nebula (seen in this closeup) is being studied for brightness distribution in relation to turbulence.

World is getting to know Rice

by George F. Will

NATURE, DOUBTLESS with kindly intentions, placed pools of oil beneath Texas, so it became renowned more for refineries than refinement, more for crackling energy than for culture. Yet Houston has one of America's cultural jewels, perhaps the best bargain in higher education.

Rice University is celebrating its 75th birthday, and in three years will celebrate its centennial. Before ridiculing Rice's arithmetic, consider its knack for other numbers.

This is the seventh consecutive year in which college costs have risen faster than inflation. Next year, the cost of private higher education will rise 6 percent: Tuition, room, board and fees will be above \$18,000 at Brown and Dartmouth, above \$14,000 at Syracuse. However, at Rice, they will be under \$11,000.

In 1891, William Marsh Rice set aside funds for building a university, but stipulated that nothing was to be done until he died. He was then murdered by his chauffeur, which created a legal tangle unraveled by the chairman of Rice's board of trustees, Capt. James A. Baker, grandfather of today's Treasury secretary.

The board then hired Rice's first president, Edgar Odell Lovett, a 36-year-old Princeton mathematician, astronomer and amateur classicist. His favorite Latin and Greek inscriptions adorn the buildings erected (designed by the architect who designed much of Princeton) during his tenure, which extended past World War II. The first head of Rice's biology department was Julian Huxley. Rice's tradition of excellence flows from what has grown to a \$1 billion endowment, 11th largest among U.S. universities, public and private. In per-student endowment, Rice ranks above all but Harvard and Princeton.

Rice's reputation as a science

and engineering school (actually, half of today's students are humanities majors) was recently revised by the selection of today's president, George Rupp, 45, former dean of the Harvard Divinity School. Today, Rice is a complex organism in a hell-for-leather city (Houston does not even believe in zoning laws) that is the capital of American individualism.

Restless 19th century communities often saw in new colleges and universities a source of rootedness. As historian Daniel Boorstin notes, advocates of new institutions used many arguments, from an anticipated increase in property values to a predicted decline in drunkenness due to the moralizing influence of higher education.

In the book of photographs published to commemorate Rice's 75th birthday, there are two touching photos that express so much of the American experience. One shows women in white dresses and men in black suits and academic gowns swarming across a dirt field in 1912, where a grove of

academe was being commanded to flourish. The other photo shows the administration building at the time of the 1912 opening ceremonies. It is an elegant Italianate structure standing in a flat field in solitary splendor. Its solitariness expresses the confidence of the American West, the certainty that growth will fill in any gaps.

The gaps have long since been filled by some of America's finest collegiate architecture and shaded by the sort of stately trees that, even more than stone, give cities a sense of having a past and a permanence. Those who say Rice is Houston's Harvard should be told that Harvard is the Rice of the Northeast.

Inevitably, discussion of Rice comes to football and this question: What is a nice guy like Rice doing in a place like the Southwest Conference, matching muscles with the likes of Arkansas, Texas and Texas A&M? Rice is small (2,600 undergraduates), rigorous (students successfully protested when administrators suggested

lighter academic requirements for athletes) and law-abiding (Southwest schools are scofflaws regarding recruitment rules). Not surprisingly, it has been 23 years — five years before today's freshmen were born — since Rice has had a winning season.

Rice is resolved to give big-time football the ol' college try, but the stadium looks even sillier than most such structures do in academic settings. It used to be regularly filled to 75,000 capacity, but now often holds crowds of just 15,000. But Rice students, who have been known to try to rhyme "Rice U." with "slide rule," are cheerfully resigned to being what they are. Their football repertoire includes an "Existential Cheer":

We're from Rice

Ain't that nice?

Who are you?

Do you know?

Rice knows what it is and more and more of the world does, too.

Will is a Pulitzer Prize-winning syndicated columnist, based in Washington.

Sighting of a Supernova

It is the first nearby supernova since the invention of the telescope; astronomers are treating it like the find of a lifetime

ONE of the odder quirks of professional astronomers is that they rarely take the time to look at the sky. They rarely need to: most of the objects they study are invisible to the naked eye in any case. Thus, it surprises no one in the field that the discovery of the most waited-for astronomical event in 400 years—the eruption of a nearby supernova—fell to the amateurs.

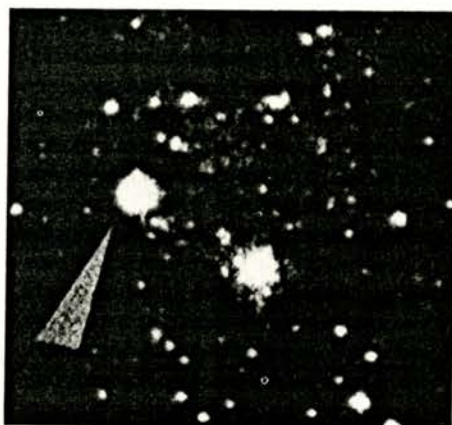
At the Carnegie Institution's Las Campanas Observatory in the Andes of Northern Chile, for example, Oscar Duhalde, a native Chilean who serves as operator at the observatory's 1-meter telescope, first noticed the supernova shortly after midnight on the night of 23–24 February, when he happened to glance up at the Large Magellanic Cloud. The exploding star had only reached fourth magnitude at the time, which made it relatively dim to the naked eye. But even then it was the brightest single object in the cloud, which is itself one of the landmarks of the southern sky. (Like its companion, the Small Magellanic Cloud, the large cloud is an irregular dwarf galaxy that orbits the Milky Way some 170,000 light-years out.)

Simultaneously, and only a few hundred meters away, Ian Shelton was working at the observatory's seldom-used 25-centimeter telescope. Shelton is not a professional astronomer—he is employed by the University of Toronto to assist researchers visiting the university's 60-centimeter instrument—but he does have a personal interest in astrophotography. As it happens, his project that night was a 3-hour exposure of the Large Magellanic Cloud. And, as it also happens, he decided to develop his plate right away that night instead of waiting.

Six hours later, at 9 a.m. EST, the telegram from Chile arrived at Brian Marsden's office at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. Marsden is in charge of the Central Bureau for Astronomical Telegrams, which serves as the official clearinghouse for astronomical discoveries. Once a finding is confirmed, he explains, his office alerts astronomical installations all over the world by telegram, telex, printed circulars, and computer mail.

In this case, confirmation was not a problem. "Almost simultaneously with the news from Chile, we got a call from the Australia-

lians," Marsden says. An amateur astronomer in Nelson, New Zealand, Albert F. C. D. Jones, had seen the eruption while scanning for variable stars and supernovas in the region of 30 Doradus, a huge region of ionized gas and active star formation located in the cloud. Jones, who has been monitoring variable stars since the end of World War II, immediately notified the head of the



The Large Magellanic Cloud: 26 February 1987. In this image, released by the Cerro Tololo Interamerican Observatory, supernova 1987A is indicated by an arrow. Just to the right is the diffuse nebula 30 Doradus.

Variable Star Association of the Royal Society of New Zealand, who in turn notified the Anglo-Australian Observatory in New South Wales.

With confirmation in hand, Marsden accordingly sent out the formal alert—although by this time, the informal word was already spreading through the community with galvanizing speed.

Supernovas per se are nothing new, of course. Indeed, they are quite common in the universe, arising in at least two different situations. In Type I supernovas, a white dwarf pulls in matter from a normal companion star until the mounting density and pressure triggers a runaway thermonuclear explosion. In the less common and somewhat dimmer Type II supernovas, a very hot, massive young star consumes all its hydrogen fuel, becomes unstable, and destroys itself.

Either way, supernovas are responsible for creating most of the heavy elements in the universe by violent nucleosynthesis, as

well as for roiling and energizing the interstellar medium. Astronomers have found that the Milky Way is littered with expanding shells of gas from ancient supernovas. And they have observed active supernovas routinely in other galaxies. But when it comes to more detailed observations, they have been frustrated by a statistical fluke. Theory suggests that a supernova should occur somewhere in the Milky Way every 15 to 50 years. And yet no supernova has gone off in our neighborhood since the ones seen by Tycho Brahe in 1572, and Johannes Kepler in 1604—both just before the invention of the telescope. Thus the community has a sense of experiencing the find of a lifetime.

"It turns out that a supernova is a terrific lightbulb for material you don't ordinarily get a look at," Robert Kirshner of the Harvard-Smithsonian Center for Astrophysics told *Science*. For example, his spectra from the International Ultraviolet Explorer spacecraft have already revealed numerous absorption features from cool gas in our own galaxy and in the Large Magellanic Cloud. Even more intriguing, the spectra also reveal material right in the vicinity of the supernova that was ejected by stellar winds or other eruptions shortly before the explosion. And finally, he says, the spectra show the ejecta from the explosion itself: a massive, turbulent shell of material moving outward at some 15,000 kilometers per second.

Back in Chile, meanwhile—not to mention at every other observatory in the Southern Hemisphere—the telescopes are swiveling toward the Large Magellanic Cloud at every opportunity. "Being this close, the supernova is bright" says Robert Williams, director of the Cerro Tololo Interamerican Observatory. "And that means we have a glut of photons, so that we can observe it at wavelengths such as the infrared and—with IUE—the ultraviolet, where we just couldn't observe supernovas before."

Also, the evidence now suggests that the object is a Type II supernova, says Williams. And because it is close, "we can now, for the first time, study the progenitor star." Indeed, a 12th-magnitude candidate for the progenitor has already been identified in previous images of the cloud. By a stroke of luck, moreover, the star had been studied spectroscopically well before the explosion. Known as Sanduleak-69.202, it is (or was) a very hot, very massive supergiant star of spectral class B3. This is generally the kind of star that theorists expect to go supernova, says Williams, so it fits. But now, he says, "we may be able to find out precisely why and how it did it." ■

M. MITCHELL WALDROP

March 7, 1988

When It Comes to Population, More Isn't Better

To the Editor:

In "The Great Majority" (editorial, Feb. 20), you discuss the contention that half the men and women who ever lived on earth are living today.

"Nathan Keyfitz, a noted demographer now in Indonesia, has been charged wrongly with making the crucial estimate," you write. "Professor Keyfitz published 'Applied Mathematical Demography' in 1977; it contains one sentence estimating that the contemporary world population was between 4 and 6 percent of the human total since the emergence of the species. Five percent became fifty when someone tripped on a decimal point, irritating Professor Keyfitz and all demographers with listed telephones ever since."

You continue: "Since most students of population agree that five billion people are now on earth, the true Keyfitz estimate means that about 100 billion people have lived at one time or another, constituting what ironists call The Great Majority. No one can imagine 100 billion people."

The totality of humanity (living plus all ancestors) can be estimated by multiplying the present population by the ratio of the birth rate to the population-growth rate. Because the current growth rate is so large (roughly 2 percent a year, which, by the miracle of compound growth means doubling every 35 years), the ratio cannot possibly be as large as 20. The birth rate would then be 20 times 2, equals 40 percent, and the death rate would be 38 percent per person per year, in which case people would hardly live beyond the age of 3! Who then would be having the babies?

We can easily confirm this preposterous result directly. In 1960, the world population was 3 billion, thus supposedly a totality (living plus ancestors) of 60 billion. By 1988, with 5 billion alive, the totality would be 100 billion, requiring 40 billion to have been born in between and 38 billion to have died, because the population grew "only" by 2 billion. Over 28

years these birth and death rates average roughly 1.4 billion a year out of an average population of 4 billion, essentially the above estimate.

Professor Keyfitz's figure probably applied to the epochs before the current population explosion: extrapolating backward at the current growth rates would place Adam and Eve in roughly the year 900 after Christ! The decimal point wasn't misplaced. It needed to be moved, owing to the increased pace of population growth.

Indeed, for people to survive to be adults automatically requires the death rate to be less than 5 percent a year, and it's probably more like 2 percent a year in actuality, which gives a birth rate to growth rate ratio of about 2.

Conclusion: roughly half the adults ever born are alive today.

I wish I could share the good feeling promoted by the rest of your editori-

And it doesn't take a genius to figure out that humankind's biggest problem is the unrestrained population growth itself. Already in some places like Ethiopia, nature is beginning routinely to apply her standard solution to overpopulation: death by starvation. In the meantime, forests are denuded for firewood, land turns to desert, wildlife is poached to extinction, and every available resource is relentlessly exhausted for money to import food, leaving nothing behind but wasteland and refugees to export the problem.

If the world population continues to grow exponentially, so will the total size of such areas, and the earth is, of course, finite. If the house rats survive and evolve into paleontologists, they are going to think the earth got hit by an asteroid.

F. CURTIS MICHEL
Houston, Feb. 22, 1988

The writer is the Andrew Hays Buchanan Professor of Astrophysics at Rice University.



Horacio Fidel Cardo

al: that 5 billion isn't really all that bad and more geniuses will be born to help solve our problems. However, the populations of the technological nations are almost constant, so any additional geniuses will be born into poverty in underdeveloped countries and will instead spend their lives preoccupied with survival.

Alice K. Harding of NASA's Goddard Space Flight Center should be able to answer one of the most important questions of all later this year. If instruments she is monitoring detect a shower of subatomic particles in the Earth's atmosphere coming from the direction of the supernova, it will mean that the atmosphere is being bombarded by gamma rays of extremely high energy.

Such gamma rays, Harding said, would mean the supernova is powered by a spinning neutron star, called a pulsar, that sends out bursts of radiation as it spins rapidly in the center of the supernova, somewhat like a celestial lighthouse.

The shower should begin within the next few months, she said. If it does, it will prove the existence of the pulsar, thus making a lot of astronomical theorists very happy. They have said for some time that pulsars are formed in supernovas, but so far no one has been able to prove it.

The shower that Harding is looking for will be detectable only with very sensitive instruments, but even amateur astronomers with small telescopes will be able to follow some of the coming events, provided they are in the Southern Hemisphere where they can see it.

Sometime within the next year or so, the star will have dimmed to the point that a "light echo" will be visible, according to Bradley Schaefer of the Goddard Space Flight Center.

Some light from the supernova travels directly to the Earth, but other light is

scattered by dust particles and gases that make up the interstellar medium. Some of that scattered light will be reflected back toward the Earth, thus producing a halo around the star that will change and evolve as light strikes different areas of the interstellar medium.

The halo, Schaefer said, "will become a very easy target for amateur astronomers for centuries."

The star itself—which has dimmed to the point that it is just bright enough to be seen with the unaided eye—will fade completely, but the halo will remain, he added.

"Like the Cheshire cat," he said, "all you are left with is the smile."

The cat, however, could return if Kenneth Brecher is right.

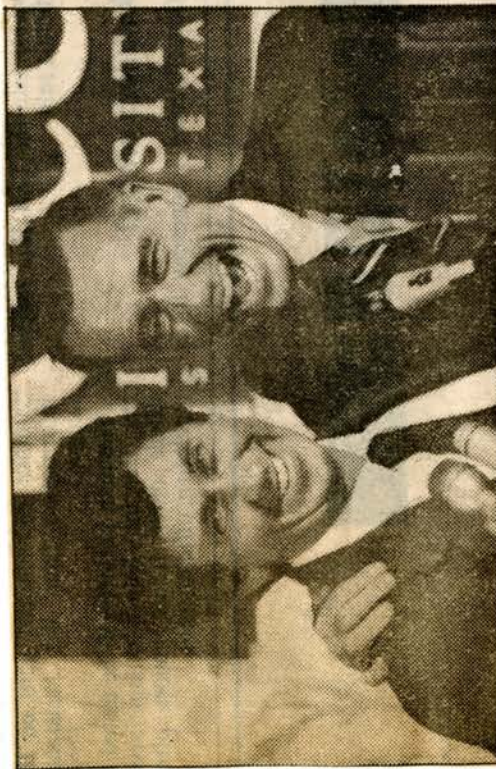
Brecher has combed through records of ancient sightings of supernovas and found that in many cases supernovas appeared in groups of two, separated by 10 to 50 years.

Perhaps the most brilliant supernova in human history occurred in 1006, Brecher said. It faded after a year or so, but other records report a similar event—though far less brilliant—in the same area of the sky in 1016.

That pattern was repeated in 1572-1612, and again in 1604-1664.

Since supernovas that are visible from the Earth are so rare, even the most scant historical records play an important role, Brecher said.

"Even if you've got crummy old records, they're worth something because they're the only thing you've got," he said.



Buster Dean / Chronicle
Soviet cosmonaut Oleg Y. Atkov, left, and former U.S. astronaut Walt Cunningham appear to demonstrate their friendship as they stressed their desire for space cooperation Wednesday at a meeting of the Forum Club.

Cosmonaut urges cooperation in space

By NICHOLAS C. CHRISS
Houston Chronicle

Soviet cosmonaut Oleg Y. Atkov and former U.S. astronaut Walt Cunningham agreed Wednesday that cooperation between their countries might be an answer to pioneering other worlds.

Atkov, who spent a then-record 237 days in space in 1984, said he hopes for a cooperative effort, perhaps, to Mars, and Cunningham who flew the first Apollo manned flight in 1968, agreed that the estimated cost alone — \$120 billion — would be worth joining forces.

Atkov also revealed it took him almost 3½ months to return to normal physical activities after his long

stay in space.

"I think the most serious problem in space is weightlessness," Atkov said.

Without constant exercise in weightlessness, he said, serious problems can evolve with the cardiovascular system and with mineral concentrations that may degenerate the body's bones.

But Atkov said serious psychological problems as well as technological problems must be overcome on long sojourns in space.

His detailed and frank discussion of long-term space problems, was one of the few times a cosmonaut has publicly discussed his experiences in the United States.

Atkov delivered a sometimes

amusing speech, in fluent English, to the Forum Club of Houston, which sponsored his stay in Houston along with Rice University.

Atkov said cooperative space pioneering would not only be cheaper but "better for all of us."

Cunningham said it is always difficult selling the long-term benefits of space to Americans, and he is not sure of the nation's space goals today because of conflict in Congress and budgetary problems.

"On a program such as going to Mars, the economic benefits to the United States of doing it with somebody else would be considerably better because it would cost much less," Cunningham said.

May 1, 1988

Cosmonaut nixes 2nd long flight

Dr. Oleg Atkov, a Soviet cosmonaut who set a space endurance record of 237 days in 1984, said he would not attempt a second record-breaking flight because of the hardships his family suffered on Earth worrying about him.

The cosmonaut's frank comments presage the kinds of serious morale problems future crews will face on long sojourns in space, said Dr. Patricia A. Santy, a psychiatrist and flight surgeon at the Johnson Space Center.

"I did not know it would be that difficult," Atkov said of his family's worries.

"It was very difficult for my wife. When I got back her hair had turned even grayer," said Atkov, who visited Houston a few days ago.

"I would like to fly again, but not for such a long time," Atkov said. "It was very difficult for my wife and my family." He has a 16-year-old daughter.

Atkov, 39, is a cardiologist. He was asked to become a cosmonaut in 1975 but did not fly until 1984, when he set the record.

He made the unusual comments during an interview at Rice University after he had spoken to Dr. Alex Dessler's space physics class Wednesday. His visit to Houston was sponsored by Rice University and the Forum Club of Houston.

His remarks were also unusual because cosmonauts, usually tight-lipped about personal matters, never have stated publicly that kind of personal reservation about long sojourns in space. And no U.S. astronauts have been in space anywhere near that long to make a similar

comparison.

The U.S. space endurance record is 84 days.

Santy said the problem of family support that Atkov discussed was a primary one that U.S. and Soviet scientists have been trying to solve.

"That is one of the impacts of these types of missions on the family and family relations, because it is going to be very tough to deal with a six-month or a year's tour of duty," she said.

"After all, we have always asked people to deal with that kind of problem only in time of war. A round trip to Mars would be even longer (than Atkov's 237 days)," she said.

A Mars round trip could take two to three years.

"But these are the kinds of problems we need to be dealing with, and this is the kind of strategy we must deal with," she said.

"I think psycho-social support for families on Earth will be one of the most important factors for good morale among future space crews on long missions," Santy said. "We are actively interested in looking into this and working with families and developing these kinds of family support plans."

Santy currently has applied for a research grant to study the problems of spaceship crews on long flights and their families on Earth.

In a news conference during his Houston visit, Atkov had stated that one of the primary problems that man must overcome in long space flights — and one that is often overlooked — is the psychological problem. The cosmonaut said it was as important as two other priorities: technical and physiological prob-

lems.

Atkov's record in space was broken last December by Cosmonaut Yuri Romanenko, who spent 326 continuous days in space aboard the Soviet space station Mir.

During his final weeks aboard the spaceship, Romanenko spent some time each day after his tasks were concluded peering out of the port-hole toward Earth. He was described as moody and homesick.

Shortly before he returned to Earth Dec. 29, Romanenko chastised personnel in mission control, and the day before he returned to Earth he got into an argument with flight controllers. He told them he felt they were piling too many tasks on the two-man crew.

Atkov told the Rice audience, including astronaut Tammy Jernigan, that there was no change of "statistical significance" in the bone structure of Romanenko despite 326 days living in weightlessness.

Soviet scientists have said privately that Romanenko suffered about a 5 percent bone calcium loss during his long flight. That compares to a 12 percent loss for Atkov on his flight.

Atkov said Romanenko's good physical shape was due to his diet, but when asked for details of the diet he refused to go any further. Instead, Atkov credited Romanenko's well being to Soviet "know-how."

However, U.S. space scientists say the Soviets apparently are using some new drugs to combat calcium loss in the bone structure. Romanenko also exercised each day for almost two hours, an essential safeguard during long flights to preclude osteoporosis.

Sammy *the Space Probe*



Owlsh Sammy I To Leave the Pad

RICE'S Sammy (not Sammy the Owl, but Sammy the space probe) is scheduled to fly this week.

Sammy I is the first of a series of four Rice engineered probes to measure light and particle energy in airglow and aurorae. (Airglow and aurorae are admired by laymen as heavenly illuminations visible at certain times of the year.)

The 50-pound payload, designed and built at Rice, will be lofted from a pad at Wallops Island, Va., 100 miles into space.

Rice University has a \$200,000 National Aeronautics and Space Administration grant to help finance the four rocket probes, the first by any university in the Southwest.

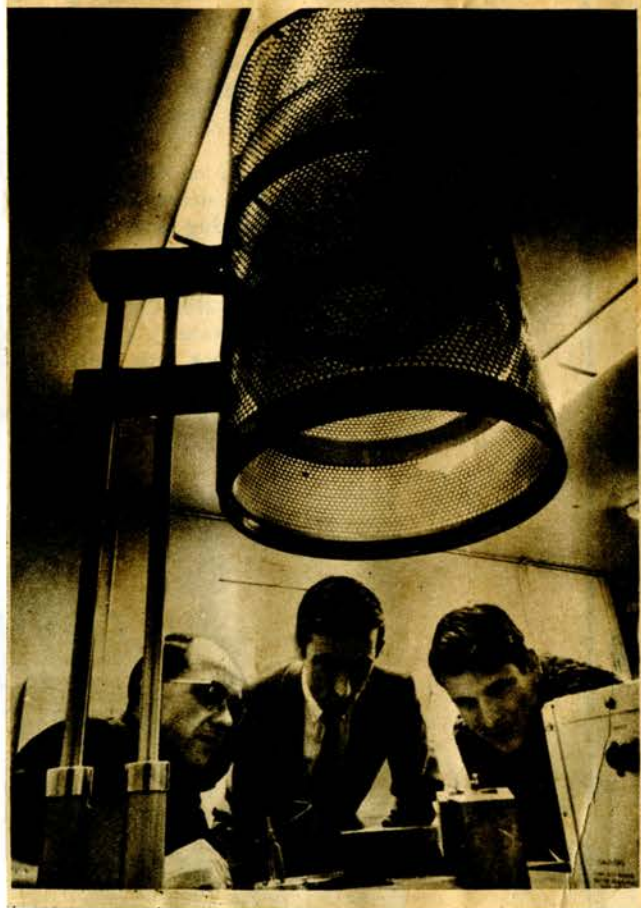
The experiments are being conducted by the Space Science Dept., under the direction of Dr. Brian J. O'Brien as part of his work on the Van Allen radiation belt.

The last three of the four Sammys will be launched some time in February or March from Fort Churchill, Canada. NASA's own Nike-Apache rockets will be the vehicle.

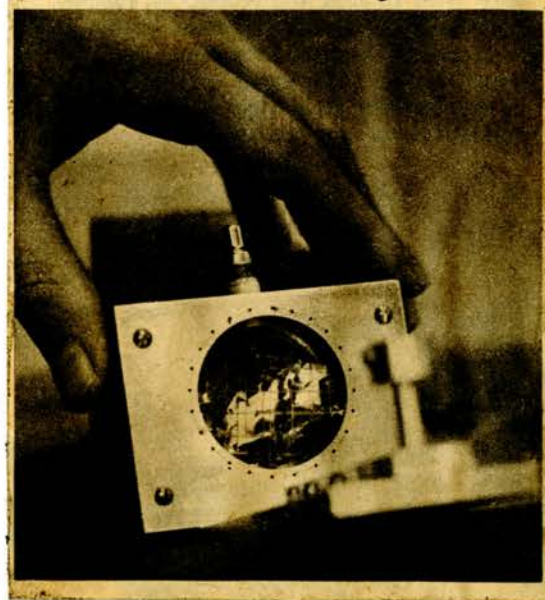
Sammy is expected to provide a valuable educational tool for the development of space research scientists and satellite engineers, Dr. O'Brien predicts.

But some romantic nonscientists are aghast at the idea of Sammy tampering with anything that lights up the heavens whether it has measurable particles or not. ■

Scientific trio inspects broken geiger tube window. From left are laboratory chief Curtis D. Laughlin, Dr. Brian J. O'Brien, head of the Sammy probe series and David Cummings, graduate assistant.

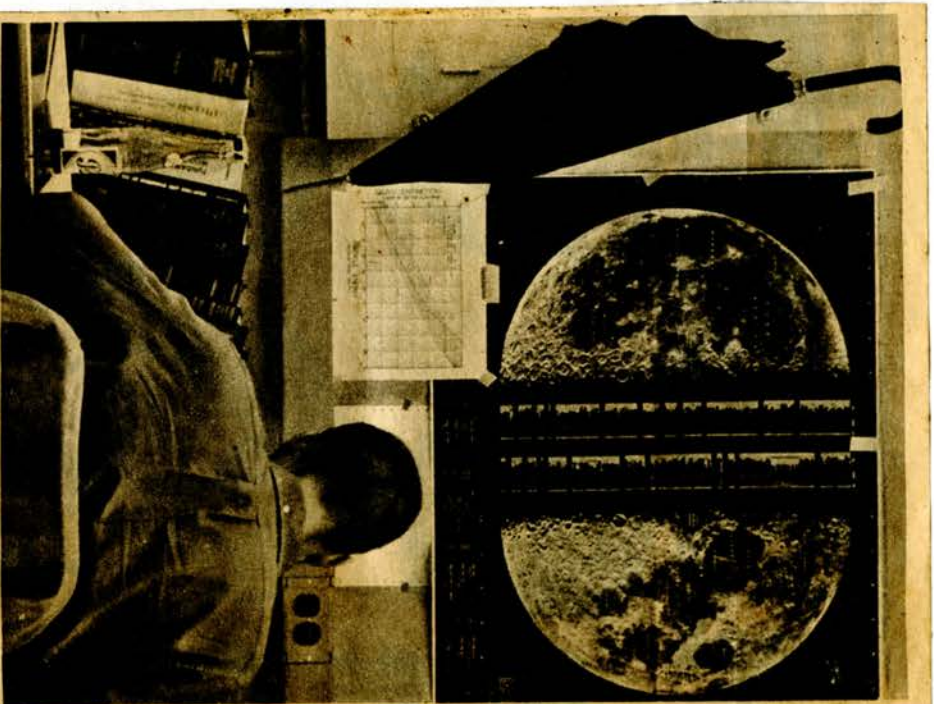


Vacuum crumbles face of geiger tube in test simulating 100-mile-high altitudes.





Circuit assembler Roberta Nutt, right, talks over problem with Janet Langston. Both girls work part-time in the Satellite Techniques Laboratory at Rice.



Plotting energy curve is graduate student William R. Sorenson who keeps a moon chart pasted on the wall, but is cautious (as the umbrella indicates) about the whole project.

the HOUSTON CHRONICLE
January, 1964

Rice Space Probe Package To Head for Test Monday

Scientists at Rice University, which established the nation's first space science department a year ago, will ship "Sammy I," their first space probe instrument package, to Goddard Space Flight Center at Greenbelt, Md., Monday.

The Goddard test will be the last checkout for the rocket-borne instruments before they are sent to Wallops Island, Va., for the Jan. 14 launching.

"Sammy I," named for the Rice mascot, will be the first of four rocket-borne measure-

ments to be made of light and particle energy in both airglow and aurorae.

The probes are being conducted in coordination with National Aeronautics and Space Administration scientists and are financed in large part by a NASA \$200,000 grant. Dr. Brian J. O'Brien, Rice space science professor, is directing the probe.

It is the first major experiment to be conducted in space by a private university in the South or Southwest.

THE HOUSTON POST
TUESDAY, JANUARY 14, 1964

Launch of Rice's Sammy Spacecraft Set for 11 PM

By BETTY MacNABB
Post Staff Correspondent

WALLOPS ISLAND, Va. — Fourteen Texans landed on this barren outer-barrier island in a driving snow storm late Monday afternoon. They are here to observe the firing of the Rice University Space Probe, which is scheduled at 11 PM Tuesday, CST.

The weather may keep Sammy Space Rocket on the launch pad, however. The National Aeronautics and Space Administration imposes some weather restrictions on rocket firings, particularly wind, because of the danger to nearby population centers, including Washington, DC.

Despite the 10-degree temperatures with sleet and snow, Sammy is ready to go. Curtis Laughlin, Rice satellite techniques laboratory chief, who has been here since Wednesday, said the Rice rocket checked out A-OK in all departments.

"IT'S BEEN going amazingly well," he said. "We're right on schedule, maybe a little ahead, and there's a chance the weather might clear up tonight."

He added, "We're very happy, and they (the NASA scientists) are very happy."

Dave Cummings, a space science graduate student from Wichita Falls, was still out at the launching area in the bitter cold at 7 PM Monday. He was making ground measurements of airglow, to be measured against the rocket data.

THE PURPOSE of the shot is to ascertain if the airglow,

which is a light blanket around the surface of the earth, is the same thing as the aurora to be found near the Arctic Circle.

W. S. Carey, electronics communication engineer, and Bob LaQuey, Houston's student assistant engineer, are the other two members of the Rice University team who are directly involved with the firing of the Sammy rocket.

The Nike-Apache nose cone, which was modified in the Rice space laboratories to accommodate the Sammy payload, arrived on Friday and also checked out perfectly.

THE SAMMY payload was "married" to the booster rocket Monday afternoon in a final check that was somewhat hampered by the 40-mile-per-hour wind gusts and blinding snow, Laughlin said.

The Sammy contains a photometer which will measure airglow emission, along with a background detector, which will subtract starlight; a pair of low-energy particle detectors and geiger counters, which will measure higher energy radiation from the particles; and two magnetometers, which will provide aspect or orientation on the magnetic fields.

The probe also will measure space temperatures up to the rocket's 100-mile zenith. It will be audible at the launch site through two low-frequency telemetry channels.

The Sammy is expected to record data and feed it to the space center control stations for about four minutes before the rocket burns up on reentry.

Rice Observers To See Sammy Rocket Firing

By BETTY MacNABB

A payload of Rice University observers, and newsmen, will leave the Houston International Airport at 10 AM Monday to see the first Sammy Space Rocket, named for the Rice owl, fired at Wallops Island, Va.

The rocket payload was developed in the university's space laboratories by scientists and students working under the direction of Dr. Brian J. O'Brien. He received a \$200,000 grant from the National Aeronautics and Space Administration to develop it.

IT IS THE FIRST time a payload has been developed by a Southern or Southwestern university. Four of the Sammy rockets will be fired 100 miles into space to study the airglow and aurorae.

The rocket instrumentation package left Houston last Monday en route to Goddard Space Center in Maryland, for final checks by NASA and Rice scientists. Curtis Laughlin, satellite techniques laboratory chief, W. A. Carey, satellite communications engineer, and Bob Laquey, a student assistant, accompanied it.

Ramon Trachta, design engineer for the probe, left Wednesday with the Nike-Apache nose cone which had been modified on the campus to accommodate the payload.

Howard A. Thompson, director of development, Lee Estes, public relations assistant, Marjorie McNeese, editor of the Rice alumni magazine, and Dick Kenyon, university photographer, will be among the observers leaving Monday morning.

RAY GOODWIN will pilot the Cameron Iron Works' twin engine jet loaned to Rice for the trip. Dr. Edward F. Becht, manager of Cameron's melting division, will be a passenger, along with writers for the Houston, Austin and Dallas news media and the World Book Encyclopedia.

of Iowa, the University of Maryland, and the Johns Hopkins University.

The Rice rocket will be the third "Sam" fired from the base. World-famous Sam and Miss Sam, the two Rhesus monkeys from Balcones Laboratory in Austin who preceded the human astronauts into space, also were fired from Wallops Island.

The space science students who worked on the probe and the engineers and professors who were unable to make the trip will be waiting for news of the firing at the Rice Student Center. A radio hookup to the launch site will broadcast news of the probe's flight to the student center lobby.

The Wallops Island station, some 40 miles southeast of Salisbury, Md. and 60 miles south-east of the Goddard Space Center, was formerly the Chinese League Naval Air Station.

THE ISLAND is about five miles long and about one-half mile wide at its widest point. It was named for John Wallop, a 17th Century Virginia surveyor.

Wallops Station is not a new space facility. A launch site was established there in 1945 by the Langley Research Center, a field station of NASA's predecessor agency.

Since 1945 more than 5,000 research vehicles have been fired there on rocket boosters ranging from one to seven stages in size. About 300 experiments are sent aloft each year for scientists and engineers in laboratories and research centers all over the country.

FIVE OTHER universities have sent up rockets at Wallops. They are the University of Michigan, the University of New Hampshire, the State University

the HOUSTON CHRONICLE
January 14, 1964

Storm May Improve Rice Space Shot

1/14/64

By WARREN BURKETT

Chronicle Science Reporter

Wallops Island, Va.—Winter's worst storm on the East Coast may give Rice University a helping hand in its first space shot, scheduled here tonight.

Curtis D. Laughlin, chief of Rice's satellite techniques laboratory, said instruments in the 50-pound payload would give a clear signal if chilled.

"Cold weather will help us," Laughlin said.

A main purpose of Rice's first "Sammy" shot is to measure the light and electrical energy in the night airglow with four photo multipliers in the rocket's nose cone.

The multipliers will amplify this energy and change it to a signal broadcast back to the main tracking station.

Laughlin said the photo multipliers will work better when cold.

Rice's launch rocket is a 22-foot Nike-Apache capable of reaching nearly 100 miles.

The Rice experiment seeks to find out if the so-called airglow is a permanent aurora similar to the Northern Lights or a different physical phenomenon.

the HOUSTON POST
January 7, 1964

TO BE LAUNCHED JAN 14

Rice's 'Sammy' Spacecraft On Way to Maryland Center

By BETTY MacNABB

The first Sammy Space Probe left Houston late Monday afternoon on a jet, headed for Goddard Space Center in Maryland.

The 50-pound instrument package will be fired 100 miles into space from a Nike-Apache rocket launcher at midnight Tuesday, Jan 14.

Three Rice University electronics specialists accompanied the package, and will help National Aeronautics and Space Administration experts make final checks on its instrumentation. They are Curtis Laughlin, satellite techniques laboratories chief; W. A. Carey, satellite communications engineer; and Bob LaQuey, student assistant electronics engineer.

RAMON TRACHTA, design engineer for the probe, will leave Wednesday with the Nike-Apache nose cone, which was modified at Rice to accommodate the Sammy payload.

Dr Brian J. O'Brien, the Rice space science professor who received a \$200,000 grant from NASA to direct a space probe research project involving study of the airglow and aurorae, will not see the first Sammy fired. He will be lecturing in California.

However, another planeload of Rice observers, along with 16 science editors and reporters

from Houston, Austin, and Dallas, will go to Goddard Space Center to observe the historic shot.

THEY WILL leave at 10 AM Monday on a Cameron Iron Works' twin-engine F-27 prop-jet plane loaned to Rice University for the occasion.

The actual firing will take place on lonely Wallops Island, Va, about 60 miles south and east of the Goddard Space Center.

Sammy I will be the first space probe fired by a Southern or Southwestern university under the NASA program.

THREE OR possibly four other Sammy Space Rockets will be fired during the dark of the moon in successive months, all from Fort Churchill, Canada, where a joint United States-Canada space research center is located. The second Sammy will be fired during the Feb 16-22 period.

Dozens of Rice University

space professors and students worked throughout the Christmas-New Year's holiday period to complete Sammy, a spokesman said. From Thursday through Sunday, as they put the finishing touches on the delicate instruments, the space enthusiasts worked day and night, many of them catnapping in the laboratory.

"It was a pretty bleary-eyed crew that placed Sammy in that wooden crate on Sunday night," the spokesman said.

MOST OF THE students who worked on the space probe will remain behind in Houston, and will be anxiously waiting for news of the success or failure of the probe.

Included will be Michael Trichell of Shreveport; David Crivell of Rhone; Henry Goldwire of Irving; and David Cummings of Wichita Falls. All graduate engineering students, they designed and fabricated four instruments included in the probe.

Two girls who assembled the instruments from the engineering blueprints, Janet Langston of Dallas and Roberta Nutt of Orange, also will remain at Rice waiting for the news.

SAMMY'S PAYLOAD includes Geiger counters, telephotometers, and other highly sensitive electronics equipment which will study the airglow and aurorae

SAMMY

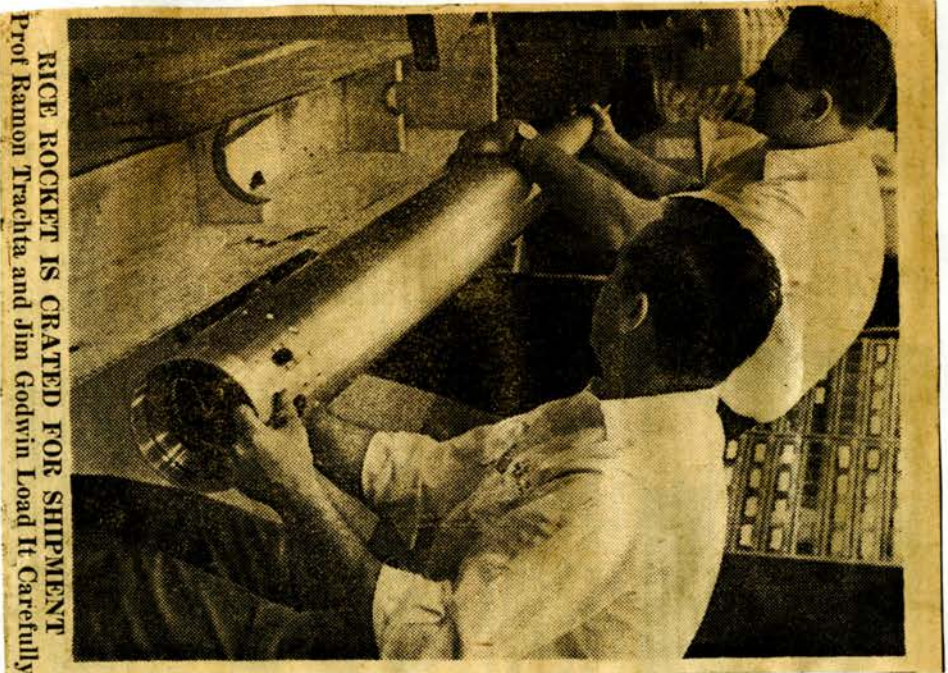
Continued From Page 1
from about 40 miles on up to the 100-mile zenith. The object is to determine if they are the same, or entirely different, space phenomena.

The Sammy will attain a speed of about 4,080 miles per hour before beginning its fiery descent to earth. It is expected to relay data for a period of about 15 minutes, but it will be visible for only about 40 seconds during the ascent.

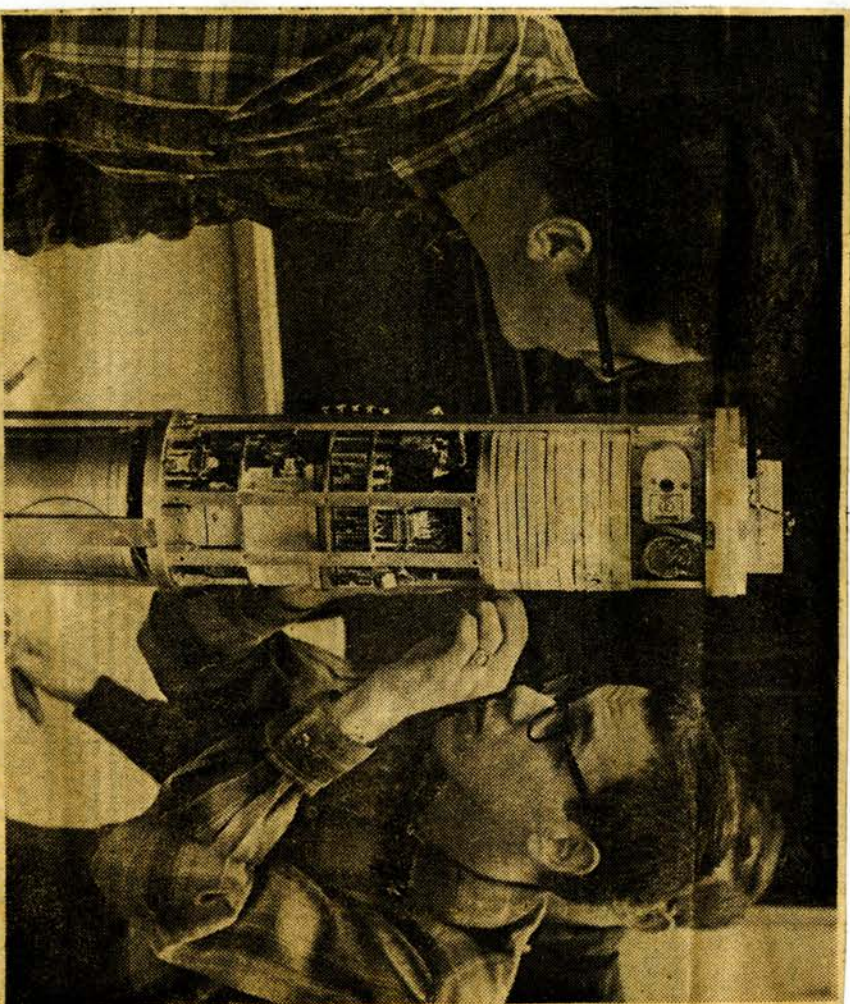
Many of the instruments used in fashioning the probe were suggested by the students, the Rice spokesman said. The tools used included everything from Popsicle sticks and floor wax to plastic tape.

AFTER THE explosive charge blows the shell from the instrument package at a height of 40,000 feet, three valve-lifter springs from a 1959 Ford police racing special will kick the package away from the nose cone, he added.

The automobile springs were the idea of Trachta, the design engineer. He owns a 1959 Ford, and was thoroughly familiar with their lift power.



RICE ROCKET IS CRATED FOR SHIPMENT
Prof Ramon Trachta and Jim Godwin Load It Carefully



SAMMY SPACE ROCKET'S "NERVOUS SYSTEM" IS WIRED IN PLACE
Dave Reasoner, Left, Mike Loeb Insert Electronic Circuits in Probe

the HOUSTON POST
January 15, 1964

HOUSTON POST JAN. 15, 1964
**NASA Launches Sammy
Rocket; Results Unclear**

By BETTY MacNABB
POST STAFF CORRESPONDENT
WALLOPS ISLAND SPACE STATION, Va. — Rice University's Sammy space rocket cleared the launching pad at 8:31 PM CST Tuesday after a half-hour delay caused by a malfunction in the payload circuits.

The rocket probe flight was successful, but left something to be desired, Rice scientists said later.

TWO SODIUM-TRAIL rockets designed to study weather patterns in this blizzard area and a Navy Research League Javelin rocket were cancelled earlier. Two later rocket shoots scheduled before daybreak also were cancelled.

Curtis Laughlin, Rice satellite techniques laboratory chief, said: "As nearly as we could tell, the payload functioned normally. It is too early to give an indication as to what we learned."

Robert Jones, National Aeronautics and Space Administration project director, said that the Rice rocket achieved a lower-than-expected apogee of 295,000 feet, or 56 statute miles, which it reached in only two minutes and 30 seconds.

IMPACT OCCURRED five minutes and four seconds after launching at a spot in the Atlantic Ocean 74 miles southeast of the launching site.

Jones said the rocket began "coning" shortly after take off — meaning spun like a top. This kept the rocket from reaching the height expected of it, 80 to 100 miles.

The second stage of the rocket, the Apache, fired late. Observers saw the first stage ignite and there was a perceptible pause before the flare of the second stage.

earth except for the area around the poles. Dr Brian J. O'Brien, the Rice scientist who received a \$200,000 grant from NASA to develop the Sammy, said that the airglow differs essentially from the Aurora Borealis.

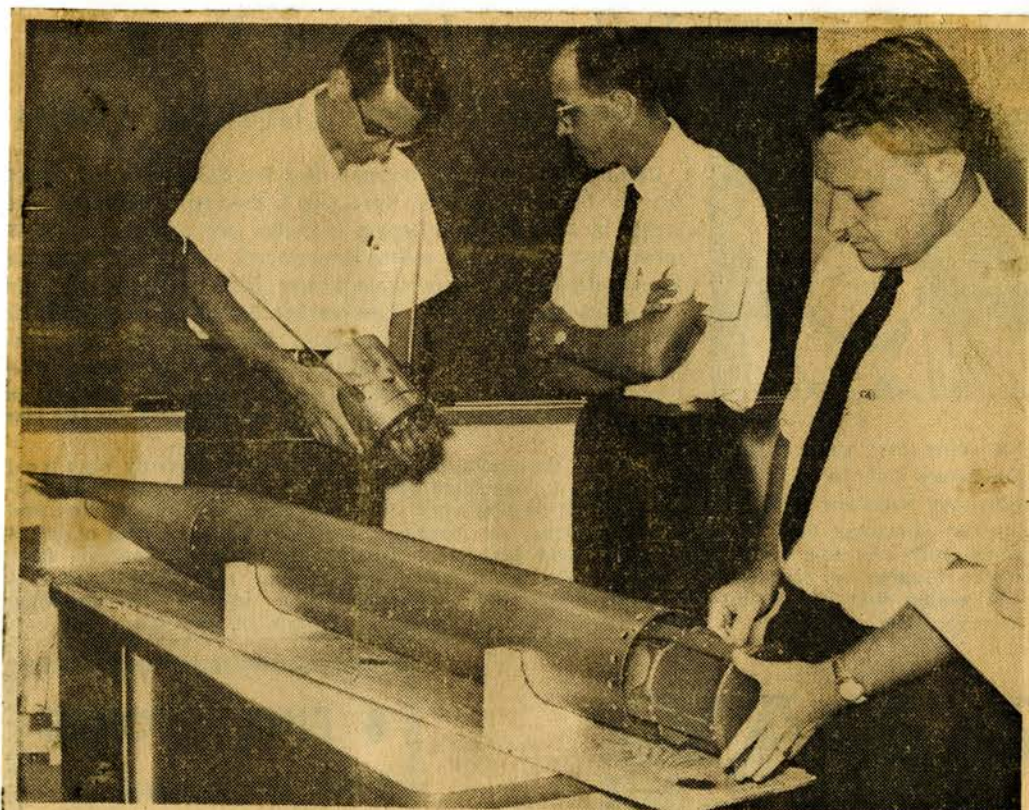
LAUGHLIN SAID that he would like to repeat the experiment here at Wallops Island before proceeding to an investigation of the aurora, or northern lights.

He said, however, that it will be a month or two before the scientists can determine what information recorded by Sammy is usable.

Sammy space rocket was expected to provide a "definitive answer" to a highly controversial theory on space phenomena, a Rice University space expert said earlier Tuesday.

DAVID CUMINGS, 22, a graduate physicist from Wichita Falls, who acted as on-the-scene handyman during the launching of the first Sammy payload briefed 14 Texas newsmen late Tuesday afternoon.

Sammy was designed to study airglow, a blanket of weak radiation which covers the



RICE SCIENTISTS AND PAYLOAD CONTAINER FOR SPACE RESEARCH
From Left Are Ramon Trachta, Curtis D. Laughlin and W. S. Covey Carey

Rice Rocket Wobbles Low Into Airglow 1/15/64

BY WARREN BURKETT
Chronicle Science Reporter

Wallops Island, Va.—Rice University's first rocket poked its cold nose into the luminescence

known as the airglow Tuesday night, but what it sniffed out will not be known until data is analyzed.

The success, if any, was qualified.

Rice's instruments, built at the university, apparently worked perfectly. They radioed back a strong signal throughout the five minutes and four seconds of flight, trackers said.

However, the two-stage Nike-Apache rocket carried the instrument's only 56 miles high. It was "barely in the airglow," said Curt's Laughlin, head of the satellite laboratory.

Landed at Sea

Laughlin expected the rocket to carry the payload more than 80 miles, passing completely through the glowing layer of sky. The instruments landed 74 miles out to sea.

The rocket fired at 8:31 p.m. Houston time. Robert Long, NASA launch director, said the low altitude apparently was caused by two failures. The second stage did not ignite as soon as expected, he said. Also, the rocket began to "cone" or wobble during flight.

Five other shots scheduled here Tuesday were canceled by weather conditions and instrument troubles. Rice's only hint of instrument trouble corrected itself, Laughlin said, delaying the countdown only 30 minutes. Lord said there was no indication of rocket troubles during the countdown.

Would Like Repeat

"We would like to repeat the experiment," said Laughlin. Rice's rocketeers want to find out if the faint glow in the night sky is a permanent aurora or if it is caused by some other physical process. Rice has three more shots scheduled for Ft. Churchill, Canada, in February. These will be fired through the northern lights passing directly over the launching site.

The "Sammy Series," named after the school's owl mascot, are financed by a \$200,000 NASA grant to the year-old space department.

Designed by Students

Sammy I was designed to measure light and particle energy in the airglow over Wallops Island. Later Sammy will take similar measurements in the aurora over Ft. Churchill.

Graduate science and engineering students at Rice designed and fabricated the experiments. Three girl students assembled the electronic circuits. The entire program is a first for Rice.

"In a few months," said Dr. Alexander Dessler, head of the Rice space science department, "we have developed a small group of scientists and engineers who soon will be very valuable additions to the nation's space effort."

Houston Post 1/26/64

5th Sammy Shot Needed, Rice Scientists Decide

Rice University space scientists will have to fire five Sammy Space Probes instead of four to get the data they need on airglow and aurorae.

The fifth probe is needed because the Nike-Apache booster rocket, fired by National Aeronautics and Space Administration Technicians at Wallops Island, Va., Jan. 14, failed to function properly.

THE SAMMY PROBE functioned perfectly throughout, but it simply was not hurled as far into space as it should have been, Rice spokesmen said. The second stage of the booster rocket, the Apache section, failed to ignite until 24 seconds after the first or Nike, and it sent a payload into a spinning movement which slowed its flight.

After studying the preliminary data sheets from the Sammy instruments, Dr. Brian J. O'Brien, the Rice scientist who received a \$200,000 NASA grant for the experimental space probes, said the nose cone was detached at the proper altitude of 140,000 feet by three Ford valve lifter springs.

HOWEVER, THE first Sammy achieved an altitude of only 295,000 feet or 56 statute miles, instead of the hoped-for minimum height of 432,000 feet—82 miles. That distance would have taken the probe all the way through the prime airglow belt, which extends from 50 to 82 miles above the earth's surface.

Because the spinning motion of the payload exerted a drag on it similar to gravity, the probe stayed in space only five minutes and four seconds, he said.

THE PROBE'S second objective, that of training for the space science students, was accomplished successfully, Dr. O'Brien said.

The failure of the first space probe to gather the needed data on airglow means that the aurorae probes from Fort Churchill, Canada, will have to be fired in rapid succession early in March, since the maximum twilight of the winter solstice will soon be over.

DR. O'BRIEN'S purpose in firing the rocket series is to determine whether or not the airglow and the aurorae (Northern lights) are the same or two different space phenomena. Some scientists believe the airglow in more southerly latitudes is merely a weak permanent belt of aurora; O'Brien believes they are quite different.

The Rice scientist, who was chief physicist of the first Australian Antarctic Expedition prior to coming to the United States, conducted a series of space probe experiments connected with the Van Allen radiation belt while a member of the faculty of the State University of Iowa.

He hopes to direct a future Rice University space experimental project involving an orbital satellite.

the HOUSTON Post
January 26, 1964

the HOUSTON CHRONICLE
January 26, 1964

Chron 1/26/64

EXTRA SAMMY SPACE PROBE SET FOR MARCH BY RICE U.

An extra Sammy Space Probe will be fired because the first Sammy shot Jan. 14 failed to rise high enough to gather needed data on airglow and aurorae because of a weak booster rocket.

Dr. Brian J. O'Brien, Rice University space scientist with a NASA grant, said the first Sammy climbed to only 295,000 feet, or 137,000 feet short of moving completely through the prime airglow belt.

Now, five Sammys instead of four must be fired in rapid succession from Fort Churchill, Canada, early in March.

Purpose of the probes, said Dr. O'Brien, is to determine whether the airglow and the aurorae (Northern lights) are one and the same space phenomena.

the HOUSTON CHRONICLE
 March 16, 1964

Weather Delays Rice Rocket Shot

Chronicle News Services
 Fort Churchill, Canada—Snow and overcast skies today caused

postponement of Rice University's rocket probe into the northern lights until midnight

tonight. Fort Churchill, on the fringe of Hudson Bay and the Arctic Circle, was chosen as the site of Rice's second rocket attempt to explore the northern lights.

The first one in January at Wallops Island, Va., failed to reach a maximum altitude because of a faulty rocket.

Students of the space science department hope to fire an instrumented nose cone through three of the light areas of the aurora borealis.

One purpose is to determine if the northern lights are connected with the radiation belt in the Earth's magnetic field.

If the rocket is fired tonight two other Nike-Apache rockets will be fired before Easter, said Curtis Laughlin, head of the Rice Satellite Technology Laboratory.

THE HOUSTON CHRONICLE Wednesday, March 18, 1964

CANADIAN MISSILE SUCCESS

Rice Rocketmen Fire Sammy II

Chronicle News Services
 Fort Churchill, Manitoba—Rice University rocketmen sent a

Apache rocket performed successfully. The instruments went through the brightest part of the northern lights as they passed over this Canadian rocket range on the edge of Hudson's Bay, Canada.

Sammy II rocket through the heart of a shimmering aurora borealis here early this morning.

Curtis Laughlin, head of the Satellite Techniques Laboratory at Rice, said both the instrument package and the Nike-

scheduled for firing at midnight.

tonight if weather conditions permit. Sammy II was postponed 48 hours because of a 60-m.p.h. blizzard that swept across the Manitoba plains Sunday and Monday.

Instruments in the rocket nose cone are designed to measure the light, radiation and electric-ity that exists in the auroras.

Dr. B. J. O'Brien, head of the \$200,000 Rice-NASA experiment, wants to see if there's any connection between the auroras and the Van Allen radiation belts.

Today's shot penetrated the aurora at about 65 miles up and flew up to about 85 miles before starting the fall back to earth 197 seconds after blast-off.

Assisting Laughlin in the shot and recording information from the payload's radios were Peter Carey, instrumentation engineer, and students David Criswell, David Reasoner and Mickey Trichel.

Rice Rocket Team to Make Canada Test

Rice University's rocket men headed today for Fort Churchill, Canada, and their second try at probing Earth's upper atmosphere.

Fort Churchill lies in the ozone of the Northern Lights, on the Arctic Circle near Hudson's Bay.

The Space Science Department students will attempt to fire an instrumented nose cone through three of the shimmering light displays.

Radiation Check

They want to find out if the Northern Lights are associated with the belts of radiation trapped in the Earth's magnetic field. The field is strongest at the Earth's poles where the so-called lines of the magnetic force bend down to Earth.

Curtis Laughlin, head of the Rice Satellite Technology Laboratory, said the first rocket would be launched Sunday night or Monday night. The other two Nike-Apache rockets will be fired before Easter, he said.

Laughlin was flying to Fort Churchill, a United States-Canadian firing range, from Washington. Graduate students Henry Goldwire and David Reasoner were to join him there, leaving from Houston.

1st Shot Failed

W. A. Carey, head of the lab's communications section, and student David Criswell were driving to Winnipeg, Manitoba, where they will catch a plane for Fort Churchill.

The lab's first shot, last January, failed to reach the maximum altitude because of a faulty rocket. The shot took place at Wallop's Island, Va.

The experiments are financed by a NASA grant.

the HOUSTON CHRONICLE
March 11, 1964

Rice May Get \$3 Million For Satellites

BY WARREN BURKETT

Chronicle Science Writer
Copyright, 1964, The Houston Chronicle

Washington — The space agency is considering a grant of about \$3 million to Rice University to build and track two large scientific satellites.

Agency officials here have been conferring with representatives of Rice's space science department on details of the grant.

Money for the project is contained in the fiscal 1965 budget under consideration by Congress. Approval may come within six months.

Rice graduate students will build the satellites under the direction of scientists and engineers at Rice's Satellite Techniques Laboratory.

The satellites likely will be named "Owl I," and "Owl II." An owl is the school mascot. The first satellite should be in orbit a year after approval of the grant.

Several National Aeronautics and Space Administration officials flew to Houston from Washington last week to discuss the project and inspect Rice facilities.

The project also calls for construction of tracking stations here and in Australia.

One station will be located in the \$2.7 million space sciences building to be built this winter at Rice University. The building was financed with \$1.6 million in NASA funds, with Rice providing the rest.

The other tracking station will be almost diametrically opposite Rice University on a line drawn through the Earth. The University of Sydney may construct the station.

Dr. Brian J. O'Brien, Rice professor of space science, this fall will spend several months at the University of Sydney.

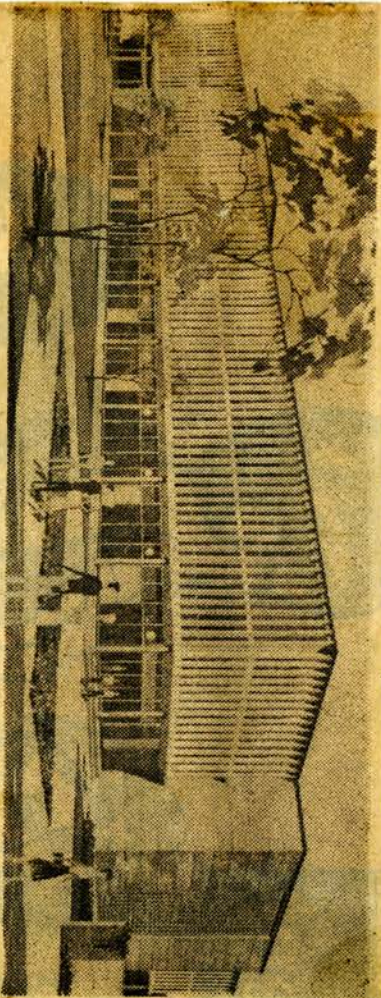
Each satellite will weigh several hundred pounds. The space agency plans to launch them from Cape Kennedy.

Instruments on the satellites will cover a variety of experiments, such as radiation belts around Earth and the effects of Earth's magnetic field upon the electrified particles and radioactive materials thrown toward Earth from the Sun.

the HOUSTON CHRONICLE
May 1, 1964

the HOUSTON CHRONICLE
May 1, 1964

RICE'S \$2.4 MILLION SPACE BUILDING



This is an architect's drawing of the Space Science and Technology Laboratory Bldg. that will be built on the Rice campus. The building will be jointly financed by NASA

and Rice to house the expanding space science research work. The building is expected to be completed by early 1966. (See Story, Page 1).

Rice to Erect

\$2.4 Million

Space Center

NASA to Share
Cost of Building
For Joint Lab

See picture Section 1, Page 24

A \$2.4 million space science and technology laboratory will be built on the Rice University campus.

U.S. Rep. Albert Thomas of Houston said the National Aeronautic Space Administration (NASA) will bear \$1.6 million of the cost. Rice will pay \$800,000.

Rice president, Kenneth S. Pitzer, hailed the "partnership between NASA and the university."

The building will house the recently established space science department and other NASA-sponsored research projects at Rice, Congressman Thomas said.

Ready in Two Years
Construction is expected to be completed in early 1966, Pitzer said.

The architectural firm of George Pierce-Abel B. Pierce, Houston, has been hired to draw the plans. The style will be contemporary.

The building will be located north of the Geology and Biology buildings near Rice Blvd., and the Kent St. entrance to the campus.

It will have three floors and a deep basement with 57,030 square feet of usable space.

The basement will include a machine shop and low-level radiation laboratories.

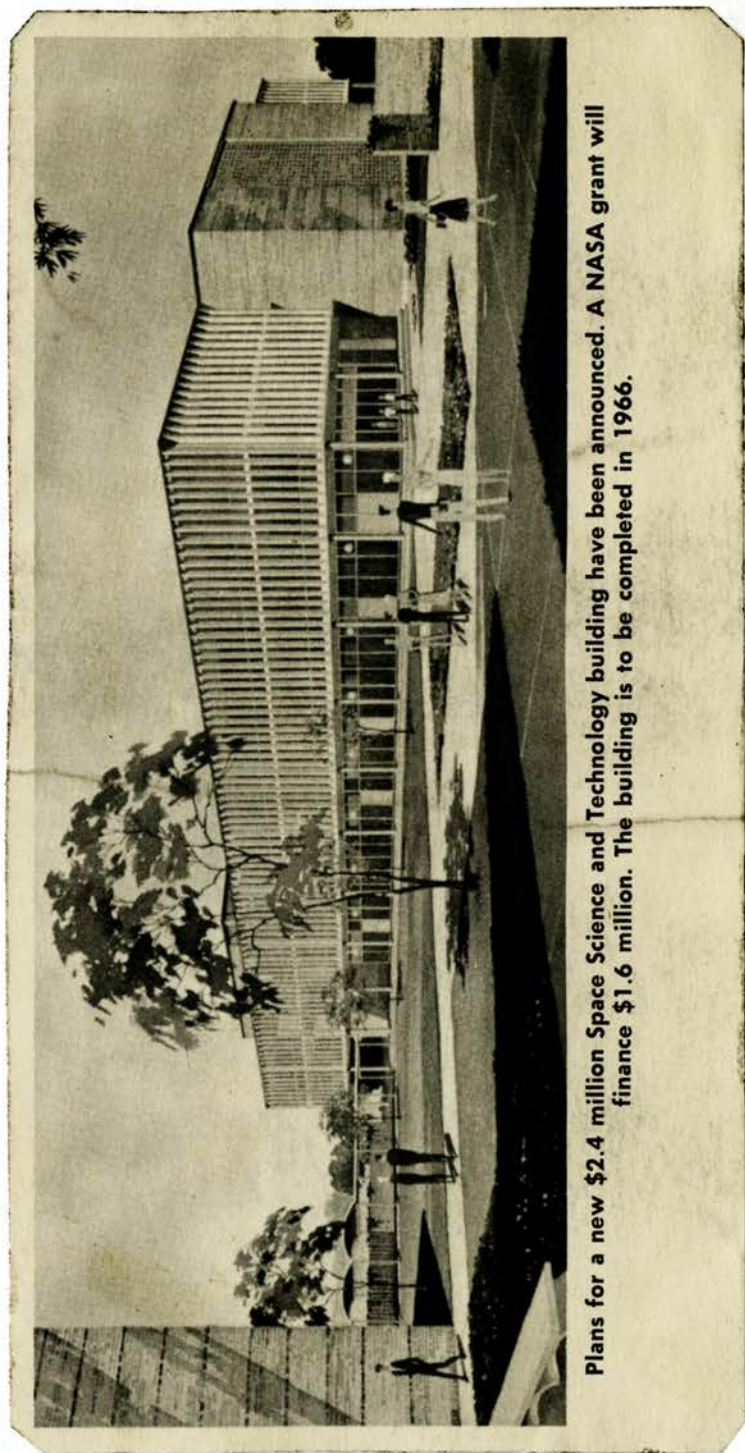
To Join Nine Units

Dr. Franz Brotzen, dean of engineering and chairman of the committee on interdepartmental research programs, says the new building will permit centralization of work on space-related projects.

Such work is now being done in nine separate departments on the campus.

Besides offices and conference rooms, the building will house research facilities for "geomagnetic, gas reaction cross section measurement and mass spectrometry, ionosound, lunar and planetary surfaces, and meteoritics experiments," a Rice spokesman said.

A computer center also will be in the building.



Plans for a new \$2.4 million Space Science and Technology building have been announced. A NASA grant will finance \$1.6 million. The building is to be completed in 1966.

the PRESIDENT'S NEWSLETTER
RICE UNIVERSITY
June, 1964

NSF Will Finance Natural Hydromagnetic Studies

Rice University has received a grant of \$160,000 from the National Science Foundation to support a three-year study of the "Natural Hydromagnetic Wave Spectrum."

Professor Alexander J. Dessler, Chairman of the Space Science Department, will direct the research on the project designed to investigate the possible effects of hydromagnetic waves in the magnetosphere.

Dr. Dessler, a specialist in hydromagnetic wave research, is the author of papers on "Ionospheric Heating by Hydromagnetic Waves" and "Upper Atmosphere Density Variations Due to Hydromagnetic Heating."

Rice University is in the process of establishing a geomagnetic observatory near Houston to obtain information on the primary hydromagnetic wave spectrum and to determine what effect, if any, that local geologic formations might have on the hydromagnetic signals recorded at the earth's surface. Houston is located near enough to the Gulf of Mexico to measure the effects of the electrical conductivity of that body of water on the signals received at the observatory.

The immediate value of the studies lies in the fact that it is now generally accepted that hydromagnetic waves are generated by the impact of solar plasma on the geomagnetic field around the earth and that the energy deposited in the ionosphere by the hydromagnetic waves may produce significant geophysical effects due to atmospheric heating.

Two research assistants, William Sorenson and Wade L. Craddock, will assemble, equip, operate the observatory, and reduce the data which they obtain, Dr. Dessler said.

It is expected that the Rice micropulsation observatory will cooperate with the geomagnetic micropulsation measurement program directed by Dr. J. Hertzler at the Lamont Geological Observatory in New York so that the detailed local data and the information received from Lamont may be used to establish patterns which will apply over a large geographic area, Dr. Dessler said.

Through the establishment of the Rice observatory valuable measurements necessary to understand the true efficiency of the hydromagnetic heating mechanism may be obtained, Dr. Dessler said.

the PRESIDENT'S NEWSLETTER
RICE UNIVERSITY
June, 1964

Fifth 'Sammy Shoot' Set At Wallops in Early July

Early next month the Space Science Department plans to complete the final rocket firing in the current "Sammy Series" of space probes.

The series, named after the Rice owl mascot, was financed by a \$200,000 grant from the National Aeronautics and Space Administration in Washington.

Four of the five rocket probes into the upper air have already been completed and have obtained a considerable amount of data on "Aurorae and Airglow." The first shot was launched from NASA rocket launch sites at Wallops Island, Virginia, and next three from the joint American-Canadian research facility at Fort Churchill, Canada. The fifth shot which is scheduled for early July will be launched from Wallops Island.

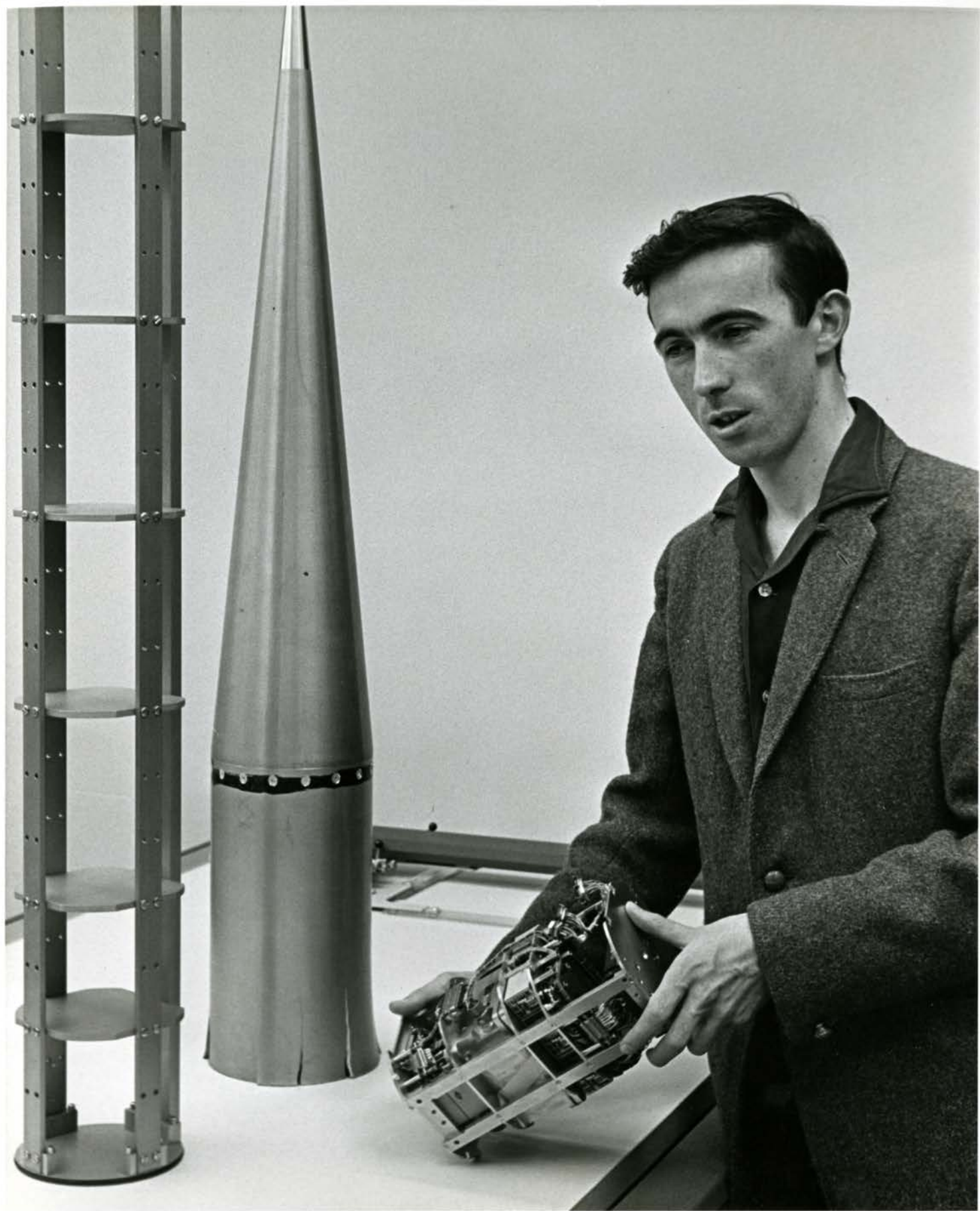
Dr. Brian J. O'Brien, Professor of Space Science and principal investigator on the project, is measuring light and particle energy in both airglow and aurorae in order to study their causes. His research may finally determine if airglow is really a weak permanent aurora or an entirely different and independent space phenomenon.

The instrument-laden payloads for the space probes were designed, constructed, and tested in the Satellite Techniques Laboratory on the campus before going to Goddard Space Flight Center for a NASA pre-launch checkout.

Instrument packages made at Rice were mated to the NASA Nike-Apache rocket for the space shots.

The series so far has met several important objectives. It is the first group of probes to obtain simultaneous definitive measurements of light and particle energy in airglow, and the design and construction of the instrument system has provided a valuable educational vehicle for the development of space research scientists and satellite engineers.

A well-coordinated team of graduate students, space science faculty and satellite techniques laboratory staff members have gained valuable experience in rocketry which will prepare them for more extensive work on space investigations with Rice satellites.



Rice Space Probe Is Launched

WALLOPS ISLAND, Va. — (AP) — The National Aeronautics and Space Administration launched an air-glow experiment for Rice University, Houston, early Thursday.

It was the fifth in a series of rocket firings to measure and study the mysterious aurorae and air glow in the night sky during the dark of the moon.

THE EXPERIMENT — named Sammy in honor of the school's mascot, "Sammy the Owl" — was flown on a two-stage Nike-Apache rocket.

It consisted of 65 pounds of instruments designed and built by professors and students at Rice's Space Science Department.

Air-glow photometers, Geiger counters, low-energy particle detectors and magnetometers were set to measure light intensity on air glow and the flow of charged particles at various altitudes.

Dr. Brian J. O'Brien, project scientist, and C. D. Laughlin, payload manager, were the Rice University officials in charge.

The first test in the series was launched from Wallops last Jan. 14. Three others were sent aloft from the Churchill Research Range in Canada.

DATA OBTAINED at the two locations will be analyzed, compared and interpreted by the university.

Officials said the rocket attained an altitude of 104 miles and landed in the Atlantic Ocean 98 miles down range.

Since the desired data was telemetered to ground stations during the flight, there was no attempt to recover either the payload or the still - attached spent second stage of the rocket.

the HOUSTON Post
July 9, 1964

COMPLETION OF "SAMMY" PROGRAM
4 out of 5 launches successful!

the PHILADELPHIA INQUIRER
July 9, 1964

the NATIONAL OBSERVER
July 9, 1964

Space Shot Tests Light Intensity

WALLOPS ISLAND, Va., July 9 (AP).—Space agency scientists fired a 65-pound package of instruments to an altitude of 104 miles early Thursday to measure light intensity in the night sky.

Before splashing into the Atlantic 98 miles down range, Sammy—named after Rice University's mascot "Sammy the Owl"—measured the air glow and the flow of charged particles at various altitudes and transmitted the data to ground stations.

The fifth in a series of rocket firings to measure and study the night sky, Sammy was launched by the National Aeronautics and Space Administration for Rice University, Houston, whose professors and students designed and built the experimental package.

Rocket 104 Miles High Measures Night Light

A Nike-Apache rocket last week sent data-transmitting instruments 104 miles into space to measure light in the night sky during the dark of the moon.

The 65 pounds of instruments used in the experiment, the fifth in a series, were designed by Rice University, Houston, Texas. The National Aeronautics and Space Administration fired the two-stage rocket that carried the instruments from Wallops Island, Va.

Data transmitted to ground stations during the flight will be analyzed by the university.

the HOUSTON POST
June 20, 1963

IN NEW SPACE LAB

Satellites With 60,000-Mile Range Will Be Built at Rice

By RALPH S. O'LEARY
Post Science Editor

Unmanned artificial satellites, able to explore space around the earth out to a distance of 60,000 miles, will be built at Rice University as a part of the program of its new space science department.

Dr. Kenneth S. Pitzer, Rice president, who made the announcement Wednesday, said the highly sophisticated space probes will be built on the university campus in a new satellite techniques laboratory.

THE NEW laboratory will include, the Rice president said, a complete telemetry and command station. This will mean that the Rice scientists will be able to interrogate the orbiting satellites as they pass over the Houston area and obtain by radio reports the scientific data they have picked up on their flights around the earth.

The new laboratory will be manned chiefly by a team of scientists trained under Dr. James A. Van Allen, professor of physics at the State University of Iowa and a pioneer in the construction and instrumentation of unmanned space satellites.



CURTIS D. LAUGHLIN
Gets Rice Appointment

lites, Dr. Alexander J. Dessler, chairman of Rice's new space science department, said.

IT WAS A cosmic ray counter, designed by Dr. Van Allen and aboard the first United States artificial satellite,

Explorer I, in January, 1958, which paved the way for one of the most startling discoveries of the space age — the existence of the two strange belts of high energy radiation circling the earth. The belts have now been named in honor of Dr. Van Allen.

The team of scientists will be headed, Dr. Dessler said, by Curtis D. Laughlin, research physicist at Iowa, as chief of the new laboratory.

Laughlin has worked with Dr. Van Allen since 1959 on the design and instrumentation of satellites such as Injun I, Injun II and Injun III, all of which have explored the Van Allen radiation belts and obtained highly significant scientific information.

OTHERS ON his staff from Iowa university will be Dr. Brian J. O'Brien, recently appointed professor of space science at Rice, and Ramon Trachta, satellite design engineer for the new laboratory. Both worked on the Injun satellites and Trachta supervised designers and draftsmen for a number of other space probes,

including the Explorer, Ranger, Mariner and Relay satellite programs.

W. S. Carey, Johannesburg, South Africa, was named satellite communication engineer for the new laboratory. For the past year he has been senior research officer of the National Institute for Telecommunications Research in Transvaal, South Africa, working at the deep space instrumentation facility there which communicated with Mariner II on its flight to Venus last fall.

Temporary facilities for the new laboratory will be set up next fall in a building on the campus being built for future use by Rice's buildings and grounds department. Later, the laboratory will be housed in a building to be constructed for all space science activities at Rice.

RICE'S FIRST space probes will be fired aboard sounding rockets in Alaska. Later some will ride piggyback on orbiting launching vehicles for space-craft and still later they will be fired into orbit aboard their own launching vehicles.

Under normal circumstances,

pected that the new laboratory at Rice would cut this time down to one year.

Both Dr. Pitzer and Dr. Dessler said the new laboratory would get an instrumented satellite in orbit. Dr. Pitzer said he expects students to Rice.

STORMS AFAR

Deep in Piney Woods, Rice's geomagnetic observatory picks up news from 93 million miles away

By BLAIR JUSTICE
Post Science Editor

Houston now has in operation a new observatory that detects the effects of storms originating 93 million miles away. These storms bring huge waves hundreds of miles long. But few people here, outside of those in the Space Science Department at Rice University, even know when such a storm is going on.

SATELLITES, hundreds and thousands of miles out in space, know it because the waves may cause the craft to lose altitude.

Deep in the piney woods of New Caney, 35 miles northeast of Houston, the geomagnetic observatory is now set up to record the full effects of these storms.

It began this month making a minute-by-minute profile of activity, and relaying the data to Rice for study and analysis.

The storms it will give evidence of are those originating on the sun. They are called solar flares. Among many other things, the flares produce magnetic storms — disturbances in the invisible lines of magnetism that surround the earth.

WHEN THE EARTH'S magnetic field gets disturbed — or in any way varies — a sensing device at Rice's magnetic observatory picks up the variation.

So sensitive is the rubidium magnetometer that the fence that encloses it in dense forest had to be erected without nails. Any nails would have caused small variations in the magnetic field detected by the sensing head.

DR. ALEXANDER J. DESSLER, head of Rice's Space Science Department,

picked a site about as remote as you can get and still be within 35 miles of Houston.

Traffic, telephone wires, power lines — all show up as reflections on the magnetic field recording device if they are around.

ABOUT THE ONLY things around the observatory site are a few cattle and armadillos — plus the waves associated with magnetic storms.

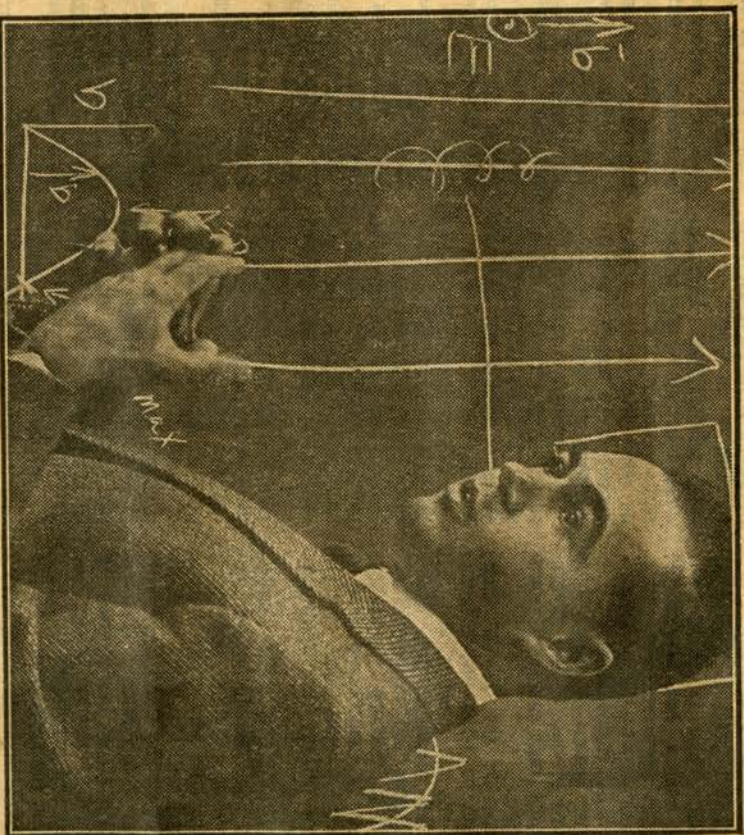
These are called hydromagnetic waves. Some authorities call them magnetohydrodynamic waves (MHD for short) since they seem to produce effects in the magnetosphere, or upper ionosphere, which is the area that starts some 100 miles out in space.

In any event, they seem to be behind a heating effect out there that may account for the increased drag that satellites seem to pick up when solar storms occur. The drag causes the satellites to lose some altitude.

"THE QUESTION THAT we're trying to answer," Dr. Dessler says, "is this: Is there enough energy — in the form of hydromagnetic waves occurring during magnetic storms — to account for the increased satellite drag?"

Bill Sorenson, 23-year-old graduate student, is carrying on the work at the observatory. The National Science Foundation has granted Dr. Dessler \$160,000 to direct the research, which is focusing on hydromagnetic waves of a certain length (200 miles) and frequency (1 cycle per second).

SORENSEN A FEW DAYS AGO was asked to show the small observatory off to Susan Jones, a 16-year-old Lamar High School junior who is taking cur-



EXPLAINING THE EFFECT OF IT ALL
Dr. Dessler sees a lot of heating upstairs

—Rice University Photo

riculum-enrichment courses this summer at Rice.

"How does it work?" she asked.

"Well," Sorenson replied, "this rubidium magnetometer sensing head detects variations in the earth's magnetic field. Some of these occur when hydromagnetic waves are present during magnetic storms."

"Oh," Susan said.

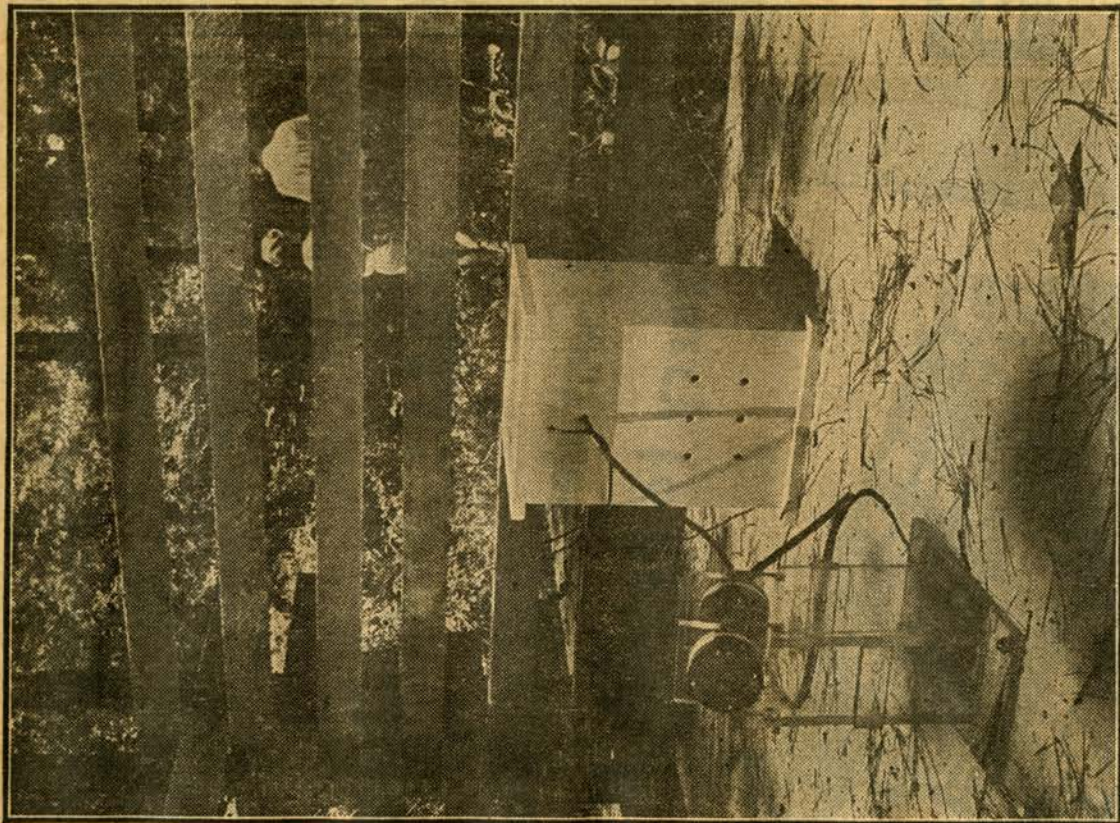
THE OBSERVATORY includes a one-room hut that houses power supply equipment for the sensing device and the transmitting of data — by telephone line — back to the Satellite Techniques Laboratory on the Rice campus. There, tracings are made of the magnetic field variations. Soon a computer will be

hooked up to the system so that more direct analysis can be made of the magnetic activity.

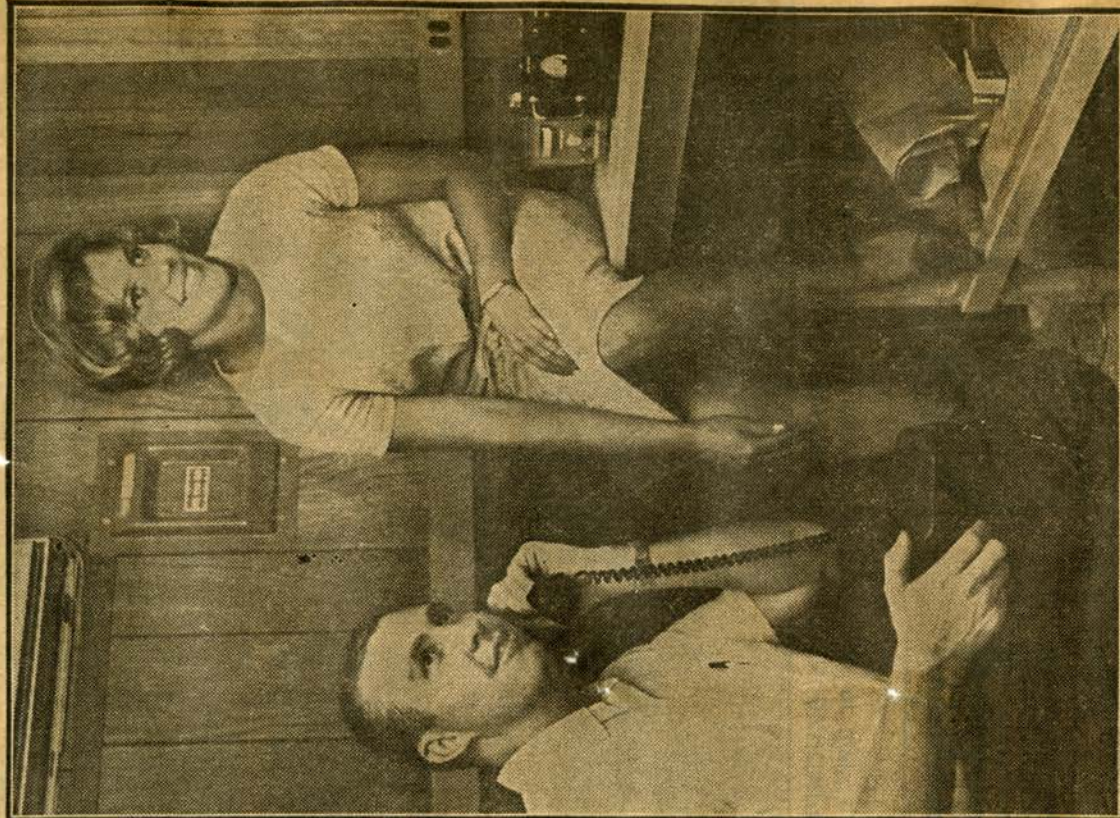
It is known that when MHD waves start streaming into the ionosphere—or any charged gas—they don't act like light waves, which pass right through without effect. They seem to try to pull the charged gas both sideways and toward earth.

A LOT OF "SCRAPING and grinding" goes on between atoms, with heat and friction the result. Or, at least, that's what Dr. Dessler and Sorenson think may be going on up there.

The observatory out among the lone pines will help tell if they are right.



CORRALING WAVES IN THE WOODS
A sensing head awaits a magnetic storm



SENDING A MAGNETIC REPORT BACK
Bill Sorenson and Susan Jones at observatory

PHOTO BY ROBERT WILLNER

August 19, 1964

5 PROBES BY RICE TEAM

Airglow, Aurora of Different Origin, Sammy Tests Reveal

By BLAIR JUSTICE
Post Science Editor

Sammy has spoken: Airglow is not caused by the same thing as aurora.

The results of five Sammy probes were announced Tuesday afternoon at Rice University with the conclusion that once and for all the theory has been laid to rest that airglow and aurora are from the same origin.

AIRGLOW IS the very faint light high in the sky that makes it possible to see the outline of your hand no mat-

ter how dark the night.

Aurora is a much brighter light that streaks and dances across the night sky for those living far enough north or south to see it. In Canada and northern regions, it's known as the Northern Lights. In the opposite direction it goes by the name of Southern Lights.

The character that probed both the airglow and aurora was named Sammy, a 60-pound package of instruments attached to a Nike-Apache rocket. It made five trips into space at altitudes up to 100 miles.

SCIENTISTS and graduate students who assembled Sammy's payload were the ones who interpreted the data sent back from the instruments aboard. They work under Dr. Brian J. O'Brien at Rice's Satellite Techniques Laboratory in the Space Science Department. NASA put up \$260,000 for the Sammy series.

Though results of the experiment did not suggest what does cause airglow, scientists now know what doesn't cause it.

Aurora originates when electrons come charging in from deep in space and hit oxygen and nitrogen atoms floating around in the upper atmosphere. The outer electrons of the atoms get all excited from the interaction and discharge their excess energy by giving off light.

NOW WHAT Dr. O'Brien and his team proved is that particle — that is, electron-bombardment is not what causes airglow.

They used three methods to come to the same conclusion. One was to count, by way of instruments aboard Sammy, the number of electrons in the airglow off the East Coast. The last Sammy was fired July 9 from Wallops Island, Va., and reached an altitude just over 100 miles.

"There weren't enough particles around to account for airglow," Dr. O'Brien said.

This conclusion was checked two other ways and the electron bombardment theory for airglow was discarded.

THREE OTHER Sammys probed aurora, having been fired March 18, 20 and 23, 1964 from Fort Churchill, Canada. From firings at both dawn and midnight, Sammy was able to show that the energy of electrons coming into the atmosphere to cause aurora is considerably less than that of electrons trapped in the Van Allen Belt.

The Van Allen Belt, consisting of radiation following the lines of the earth's magnetic field, has been associated with aurora. One theory was that particles "leaked" out of the belt into the atmosphere, causing aurora. Dr. O'Brien said this theory has been discounted.

No one at this time knows where the electrons come from that cause aurora. And instead of aurora being caused by Van Allen Belt radiation, it may be that the Van Allen radiation is the effect of some "mechanism" that causes aurora. At least, that possibility was suggested by Dr. O'Brien Tuesday.

Airglow: 'What Causes The Darn Thing?'

BY WARREN BURKETT
Chronicle Science Writer

One year and five rockets later, Rice University scientists know that auroras and airglow are not the same thing.

But they hold only partial answers to the questions on Earth and space that they set out to probe.

"What causes the night airglow? What makes the shining auroras? Is it the same cause? Members of the new Space Science Department had asked the questions.

"Nobody knows what causes a day thing, that's the trouble," Prof. Brian J. O'Brien, head of Rice's Sammy rocket project, glow.



declared Tuesday as he and his students completed their official report. "We do know that auroras and airglow are not the same."

Airglow, he explained, contains 80 times as much green light as it does a deep violet glow. Auroras, or Northern Lights, shed only twice as much green light as violet into the Sammy rockets' instruments, he said.

From this difference in the measured light, O'Brien concluded: "Less than 3 percent of the airglow is due to auroral causes, electron bombardment. This is comparable to zero."

Very Sharp Band

Counters that totaled the times an electrified particle (electron or proton) hit the rockets also said the same mechanism that causes aurora cannot cause airglow.

"There just weren't enough particles to excite light of the intensity we observed," O'Brien said.

Figures analyzed by David Cummings and Robert LeQuey, graduate students, showed the airglow to lie in a very sharp band about 58 miles high. The glowing layer, mainly oxygen, is only about four miles thick.

"The cause of airglow must be chemical," said O'Brien, "but no one has gotten a chemical reaction in the laboratory that gives this much energy."

Rockets fired into Northern Lights, over Fort Churchill, Canada, were successful, too.

Still Guessing

Two rockets fired at night revealed that the auroras may turn on and off as rapidly as every tenth of a second. The Northern Lights occur when charged particles hit the air like bullets, causing the oxygen shots are under study by the

to glow like the face of a television screen.

"We don't know what energizes the electrons," said O'Brien. It could be Earth's magnetic field or its rotation.

The rockets found more high-energy electrons in a dawn launch than during the two night launches. The auroras are primarily caused by the impact of lower energy particles, O'Brien said.

The cause might be Earth's passage through the "solar wind," a supersonic flow of particles blasted from the Sun. "No one knows of anything that would divert one per cent of this solar wind into the auroral zone," O'Brien said.

"We'll be going back next winter asking some specific questions," he said. The exact plans for more Sammy rocket ginning, Rice officials con-

National Aeronautics and Space Administration. O'Brien hopes NASA will finance this next series as it did the first.

The fall, O'Brien said, the Space Science Department will enroll 30 full and part-time graduate students. It had 12 students its first year.

O'Brien is leaving for a vacation in his homeland of Australia. "I hope to hibernate," he said. This drew a laugh at Tuesday's press briefing.

He's going to Sydney—where Rice and the University of Sydney are setting up a cooperative satellite program. Sydney will have one tracking station, Rice the other.

Construction should start this winter on the NASA-funded Space Science building here. It was a good year for a beginning, Rice officials concluded.

RICE PAYLOAD LAUNCHED FROM WALLOPS

NASA launched an airglow experiment for Rice University from Wallops Island July 9.

This was the fifth in a series of firings to measure and study the nature and causes of aurorae and airglow in the night sky during the dark of the moon--phenomena which are as yet little understood. The first in the series was sent aloft from Wallops Island on the night of January 14, 1964. The other three tests were launched from the Churchill Research Range in Canada. Data obtained at the two locations will be analyzed, compared, and interpreted by Rice University's Space Science Department in Houston.

Instrumentation in the 65-pound payload was designed and built by professors and students in the University's Space Science Department, which was created in January 1963. This series marked Rice's first venture into space, under a NASA grant. Dr. Brian J. O'Brien, Rice University, is the Project Scientist and C. D. Laughlin, also of Rice, is the Payload Manager. Harvey C. Needleman is the Wallops Station Project Engineer.

Designated Sammy in honor of the school's mascot, "Sammy, the Owl," the experiment was flown on a two-stage Nike-Apache sounding rocket, reaching a peak altitude of 104 statute miles. Impact of the payload and spent second stage, which were not separated during flight, occurred 98 statute miles downrange in the Atlantic Ocean. There was no attempt to recover the payload since desired data were telemetered to ground stations during the flight.

To measure light intensity, or airglow, and charged particle flux as functions of altitude, the payload was equipped with airglow photometers, Geiger counters, low-energy particle detectors, and magnetometers.

October 19, 1964

New NASA Program Would Fund University Satellite Development

Washington—Universities will be able to design and build their own satellites with government funding under a program being considered by the National Aeronautics and Space Administration.

The program, which is now awaiting final approval, would put the initiative for proposing and developing complete scientific payloads in the hands of university groups which have performed well on past NASA projects. It also would give these universities contracting authority that had been the exclusive responsibility of NASA.

Satellites in this effort, to be called the University Explorer Program, would be launched from NASA's Wallops Island facility as Scout vehicle payloads.

If approved, the first satellite funded under the new program will be a 125-lb. payload developed by a Rice University group under the direction of Dr. Brian O'Brian. He formerly was associated with Dr. James Van Allen at the State University of Iowa.

The Rice satellite will study the relationship between the Van Allen radiation belts and the auroral phenomena found at high latitudes. The Rice proposal calls for a circular orbit at an inclination of 70-80 deg. The Scout vehicle could boost the satellite to an

altitude of from 500 to 600 mi.

The O'Brian group proposal has been given tentative approval by NASA's space science office, and a contract to build the satellite could be negotiated within a week or two after the university program is approved, according to Marcel Aucremanne, manager of NASA's Explorers and sounding rockets programs.

Aucremanne will have over-all direction of the university program, and Wallops Station scientists will be assigned as managers of individual satellite projects. Wallops also will be the contracting agent for the space agency.

A second satellite proposal, from a group at the University of Michigan,

also is being evaluated, Aucremanne said. A detailed design has not been developed yet. Program activity for Fiscal 1965 activity probably would be limited to funding the Rice satellite and authorizing the Michigan group to begin design work, he told AVIATION WEEK & SPACE TECHNOLOGY.

Total cost of developing and launching the Rice satellite has been estimated at \$5.5 million. Funds for the program will come from the Explorer satellite budget.

Proposals made by university groups under the program will be evaluated to insure the scientific experiments are sound, Aucremanne said. Then the project objectives will be compared with the over-all objectives of NASA's scientific satellite program to determine the need for such experimentation.

Once a proposal has been accepted, a phased contract will be negotiated, with Phase 1 covering satellite design and design review by NASA. Before the space agency pays for any hardware, a prototype will be built and tested under Phase 2 of the contract.

One of the qualifications university teams will have to have in the early phases of the program will be experience in building payloads for sounding rockets or experiments for NASA satellites, Aucremanne said. As the program evolves, it may expand to include inexperienced groups who would work with an experienced space contractor.

Contractor assistance also can be sought by experienced groups such as the Rice team. Under the terms of the program, the universities will be able to subcontract fabrication of the spacecraft to an aerospace contractor. If they have the "in-university" capability, they may build the entire payload themselves, with limited contractor assistance.

"One of the benefits of the program may be the tying together of capable university scientific groups and industry," Aucremanne said.

The program supplements the space agency's sustaining university program, and is a direct outgrowth of university work on sounding rocket payloads and satellite experiments, according to Aucremanne.

The new program also reflects the thinking of NASA Administrator James E. Webb, who has said more direction in the application of NASA's technological base should come from outside the space agency (AW&ST Sept. 21, p. 22).

Aucremanne said the move toward increased university participation evolved naturally for several reasons.

"There has been an increasing desire among groups in the scientific community to have the opportunity to build their own satellites," he said. "They have their own ideas on how they want to conduct experiments."

Rice Earth Satellite Grants Nearing OK

BY WARREN BURKETT
Chronicle Science Writer

Rice University stands only a few weeks away from approval of a multimillion-dollar grant to build and fly its own Earth satellite, space agency officials said today.

The National Aeronautics and Space Administration also approved another \$200,000 for three more Rice rocket launches.

Instruments on the rocket probes, fired straight into the atmosphere, will pave the way for instruments to be carried aboard the Earth-circling satellites. Both projects will explore connections between the Van Allen radiation belts, night airglow and the Northern and Southern Lights.

Both are directed by Dr. Brian J. O'Brien, Rice professor of space science. The space science department and Satellite Techniques Laboratory team launched five rocket probes last year in their first year of operation.

Estimated Cost

NASA officials said no figure could be given on the satellite program being negotiated by Rice and NASA. Aerospace experts estimated the cost at \$5.5 million to build and track two satellites.

Final negotiations hinge on O'Brien's return this month from Australia where he is vacationing and discussing a joint tracking project with the University of Sydney.

Raymond Miller and Marcel Aucremann of NASA, working with Rice, said the satellites will weigh about 125 pounds. They will orbit about 500 miles up at an angle about 80 degrees of the equator. Plans call for launching from Wallops Island by an advanced Scout rocket.

Detailed Studies

The project's first phase calls for detailed design studies of the satellites construction. Rice also will have to demonstrate ability to build equipment and pose experiments that meet NASA standards.

Two of the sounding rockets approved Wednesday will carry similar experiments to those launched last year, Rice officials said. These will be lofted by Nike-Apache rockets.

The third probe will be much heavier, carry some television equipment, and return much more data. It will be launched by a large Aerobee-Sparrow rocket.

The new rocket launches could begin in February from Fort Churchill, Canada, Rice officials said.

Launching the first satellite probably is more than two years away. The grant also includes money to provide radar tracking and data collecting equipment in the Rice Space Science building now in the final design state. The building was provided by a grant of \$1.8 million from NASA and \$800,000 from Rice.

After designing the satellite, NASA officials said, Rice must build and test a "prototype" or experimental satellite.

Data Processing

Then the school's Space Science Laboratory will build two "flight article" satellites for launch from Wallops Island.

The final phase of the grant will cover processing data about the radiation belts, the auroras, and the airglow for presentation to the scientific community.

The satellites will be built under a new NASA program that allows university scientists to build or contract for satellites used in university teaching and research programs. The University of Michigan also has a proposal for a satellite up for NASA approval.

the HOUSTON CHRONICLE
October 22, 1964

Rice To Get NASA Grant For Sammy Rocket Probes

Rice University will receive a \$200,000 grant from the National Aeronautics and Space Administration for a second series of Sammy rocket shoots, Sen. Ralph Yarborough's office in Washington announced Wednesday.

Rice officials confirmed the grant to Dr. Brian J. O'Brien of the university's space department. Dr. O'Brien and Curtis Laughlin, head of the satellite laboratory, were both out of the city and could not be reached for details.

However, the Rice spokesman said the grant is an extension of the original \$260,000

grant for the Sammy series, in which five rocket probes were fired from Wallops Island, Va., and Fort Churchill, Canada, last January through March.

The new series will consist of three probes, all of them to be fired from Fort Churchill, beginning in Feb. 1965. The rocket probes will be boosted into space by two of NASA's Nike-Apache boosters and an Aerobee 300, also known as the Sparobee.

The rocket series, named for Sammy the Rice Owl, are designed to analyze particles and light flux in the aurora and airglow 65 to 100 miles out in space.

the HOUSTON POST
October 23, 1964

Young Rice Prof Will Seek Job as Scientist-Astronaut

By JIM MALONEY
Post Reporter

A young assistant professor at Rice University is going to apply to become one of the nation's first scientist-astronauts.

Dr. F. Curtis Michel said he has no special yen for space travel, but he does want a chance to study the scientific secrets awaiting manking in space.

"THIS IS WHAT science is. This is what it is all about, finding the unknown and attempting to understand it," Dr. Michel said.

Dr. Michel, a quietly handsome man with short brown hair combed forward, sees no real purpose in manned space flight beyond the scientific advance it offers.

He is a frank, dedicated physicist who has no intention of becoming anything else. He sees the space program as an opportunity to advance the

area of science that interests him most.

SPEAKING OF going to the moon as a scientist-astronaut, Dr. Michel said:

"Why go otherwise if not for its scientific interest? If the only purpose is just to get there, it means nothing. If there is not some philosophic reason, some scientifically interesting things to be learned, what's the purpose?"

But Dr. Michel believes the exploration of the moon and beyond is well worth what it is costing.

"Throughout history, every time man has undertaken new understand new fields, the rewards have been far greater than he could have ever dreamed of," he said.

"THE UNKNOWN has always been far more interesting than it has ever been given credit for being."

The Manned Spacecraft Center announced last week that it is accepting applications

from young men who want to be scientist-astronauts.

Michel seems ideally qualified.

He is 30 and holds a doctor's degree in physics from the California Institute of Technology.

He has flown more than 500 hours in jet aircraft, which is not a requirement to become a scientist-astronaut — just a bonus Michel offers.

HE WAS A teaching fellow at Cal Tech and worked at the guided missile division of the Firestone Tire and Rubber Co.

Dr. Alexander J. Dessler, head of the Rice space science department where Michel is an assistant professor, said he believes that hundreds of young scientists throughout the country will apply to become scientist-astronauts.

"It is a chance to go some places and do original work that no one has ever done before," Dessler said.

Dessler said Rice's door will be open to any of the scientists who are taken into the space program.

HE EXPLAINED that they would be able to do research at Rice and work there as teaching faculty members.

Michel applied once before to become an astronaut. He does not know for sure, but feels that he was not accepted because he did not have enough flying time.

Regular astronauts had to be test pilots or have more than 1,000 hours of flying time in jets to qualify.

Asked how he would feel about leaving the academic community, Michel said:

the HOUSTON POST
October 25, 1964

"I REALLY would not want to leave the academic world. If I leave, it will be as a scientist. I would not be interested any other way."

He explained that scientific advancements are made so rapidly today that it will be vitally important for those chosen as scientist-astronauts to remain close to academic communities to remain abreast of these advances.

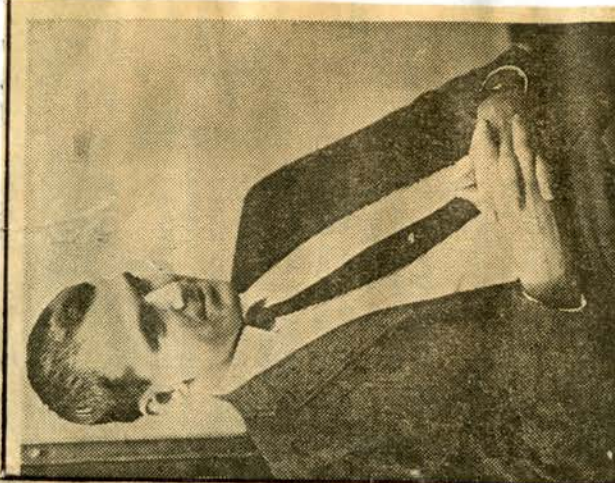
Michel said his wife accepted his decision to attempt to become a scientist-astronaut with "restrained enthusiasm."

Just before coming to Rice a year ago, Michel got some practical field geological experience during a trip to Australia to study the Henbury Crater.

MICHEL IS A firm believer that man, not instrumented packages, offers the best method of exploring the moon.

He explained that "we can design instruments to answer questions that we are smart enough to ask, but we probably do not know some of the most important questions."

"That is like saying computers are taking the place of scientists. They are not."



SCIENTIST-ASTRONAUT HOPEFUL
Dr Michel Is Also Jet Pilot

Rice Request for Satellite Research Is OK'd by NASA

BY THE POST WASHINGTON BUREAU

WASHINGTON — Congressman Albert Thomas of Houston was notified Thursday that the national space agency has approved a proposal by scientists at Rice University for a satellite to study the Northern Lights and other near-earth phenomena.

The Explorer-type satellite will be designed, developed and built by a group at the university headed by Dr. Brian J. O'Brien as the principal investigator.

Instruments in the spacecraft will measure radiation

and radiation loss in the Van Allen belts, aurorae and airglow, bombardment of the upper atmosphere by energetic particles from space and galactic and solar cosmic rays.

The 125-pound satellite will be known as Owl and will go into a near-circular orbit at an altitude of about 400 miles.

The Rice University spacecraft and its experiments will be tested at National Aeronautics and Space Administration facilities under the direction of NASA's Wallops Station at Wallops Island, Va.

Rice Gets OK To Carry On Satellite Work

Chronicle Washington Bureau

Washington — The National Aeronautics and Space Administration has approved a proposal by scientists of Rice University for a satellite to extend studies of auroral activity and other near-Earth phenomena.

The project was announced by Rep. Albert Thomas of Houston.

The Explorer - type satellite will be designed, developed and built by a Rice group headed by Dr. Brian J. O'Brien.

The Rice group has gained experience in satellite development through its work with Dr. James Van Allen of the State University of Iowa.

The proposed space craft will extend high altitude phenomena studies by satellites and sounding rockets.

Instruments on the space craft will measure radiation and radiation loss in the Van Allen belt, auroral and air glow, bombardment of the upper atmosphere by energetic particles from space and galactic and solar cosmic rays.

It is planned to put the 125-pound satellite, called Owl, into an orbit at a 400-mile altitude.

the HOUSTON POST
February 7, 1965



SPACE SCIENCE AND TECHNOLOGY BUILDING
Rice, NASA Team Up To Finance New Structure

For Rice Space Building **Satellite To Break Ground**

A signal from a satellite will detonate a small explosive charge to break ground Friday for Rice University's \$2.5 million Space Science and Technology Building.

Rice President K. S. Pitzer said James E. Webb, a major supporter of space research on university campuses, will be principal speaker at the 4 PM ceremonies.

WEBB IS administrator of the National Aeronautics and Space Administration, a Washington agency which is co-financing the building with Rice.

The three-story building, including a deep basement, will be just north of the biology and geology buildings near the Kent and Rice Boulevard entrance to the campus.

The contract is held by Linbeck Construction Corporation, with work to begin immediately after the ceremonies. The building should be completed by June, 1966. It was designed by Pierce & Pierce, architects.

Dr Franz Brotzen, dean of engineering and chairman of the Committee on Interdepartmental Research Programs, said the building would allow consolidation of projects in progress in different departmental areas on the campus.

Dr Alexander J. Dessler, chairman of the Space Science Department, which recently was given approval to direct the first satellite program authorized under the new NASA University Explorer program, said the new building would house:

OPERATIONS connected with the Sammy rocket probes, now underway in a temporary building across the campus. These include design-to-testing work on payloads, a telemetry and command station to communicate with spacecraft, and data reduction and analysis.

Offices and conference rooms.

Low-level radiation laboratories.

Research equipment of geomagnetic field measurements, gas reaction cross-section measurements and mass spectrometry.

Lunar and planetary surfaces, and meteoritics experiments.

EQUIPMENT for research on microwave ultrason-

ics, phase transformations, x-ray and optical metallography, quantum electronics, solid state radiation detection, and mechanical metallurgy and electron microscopy.

The building will have a total of 51,048 square feet of assignable space. The basement will have machine shop equipment and a large elevator in which to move satellites.

the HOUSTON CHRONICLE
June 20, 1963

Rice U. to Direct Shots in Canada

Rice University will begin building satellites for space exploration in its Satellite Techniques Laboratory opening this fall.

The university plans to launch satellites within a year from the United States-Canadian range at Ft. Churchill, Canada.

Dr. Kenneth S. Pitzer, Rice president, said the campus laboratory will have facilities to design, build, test and operate individual experiments and complete satellite payloads.

The laboratory will have a command station able to control satellites and other spacecraft 60,000 miles or more from the earth and computers able to analyze data from the experiments.

Dr. Pitzer said the laboratory will cut at least a year off the time needed to construct and launch a scientific satellite.

The laboratory will be part of the new Department of Space Sciences under Dr. Alexander J. Dessler.

Rice went to the State University of Iowa for two of the three men who will head the laboratory staff. The men helped build satellites at Iowa for Dr. James A. Van Allen, discoverer of the earth's radiation belts.

The Iowans are laboratory chief Curtis D. Laughlin, research physicist, and Ramon Trachta, satellite design engineer who helped plan Venus experiments for the Mariner satellite.

Third member of the laboratory staff is W. S. Carey, formerly senior research officer for the Deep Space Instrumentation Facility in Transvaal, South Africa.

This was one of three stations used to track the Mariner spacecraft that flew past Venus.

Carey will be Rice's satellite communications engineer.

The laboratory will be housed in a building under construction for the Buildings and Grounds Department until the Space Science Department can be housed in one building.

Dr. Brian J. O'Brien, physicist and jet pilot, is the other member of the space science faculty.



CURTIS D. LAUGHLIN
Satellite Lab Chief

Owls I and II, Naturally

2 Rice Satellites OK'd

By BLAIR JUSTICE
Post Science Editor

Not one, but two Rice University satellites — which will be put in criss-crossing orbits — have been approved as the first in a precedent-setting "University Explorers" program.

The satellites will be launched about one month apart about two years from now, Dr. Brian J. O'Brien, principal investigator, said Friday.

UNDER THE NEW University Explorers program, sponsored by NASA, scientists will not only put experiments aboard the satellite but will also propose a design and do the actual building of the payload. Previously, the design and building were handled by NASA.

Rice is the first of a number of universities that are expected to build satellites under the new program. No figure was released on the cost of the two Rice satellites, but un-

officially \$5.5 million has been given as an estimate.

"Owl" will be the name of the Rice satellites. Both Owl I and Owl II will be launched from the Western Testing Range in Point Arguello, Calif. Rice also has a series of rocket launchings called "Sammy." The satellites will weigh 140 pounds each.

IT WAS announced Thursday in Washington that Owl I had been approved. Friday it developed that Rice had proposed a pair of criss-crossing satellites, both of which have now been approved by NASA.

Depending on how accurate their launchings are, Owl I and II will criss-cross over the equator at an estimated distance apart of 100 miles, said Dr. O'Brien, who will be in charge of their design and construction at Rice's Space Science Facility here. Both will be in a circular orbit at an altitude of about 400 miles.

The satellites will collect data on aurora (both the Northern and Southern Lights),

Van Allen radiation and cosmic rays.

IN THE CASE of both aurora and Van Allen radiation, they will seek the answers to two main questions:

1) Do the particles that cause the phenomena come from the sun or are they "just sitting out there waiting to be accelerated"?

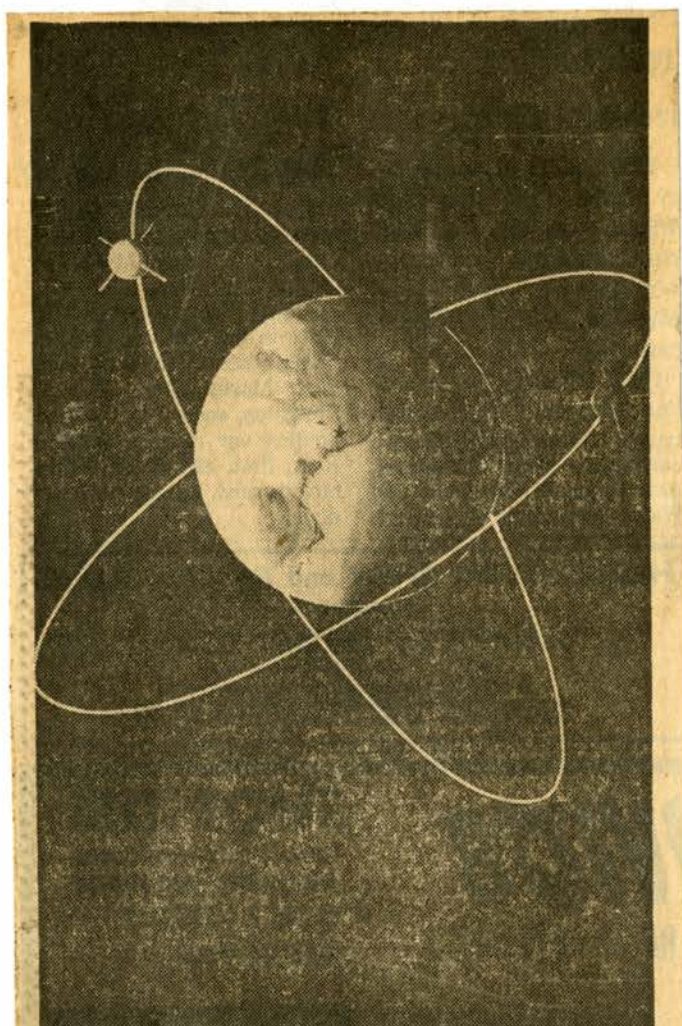
2) How do they get their energy, their acceleration?

Dr. O'Brien noted that the particles that cause the Northern and Southern Lights may come from the same place as those in the Van Allen radiation zone.

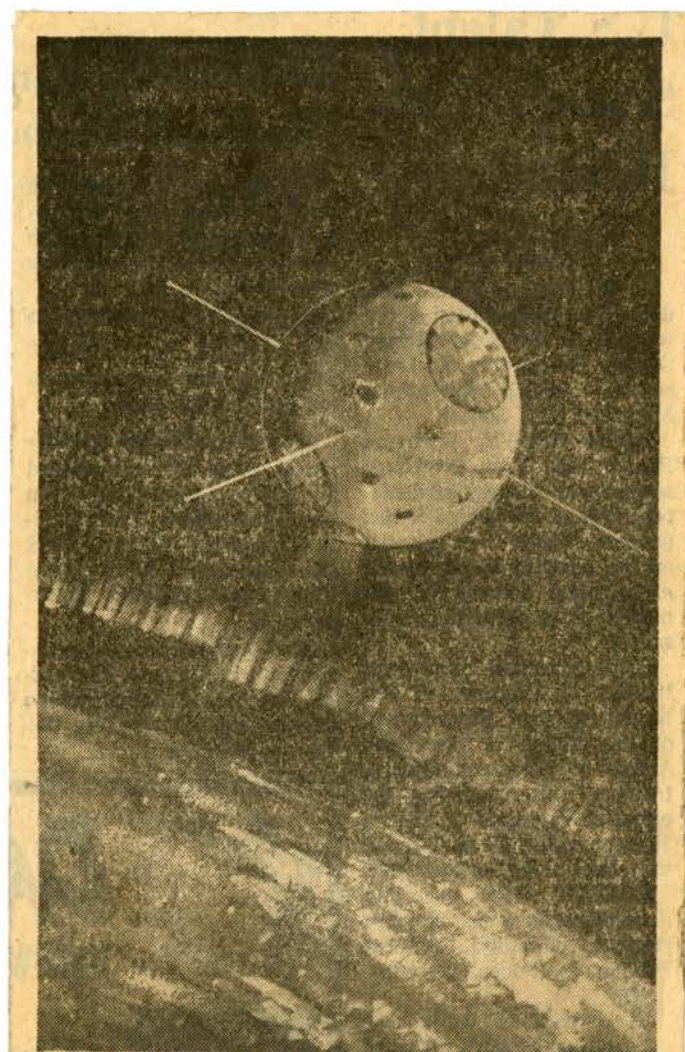
The aurora occur about 60 to 100 miles up from charged particles hitting the atmosphere. The Van Allen radiation stretches from an estimated 200 miles to 50,000 miles out with two belts occurring at an altitude of about 2,000 and 10,000 miles. The charged particles trapped in the belts are of higher velocity than those elsewhere in the radiation zone.

THE PAIR OF criss-crossing satellites offers several advantages, Dr. O'Brien said. One is that both the Northern and Southern Lights can be studied simultaneously and data gathered on whether the same particles are involved in both. Also, as one satellite studies radiation on the day side of the earth, the other can collect information on the night side.

The cosmic rays studied by Owl I and II will be those coming from galaxies and from the sun.



PAIR OF OWL SATELLITES CRISS-CROSSING
 One Measures Night Conditions, The Other Day



OWL MAKING AURORA STUDIES IN SPACE
 TV Camera at Bottom and Geiger Counter on Top

NEW ERA DAWNS AT RICE WITH SATELLITE ASSIST



Photo by Richard Pipes, Chronicle Staff

The ground for the new Rice University Space Science and Technology Building was broken in space-age style Friday. A pre-recorded signal from a satellite set off a small explosive charge to send the traditional

shovelful of dirt flying. The \$2.5 million building is financed in part by the National Aeronautics and Space Administration, which contributed \$1.5 million of the cost.

NASA Picks 6 Scientists For Trips to Moon



DR. CURTIS MICHEL
Astronaut-To-Be



DR. DUANE E. GRAVELINE
Now Employed at MSC

Rice Prof Is Among Choices

BY JIM SCHEFTER

Chronicle Reporter
Copyright, 1965, The Houston Chronicle

A Rice University instructor is among six scientist-astronauts scheduled to be named Moon astronauts Tuesday by the Manned Spacecraft Center.

The group includes two medical doctors, a geologist, another university instructor and a physicist. Two are pilots; one is a bachelor. They are:

- Dr. F. Curtis Michel, 31, engaged in research and teaching of space sciences at Rice, a pilot.

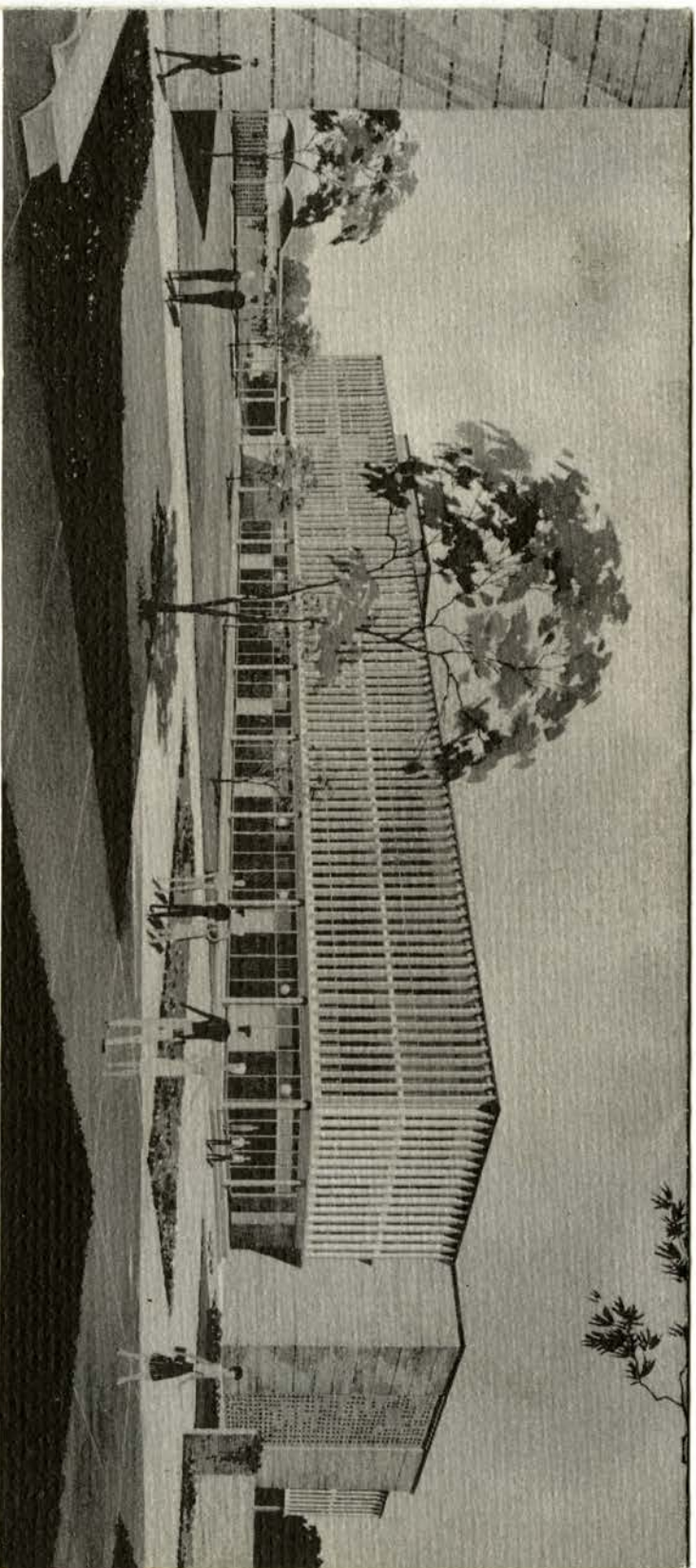
- Dr. Owen K. Garriott, 34, an electronics engineer and instructor at Stanford University, Palo Alto, Cal.

- Dr. Edward G. Gibson, 28, a physicist with a research firm in southern California.

- Dr. Duane E. Graveline, 34, a doctor in the medical programs office at the Manned Spacecraft Center.

- Dr. Harrison H. Schmitt, 29, a geologist with the U.S. Geological Survey in Flagstaff, Ariz., and a bachelor.

- Dr. Joseph P. Kerwin, 33, a flight surgeon and pilot for the Navy, stationed in Jacksonville, Fla.



Ground-Breaking Ceremonies
for the

SPACE SCIENCE AND TECHNOLOGY BUILDING

RICE UNIVERSITY

February 12, 1965

Space Groundbreaking

Work has begun on Rice University's \$2.5 million Space Science & Technology Building after an official groundbreaking with Administrator James E. Webb of the National Aeronautics & Space Administration as principal speaker.

Contract for the building (being jointly financed by a \$1.6 million grant from NASA and approximately \$900,000 from Rice University) was awarded to Linbeck Construction Corporation, which started work immediately after the February ceremonies. Completion of the new facility is scheduled for June 1966. The building was designed by the architectural firm of George Pierce-Abel B. Pierce and includes a total of 51,048 square feet of assignable space in the three stories and deep basement.

Dr. Franz Brotzen (Dean of Engineering and Chairman of the Committee on Interdepartmental Research Programs) said the new building will allow work on space-related projects (now being carried on in nine separate departments around the campus) to be concentrated in the single facility.

Dr. Alexander J. Dessler (Chairman of the Space Science Department) said



\$2.5 MILLION SPACE BUILDING
... under construction now at Rice

the building will include all facilities for the design, construction, check-out and environmental testing of space-research payloads, a telemetry and command station to communicate with spacecraft, facilities for data reduction and analysis.

Also (in addition to offices and conference rooms) it will house research facilities for geomagnetic field measurements, reaction cross-section measurements and mass spectrometry, lunar, planetary surfaces, and meteoritics experiments. Materials-research facilities will include microwave ultrasonics, phase transformation, X-ray, metallography, quantum electronics, solid state nuclear detector, rough polishing and specimen preparation, and mechanical metallurgy laboratories.

A high-speed computer center will expedite the rapid integration of data being generated by various research laboratories.

Owl Into Orbit

Rice University is the first university in the United States to receive approval to design and build its own satellites under the new University Explorer Program (sponsored by the National Aeronautics & Space Administration).

The project gives Rice scientists (headed by Dr. Brian J. O'Brien as principal investigator) the authority to extend studies of auroral activity and other near-earth phenomena through a satellite program. The Rice program will be named "OWL" (for Rice's mascot).

Dr. O'Brien's plan is to orbit two 140-pound satellites into near-circular orbits at about a 400-mile altitude and inclined to the equator between 70 and 80 degrees. The first satellite has been authorized and tentative approval has been given for the second to be fired into an inter-related orbit about a month after the first.

Rice Rocket Probe of Aurora Successful

A rocket probe of the storied aurora as the rocket passed through, and it sounds like a "bang-up" number one success," according to Dr. Alexander J. Dessler, who heads the space science department at the university.

A two-stage Nike-Apache missile sent a 57-pound payload 130 miles into space from a launch pad near Fort Churchill, Canada, shortly after midnight Friday, Dr. Dessler said.

"Evidently all the instruments worked perfectly. The cone separated on schedule, television cameras photographed the au-

Although preliminary results show the shot was "eminently successful," it will take several weeks to analyze the data obtained with a computer, he said. The shot was delayed 24 hours to await ideal conditions.

Dr. Dessler explained that "the aurora has to be the right kind and in the right location—within range of the rocket."

The scientists sought to discover the origin of electrons in the light-emitting atoms that produce the aurora borealis—the northern lights—and how they

acquire their energy. Ground cameras filmed the aurora at the time of the shot to help determine its detailed structure and obtain other information. All told, three billion measurements were taken by scientific equipment.

Dr. O'Brien plans to return to Fort Churchill in a year to fire a Javelin missile and two more rockets are planned for the fall of 1966. The rocket range at Fort Churchill, 160 miles north of Winnipeg, is operated by the U.S. Air Force in conjunction with the Canadian government.

The study is part of a long-term space research project sponsored by the National Aeronautics and Space Administration. With Dr. O'Brien are David

Lowe, the payload manager; Del Oehme, designer of the telemetry system; and Bob LaQuey, Larry Westerlund, Mickey Trichel and David Reasoner, all graduate students at Rice.

the HOUSTON CHRONICLE
April 4, 1965

Space 'Lights' Probed Rocket Launched By Rice Research Team

FORT CHURCHILL, Man., Canada—(AP)—A Rice University research team probed the secrets of the "Northern Lights" Saturday with a two-stage rocket that soared 130 miles into space.

Dr. Brian O'Brien, who heads the project at the university in Houston, said preliminary results show the shot was "eminently successful."

The Nike-Apache missile with a 57-pound instrument payload was fired from the rocket range at this northern community on the western shore of Hudson Bay.

IT IS PART of a long-term space research project sponsored by the U. S. National Aeronautics and Space Administration.

Dr. O'Brien said it will take

several weeks to analyze the data obtained with a computer.

The shot was delayed 24 hours to await ideal conditions.

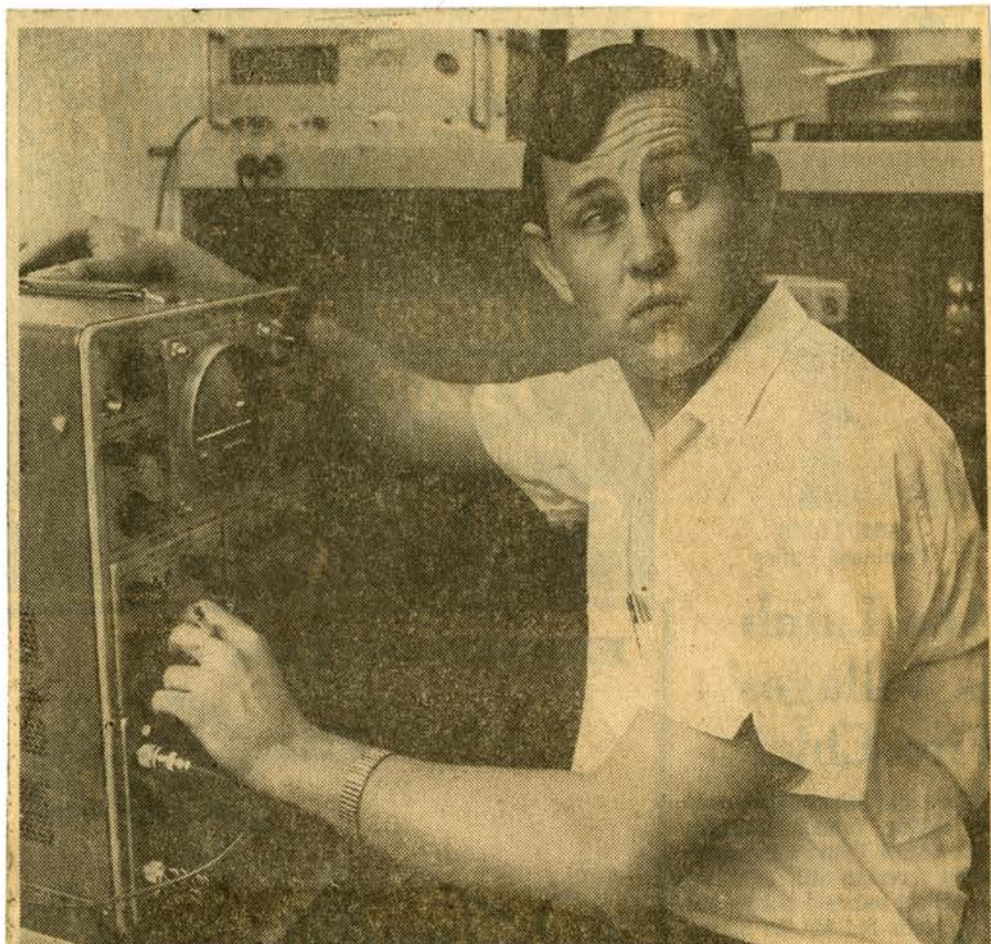
The scientists sought to discover the origin of electrons in the light-emitting atoms that produce the Aurora Borealis—the Northern Lights—and how they acquire their energy.

GROUND CAMERAS filmed the Aurora at the time of the shot to help determine its detailed structure and obtain other information. All told 3 billion measurements were taken by scientific equipment.

Dr. O'Brien plans to return in a year to fire a Javelin missile and two more rockets are planned for the fall of 1966.

the HOUSTON POST
April 4, 1965

the HOUSTON POST
April 15, 1965



WADE CRADDOCK WORKS WITH OSCILLOSCOPE
It Will Test Electronic Systems in Balloon Project

By NOE PEREZ

Post Reporter

In about three months, a space science team from Rice University will turn loose a balloon the size of Houston's 44-story Humble Building.

The balloon, which will rise about 20 miles into the skies above Palestine, Texas, will carry a gamma ray telescope for a closer look at the remains of a star that exploded centuries ago.



Perez

THIS IS ONE of several projects which are in progress or are being planned by Rice space scientists.

"The projects are selected on the basis of the interest and curiosity of faculty members, which is traditional with research, as compared with technological development," said Dr. Alexander J. Dessler, head of the department.

The students, however, have a big stake in the projects, Dessler emphasized.

"Students are involved," he said. "This is an important factor. The university is an educational institution, and not a research institution. The research here is used as a tool for graduate education."

Wade Craddock and Darwin Ellis, graduate students, are working with Dr. Robert C. Haymes on the balloon project, for example.

HAYMES SAID he and his students designed the sensitive telescope to be used in the experiment.

"We are trying to teach our students how to face the unknown and solve a novel problem, something which is good for everyone, up to the President of the United States," Dessler said.

Craddock and Ellis, with Dr. Haymes, will be probing the secrets of the Crab Nebula, so called because the star in its disintegrated state appears to some to have the shape of a crab.

Some Chinese astronomers first observed the Crab Nebula in 1054 AD as a pinpoint of white, and as it grew brighter, they called it a gassed star, Haymes explained.

THE STAR actually had exploded 3,500 light years earlier. To put it another way, the star was 3,500 light years of distance from the earth.

Dessler described the explosion of the star as being similar to that of a hydrogen bomb, its remains consisting of radioactive debris, or fallout.

"It is thought that there is still enough radioactive debris left for the gamma ray telescope to detect," Dessler said, adding that the gamma ray is something of a "penetrating X-ray."

HAYMES SAID he and his students are now working on a pointing control, so that the telescope will be able automatically to point itself at the Crab.

As Haymes explained it, the telescope actually will be up a distance closer to 25 miles, about 130,000 feet.

"It will look at the Crab about six hours, and will radio back data as it goes," Haymes said.

"Its job will be to look for radioactivity and measure it, so we can try to ascertain if the theories on why stars explode are correct."

ONE THEORY is that when a star uses up its nuclear fuel, it becomes devoid of heat, it collapses and then it explodes like an H-bomb with 10-to-the-27th-power megatons of force.

"During the first 90 seconds," Haymes said, "it gets about 100 trillion times brighter than normal. During this time, a lot of radioactive isotopes are formed, and it's these that we will try to find traces of."

Haymes is hoping for July as launching time for the gigantic balloon that'll carry the ultra-sensitive telescope.

MEANWHILE, the university's sounding probes such as the Sammy that are put aloft by the Nike-Apache missile, will continue into the indefinite future, Dessler said, because this work is "good for the students."

The latest in the Sammy series, Sammy VI, went up April 3 in Canada, for another look at the aurora borealis, more commonly known as the northern lights.

The Rice Sammy team is headed by Dr. Brian J. O'Brien. He is being assisted by David Lowe, payload manager; Del Oehme, telemetry systems designer, and Bob La Quey, Larry Westerlund, Mickey Trichel and David Reasoner, graduate students.

"Another experiment involving sounding of the upper atmosphere, this one to measure magnetic fields, also is planned towards the end of this summer," Dessler said. "It'll be Haymes again."

"Then, Dr. Freeman (John W. Jr.) has a plasma experiment."

THIS WOULD involve investigation of ionized gases in space. The ionized gasses in fluorescent and neon tubes are plasmas. These gases approach the plasma stage at a temperature of 3,500 degrees Fahrenheit, and are fully within the state at 15,000 degrees Fahrenheit and above.

For Dr. Freeman's experiment, a geostationary satellite will be launched, Dessler said. The satellite will orbit the earth every 24 hours, and with the earth also turning once in 24 hours, the satellite will give the appearance of being stationary, he said.

Recently, Rice became the first university in the United States to receive approval to design and build its own satellites under the new University Explorer Program sponsored by the National Aeronautics and Space Administration.

THE DIFFERENCE between sounding rockets and satellites is that the latter go into orbit around the earth.

The first launch in this series, however, would not be until about July, 1967, Dessler said.

"The Explorer series is a big and new program, and it takes time to get all the paper work cleared with NASA," he said.

"We expect to get started this July, and the first launch would occur about two years after we get started. The second launch would come about two or three months later."

"THIS WOULD be a continuation of the Sammy series, which has been studying the aurora and air glow phenomena."

The space science department, Dessler said, has been "growing at the rate we'd planned (two years ago, when it was begun) — about two faculty members and 10 students per year."

By the time the new Space Science and Technology Building, now under construction, is completed in 1966, the department will have about 40 graduate students; nine faculty members, and an equal

number of research associates, and about a dozen staff members, he said.

The \$2.5-million building is being financed with a \$1.6-million grant from NASA, with the balance provided by Rice.

The current space science faculty also includes Drs. John A. S. Adams, F. R. Allum, Donald D. Clayton, F. Curtis

Michel, Peter B. Shaw and G. King Walters. Allum, Freeman and Shaw are research associates.

Dr. Michel is being considered by the National Academy of Science as a scientist in the team of astronauts who will land on the moon.

the HOUSTON CHRONICLE
June 27, 1965

Smaller Than Hoped

The number chosen is far smaller than National Aeronautic and Space Administration officials had hoped. But qualifications proved to be so high that most scientists could not meet them. Officials wanted 10 to 20 new astronauts who are under 35, have advanced scientific degrees and are in top physical condition.

None of the scientist-astronauts will make a space flight until after the first landing on the moon in 1968 or 1969, officials said. They are to spend most of the next year in pilot training, then will take up full-time positions at the Manned Spacecraft Center. Those who can't fly jets will be taught to do so.

Michel and Kerwin are already qualified jet pilots.

Wisconsin Native

Michel is a native of Wisconsin. He received his doctorate in physics from the California Institute of Technology in 1962, then specialized in aerospace sciences.

He came to Rice in 1963 where he attracted the attention of space center officials for his research into solar winds and his efforts to establish the nation's first college courses in space science.

Michel learned to fly in the

Air Force. He lives at 6415 Mercer with his wife, Beverly, and their son, Jeff, 2.

On Stanford Faculty

Owen Garriott is on the faculty of Stanford University, teaching electronics. He was born in Enid, Okla., took his undergraduate work at the University of Oklahoma and his doctorate at Stanford.

He is married and has three sons.

He once served as a consultant to the Office of Space Sciences at NASA headquarters in Washington.

well known in the Southwest, particularly in the copper regions of Arizona.

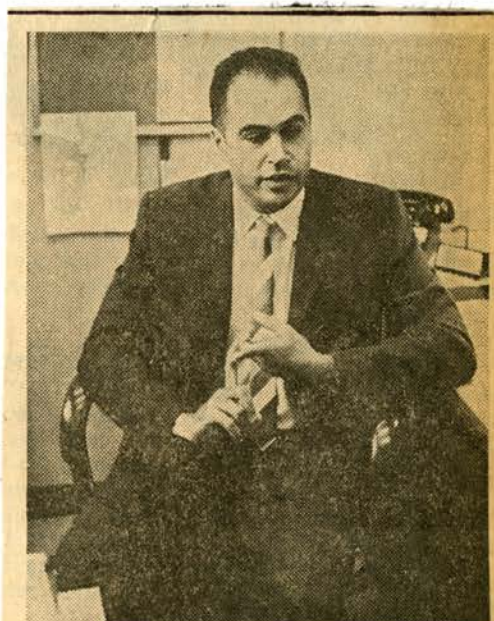
The six were chosen from more than 1700 original applicants. A selection board from the National Academy of sciences trimmed the number to little more than 100.

Rigid Physicals

From that group, Manned Spacecraft Center officials eliminated all but about 25 and sent this last group to the School of Aerospace Medicine in San Antonio for rigid physical examinations.

Final selection was apparently made within the last week.

All six will be introduced during a press conference at the space center Tuesday afternoon.



RICE WELCOMES SPACEMEN
Dr Dessler Heads Department

the HOUSTON POST
July 18, 1963

WOULD BE NORTH OF HOUSTON

Rice Plans Observatory To Study Pulses in Atmosphere

By RALPH S. O'LEARY
Post Science Editor

Rice University hopes to build the area's first geomagnetic observatory 35 miles north of Houston chiefly for research into an atmospheric phenomenon which has puzzled scientists for more than 150 years.

This was announced Wednesday by Dr. A. J. Dessler, chairman of Rice's new space science department, at a conference at which he introduced four newly-arrived members of his staff.

He also disclosed:

1) **HIS DEPARTMENT** plans to fire a series of rockets 100 miles into the atmosphere from Wallops Island, Va., and Fort Churchill, Canada, beginning in December in its first space project—research into the causes of auroras and a strange luminosity in the skies called the air glow.

2) Dr. F. Curtis Michel, the

physicist in the department who is Rice's candidate for the first job as scientist-astronaut, is now in Australia on a research project in which he hopes to learn what to expect if he investigates craters on the surface of the moon.

"We have made an application for a \$200,000 grant from the National Science Foundation for the new geomagnetic observatory," Dr. Dessler said. "We have every reason to expect that the application will be approved."

THE CHIEF task of the new observatory, he said, would be to investigate the strange low-energy pulses in the earth's atmosphere which scientists have discovered are caused by electromagnetic waves of almost incredibly low frequency and long wavelength.

"Scientists first became acquainted with these electromag-

netic waves more than 150 years ago as a result of research into the causes of the strange pulses which made the needles of their compasses jump slightly away from north for no apparent cause."

It has since been found that the energy pulses are electromagnetic waves, just like the radiation, including visible light, which comes from the sun, he said. The only difference is that where visible light oscillates at around 100,000 billion cycles a second, this low-energy radiation oscillates at from one to 10 cycles a second.

THE LOW-ENERGY waves set up currents in the earth, which are already under investigation by a team of scientists at the University of Houston with a coil of 200 miles of cable buried on the University of

See RICE on Page 2



NEW SPACE STAFF—These are newly-arrived members of the staff of the new science department at Rice University. They are, from left, W. S. Carey, satellite communications engineer; Ramon Trachta, satellite design engineer; Curtis D. Laughlin, chief of the satellites technique laboratory, Dr. Brian J. O'Brien, professor of space science, and Dr. Dessler.—Post Photo by Dan Hardy

RICE OBSERVATORY

Continued From Page 1 the new satellites techniques Houston - owned Camp Wallace tract near Hitchcock.

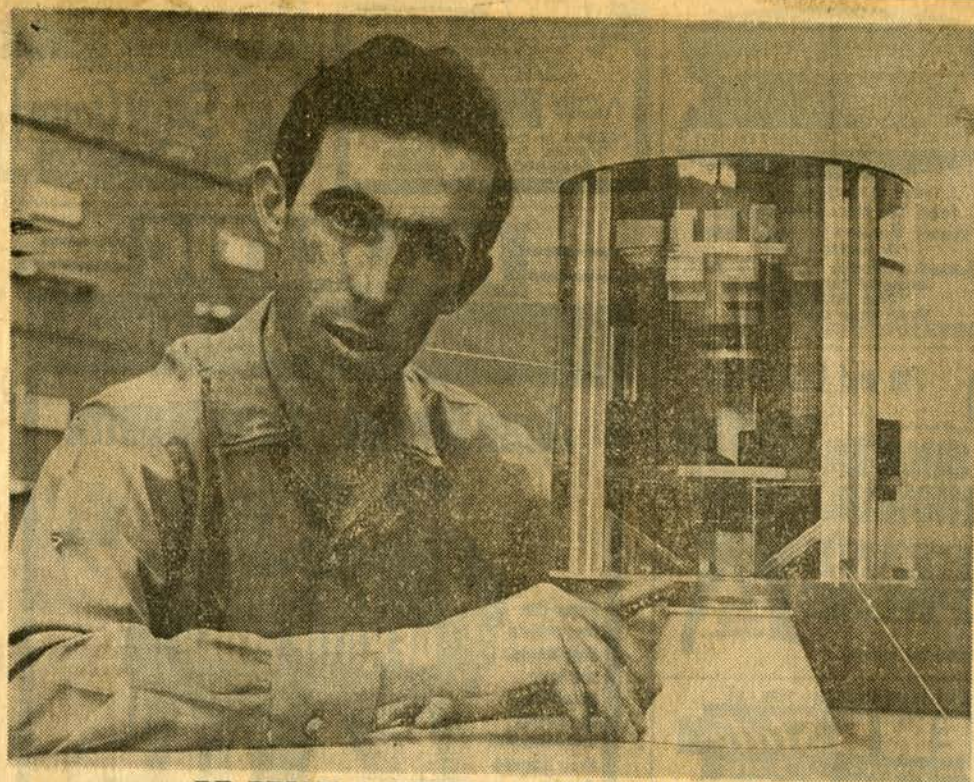
"The observatory is being placed 35 miles from Houston to get away from noise, power lines and other interference," Dr. Dessler said. "It will be the first in this area and will work with one which the U. S. Coast and Geodetic Survey plans to build soon in the Dallas area."

The first space project of the new department was described at the conference by Curtis D. Laughlin, the research physicist from the University of Iowa, who has been named chief of rockets carrying a 50-to-75-pound of a large meteorite more than

payload of geiger tubes, photo-meters and low energy particle detectors," Laughlin said.

DR. MICHEL, who was added to the staff of Rice's new space department in the spring, is now in Australia with a geological party headed by Dr. Eugene M. Shoemaker, an astrogeologist who is now chief consultant to the National Aeronautics and Space Administration on the geology of the moon.

The group is making a study of a series of 13 craters in Central Australia near a place known as the Henbury Crater Station. They are believed to have been formed by the fall of a large meteorite more than



DR BRIAN J. O'BRIEN WITH 'BABY OWL'
Rice Professor Shows Miniature Mockup of Satellite

Rice Gets Contract To Build Satellites

By NOE PEREZ
Post Reporter

The National Aeronautics and Space Administration in Washington said Friday a \$3.7-million contract has been awarded to Rice University to design and build its own satellites.

The contract had been pending since February, when NASA made Rice the first — and to date, the only — participant in its University Explorer Program.

Approval of the contract allows the university to build two orbiting satellites, and to prepare one backup satellite during a three-year period. The first launch is set for summer of 1967.

UNDER THE direction of Dr. Brian J. O'Brien, Rice space science professor, Project Owl, named after the school mascot, will expand the university's probe into the aurora and airglow phenomena.

Rice's attempts to crack the secrets of the Aurora Borealis, more commonly known as the Northern Lights, began with the shooting of a series of five Sammy sounding rockets.

The latest of these was in April, from Fort Churchill, Canada. Wallops Island, Va., was the earlier launching site.

OF THE NEW project, Dr. Alexander J. Dessler, chairman of the Rice Space Science Department, says:

"I am particularly pleased that we will be able to conceive our scientific objectives and then build our own satellites to meet these specific needs.

"The experience which the Rice students will get in the project will give them rare insights into space research."

THE FIRST Owl satellite will be launched from the Pacific Missile Range, about 100 miles north of Los Angeles.

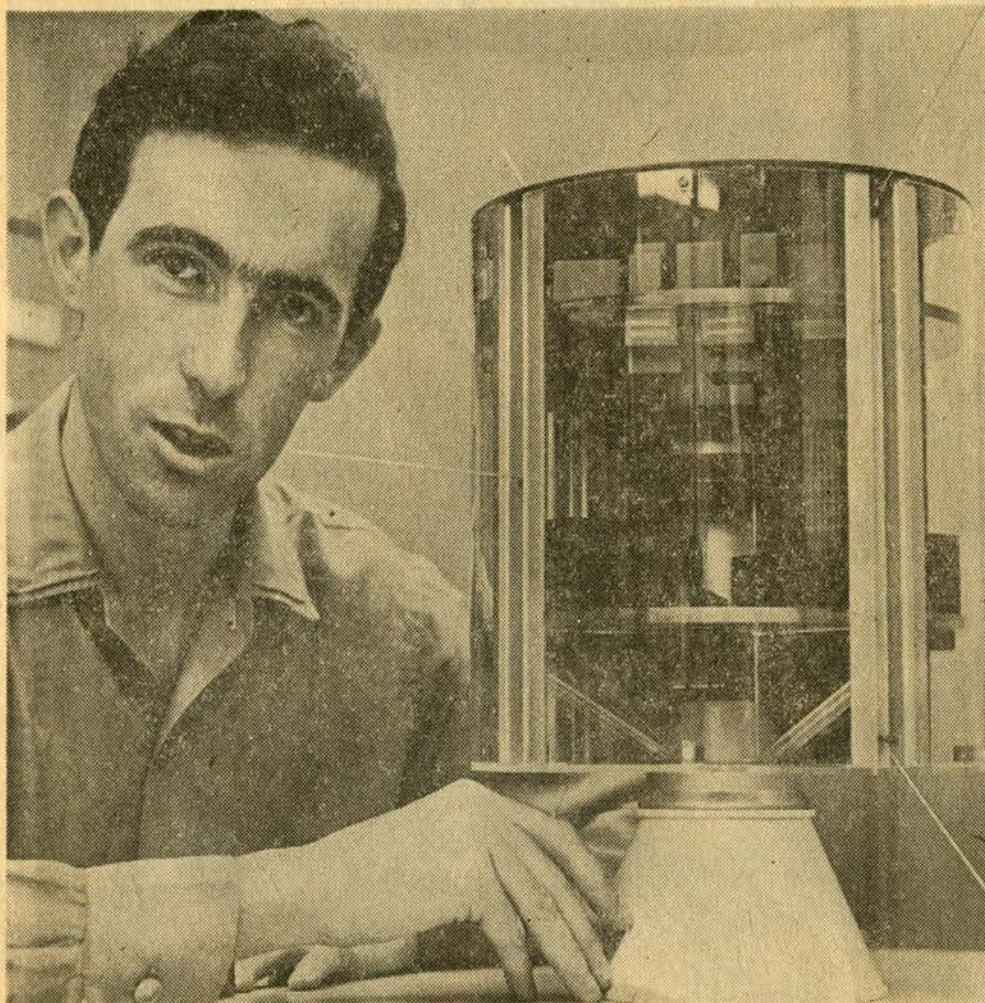
It will measure radiation

and radiation loss in the Van Allen belts, aurorae and air glow; bombardment of the upper atmosphere by energetic particles from space, and galactic and solar cosmic rays, Dr. O'Brien said.

About a month later, a second satellite will be launched into an interrelated orbit, so that Rice scientists, for the first time, will have the advantage of measuring particles and light flux simultaneously, in both day and night conditions, and in the northern and southern hemispheres.

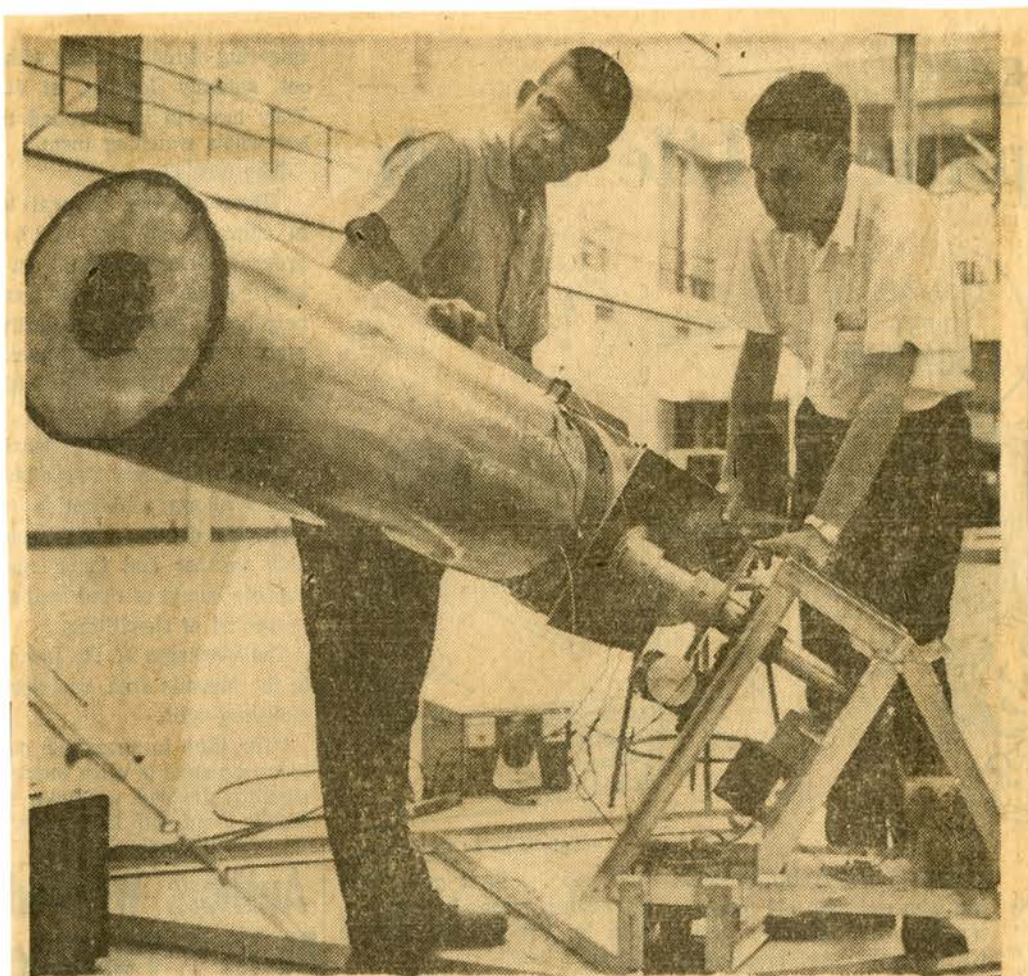
the HOUSTON POST
August 7, 1965

RICE'S OWN SATELLITES



The federal space agency has granted a \$3.7 million contract to Rice University allowing the school to design and make its own Explorer satellites for launching in the summer of 1967. Head of the program, to be

known as "Project Owl," is Dr. Brian J. O'Brien, professor of space science at Rice. Dr. O'Brien is shown demonstrating a model of the 140-pound satellites.



RICE 'EYE' TO PEEK AT CRAB NEBULA

The super-sensitive telescope that will soon probe the secrets of the Crab Nebula — the remains of a star that exploded centuries ago — gets its preliminary test by Dr Robert C. Haymes, Rice University assistant professor of space science, and Wade L. Craddock Jr, one of several graduate students assisting Haymes on the project. The 200-pound telescope assembly, which will point itself automatically at the Crab at the right time, will ride up about 25 miles on a gondola attached to a balloon the height of Houston's 44-story Humble Building. The launch will be about Sept 1 from the scientific balloon station at Palestine.

Rice Balloon To Study Exploded Star

By BLAIR JUSTICE
Post Science Editor

PALESTINE — Rice University scientists Tuesday night launched a mammoth balloon that was on its way to Columbus, Ga., with equipment aboard to study a star that exploded in the year 1054.

In making the launch at 10:05 PM at the Balloon Flight Station of the National Center for Atmospheric Research here, Rice became the first Texas university to send up experiments from the two-year-old facility.

Dr. Robert C. Haynes, assistant professor of space science at Rice, described the launch as "smooth." Technical difficulties and weather problems had been factors in keeping Dr. Haynes and his Rice associates from launching the balloon during the past three weeks.

COLUMBUS WAS estimated to be the area where a payload on the balloon would be dropped at noon Wednesday.

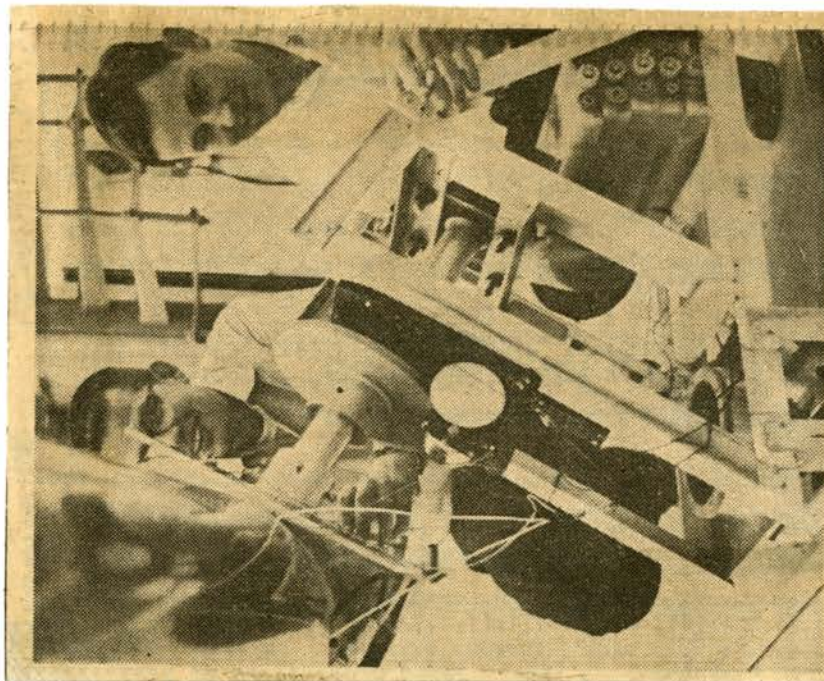
This will occur, provided no mishaps occur en route. Dr. Haynes said that a critical point in the flight occurs when the balloon reaches the tropopause (some 30,000 to 50,000 feet altitude) where extremely cold temperatures are encountered. Another critical point concerns whether the balloon reaches its ceiling of 125,000.

If these points are passed without mishap, then the experiment, Dr. Haynes said, will be a success as far as the flight is concerned.

AFTER RECOVERY of the 615-pound payload, scientists will begin analysis of data collected while the balloon was

aloft. The payload reaches ground by parachute, which is activated by a radio signal from the balloon station here. A plane, which took off shortly after the launch Tuesday night, will keep the balloon in sight until the radio signal is given to drop the payload.

Included in the payload is a gamma telescope designed to pick up radiation from the star that exploded in 1054 and is known as Crab Nebula. Rice University scientists are checking the hypothesis that the exploding star is radioactive and, if it is, their data will help determine what factors are behind the explosion.



RICE TEAM TO STAR-GAZE

Dr. Robert Haynes, assistant professor of space science at Rice University, and graduate student Wade Craddock Jr. of Arlington look over a radiation detection telescope which will ride a balloon the size of the Humble Building high above the earth for research on star explosion. The balloon is to be launched from Palestine, Texas, early next week.

***RICE TO SEND UP BALLOON
AS BIG AS HUMBLE BUILDING***



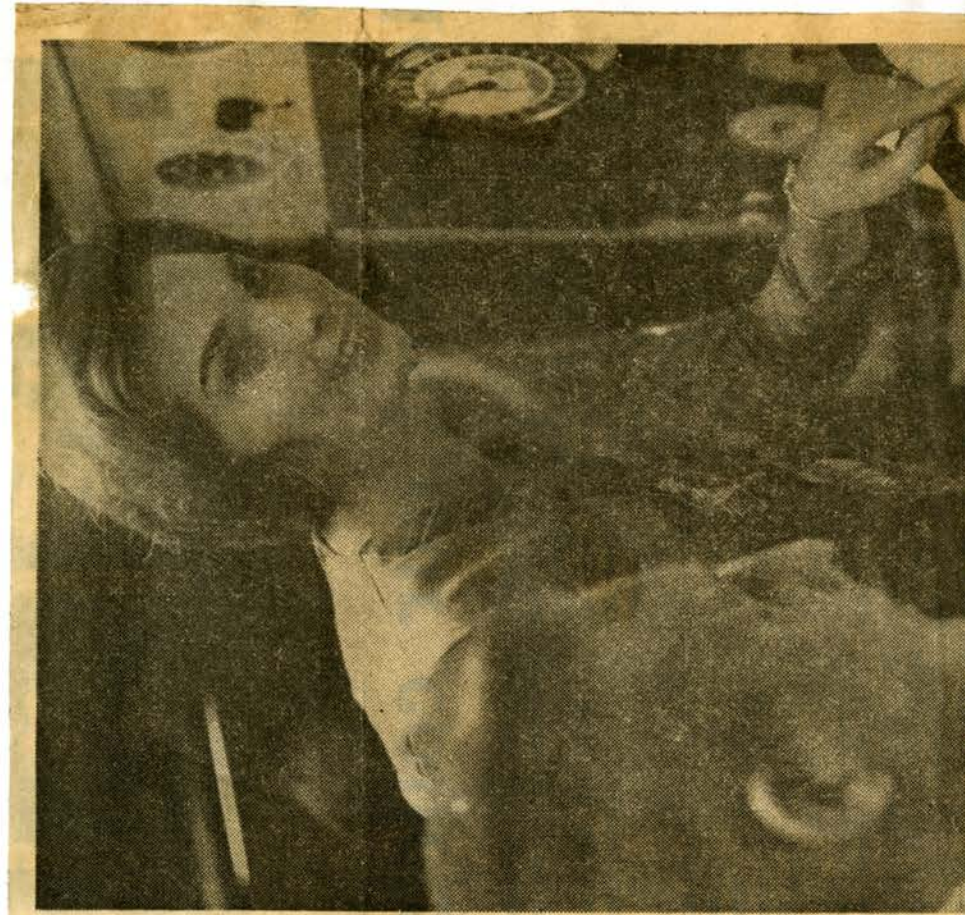
DR ROBERT HAYMES CHECKS DECODER
It Will Receive Data From Telescope on Balloon

Astronauts Poole and Bowman, left, from 2001 contemplate how to handle a rebellious computer. Students in a new Rice University science fiction series for the general public will be contemplating this film, along with other films and books, as part of the three class series. Dr. Robert Haymes, below, of the Rice Space Physics Department, will be discussing the actual facts behind the science in the science fiction course as part of the series' cooperative effort.

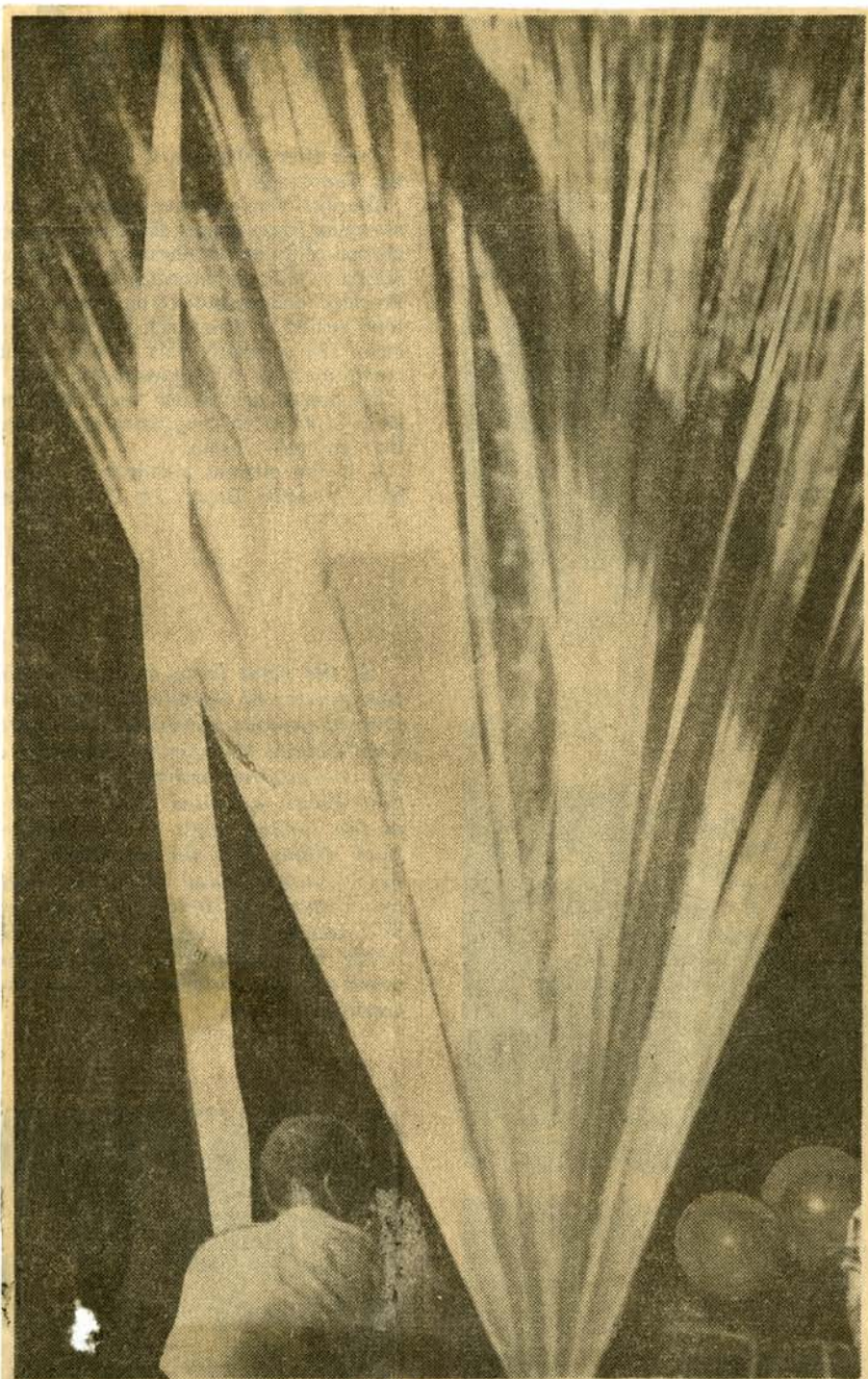




Finding where Rice balloon should land
... Newlyweds Darvin, Linda Ellis



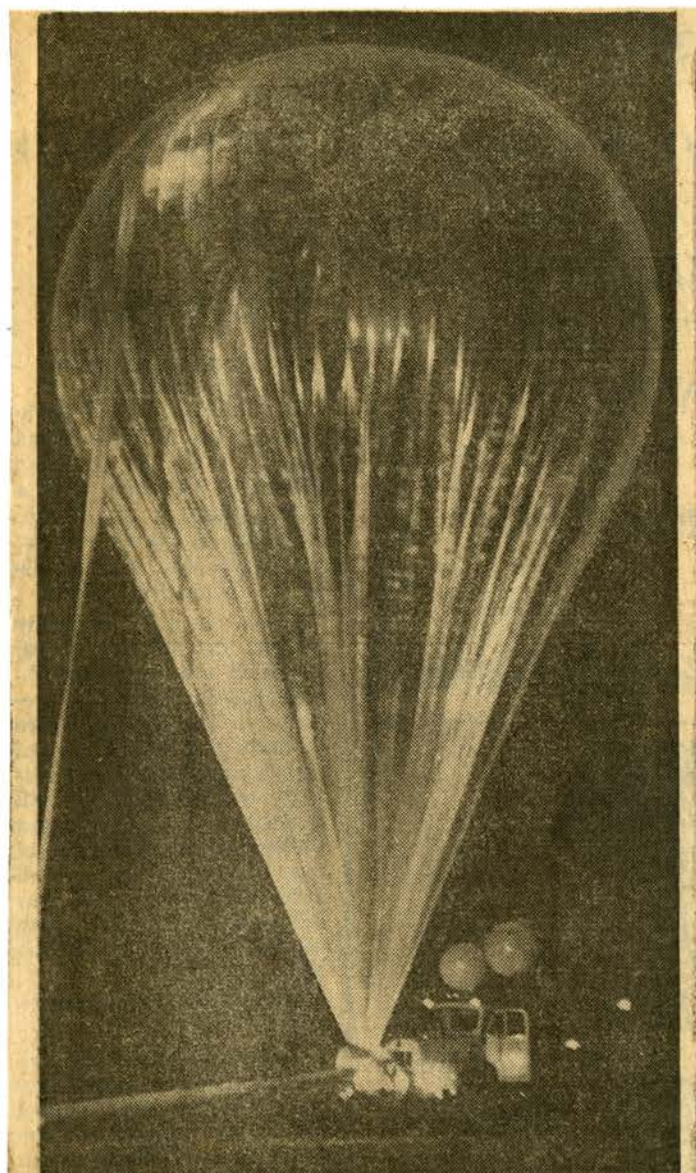
Following latest data in control room
... Beverly and Larry Westerlund



Filling Rice balloon up with helium

... small balloons are pibals

the HOUSTON POST
October 21, 1965



RICE BALLOON AT LAUNCH IN PALESTINE
In the Air, It Was as Tall as 42-Story Building

—Photo by Lee Estes

Balloon Star Study Fairly Successful, Rice Scientists Say

By BLAIR JUSTICE, Post Science Editor

Rice University scientists Wednesday night described as "reasonably successful" their first experiment to use a high-altitude balloon to study a star that exploded 900 years ago.

The balloon, launched at Palestine at 10:05 PM Wednesday, was cut loose from its payload at 9 AM Thursday near Meridian, Miss.

THE 871-POUND payload, consisting of a gamma-ray telescope and other scientific instruments and control equipment, landed by parachute in a pasture at 9:32 AM.

A recovery truck from the Balloon Flight Station at Palestine picked up the gear and headed back to Houston and Rice shortly afterward.

Dr Robert C. Haymes, in charge of the experiment, said he had hoped to keep the balloon and payload aloft until noon Wednesday.

"Our batteries that serve as power for the gamma-ray telescope went dead," he said, "so we decided to bring the payload down early."

DR HAYMES said that despite the early cutoff, "we got more data than we really expected." He said that after reaching 124,000 feet, the gamma-ray telescope "locked in" on the exploding star—called Crab Nebula—and data began to be fed back to ground by radio and electronic signals.

"The data is all in and we will start analyzing it here at Rice," said Dr Haymes after returning from the balloon station operated by the National Center for Atmospheric Research just outside of Palestine. Dr Haymes is an assistant professor of space science at Rice.

THE BALLOON launch was the first made at the station by scientists from a Texas college. With the data Dr Haymes and his graduate students collected, they hope to determine what radio-activity may be coming from Crab Nebula and to figure out some of the factors in why the star exploded in 1054.

Winds in the stratosphere started carrying the huge balloon south and toward the Gulf after maximum altitude was reached about midnight. But the winds then changed again and went back to pushing the balloon toward the east at about 40 miles an hour.

A radio signal from a plane that followed the balloon in flight was used to cut the payload and its gondola off from the huge balloon filled with helium.

DR HAYMES said a second balloon flight will be launched to get additional information on radiation from Crab Nebula. He said no second flight would be made before December.

"One thing we will want to study is why the batteries went dead when they did."

The 'Cape Kennedy' in Texas keeps busy

By BLAIR JUSTICE, Post Science Editor

PALESTINE—Suddenly it's in the air. An eerie sight—at least at night. Searchlights dance around it, following its rapid ascent.

Then there's a big puff of white cloud: Cornstarch of all things.

"JUST LIKE YOU BUY in the grocery," says Jack Warren, assistant base superintendent at the Palestine Scientific Balloon Flight Station. "It keeps the folds on the balloon from sticking together."

The shape of the balloon, how it fills out once in the air, is a crucial factor. The scientists, the base personnel, the inevitable spectators—all keep watching as the huge silver teardrop keeps going up and up at 1,000 feet a minute.

Already lost from sight are the "pibals" that were sent up. They are miniature compared to the scientific balloon, which would cover two acres if laid out flat.

THE PIBALS (for pilot balloons) are released at various intervals before the main launch. They are used to give base personnel an index of what the winds are doing.

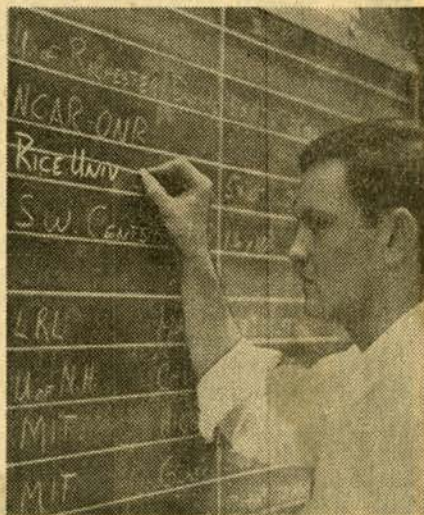
The winds are still something that leave even scientists at their mercy. No one yet has come up with any consistent way to predict what kind of tricks nature may play in the stratosphere, where the big balloon is headed.

This balloon, on this particular night, belongs to the space science department of Rice University — specifically, Dr Robert C. Haymes, assistant professor, who has a \$135,000 grant to study a certain kind of radiation given off by stellar formations, such as Crab Nebula, which is a star that exploded more than 900 years ago.

IN THE CONTROL room on the second floor of the flight station facility, the Federal Aviation Agency is being briefed on the direction the balloon took off (northeast) and its expected movement (easterly) as it approaches its ceiling of 124,500 feet.

Frank McCreary, base superintendent, notes that one reason Palestine was picked to be the nation's Number 1 balloon flight station is that it is out of so many of the flight patterns of commercial and private aircraft.

In the control room, the balloon's ascending velocity, its ground speed, its temperature zone — all are kept under surveillance by telemetry, by electronic signals sent back from the balloon to the ground station.



The time for Rice
... Wade L. Craddock Jr

DR HAYMES is pleased with the smooth launch. Precious cargo is in the gondola attached to the polyethylene plastic balloon, which is full of helium. In the payload, there's a long gamma-ray scope, which is intended to collect data on the radiation sent out by Crab Nebula.

McCreary is also happy with the launch. He says the station's record for successful launches continues to be good.

"We've had only two failures out of 50 flights since May," he says. After more than two years of operating the station — which opened on Aug 1, 1963 — McCreary is still convinced Palestine was a good choice for a site.

"The weather has lived up to our expectations. We can launch here just about any month in the year. In December, we sometimes go out to Page, Ariz, to launch a few balloons, but outside of that, we're busy here all the time."

McCREARY is a meteorologist who is naturally weather-conscious. The surface winds don't cause much trouble, he says, at Palestine. Most launches are scheduled for sometime around sunrise when the winds are most favorable.

The Rice University balloon went up at night for obvious reasons. Its equipment is designed to study a star formation some 3,500 light years away, and full advantage had to be taken of the darkness to get as much data as 12 hours flight time would permit.

A "recovery truck" for this particular launch is already over in Louisiana, anticipating the flight direction of the balloon. When the balloon is cut off — by radio signal — from its gondola, containing the scientific equipment — the "payload" is expected to parachute to earth somewhere near the recovery truck. This makes recovery real easy.

Rice Scientists Seek Answers To Mysteries of 'Night Airglow'

By RALPH S. O'LEARY

For more than a half-century, the world's scientists have been puzzled about the cause of a faint general illumination of the sky which is visible from the ground on clear, moonless nights.

Since the Space Age began, this strange sky brightness also has been detected from above by astronauts orbiting the earth. It appears to them as a faint luminous band around the horizon during the night portions of their missions.

THE UNUSUAL brightness has been named the "night airglow" and is believed to be allied to the brilliant auroras which are frequently visible in the Arctic and Antarctic during the six-month-long winter night.

In recent years, it has been determined that the faint illumination results chiefly from the emission of light by excited oxygen atoms in the rarefied air at heights of up to 60 miles or more.

But what makes the oxygen atoms so energetic so high up in the atmosphere is still very much a scientific mystery.

A GROUP OF scientists from the new space science department of Rice University has now embarked upon a research program, which it is hoped will help clear up some of the mystery.

Curtis D. Laughlin, chief of laboratory,

the new department's satellites communication engineering techniques laboratory, told about it Tuesday shortly after the arrival at Rice of the aluminum containers for the 50-pound payloads. It is planned to fire to an altitude of 100 miles in the program beginning in December.

"We are awaiting the go-ahead on the project from the National Aeronautics and Space Administration, which is expected any day now," he said.

"WHEN IT COMES, our plans call for firing the first of the rockets at the NASA launching base at Wallops Island, Va., on a moonless night in December and three more from Fort Churchill, not far below the Arctic Circle in Canada, sometime in January or February. We have a fifth payload for backup use if necessary."

The Wallops Island shot will probe the region of greatest intensity of the airglow, he said. The three shots in Canada will be fired into the first three brilliant auroras that appear in that area in January or February.

THE 30-POUND container of shiny aluminum for the flights, supplied by NASA, was exhibited for the first time Tuesday in the temporary quarters of the new satellites technique laboratory.

Laughlin, Ramon Trachta, satellite design engineer for the laboratory, and W. S. Carey,

near, were already busy preparing the 50 pounds of scientific instruments to be housed in it for the 100-mile-high, eight-minute-long ride into space.

The instruments will include photometers, devices to detect and determine the intensity of the faint airglow; geiger counters and

See AIRGLOW on Page 8

AIRGLOW RESEARCH

Continued From Page 1 said, to determine if it is sufficient to cause the excitation of the atoms of oxygen.

THE GEIGER counters and particle detectors aboard will be used to detect particle radiation at the altitude of the airglow layer, Laughlin said.

The research physicist, who was with Dr. James A. Van Allen's physics laboratory at the University of Iowa before coming to Rice, said that some scientists believe that energetic electrons dribbling out of the bottom of the inner Van Allen radiation belt might supply the energy to excite the oxygen atoms in the airglow layer.

The detectors aboard the sounding rockets will measure the energy of such radiation, he

"**THIS IS THE** first time such a double purpose experiment measuring the intensity of the light emission in the airglow and the energy of radiation leaking out from the Van Allen belt has been tried to my knowledge," Laughlin said. "It may be that our results will enable us to rule out the electrons from the Van Allen belt as the cause of the airglow."

The Rice payloads will be fired by Nike-Apache two-stage, solid-fuel rockets, developing a thrust of more than 54,000 pounds.

Telemetry through the antenna section at the rear of the payload will transmit the scientific data obtained to the ground station at Wallops Island.

"NASA SUPPLIES the telemetry for such sounding rocket shots but we will have our own telemetry station along for good measure," Laughlin said.

The shiny aluminum containers and their scientific instrument packages will plunge into the Atlantic Ocean after the eight-minute Wallops Island flight and into Hudson Bay after the Fort Churchill launchings.

"We will make no attempt to recover the equipment," the Rice scientist said. "If we included a parachute recovery system, we would have to sacrifice 75 per cent of our scientific payload."

Niki II Firing Today

Rice U To Probe Ionosphere

Does heat from the sun produce electricity in that 100-mile-high layer of thin air known as the ionosphere?

Rice University scientists hope to get data on this question with a space probe scheduled to be launched at 10 AM (Houston time) Thursday at Wallops Island, Va.

PAYLOAD ABOARD the rocket will include instruments designed to measure the intensity and direction of the electric current that is believed to exist in the ionosphere.

The ionosphere makes possible long-range communication by radio, since radio

waves "bounce" off the layer of air and can be directed to ground points far removed from the transmitter.

There is a theory that heat from the sun induces an electric current in the ionosphere, which can be measured even on days when no sun spots or solar flares can be seen. It is known that solar storms cause electrical disturbances in the ionosphere. The Rice space scientists hope to confirm that even on "calm" days, heat from the sun induces an electric current.

NASA WILL launch the Nike-Apache rocket that will

carry the 49-pound payload into the ionosphere.

The research is financed by a \$98,000 grant from NASA. Dr Robert C. Haymes, assistant professor of space science at Rice, is in charge.

A similar "sounding rocket" was launched late in November. That shot was called Niki I, named after the child of Mr and Mrs Paul Cloutier. Cloutier is a space science graduate student who has installed a cesium vapor magnetometer aboard the current rocket to measure the huge 100,000-ampere current believed to exist in the ionosphere. The current shot is known as Niki II.

UNDER NASA sponsorship, Rice conducted six experi-

the HOUSTON POST
November 14, 1965

Rice Designs Instruments For Rocket Probes

Instruments to measure intensity and direction of electrical current believed to exist in the 100 mile-high ionosphere have been constructed on Rice University's campus.

They will be shipped today to NASA's Goddard Space Flight Center for final preflight tests.

Later the instruments will be sent to NASA's station at Wallops Island, Va., for a series of rocket probe shots. A Nike Apache rocket will be used to launch the first of two probes on Nov. 22 and the second one shortly before Dec. 25.

Dr. Robert C. Haymes, assistant professor of space science at Rice, is in charge of the research project financed by a \$98,000 grant from NASA.

Rice scientists hope the instruments will confirm the theory that heat from the sun induces an electrical current in the ionosphere which may be measured even during the relatively calm days in which no sun spots or solar flares are seen.

Rice Instruments To Test Electricity in Ionosphere

Instruments designed to measure the intensity and direction of electrical current believed to exist in the 100 mile-high ionosphere have been constructed at Rice University.

These instruments will be shipped Sunday to the Goddard Space Flight Center for final pre-flight tests. Later they will be sent to Wallops Island, Va, for launch.

A Nike Apache rocket will launch the first probe about 10:30 AM on Nov 22. The sec-

ond launch will be shortly before Christmas.

Dr Robert C. Haymes, assistant professor of space science at Rice, is in charge of the research project financed by a \$98,000 grant from NASA. Paul Cloutier, a graduate student from Opelousas, La, is responsible for some of the detailed instrument work.

The probes will be the seventh and eighth by Rice University in conjunction with the National Aeronautics and Space Administration.

Rice Launches 49-Pound Space Probe

Rice University scientists successfully launched a space probe today from the National Aeronautics and Space Administration launch site at Wallops Island, Va.

"Instruments and telemetry functioned well. It's a successful shot," said Dr. Robert C. Haymes, assistant professor of space science at Rice.

Dr. Haymes is in charge of the NASA-financed \$93,000 project. The object of today's launch was to loft a 49-pound instrumented payload more than 100 miles into space to measure the intensity and direction of electrical current believed to exist in the ionosphere surrounding Earth.

Called the "Niki-2," the shot is the second experiment in the current Rice series to be launched and the eighth rocket-carried space experiment to be conducted by Rice and NASA. The first "Niki" was launched last November.

Today's probe was launched at 10:16 a.m., Houston time and reached a peak altitude of 110 miles, Dr. Haymes said.

the HOUSTON CHRONICLE
February 17, 1966

the HOUSTON POST
February 18, 1966

Rice U Space Probe Launched

Rice's University's space probe of the ionosphere was launched successfully Thursday morning. Instruments aboard the Nike-Apache rocket

flares going on.

The firing, at 10:16 AM (Houston time), took place at Wallops Island, Va. Dr. Robert C. Haymes, assistant professor of space science at Rice, said the electronic equipment in

the 49-pound payload aboard the rocket operated as designed in sending back information the researchers wanted.

The rocket reached an altitude of 110 miles. The iono-

sphere is a layer of air, starting about 100 miles up, that is used for "bouncing" radio waves back to earth.

The launch Thursday was dubbed Niki II. A similar shot, Niki I, took place in November.

Star-Gazer Balloon

May Go Up Monday

By BLAIR JUSTICE
Post Science Editor

A balloon as large as any ever launched from the Palestine Scientific Balloon Flight Station will take to the skies Monday or Tuesday morning, if all goes well for the Rice University scientists there for the project.

Dr. Robert C. Haymes, project director, said the balloon would carry a payload of about 900 pounds and was expected to reach an altitude of 130,000 feet.

VOLUME OF the balloon, which will be filled with helium, is 10.5 million cubic feet.

"This is as large as any balloon launched here before," said Dr. Haymes, who is an associate professor of space science at Rice.

Purpose of the flight is to gather data on Crab Nebula, the gaseous remains of a star that exploded some 3,500 years ago.

THE MAIN instrument the Rice balloon will be carrying is a 5-foot-long gamma ray telescope. Once the balloon is at maximum altitude, an electronic signal will be given to turn the telescope toward Crab Nebula. The telescope will fo-

cus on the mass of gas for four to five hours.

"We want to see what, if any, radioactivity can be picked up from the exploded star," Dr. Haymes said.

Plans call for the balloon to be launched at 7 AM, whatever morning the flight comes off, and for a signal to be given 13 hours later that will cause the balloon to drop earthward. Dr. Haymes expects for the balloon to drop in the vicinity of El Paso.

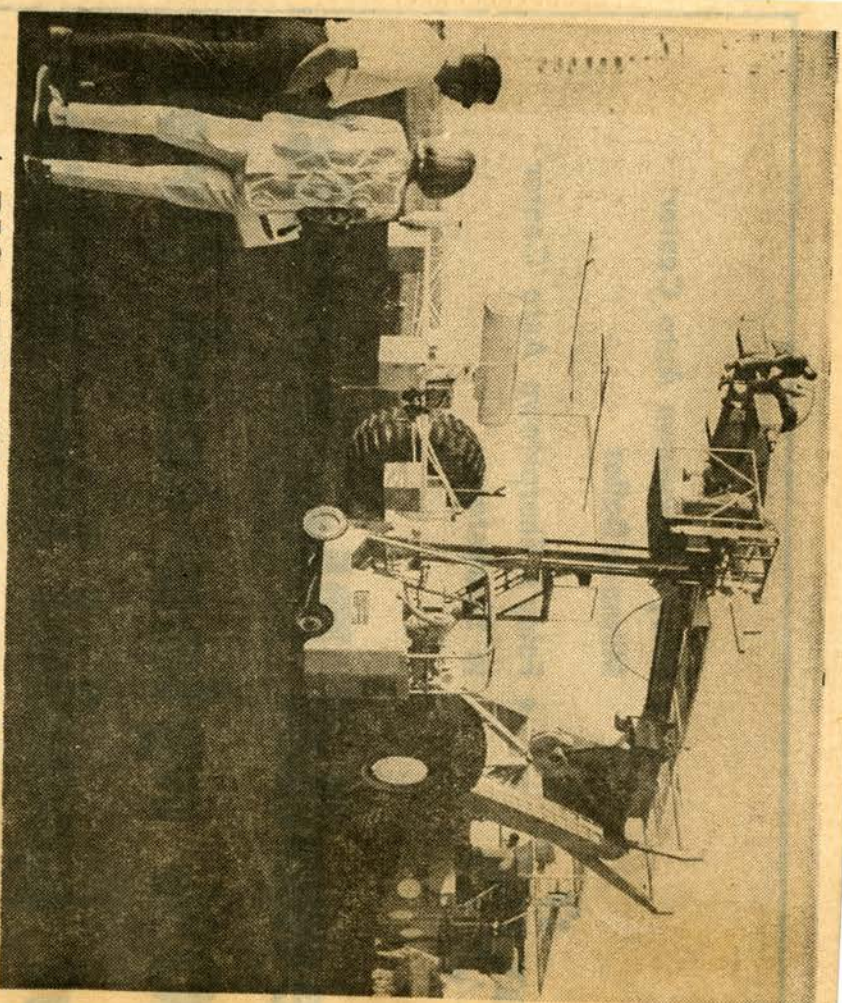
FOUR MEMBERS of the Rice space science department, including Dr. Haymes, is at Palestine for the flight.

Dr. Haymes and associates sent up their first balloon for the study of Crab Nebula last fall. It was a 5-million-cubic-foot balloon that went eastward and reached an altitude of about 124,000 feet.

Data collected from that flight indicated that some radioactivity is being emitted from the star.

The study is supported by a \$166,500 grant from the Air Force Office of Scientific Research. Dr. Haymes plans to launch two more balloons from the Palestine station later this summer.

the HOUSTON POST
June 3, 1966



A BIG LETDOWN FROM TINY TIM

As Dr. Robert C. Haymes, associate professor of space science at Rice University, and his wife watch, National Center of Atmospheric Research technicians prepare to lower a 900-pound X-ray telescope to the ground. The radiation detection instruments were to be lifted to 130,000 feet by a 55-story-high plastic balloon from the Palestine, Texas, launch site. After waiting more than two weeks for the proper weather for a high level observation of the radio active debris of the "Crab Nebula," the residue of a star observed to explode in 1054 AD, disappointed Rice scientists Saturday had to wait one more day to launch their balloon when a last minute failure of a radio on board the gondola did not respond to test signals which would have called the payload back to earth near El Paso. The 20-ton armed monster, nicknamed "Tiny Tim," is shown holding the gamma ray telescope for the fork lift truck which returned the instruments to their hangar to await another effort at dawn Sunday.—Photo by Lee Estes

the HOUSTON POST
June 3, 1966

Rice Star-Gazing Balloon Recovered

The study is under the direction of Dr. Robert C. Hames, associate professor of space science at Rice.

A 55-story balloon sent aloft, balloon was launched from Palestine shortly after midnight.

The major objective of the five-foot-long gamma ray telescope was to view the emissions of an exploded star known as the Crab Nebula, 3500 light years from Earth.

Scientists obtained nearly a full run with the instrument, however. They had planned to bring it down about noon. The command system fault cropped up at 132,000 feet.

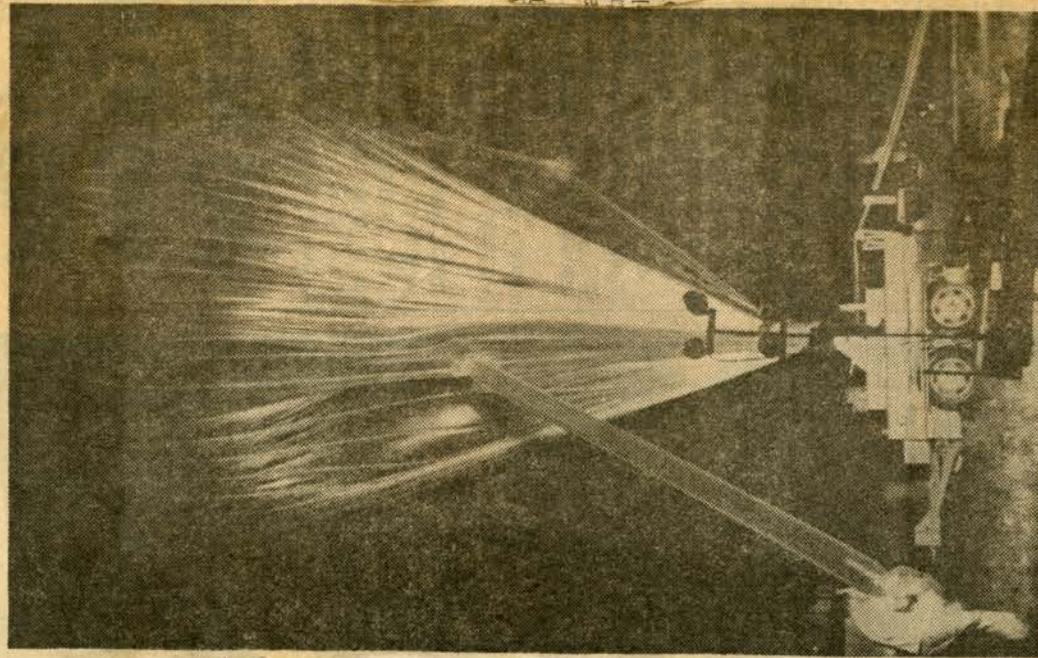
The difficulty prevented scientists from radioing pointing orders to the flying telescope. The

subject of two other balloons mounted telescopic studies by scientists at Rice University.

Scientists hope to compile data from the three flights that will increase their knowledge of what causes stars to explode.

The Crab nebula explosion was noted in the year 1054 by Chinese astronomers and by Navajo Indians who recorded it on the walls of caves found in the western part of the United States. The ancients said the Crab nebula, before it burst, was visible in the daytime for two months.

The gaseous remnants of the ancient star have been the ob-



BALLOON LAUNCHED BY RICE
Purpose Was Study of Crab Nebula

Balloon Flight Is Cut Short By Scientists

Palestine (AP)—Rice University scientists launched a gigantic research balloon from the Palestine Scientific Balloon Flight Station Sunday morning but it was ordered back to Earth nearly seven hours later, far to the west of this East Texas city.

A spokesman said a chase plane sighted the balloon about four miles north of Robert Lee. The payload, carrying instruments to gather data on the remains of an exploded star, was later found near Blackwell, about 50 miles north of San Angelo.

The balloon, which stood 55 stories high when fully inflated with 10.5 million cubic feet of Helium, was brought down by remote control about 1:15 p.m. after a transmitter in the payload gondola failed, evidently because of a dead battery.

On command, the 900-pound payload separated from the balloon and dropped by parachute. It was spotted by Harold Ware Jr., 13, who was visiting in the Blackwell area.

Plans originally called for a 13-hour flight, but Rice scientists said they were quite pleased with the data recorded on the abbreviated mission.

The spokesman said the instruments, including a five-foot-



UPI Telephoto

TEXAS-SIZE BALLOON IS READIED Undamaged Payload Is Recovered

long gamma ray telescope, were undamaged and they will be returned to Rice for study and use in two other flights planned later this summer.

The study of the Crab Nebula, the gaseous remains of a star that exploded more than 3000 years ago, is supported by a \$166,500 grant from the Air Force Office of Scientific Research. Dr. Robert C. Haymes, associate professor of space science at Rice and director of the

project, launched a similar balloon from Palestine to gather data on the Crab Nebula last fall.

Satellite in Orbit Was Made at Rice

One of two satellites launched into orbit aboard an Air Force rocket from Vandenberg AFB, Cal., Thursday was made by Rice University under contract to the Office of Naval Research.

The other satellite, a 47-pound twin of the Rice-made vehicle, is one of a series of Army SECOR satellites making three-dimensional maps of the Earth's surface.

The ONR-Rice satellite has been designated Aurora 1 because its chief task will be the examination of the electrical and magnetic events in the atmosphere that lead to the formation of the so-called "northern lights" in the northern latitudes.

Polar Orbit

Dr. Brian J. O'Brien, professor of space science at Rice, will be in charge of the project, operating under a \$150,000 ONR research contract.

Aurora I and the SECOR satellite were shot into a near circular orbit 2000 miles high by the Air Force's new Thor/Burn-

er 2 rocket. The payload is in a polar orbit, meaning that it is circling the planet in a north-south path that, in a 24-hour period, passes over every area of Earth.

Three devices on the Aurora 1, two sensitive to light frequencies and one capable of electronically recording the passage of atomic particles, will be used to measure auroral events.

The northern lights are caused by electrons and protons (negatively and positively charged particles) bombarding Earth's atmosphere. Aurora 1 will measure the light caused by the showers and the number and intensity of the atomic particles.

"In a way, the research studies of auroras may be likened to an analysis of a television set," O'Brien said. "In a television set, electrons hit a screen which glows and emits light. In auroras, the Earth's protective atmosphere is analogous to the TV screen—when bombarded by

the HOUSTON CHRONICLE
June 30, 1967

the HOUSTON POST
July 1, 1967

First Rice Research Satellite Is Fired From Vandenberg

Rice University, in co-operation with the Air Force, Navy and Army, has launched its first space satellite, called Aurora I.

and Denmark are to gather data from the satellite, supplementing Rice's receiving station on the Houston campus.

The satellite, lofted Thursday from Vandenberg Air Force Base, Calif., is reported functioning well and in a stable orbit.

It is designed to study auroras, commonly known as the Northern Lights. Coupled with the Aurora I is an Army SECOR instrument package, designed to make geodetic maps of the earth's surface.

A six-inch bar magnet in the Aurora I is to align the satellite with the earth for its studies. It is expected to be stabilized in about a month, when aurora studies will begin.

Tracking stations in Norway, New Zealand, Alaska

July 23, 1967

HOUSTON CHRONICLE
Page 10, Section 3

Sunday, July 23, 1967

Area Colleges' Role in Putting A Man on Moon

BY JACK AMERINE

Chronicle Reporter

Houston area universities are playing an indirect but important role in putting a man on the Moon.

The National Aeronautics and Space Administration is pouring about \$5 million a year into six institutions here and smaller sums into other schools around the state.

The research the schools are doing is pointing the way perhaps as much as 10 years ahead of the contractors now building space hardware.

Studies are being made, for example, of the behavior of metals at very high and very low temperatures.

Rice, UH, A&M

The basic research is the type of work the schools have always done. The \$6.7 million NASA projects at Rice University could not have been undertaken if Rice had not already been working in those fields.

At the University of Houston, \$1.8 million in NASA funds is furthering work in the new field of systems engineering, which is bringing many fields of studies together to solve all aspects of a huge problem.

The projects are on a continuing basis, funded over several years. As one riddle is solved, a new one is presented by NASA along with funds needed for an answer.

New Buildings

The most obvious benefit to schools is new buildings constructed partly with federal money to carry on the research.

times faster than the speed of sound. He has a \$19,680 grant to further his work.

Effect on Area

The effect of such men is dramatic in a community, claims a Rice spokesman. One creative scientist generates jobs for a 10-man engineering staff, which in turn buys goods and services from 100 people in the community, that brings it right home.

Many more students apply to Rice for the space science graduate program than can be accepted. The lucky ones will be in on the launching of Rice's Owl satellites in 1968,



DR. C. J. HUANG
Conducts Faculty Seminar

studying the northern lights. That's a \$937,227 project.

Other Rice students are trying to discover basic laws of the behavior of solids at high temperatures, a \$1.75 million study that has been going on since 1961.

Still other Rice students are



PROF. ANGELO MIELE
Works With Hypersonic Wings

using a \$279,736 federal grant to search for ways to measure certain electrified particles in the solar winds — unseen waves of energy that span out from the Sun.

At the University of Houston, students are spending \$214,705 finding out what kind

Facilities Benefit

The most interesting research projects and the best facilities in turn attract the world's best brains to the faculty. An example is Dr. John F. Oro of the University of Houston, who with others has a \$99,600 grant to study the carbon in the first rocks brought back from the Moon.

University of Houston dean of faculties John Allred calls Oro "one of the eight best men in the country in his field."

Rice's space science dean, Alexander Dressler, is counted a world authority on the magnetosphere, the area surrounding Earth affected by the planet's magnetic field.

Rice's Angelo Miele is considered unsurpassed in research on hypersonic wings, exotic shapes that one day may permit the design of passenger-carrying planes capable of traveling eight or nine

Rice has a new \$2.5 million science and technology building, built with a \$1.6 million federal grant. Texas A&M University received \$1 million last year for a laboratory for general research.

The University of Houston expects to build a \$3 million research building near the space center in 1969, with one-third federal money.

The side effects of the research are important. Rice received a little over \$1 million and the University of Houston received a little under \$1 million last year to train graduate students in such fields as aeronautics, astronautics and astrophysics.

Rice in turn was able to hire 14 professors to teach 40 of the most promising students in the country.

Rice Balloon Scope Studies Star's Remains

the HOUSTON CHRONICLE
August 10, 1966

A 55-story-high balloon, sent up by Rice University scientists, drifted westward from Palestine today, its five-foot-long gamma ray telescope centered on the remains of a giant star that the Chinese and Navajo Indians saw explode nine centuries ago.

The telescope is studying emissions of the exploded star, known as the Crab nebula, 3500 light years from Earth.

Lee Estes of Rice said the purpose of the balloon flight is to study the radio active debris for some explanation of the gigantic explosion in the heavens.

The gaseous remnants of the ancient star have been the object of two other balloon mounted telescopic studies by scientists at Rice University.

Scientists hope to compile data from the three flights that will increase their knowledge of what causes stars to explode.

The Crab nebula explosion was named in the year 1054 by Chinese astronomers and by Navajo Indians who recorded it on the walls of caves found in the western part of the United States. The ancients said the Crab nebula, before it burst, was visible in the daytime for two months.

The balloon was lofted at 12:49 a.m. today and at 6 a.m. was 40 miles west of Waco at an altitude of 130,000 feet. In that rarified atmosphere, scientists hope to get clear telescopic pictures of the gaseous

formation adrift 3500 light years away. A light year is the distance light travels in one year at a speed of 186,000 miles a second.

The balloon, being tracked by a station at Midland, was expected to be brought down near El Paso about noon today.

The study is under the direction of Dr. Robert C. Hames, associate professor of space science at Rice.

the HOUSTON POST
August 11, 1966

Rice U Space Project

High-Flying Scope Scans Jupiter

By POST TEXAS NEWS SERVICE

PALESTINE — Rice University scientists seeking to obtain electronic data on radio activity within the Crab Nebula, got a bonus shot at Jupiter Wednesday with an instrument package lofted by an unmanned balloon from here.

Dr Robert C. Haymes, associate professor of space sci-

ence at Rice said an electronic gamma ray telescope, weighing 900 pounds, recorded data on the Crab Nebula and unexpectedly got a good fix on the planet Jupiter.

HE SAID IT may take several weeks to evaluate the recorded data.

The telescope was lofted early Wednesday morning by a

500-foot long balloon containing 10.5 million cubic feet of helium. The launch was made from the National Center for Atmospheric Research Balloon Flight Station here.

The balloon rose to 132,000 feet by 4:40 AM and recorded data as it drifted on a westerly course. The payload was dropped by parachute on an electronic signal and recovered at 10 AM near Midland.

THE STUDY of radio activity within the Crab Nebula, the gaseous remains of a star that exploded about 1054 AD, is being financed by a \$166,500 grant from the U.S. Air Force Office of Scientific Research, Dr Haymes said.



Owl Satellites May Clarify Van Allen Belt Aurora's Role

By JACK ROBERTSON
Fairchild News Service®

DALLAS. — Rice University's two "Owl" satellites hope to unravel how the Van Allen radiation belts cause the aurora borealis.

A. J. Dessler, chairman of the school's space science department, said the satellites will orbit simultaneously and sample the radiation belts at the same time they view auroras by television.

"We will then see what the connection is between radiation levels

and types of particles with auroras," he said.

Mr. Dessler was interviewed while here to address a space physics seminar at the Graduate Research Center of the Southwest.

The two satellites — nicknamed for the Rice University Mascot — will be launched in criss-cross orbits in 18 months. They will use slow-scan television cameras to look for aurora borealis. Images will be digitized and recorded for later playback to earth.

Standard telemetry channels will handle the digitized TV relay to earth, since a high resolution picture is not needed, Mr. Dessler said. The brightness of the aurora is expected to show up well against the night sky, making identification easier after the digitized image has been reconstructed on earth.

The television scan will use a several-second per frame rate. A conventional space television vidicon and camera system will be used.

Scout Boosters.

The Owl satellites weigh 155 pounds, and will be boosted from Wallops Island by scout missiles. Because orbits will criss-cross, researchers will get simultaneous readings from two different parts of the sky. The satellites will be placed in a high-inclination orbit of about 1000 kilometers.

Rice also plans to launch a small aurora satellite and fire small rockets into the aurora under the satellite to get simultaneous radiation data.

The Owl satellites will also carry a battery of 25 radiation counters and sampling devices. These will include electron, proton, Lyman Alpha and Beta particle detectors. Spectroscopy measurements will be made at several levels.

In his talk here, Mr. Dessler suggested the solar magnetic field may trail out like a tail behind the sun as it moves toward the "belt" stars of Orion. Such a theory, however, is disproved if magnetic field measurements from three solar probes are correct — Mariner 2 and 4 and Imp 1. All found a perpendicular downward direction in the solar magnetic field, which would preclude any magnetic tail, he said.

However, Mr. Dessler questioned the accuracy of the three measurements — claiming magnetometers on solar probes are not that sensitive and cannot be calibrated in flight. He also said Pioneer 6 and Imp 3 failed to find the disputed downward magnetic direction.

ELECTRONIC NEWS
August 22, 1966

CHEMICAL and ENGINEERING NEWS

September 2, 1963

► **A study of the basic causes of "night airglow" is being started** by scientists at Rice University, Houston, Tex. Night airglow is the faint illumination seen on clear, moonless nights. It comes mainly from light emitted by excited oxygen in the earth's atmosphere above 60 miles or so, according to Dr. Curtis D. Laughlin of Rice. However, cause of the excitation isn't known; radiation from the Van Allen belt might be a major factor. In December, the first sounding rocket carrying the Rice group's instruments is scheduled for firing from Wallops Island, Va. The instrument package will include geiger counters, a scintillation detector for low energy particles, a magnetometer, and photometers.

the HOUSTON POST

October 13, 1963

Space Scientists Will Talk at Rice

A series of weekly lectures on space science by scientists from the Southwest Center for Advanced Studies of the Science Research Center, Dallas, will open at Rice University at 3:30 PM Monday.



The first speaker will be Dr. Francis S. Johnson, head of the division of atmospheric and space sciences at the Dallas research center.

Johnson The talks are sponsored by the National Aeronautics and Space Administration and will be held in the university's chemistry conference room.

Five lectures by scientists from the Dallas center and six by members of the Rice faculty, including Dr. Alexander J. Dessler, chairman of the university's space science department, will be delivered in the series.

NASA Selects Scientists To Evaluate 7 Experiments

HOUSTON, Tex. — Leading scientists from throughout the United States have been appointed principal investigators by the National Aeronautics & Space Administration to help develop seven major experiments.

The experiments will be taken to the moon as part of the Apollo Lunar Surface Experiment Package (ALSEP) program for which Bendix Corp. Systems division, Ann Arbor, Mich., is prime contractor.

The scientific teams and their experiments:

Dr. George Sutton, Columbia University, and Dr. Frank Press, Massachusetts Institute of Technology, for the passive lunar seismic experiment.

Dr. C. P. Sonnett, Ames Research Center, Moffett Field, Calif., and Jerry Modisette, Manned Spacecraft Center, Houston, for the lunar surface magnetometer experiment.

Dr. C. W. Snyder and Dr. Douglas Clay of Jet Propulsion Laboratory, for the solar wind experiment.

Dr. J. W. Freeman, Jr., Rice University, for the suprathermal ion detector experiment, and Dr. Francis Johnson, Graduate Research Center of the Southwest, for the cold cathode gage experiment.

Dr. Marcus G. Langseth, Columbia University Lamont Geological Observatory, Dr. Sidney Clarke, Yale University, and Dr. M. Eugene Simmons of Massachusetts Institute of Technology, for the heat flow experiment.

Dr. B. J. O'Brien, Rice University, for the charged-particle lunar environment experiment.

Dr. Robert L. Kovach, Stanford University, and Dr. Joel S. Watkins, United States Geological Survey, for the active seismic experiment.

Each ALSEP will have a minimum of four lunar experiments apiece; will weigh about 170 pounds and be contained within a volume of

about 12 cubic feet when installed in the Lunar Module.

The ALSEP will be placed in the scientific equipment bay of the lunar module in the octagonal LM descent stage behind a removable panel. The ALSEP system also includes the radioisotope thermoelectrical generator and fuel cask which is part of the electrical power subsystem.

The cask will transport the capsule containing the radioisotopic fuel source to the moon.

The seven experiments will remain on the moon's surface after the astronauts leave, and continue to sense lunar environmental characteristics and transmit results, in the form of digital data, back to earth.

Marshall Laboratories Gets ALSEP Award

Torrance, Calif.—Marshall Laboratories, a subsidiary of Marshall Industries here, has been awarded a \$1-million contract by Rice University for the complete development of a suprathermal ion detector experiment (Side) for the Apollo lunar surface experiment package (ALSEP).

Side is one of seven key experiments to be incorporated in the ALSEP package (AW&ST July 25, p. 94).

It will be designed to measure suprathermal ions in the atmosphere at the lunar surface.

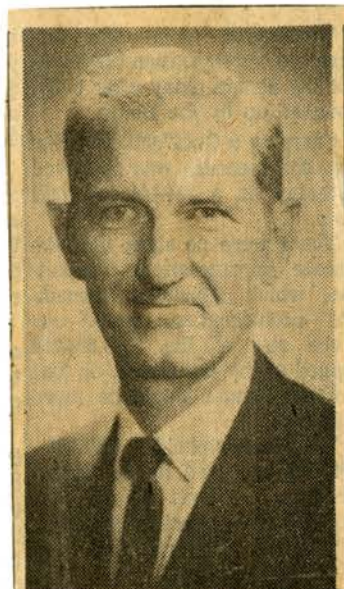
Under the contract, Marshall Laboratories has been assigned responsibility for development and fabrication of the entire Side experiment, including management and programming.

Qualification testing and calibration of the experiment will be carried out by Rice University.

Marshall also will assist in the integration of Side with the ALSEP package, which is being developed by the Research Div. of Bendix Corp. The number of Side units to be delivered by Marshall includes one astronaut training model, one breadboard, two engineering models, one prototype, three qualification instruments, four flight instruments and two flight spares.

The Side experiment will be designed and built to survive and operate for one year at lunar surface temperatures ranging from -250 to $+250^{\circ}\text{F}$. Principal investigator for the ALSEP/Side experiment is Dr. John Freeman of Rice. The contract covers approximately two years.

September 21, 1966



Dr. William E. Gordon, dean of engineering and science at Rice University, has been awarded the Balh van der Pol Gold Medal by the General Assembly of the International Scientific Radio Union in Munich, Germany. The award, cites Dr. Gordon's studies of the ionosphere and development of revolutionary electronic equipment to further these studies.

the HOUSTON CHRONICLE
October 28, 1966

Rice U. Project to Probe Origin Of Mysterious 'Northern Lights'

Rice University scientists plan to probe the origin of the mysterious "northern lights" by firing a rocket straight into the display next month.

The rocket, to be fired from Fort Churchill, Canada, will carry three instruments designed to measure and identify the atomic particles in the lights, known as the aurora borealis.

Launch of the four-stage Javelin rocket is expected between Nov. 7-18 while the Moon is "new." The Moon figures into the launch because other instruments on the rocket will attempt to measure atomic

particles near the lunar surface as the rocket shoots above the Earth's atmosphere.

The project, which includes two more Javelin probes next year, is headed by Dr. B. J. O'Brien, professor of space science at Rice and an early investigator of the Van Allen radiation belts found to encircle the Earth.

The project is financed by a \$987,277 grant from the National Aeronautics and Space Administration.

Scientists have already found that the aurora borealis and its southern hemisphere counterpart, the aurora australis, are

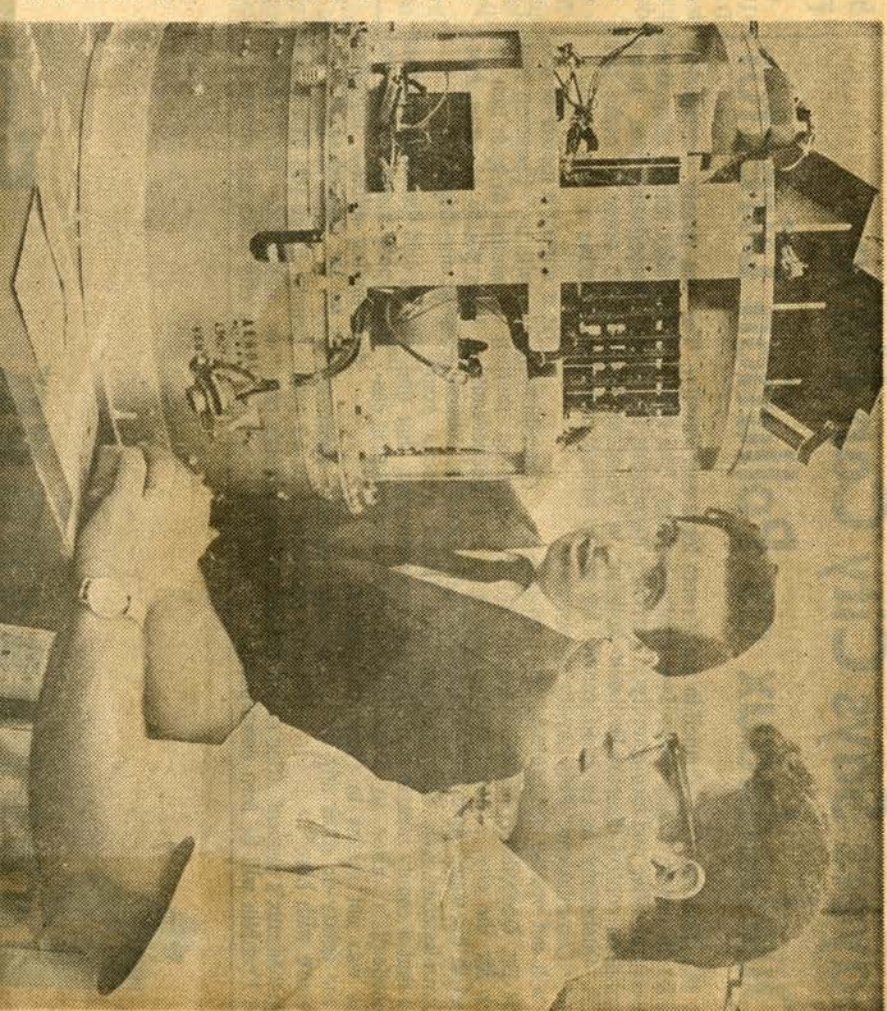
caused by discharges of fast-moving electrons and protons. But still unknown is the source of these bits torn from atoms and sent whirling into Earth's atmosphere.

The Rice instruments aboard the rocket are designed to measure the speed, concentration and identity of the particles in the aurora to determine if they come from the Sun, as many scientists suspect.

"We know there is some 10 times as much hydrogen as helium on the surface of the sun," O'Brien said. "At high altitudes above the Earth, the ratio may be as high as 1000 to 1."

"If we find alpha (helium) particles in the auroras, and if they are one-tenth the abundance of protons (the nucleus of a hydrogen atom), then our tentative conclusion will be that they were once in the Sun's atmosphere."

The 49-foot-long rocket will shoot its 140-pound payload of instruments about 500 miles above its launching site, not far from the Arctic Circle. During the 20-minute arcing



RICE SCIENTISTS STUDY PAYLOAD TO BE FIRED INTO SPACE
Dr. O'Brien, Left, With David Reasner, Payload Manager of Project

flight, the vehicle will travel be destroyed on impact. The measurements to Fort Churchill about 300 miles downrange and instruments will radio their bill.

the HOUSTON CHRONICLE

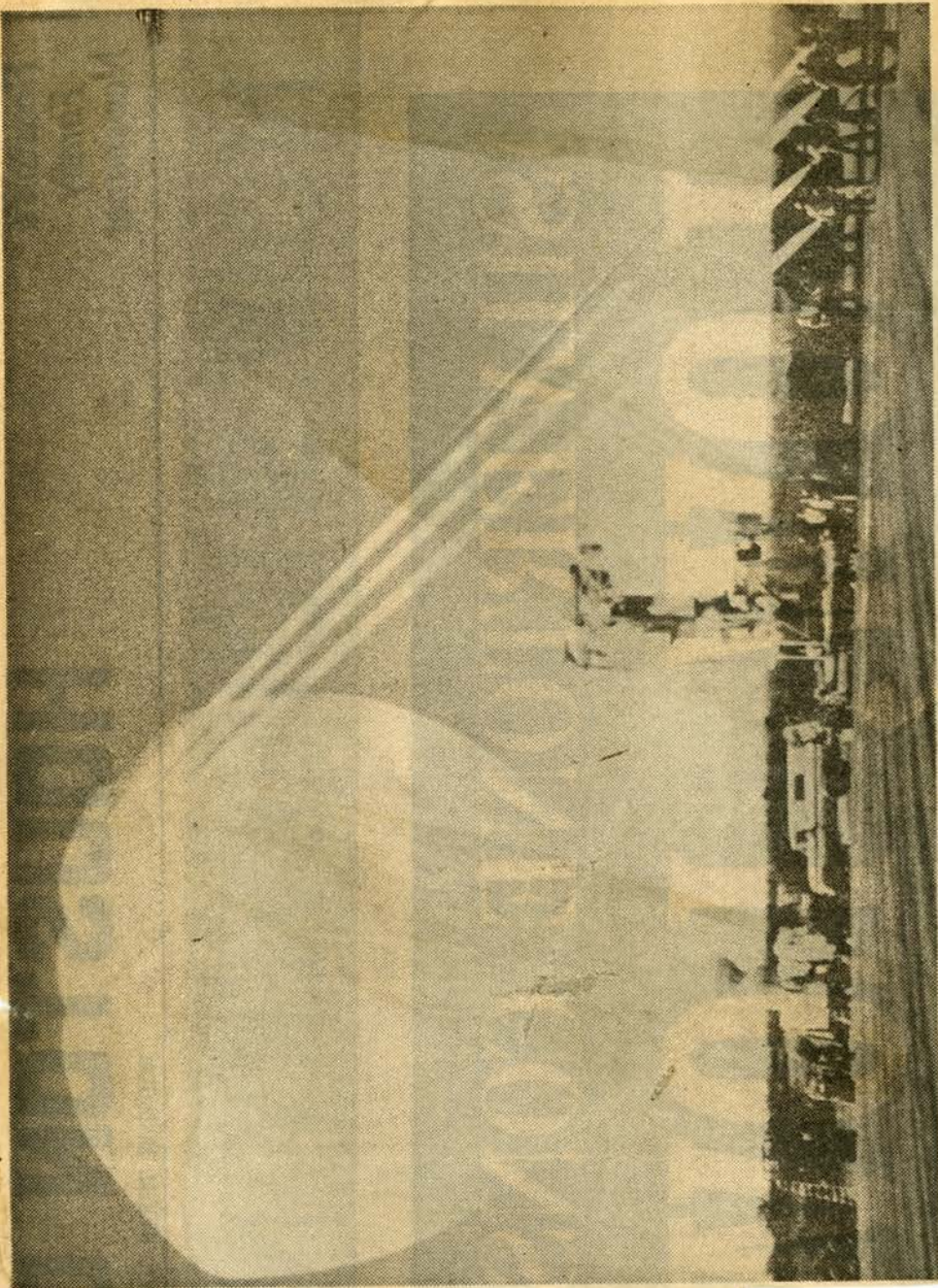
November 27, 1966

High Altitude Balloons Give Space Clues

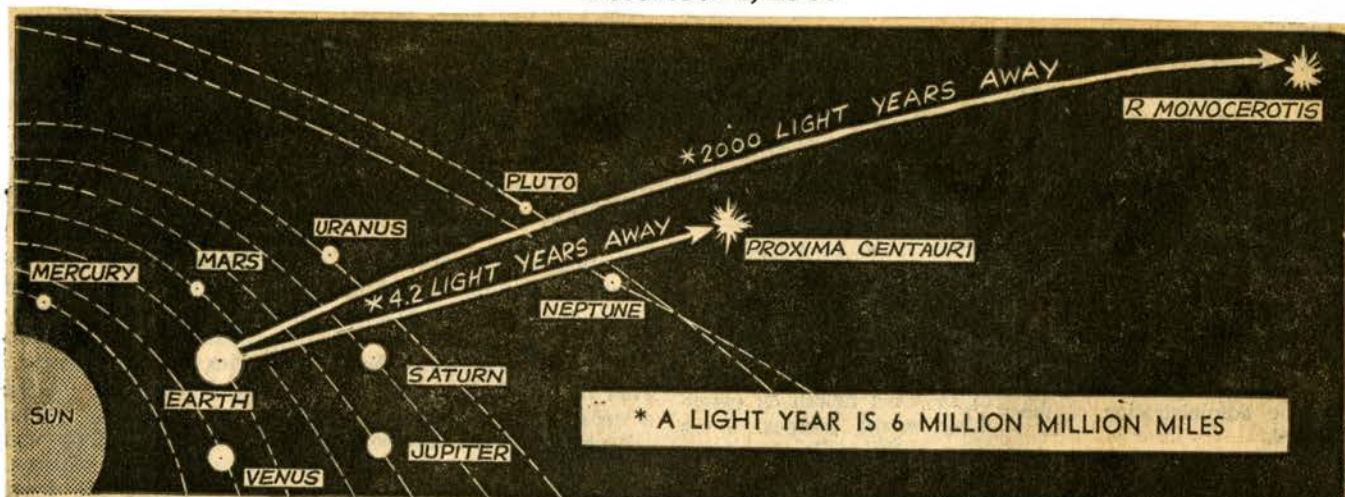
BY JOE CALVIT

Palestine, Texas (AP)—Scientists with space-age problems are finding many answers at a Texas installation which in three years has become the nation's busiest scientific balloon flight station.

Palestine by the National Center for Atmospheric Research have aided professors and astronomers from colleges and universities all over the country in their studies of the planets and stars, stratospheric conditions, gamma and cosmic rays and in dozens of other space experiments.



READY FOR LAUNCH AT PALESTINE, TEXAS, FACILITY
Busiest Balloon Flight Station in United States



New Star System Appears To Be Forming

Rice Scientists Reveal Discovery

By MARY JANE SCHIER
Post Reporter

Space scientists at Rice University revealed Saturday they have made the first observations ever reported of what apparently is a new stellar-planetary system now forming far out in the universe.

The discovery should provide astronomers with the long-sought missing link in their efforts to understand how stars evolve over millions of years.

Dr Alexander Dessler, chairman of Rice University's space science department, called the findings "perhaps the most significant development" in astronomy research in years.

IN EFFECT, the observations made by a group headed by Dr Frank J. Low confirm previous theories that our solar system really is not unique but one of several — maybe many — star-and-planetary systems.

Dr Low explained that while the bright celestial object his group observed "is just now being born, many millions of years hence it might resemble our own solar system."

Besides the specific observations of this object — which astronomers call R Monocerotis — Dr Low's team also



DR FRANK J. LOW
Holds PhD From Rice

looked at some 30 other far-away stars, at least 10 of which they found have similar properties as R Monocerotis.

CONCEIVABLY, each of these newly discovered young stars could develop into a stellar-planetary system in some ways comparable to the sun and its planets.

At any rate, the Rice group's discovery is expected to afford astronomers the first opportunity to really study the evolution of stars.

By observing a number of

pre-planetary formations, Dr Low said scientists should be able to establish a pattern or sequence for helping them understand how and exactly where stellar evolutions begin and progress.

"WE FEEL LIKE this truly is the missing link in studying the stars . . . a very exciting discovery," the dark-haired professor of space science said.

Dr Low holds a joint appointment at Rice and the University of Arizona in Tucson, where he maintains a home.

Working under grants given to Rice from the National Science Foundation and the National Aeronautics and Space Administration, Dr Low made his observations at the University of Arizona's Lunar and Planetary Laboratory.

THE FINDINGS, announced here Saturday by Rice officials, will be published in the English scientific journal *Nature*, expected to be released this week in the United States. Bruce J. Smith, a Rice graduate student who helped with the research work, co-authored the article.

Dr Low's group made its observations with a new kind of telescope which can provide firm and fine measurements of infrared light.

Before undertaking the astronomy study, Dr Low had developed a special detection instrument for use in the telescope, which was designed by Dr Harold Johnson of the Lunar and Planetary Laboratory.

DR LOW, WHO received his PhD in physics from Rice in 1959, said R Monocerotis is at least 2,000 light years from the earth. (A light year represents the distance light travels in a year, or 6,000,000,000 miles.)

The faraway star probably is very bright, perhaps almost 1,000 times as bright as the sun, he said.

Dr Low explained that his findings indicate a star is surrounded by a cloud of thick dust which absorbs and re-radiates the energy produced by its luminous core.

"WE HAVE known for some time that stars have to be forming all the time, but we had never seen one forming. Now we know why — there was dust around them.

"Very young stars were supposed to be very bright and you ought to see a lot of them. The reason why we could not now is clear, since the dust cloud was part of the evolution process," he said.

THE TRUCK is kept in radio contact with a "recovery plane," which takes off from the Palestine airport, just adjacent to the balloon flight station.

McCreary comments on the tricks played by winds in the stratosphere.

"They start shifting on us around September. We get them from the east during the summer, then they start coming from the west in September. Before there is any complete transition, the winds sometimes seem to be blowing in opposite directions at the same time.

"FOR INSTANCE, only a few weeks ago we sent a balloon up and after 24 hours, it had gone no farther than around Lufkin.



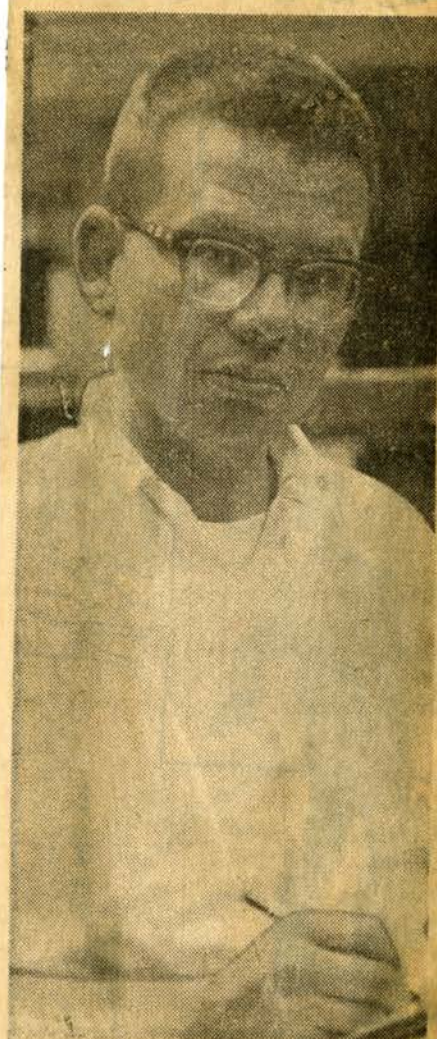
Students a big help ... Gerald Fishman

"On the other hand, we've had winds take our balloons as far west as almost the California boundary line and as far east as Wilmington, NC."

THE ELECTRONIC signals coming back from the Rice balloon indicate all is well so far. But other things can go wrong—such as batteries going dead that furnish power to the gamma-ray "telescope." And in the next few hours, this is what happened in the case of the balloon sent up by Dr Haymes and his graduate students.

Meanwhile, McCreary mentions that university scientists from all over the country are using the Palestine station. "We are averaging about 100 launches a year. I guess we could take care of 150. At the rate we're going, we'll be at capacity before too much longer."

The station is operated by the National Center for Atmospheric Research. NCAR is putting Palestine on the map—at least in the lofty circles of what's going on in the earth's atmosphere.



Man with a dream ... Dr Haymes at work

the HOUSTON POST
December 10, 1966

Rice Space Project Set In Arctic

Identical piggy-back payloads developed by Rice University space scientists will be used in a unique rocket research probe to be launched in mid-February from Fort Churchill, Canada.

The probe, termed Javelin Twins, will utilize a new concept for studying the mysteries of Arctic auroras, the luminous phenomena consisting of streamers or arches of light in the night skies.

THIS NEW concept involves use of two payloads, each identically instrumented with six powerful detectors, which will be launched together atop a four-stage Javelin rocket.

The probe will be fired directly into an Arctic aurora and out of the earth's atmosphere to an altitude of approximately five miles, explained the Rice scientists participating in the project, funded by the National Aeronautics and Space Administration.

As the rocket arcs into the aurora formation, one of the payloads will be separated from its twin by a spring mechanism to allow the two to follow the same trajectory but at different time intervals.

The identical instrumentation will make consecutive examinations of the energetic particles — the electrons and protons—that trigger the auroral display.

BY CORRELATING the two sets of measurements, the Rice group should be able to make the first definitive analysis of the characteristics of the energetic particles.

Dr Brian J. O'Brien, space science professor, heads the Rice project, much of which was developed by graduate student Larry Westerlund. Graduate students Jim Burch and Bob LaQuey designed two of the detectors to be carried in the payloads.

THE RESEARCH is aimed at learning more about the source of auroral energy, although many scientists say the sun provides the ultimate source for auroral displays.

This probe will be the second rocket launching scheduled in a single week by Rice space researchers. It will follow back-to-back the launch of a sounding probe designed to test the theory that the sun is the source of the aurora's energy.

Rice Experiment In Space Starts Next Week

Rice University scientists' equipment aboard the latest U.S. weather-communications satellite will probably be turned on early next week.

The Rice experiment, first one prepared by a Texas school for a space flight, involves measuring the convective current in the plasma with which the sun bathes the earth.

IT IS ONE of six environmental measurement projects aboard the Applications Technology Satellite-B mission launched Tuesday from Cape Kennedy. The combination weather observer-board-cast satellite was scheduled to reach its geostationary orbit about 22,300 miles high sometime early Saturday.

Dr John W. Freeman Jr., assistant professor of space science, is directing the Rice study with a \$212,000 grant from NASA.

ANOTHER RICE experiment in outer space will be conducted on the nation's first biological satellite, now scheduled for launch Wednesday from Cape Kennedy.

This study, under the direction of Rice biology researchers Drs Edgar Altenburg and Luolin S. Browning, will test the genetic effects of the weightless environment of space—through use of more than 10,000 fruit flies, some of which will be born during the satellite's three-day orbital journey.

HOUSTON CHRONICLE
Page 2, Section 1

Friday, February 10, 1967

Rice Gets \$200,000 Grant From NASA

Rice University has received Space Administration. The funds a \$200,000 sustaining grant from will be used for containing the National Aeronautics and space related research projects.

the HOUSTON CHRONICLE
February 10, 1967

Rice Rocket Launched By Students

Rice University graduate students today successfully launched a four-stage rocket 500 miles into the Arctic skies in a probe to study the relationship of the Northern Lights and the Sun.

Detectors on the payload will measure for the presence of helium nuclei particles and, if there, their ratio to hydrogen protons known to exist in the Aurora.

Rice graduate student David Reasoner led the student party to Canada for the shot. Dr. Brian J. O'Brien of Rice is the principal researcher in the project, which is part of a contract with the National Aeronautics and Space Administration.

Another rocket bearing two identically instrumented payloads will be launched next week.

2nd Rice Rocket Set For Launch

The second in a series of Rice University rockets was ready for launching at Fort Churchill, Canada, today as part of the university's study of the relationship between the Northern Lights and the Sun.

The first rocket was fired successfully Thursday.

Dr. Brian J. O'Brien, professor of space science at Rice and director of the auroral study under a NASA contract, said the first rocket probe functioned perfectly. It was lifted into an auroral formation about 500 miles above the Earth and radioed back "an abundance of scientific information," Dr. O'Brien said.

It may be two or three weeks before the data can be analyzed and conclusive results announced, he said.

Rice Rocket Probes Space Near Arctic

The first rocket probe in a new space research series by Rice University scientists was successfully fired Thursday from Fort Churchill, Canada, near the Arctic Circle.

Another rocket with a second Rice payload is on the pad and ready for launching sometime between now and the end of next week.

Thursday's rocket was lifted to an altitude of about 500 miles by a four-stage Javelin rocket. Its purpose was to determine whether the energetic particles that cause the mysterious auroral lighting displays may have been emitted by the sun.

The purpose of the second rocket launch is also to study the aurora.

the HOUSTON POST
February 10, 1967

While Others Cry 'Drain'

Houston Colleges Enjoy 'Brain Gain'

By **DONNIE MOORE SMITH**
Post Reporter

While other parts of the nation are screaming "brain drain" as the better teachers and students are going elsewhere for higher wages and more fringe benefits, Houston is on the "brain gain" end.

The Manned Spacecraft Center is like a magnet pulling in highly talented and trained people.

And while many of these people make academic contributions to local colleges and universities by lecturing and co-operating in research, they also add to the school budgets by enrolling their children as full-time students and themselves as part time.

TO CO-ORDINATE its growing operational interchange with colleges and universities, a new department has been established within the director's staff at the Manned

Spacecraft Center. Dr James Youngblood, a Rice University graduate, holds the new position of assistant for academic relations.

Rice University was cited by President Kennedy as one of the reasons for locating the Manned Spacecraft Center in Houston.

It has several NASA research projects underway in various departments. The Space Science Department has conducted a successful series of rocket probes into the ionosphere to study aurorae and the causes of air glow, and is studying variations in the earth's magnetic field through a Hydromagnetic Wave Observatory.

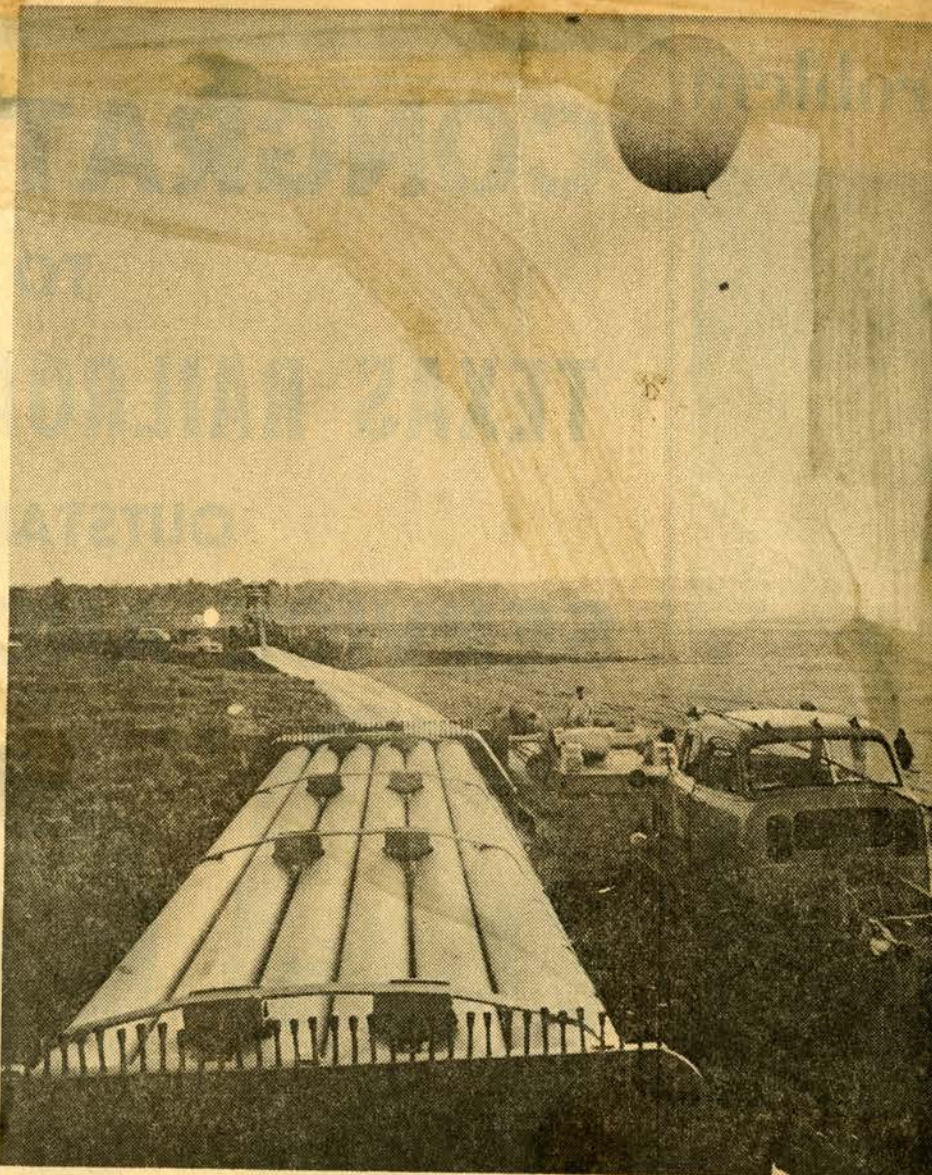
RICE SCIENTISTS are also studying the physical properties of exploded stars and other mysteries of outer space with gamma ray telescopes hoisted above the earth's atmosphere by balloons.

The first university in the nation to receive approval to design and build its own satellites under the new NASA University Explorer Program was Rice University. Two OWL satellites of Rice are scheduled to be launched in 1967.

Rice officials say a pleasant, informal interchange exists between MSC and Rice, and each uses the special capabilities of the other.

Rice scientists, both faculty and students, make frequent use of the vast array of test facilities at MSC. Rice professors, in return, are often called upon to help develop full utilization of various pieces of MSC equipment and to instruct NASA personnel in its operation.

A **RICE** associate professor of space science, Dr Curtis Michel is currently on leave of absence while serving as scientist - astronaut in the manned spacecraft program. But he is continuing to do research at the university.



RICE SCIENTISTS LAUNCH 55-STORY HIGH BALLOON FROM PALESTINE
Helium Tubes Pumped Gas Into Main Balloon Before Flight

Another scientist - astronaut, Dr Edward Gibson, has recently been appointed to the Rice staff as space scientist to carry out research work.

The proximity of Rice to MSC has proven extremely beneficial to the development of several Rice research projects. Two are to be included among experiments that will be placed on the surface of the moon by American astronauts.

Dr Michel is co-investigator in one of the projects with Dr John Freeman, assistant professor of space science.

THE OTHER experiment is headed by Dr Brian J.

O'Brien, professor of space science.

Dr Dieter Heymann, associate professor of geology and space science, has recently been named as one of the principal investigators who will study geological samples returned by astronauts from the moon.

Several employees of MSC are enrolled as part-time students taking graduate courses at Rice. Many full-time Rice students, on the other hand, have been employed in a 10-week summer intern program at MSC.

Rice is not the only university to derive educational benefits from MSC. Next summer

the HOUSTON CHRONICLE
March 19, 1967

Balloon Test Called 'Good Experience'

Rice University scientists said today they gained good experience and additional data from their latest balloon flight to study the remnants of an exploded star.

The 55-story-high balloon hoisted a gamma ray telescope to an altitude of 130,000 feet Sunday during its 11-hour flight. The balloon was launched at Palestine, Texas, and came down near Cisco, about 215 miles away.

About eight hours into the flight, the motor turning the telescope went out.

This was the sixth in the series of balloon flights probing the Crab Nebula, the apparent gaseous remains of a star that exploded in 1054. It is about 3500 light years from Earth.

Rice Rocket Probes Northern Lights

Two Rice University scientific payloads were rocketed into the Arctic skies Saturday to radio back information designed to help determine the cause of the Northern Lights and the source of their radiation.

The twin payloads soared about 500 miles high on a four-stage Javelin rocket from Fort Churchill, Canada, near the Arctic Circle.

The launch, one of a series, is financed by a National Aeronautics and Space Administration grant. The project is headed by Dr. Brian J. O'Brien, space science professor. The information will be recorded on magnetic tape and analyzed at Rice.

Dr. Goldwire Of Rice U Awarded Astronomy Grant

Dr. Henry C. Goldwire Jr., of 2322 Southgate, a teacher of physics and space sciences at Rice University, is among 10 American university faculty members who have been awarded grants for the first summer institute in observational astronomy.

The program, which begins Monday at the State University of New York at Stony Brook, is sponsored by the National Aeronautics and Space Administration.

The aim of the institute is to acquaint future workers in space astronomy with methods and results of ground based astronomical research.

Dr. Goldwire, who received his Ph.D. at Rice, was the winner of the four-year Chance Vought Scholarship to Rice in 1959.

Huge Rice Balloon in Fine Flight

Rice University's gigantic balloon, armed with instruments searching for gaseous remains of the Crab Nebula, sailed about 198 miles through the sky Sunday from Palestine to near Cisco.

The flight was described as a "good scientific flight" by Alfred Shipley, who is in

charge of launching and recovery of the balloon that is as tall as a 55-story building.

He said a recovery crew was at the scene late Sunday to pick up the instrument package and other gear.

The balloon was designed to reach an altitude of 130,000 feet.

Dr. Robert C. Haymes, associate professor of space science at Rice, is in charge of the research into the remains of a star that was observed to explode in 1054.

The launch was at 6:15 AM and the instrument package

parachuted to earth about 5:30 PM.

the HOUSTON POST
June 5, 1967

UNDER NASA GRANT

Rice U. Scientists Making Space Debut

the HOUSTON CHRONICLE
November 10, 1963

BY TOM MULLVANY

Chronicle Reporter

Rice University scientists will make their debut into space next month, financed by a grant from NASA to the Space Science Department, President Kenneth S. Pitzer announced Saturday.

The inaugural will come about the middle of next month with the launching of the first of four rockets loaded with instruments to search the atmosphere 100 miles above Wallops Island, Va.

Three additional rockets, also laden with instruments, will be sent aloft above Ft. Churchill in the northern part of Manitoba, Canada, during January and February.

Designed at Rice

The instrument-laden payloads, each weighing 50 pounds, are being designed, constructed and tested at the Satellite Techniques Laboratory at Rice. They will be launched by NASA's Nike Apache rockets.

This work is already well advanced because Rice dipped into its own funds, in anticipation of the grant to set up the laboratory and equipment early last summer.

Dr. Pitzer explained: "By buying the equipment early in the summer with Rice University funds, we saved several months in our educational and research programs."



PHYSICIST DR. O'BRIEN LECTURING ON ROCKETRY
Prepares Rice Students for Spots Into Space.

Prime Goal

The prime goal in this quest is to determine the answers to questions which have been puzzling scientists for several decades since the first recorded detection of the weak glow seen in the sky during dark phases of the moon.

Scientists have labored individually and collectively to solve this problem but the answers still elude them. The program at Rice will mark the first effort in this field by a university in the Southwest.

Heading the Rice program is Dr. Brian J. O'Brien, professor of space science, who came here from Dr. James Van Allen's team of physicists at Iowa State University.

New Approach

For O'Brien, the work will constitute a continuation of studies he had been pursuing for four years while working with Van Allen, discoverer of the Van Allen Radiation Belt.

But, it will mark a new approach to the problem for, as

Dr. Alexander Dessler, head of the Rice Space Science Program, said: "This will be the first rocket probe to obtain simultaneous definitive measurement of light and particle energy in airglow."

Educational Tool

This is a one-year grant, Dessler explained, and while

some of the grant will go for ground equipment which will be used in later space experiments, "the major portion is related directly to the gathering of scientific evidence on aurorae and the sources of airglow."

Besides its immediate objective of this research, Dr. Pitzer said, the program will provide a valuable educational tool for the development of Rice of space research scientists and satellite engineers.

It will assist in building up a team of faculty, staff and students with experience in rocket work which will prepare them for later satellite research projects.

Graduate Program

Five members of the present staff and faculty already have had extensive experience with satellites and will use their experience in preparing the graduate students for their own space investigations.

Responsibility for the design and construction of separate instrument devices for the payload package has been assigned to four graduate students.

These are Michael Trichel of Shreveport, David Criswell of Rhom, Texas, Henry Goldwire of Irving, and David Cummings of Wichita Falls. They will work under the supervision of Curtis D. Laughlin, chief of the satellite laboratory and engineers Ranton Trachta and W. S. Carey.

Analyze Data

Later these graduates will be called on to analyze the data gathered by their instruments for use in completing their MS or PhD thesis requirements.

Observed O'Brien: "Other students from Electrical Engineering are also working part-time on the construction of circuits within the instruments. Thus, the experiment is providing the best possible experience to the most students in the shortest possible time."

INDUSTRIAL RESEARCH

May, 1967

Honorable Mention – Laboratory of the Year

- Maximum flexibility in the use of space.

- Centrally located service facilities such as the library, a restaurant, medical clinic, personnel offices, and reproduction department.

- The ability to make extensive changes in laboratories with limited interruption of work.

- Minimum pedestrian traffic past and through offices and laboratories.

- A central air-conditioning system.

- Minimum distance from parking lots to the buildings.

- A road system which would eliminate pedestrian traffic across roads, plus minimize traffic congestion on public roads.

- Construction and operating costs were to be as low as possible.

Cite functional beauty

In his design of the new facility, Saarinen not only captured all of the necessities as outlined above, but from an aesthetic viewpoint, the building he created is unrivaled as a formal setting for a technological structure.

And so it is by virtue of the beauty and functionalistic design of the Bell Telephone Laboratories at Holmdel, that a panel of *Industrial Research* Editorial Advisory Board members and prominent architects, selected this facility as the first annual "I-R Laboratory of the Year."

The Editorial Advisory Board representatives consisted of Dr. James Hillier, vice president, research laboratories, Radio Corp. of America; Dr. Glenn A. Nesty, vice president, research and development, Allied Chemical Corp.; and Dr. Clyde E. Williams, former president, Battelle Memorial Institute.

The architect's viewpoint was represented by Harold C. Bernhard, partner, Shreve, Lamb, & Harmon Associates, New York; Robert W. Cutler, partner, Skidmore, Owings & Merrill, New York; and Dean Kenneth A. Smith, School of Architecture, Columbia University.

Together with Dr. Victor J. Danilov, executive editor, *Industrial Research*, this group selected the Laboratory of the Year and cited two others for honorable mention from among those R&D facilities completed since Jan. 1, 1966.

Honorable mentions went to the National Center for Atmospheric Research Bldg. in Boulder, Colo., and the Rice University Space Sciences & Technology Laboratory in Houston.

Similar to the Bell Telephone Laboratories' external corridors and the NCAR building's "alternative route," the Rice University Space Science & Technology Laboratory boasts an outside passageway surrounding the hub of research activity.

The Texas laboratory was honored on the basis of its extremely tasteful contemporary design. The clean character of the \$1.8-million building is attributed to Houston architects George and Abel B. Pierce. The unique exterior of the 7,500 m² (84,000 sq ft) building provides an inviting picture of practical and functional design.

As pointed out, arriving at a winner in such a competition was not a simple task. There were many outstanding laboratories among the finalists. Included in the list were:

the HOUSTON CHRONICLE

July 28, 1967

Rice Payload Launched Aboard Spacecraft

An experiment prepared by assistant professor of space science, under a three-year contract from the National Aeronautics and Space Administration, was launched today from Vandenberg Air Force Base in California.

The object of the Rice payload is to study cosmic radiation that strikes the spacecraft as it circles the Earth at an altitude ranging up to 575 miles above the surface. The satellite contains more than a dozen experiments.

The Rice experiment is directed by Dr. Hugh Anderson

will the Earth and returning science-field lines extend farther from the surface.

Dr. Anderson said the Rice experiment also may help to determine the length of the magnetic tail—an elongation of the Earth's magnetic field that pierces outward into space over the night side of the planet.

Scientists have not yet been able to find precisely how far the Earth's magnetic outward this "tail" goes.

The plan calls for the satellite to orbit the Earth in a north-south direction; a nearly polar orbit. This will permit the instruments aboard the spacecraft to pick up measurements in the Earth's polar regions, able to find precisely how far the Earth's magnetic outward this "tail" goes.

the HOUSTON CHRONICLE
January 14, 1968

BY ARTHUR HILL

Chronicle Science Editor
© 1968, Houston Chronicle

Space scientists at Rice University have discovered what appears to be a new source of energy in the remains of a stellar explosion observed a thousand years ago on Earth.

Detectors flown in a balloon high above the plains of Texas have found gamma rays, a form of atomic radiation, pouring from the exploded star, now known as the Crab Nebula, with an intensity for which there is no known explanation.

This is the first time a stellar object has been proven to emit gamma rays. The discovery may open up a new kind of astronomy just as the discovery that some objects in the sky emit radio waves formed the beginning of radio astronomy in the late 1930s. X-ray astronomy was also begun in a similar fashion a few years ago.

Nebula Unusual

The Crab Nebula is unusual in that it radiates all types of waves, from visible light through radio, X-ray and now gamma rays. Indeed, the Rice scientists were unable to find how far up the radiation ladder, or spectrum, the Crab Nebula is emitting energy.

"There are evidently objects in nature that are producing energy by some process unknown to us," said Dr. Robert C. Haymes, associate professor of space science at the university.

The results of the Rice experiment are reported in this month's issue of the *Astrophysical Journal*. Haymes shares credit with D. V. Ellis, for whom this is a doctoral thesis, G. J. Fishman, J. D. Kurfess and W. H. Tucker.

The research is sponsored by the U.S. Air Force.

Rice has made six balloon flights to study the Crab Nebula beginning in October, 1965. According to Chinese observers of the time, the star

that produced the nebula exploded in the 11th century.

Last Flight

The last, and most successful of the Crab Nebula flights, occurred June 4, 1967, and is the basis for the report. The equipment is flown in a balloon to lift it above most of Earth's atmosphere, which absorbs gamma radiation.

On June 4, the balloon, released from the National Center for Atmospheric Research at Palestine, Texas, ascended to 128,000 feet and remained there for about 8 hours, drifting westward. It was recovered near Cisco, Texas.

While in flight, the gamma ray detection device was aimed at the Crab Nebula for 10 minutes and then away from it for 10 minutes. The difference between the two readings represents the gamma radiation output of the exploded star.

The Crab Nebula is between 3500 and 6000 light-years away (a light-year is the distance covered by light, which travels at 186,000 miles a second, in a year). This places it in the same galaxy as the solar system.

Oval-Shaped

To the eye, the object is a wispy, roughly oval-shaped splotch on the sky. It is about 6 by 3 light-years across. The X-rays emitted by the nebula appear to come from a nucleus within the object that is about 1 light-year in size.

It may be, Haymes suggested that the gamma ray source lies somewhere inside this nucleus.

The scientists have examined — and discarded — all known theories for the production of gamma rays. There are basically four types of theories.

One is radioactivity, but by its very nature radioactivity tends to release its energy as sharply defined wavelengths.

(See BALLOON, Page 26)

Balloon Detects Rays From Exploded Star

The detector found energy emitted at all wavelengths.

Moreover, the total energy output from the nebula is about 50 times greater than could be expected from radioactivity, Haymes said.

Another theory is that the energy may be coming from a neutron star at the center of the nebula. No one has ever seen such a star, but their existence has been postulated.

Here again, the wavelength pattern of the energy does not match the neutron star picture, which, if it exists, would have the mass of the sun packed into a dense sphere 8 miles across and glowing gamma ray hot at a temperature of 1 billion degrees.

Glowing Hot

The same can be said of the theory that the entire nebula is at a temperature of billions of degrees and glowing gamma ray hot, Haymes said.

The only theory that fits even remotely, he added, is the "synchrotron" idea, which supposes that the nebula is acting like a huge atomic accelerator speeding up electrons until they give off gamma ray energy.

The problem here is that an electron traveling this fast would last only about a year.

Civilized Race

The scientist noted that the energy being generated by the Crab is about the same as if a planet about the size of Earth had been totally destroyed, converting all its matter into energy.

This brings up the possibility of a civilized race, far superior to humans technologically, somehow making a "mistake."

This cannot be ruled out, but it would be difficult, perhaps impossible, to prove, Haymes said. Some natural explanation seems more likely.

"I am frankly baffled. All I can say is that the experiment seems to have cast into serious doubt all of the present theories," he said.

the HOUSTON CHRONICLE
March 3, 1968

Rice Scientists Launch Rocket

Rice University scientists Saturday successfully launched a second Javelin rocket into the Northern Lights over Fort Churchill, Canada, near the North Pole.

The rocket reached an altitude of about 500 miles, separated and passed through the auroral formation, measuring the dispersion of electrons and protons which turn the sky into brilliant colors.

The experiment was sponsored by a research grant from the National Aeronautics and Space Administration.

The first Javelin was launched March 17, 1967.



Launch truck nicknamed "Tiny Tim" and its crew wait for completion of night balloon experiment at research center in West Texas.

SALLYPORT

April 15, 1968

SUCCESSFUL LAUNCH OF SPACE PROBE BALLOON

Reached 126,000 feet

A giant helium-filled balloon rose swiftly into the sky at Mildura last night carrying with it a \$100,000 payload of instruments to study gamma radiation in deep space.

At 9.22 last night the 306ft diameter balloon, measuring more than 500 ft in height, was hovering at 126,000 feet, four thousand feet short of its top estimated ceiling.

Last night's launching, for research scientists from Rice University, Texas, USA, was described as a success.

The previous attempt to get a giant balloon into the air was hindered on the launching night when the balloon rose to only 6000 feet after 36 minutes in the air.

The fault, in the first launching to study gamma radiation in the Southern Hemisphere, is believed to have been caused by poor quality helium, a fault which has upset some overseas experiments but previously not worried Australian balloon launchers.

4.30 p.m. launch

Yesterday's balloon, with its 1000 lbs payload, left the Balloon Launching Station at 4.30 p.m. and soon reached 93,000 feet.

At 6 p.m. it was getting dark on the ground, but the balloon, some 30 miles east of Mildura, was still plainly visible.

It would have stayed visible for longer — shining like a yellow moon — if it had not been for dense cloud cover.

The cut-down had been timed for 1.30 a.m. today.

It was thought that the balloon and its payload would land somewhere near Griffith, New South

Wales, short of the estimated touch-down point of Hillston.

A recovery team left Mildura Airport at 2 a.m. today to retrieve the equipment.

The U.S. scientists said the Mildura Balloon Launching team were on stand-by last week and at the weekend waiting for suitable weather conditions.

Wind conditions in the upper atmosphere yesterday afternoon moderated to an acceptable 30 knots to allow the flight to take place.

Last night's launch followed a week-long wait by Dr Robert Haymes and his team—Drs D. Ellis, J. Kurfess and Mr D. Oehme.

The flight was the second in a series of four planned from Mildura.

Dr J. Kurfess, a spokesman for the team, headed by Dr Robert Haymes, said last night that conditions for the first of a series of four exploratory flights in Australia looked favorable.

"Forecasts indicate that ground-level conditions over the launching field will moderate today.

"High altitude winds, too, should have dropped to an acceptable level by that time," he said.

Dr Kurfess said that late last week 124-knot winds had been blowing in the upper atmosphere.

A helium-filled balloon, more than 36 feet in diameter, will be used to take a gamma ray scanner 25 miles above the earth.

The scanner and allied radio transmitter will relay its finding back to the station at Mildura where all information will be taped and later correlated in the U.S.

Dr Haymes (Associate Professor of Space Science) said last week that the work of his team (Drs D. Ellis and J. Kurfess, research associates, and Mr D. Oehme, electronics en-

gineer) from Rice University, Texas, was the first step to discovering how these unknown power sources, in some instances billions of light years away from earth, could be harnessed for use by man.

He said the sources were far beyond the solar system, and even beyond the Milky Way. "The fact that we can see them at all means they must radiate an

awful lot of energy," said Dr Haymes.

"Our U.S. tests have revealed that there is some gamma radiation from outside sources," he said.

Dr Haymes added that Australia had been chosen for a continuation of the Palestine, Texas tests because it was only possible to observe many of the sources in the Southern Hemisphere.

SUNRAYSIA DAILY

April 25, 1968

About 100 people saw the launching at 10.25 p.m.

When this edition went to press, men of the Balloon Launching Station had still not decided whether to allow the balloon to continue on its ascent, or to destroy it by radio command and allow its valuable payload to drop to earth by parachute.

At midnight the balloon had reached 28,000 ft and was about 14 miles east southeast of Mildura.

The balloon itself had cost about \$6000. The helium used to fill it cost another \$3000.

Neither of these items would have been recoverable even if the flight were a success, but the big worry early today was the likely fate of the \$100,000 payload of instruments the balloon was carrying.

Using radar, the trackers of Mildura Weather Station were able to tell the direction of the balloon and its distance from Mildura.

This was all right as long as the balloon's payload was in the air. Once the payload was cut free from the balloon, the station would have to rely on its radars continuing to operate so it could be found by direction finding apparatus.

If the balloon was allowed to continue its flight the risk then would be how far it would be blown once it

climbed into the strong westerly jet streams.

Even if the flight had gone as planned the payload would have dropped as far away as Roto, 200 miles northwest of Mildura near the Broken Hill Sydney railway.

But caught in a slow ascent by the jet streams, the balloon could have been blown well beyond this point.

The balloon was sent up by the station for scientists of the Rice University, Texas, who are carrying out experiments on gamma rays for the U.S. Air Force Office of Scientific Research.

They had hoped to get information from their scanning equipment that would help pinpoint the source of powerful gamma rays from outer space well beyond the solar system.

Last night's flight was to be the first of four planned for Mildura.

Must be found

But recovery of the equipment will be necessary before the others can go on.

The balloon used last night was the biggest sent up here. It measured just over 500ft from its top to the bottom of the payload beneath it.

When fully inflated the balloon would have been 306ft in diameter. Its surface was made up of more than six acres of polythene sheeting.

The payload was also the biggest and the heaviest attempted here. Its base was 9ft square and it weighed about 1000 lb.

The launching technique used last night was new. Instead of the launching truck being driven under-

neath the rising balloon for launching from a rear-mounted platform, it remained stationary until the balloon rose over it for launching from a platform mounted over the front of the truck.

Everything went well with the early stage of the launch. Then just after the payload was transferred from the truck to the balloon the payload swung viciously and bumped heavily against the truck platform.

Flight leader Mr Don Scott, of San Mateo Avenue, Mildura, who was at the top of the platform directing the release, was hit by the payload as it swung. Main impact of the blow was from the crinkled paper pads at the base of the payload and he was not seriously hurt.

Hovered

The payload was transferred to the balloon successfully, but instead of rising rapidly the balloon hovered for about five seconds with the payload about 20 ft. from the ground. Then it rose slowly and disappeared into the night.

Immediate tracking of the balloon was not possible because a red flashing light beneath the payload had not been switched on.

The balloon drifted in the direction of Nichols' Pt and over the populated area at around 500 ft.

Had the flight gone normally, the recovery of the payload would have begun at the estimated impact time of 10.15 a.m. today.

It is not known when the impact time will be now if the flight is allowed to continue.

May 7, 1968

SPACE PROBE FLIGHT PUZZLE

"Slow" balloon cause still a mystery

Technicians of Mildura Balloon Launching Station still did not know last night what caused Tuesday night's high altitude balloon to rise at a slow rate.

Because of the behavior of the balloon the flight was only a partial success — although scientists say they did get about an hour's scanning of outer space with their apparatus.

The balloon should have climbed to 135,000 ft in about 2½ hours, and should then have floated for about eight hours while the equipment went to work to scan distant space to try to pinpoint the source of gamma rays.

But it was still climbing about 100ft a minute at 8.50 yesterday morning when pre-set timing mechanism cut the payload away from the balloon.

At this stage the balloon was about 126,000 ft above the eastern limits of the Murrumbidgee Irrigation Area.

Near Temora

Forty-five minutes after cut-down, the payload landed in timbered country about 10 miles west of Temora, 285 miles east of Mildura.

Dr J. Kurfess, one of the American scientists working on the experiment, was with the recovery party on the ground.

After a brief inspection of the payload he reported by radio that it had suffered only slight damage on impact and that the damage was nothing to worry about.

The recovery crew had set off from Mildura about 2 a.m. yesterday. It reached

the payload about 10.45 a.m.

Yesterday afternoon an aircraft from Mildura took drivers Jeff Walker and Trevor Gili to Griffith to relieve the recovery vehicle drivers Don Scott and Harry Broad.

These four men, who also make up the major part of the balloon launching crew, have been with the Mildura station since it began putting up balloons more than seven years ago.

Tuesday night's flight was the 394th in which they have participated here.

When the two recovery drivers were relieved they had travelled about 470 miles since setting out early yesterday.

Dr Kurfess and a radio technician, who were with the recovery crew, also came back to Mildura by plane yesterday afternoon.

Dr Kurfess is one of four Americans on the space probe. They are doing the work for Rice University,

Texas, under sponsorship of the U.S. Air Force Office of Scientific Research.

Another balloon flight in the present series will be attempted just as soon as the equipment is again made ready and weather conditions are suitable.

Two other flights are also scheduled.

Panel Recommends Dumping Rice Satellite Project

Program Plagued By Delays

BY ARTHUR HILL

Chronicle Science Editor

A blue-ribbon committee of scientists Saturday recommended cancellation of Rice University's Owl Satellite program.

The recommendation goes to the National Aeronautics and Space Administration.

The program has been plagued with delays and burgeoning costs. Originally scheduled for launch in January, 1969, the satellite program is at this point 1½ years behind schedule.

The chief project scientist resigned from Rice last September. The university proposed that a new management team be allowed to continue the effort.

The 18-member committee met Friday and Saturday at Rice to discuss whether the scientific aims of the satellite program are still valid in view of the delay.

Although the space agency could overrule the committee's decision, it has never previously done so.

At least \$3.5 million of the \$4 million budget for the Satellites has been spent, according to Dr. Alexander Dessler, head of the department of space science at Rice.

Had the project continued, a member of the new group that would have managed the program estimated the total cost would have run from \$8 to \$11 million.

The scientists debated the program until some of them had to leave to make airplane connections Saturday afternoon. This, Dessler said, indicates the vote was close and the decision a difficult one.

No major objections to the experiment proposed for the Owl were raised during two intensive periods of questioning, Dessler added. But members of the committee did wonder if better ways of accomplishing the same scientific goals were not available considering progress made since the original proposal was made.

First One Visible

Rice Astronomers Discover Pulsar In Crab Nebula

BY ARTHUR HILL
Chronicle Science Editor

Rice University space scientists today announced that fluctuations in high-energy atomic particles from the remnants of an exploded star match the "blinking" on-off pattern of a pulsar.

Pulsars are so named because they transmit bursts of radio waves on an incredibly regular cycle.

In looking at the exploded star, called the Crab Nebula, astronomers found a radio source sending out bursts at 30 times a second and a source of light winking at the same rate.

The Rice discovery of the pulsating atomic particles, called gamma rays, indicates that the pulsar—the first to be seen as well as heard—is also radiating at the high end of the energy spectrum.

Official Announcement

"The discovery of a gamma-ray pulsar in the Crab Nebula gives a new impetus to the entire field of gamma-ray astronomy," said Dr. A. J. Dessler, chairman of the space science department at Rice.

"The clues discovered by astronomers at Rice are important steps in giving man a better understanding of the nature of his universe," Dessler added.

The discovery of the gamma-ray pulsar was officially announced in Rome, Italy, by Dr. Robert C. Haymes, associate professor of space science at Rice.

He is attending a symposium on gamma and X-ray as-

tronomy sponsored by the International Astronomical Union.

Discovery Supports Theory

Finding a pulsar that emits radio, light and gamma radiation furnishes further support for the theory that pulsars are incredibly dense neutron stars; a rapidly spinning kernel of matter and energy about 10 miles in diameter left by a dying star.

The Crab Nebula is a cloudy object 6500 light-years away that was formed when a star exploded in 1054 A.D. The pulsar can be seen in the midst of the cloud and, if the neutron star theory is correct, is located in the area from which the star exploded.

A light-year is the distance light travels in one year at a speed of 186,000 miles per second.

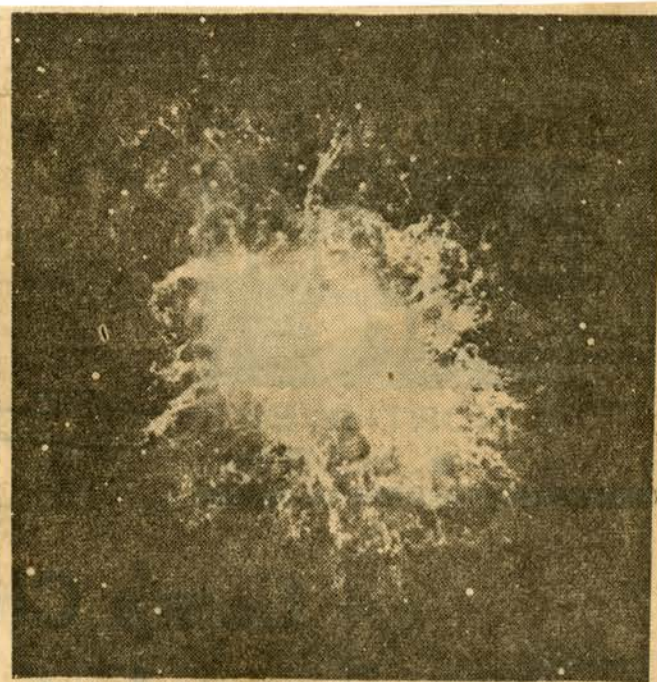
Data From Balloon

Haymes and two graduate students, Gerald J. Fishman and Frank R. Harnden, found the gamma-ray pulsar by re-examining electronically, with a computer, tape-recorded data gathered from a high-flying balloon experiment June 4, 1967.

The balloon carried a gamma-ray detector over West Texas at an altitude of 26 miles. Gamma rays do not penetrate to the surface of the Earth. They are stopped by the atmosphere.

The gamma-ray pulsations are very faint, but the Rice scientists found them by knowing from radio and optical observations what pulsation intervals to expect.

the HOUSTON CHRONICLE
May 9, 1969



CRAB NEBULA SOURCE OF GAMMA-RAY PULSAR
Pulsar Discovered by Rice U. Astronomers

the HOUSTON POST
May 9, 1969

Rice Unlocks Celestial Clue

By HENRY HOLCOMB, Post Reporter

Rice University scientists have achieved a history-making discovery that will give mankind bold new clues about the nature of the universe and what happens to a dying star.

They have discovered the existence of a gamma-ray pulsar originating in the remnants of a star that exploded in the year 1054 AD—the Crab Nebula.

THE ANNOUNCEMENT of this historic discovery was scheduled to be made Friday morning to the International Astronomical Union Symposium on Non-Solar Gamma and X-ray Astronomy in Rome, Italy, by Dr. Robert C. Haymes, 37, associate professor of space science at Rice.

Dr. Haymes was assisted in the work that led to the discovery by Gerald J. Fishman, 26, of Saint Louis, and Frank R. Harnden Jr., 23, of Dallas, both graduate students at Rice. The project was financed by the U.S. Air Force Office of Scientific Research.

The finds were made through an exhaustive computer analysis of data recorded nearly two years ago by a Rice balloon probe 26 miles above the earth's atmosphere.

RADIATION FROM THE Crab Nebula was found as a result of the probe, and reported to the scientific community. But the historic discovery to be announced Friday was not made until about three hours of data recorded on magnetic tape was restudied this spring.

The existence of pulsars was not discovered until 1967, several months after the balloon flight. These pulsars, regular

radio signals, were first nicknamed "little green men" (or LGMs) because for a time scientists thought they represented

See DISCOVERY on Page 16



RICE PHOTO OF CRAB NEBULA
Source of Gamma-Ray Pulsar

Continued From Page 1
an attempt at interplanetary communication by life in another solar system.

THIS THEORY was quickly ruled out. A year ago scientists suggested that neutron stars might be the source of the radio signals.

Last October optical astronomers spotted what some call "searchlight pulsars" in the Crab Nebula. This prompted the Rice scientists to go back to their Crab Nebula data from the 1967 balloon flight.

The neutron star producing the pulsar from the crab, if present theory is correct, is an incredibly condensed star which has a diameter of only about 12 miles and a mass the equal of seven-tenths of the earth's sun.

THE "SEARCHLIGHT" pulsar spotted by the optical astronomers, using traditional telescopes, turns itself on and off 30 times per second.

The radio signals discovered by the Rice scientists pulsate at the rate of 30 times per second. These two facts lead scientists to believe the neutron star sending the light flashes and radio signals is spinning at the incredibly fast rate of 30 revolutions per second.

Dr. Haymes said the energy to produce just one of these radio pulses is equal to the amount of electrical power that could be turned out by all present generating facilities on earth during the next 10 million years.

THE LIGHT flashing on and off 30 times a second is brighter than the earth's sun, he said.

In order to prove the existence of a gamma-ray pulsar and to document the slow-down rate of the pulsar, the data recorded during the balloon

flight had to be broken down into nanoseconds (astronomical unit equal to one billionth of a second and fed into the huge computer at Rice.

Many correction factors had to be written into the computer program, Dr. Haymes said. Such things as the position of the earth around the sun, the earth's rotation, and the position of the balloon had to be timed to the nearest billionth of a second.

THE NEW PULSAR discovered here radiates faster than any previously known pulsar. The slow-down rate data gathered by the Rice scientists will enable scientists to determine how long the pulsar will last.

The radio signal from the neutron star, which is 2,500 light years from earth, had to be weeded out of static just about as strong as the signal itself.

NASA, RICE TO SEND 4 ROCKETS ON SPACE STUDY

HOUSTON, Nov. 10 (AP) — The space agency and Rice University are teaming up to send four rocket probes into space to study aurorae and airglow.

Kenneth S. Pitzer, Rice president, announced Sunday the university has received a \$200,000 grant from the National Aeronautics and Space Administration to conduct "rocket-borne measurements of aurorae and airglow and study their causes."

Rocket Probes

Using the four rocket probes, Dr. Brian J. O'Brien, professor of space science at Rice, intends to measure light and atomic particle energy in both airglow and aurorae and finally determine if, as some scientists believe, airglow is really a weak permanent aurora or an entirely different and independent space phenomenon.

The NASA grant will finance the major portion of the experiments in the space probe series to be called "Sammy I, II, III and IV," after the school's mascot, "Sammy, the owl."

3 Payloads

The first rocket probe will be 100 miles into space and will be launched about mid-December from Wallops Island, Va. The remaining three payloads of instruments will be fired into aurorae from Fort Churchill, Canada, in January or February.

The payloads are being designed, constructed and tested in the satellite techniques laboratory at Rice.

The 50-pound instrument packages will be launched by NASA's Nike Apache rockets from NASA launch sites.

BEAUMONT, TEXAS
ENTERPRISE
November 11, 1963

ODESSA, TEXAS
AMERICAN
November 10, 1963

NASA Gives Rice Airglow Study Grant

HOUSTON (UPI)— Rice University President Kenneth Pitzer said Saturday the National Aeronautics and Space Administration (NASA) has given the school a \$200,000 grant for a study of the airglow in space.

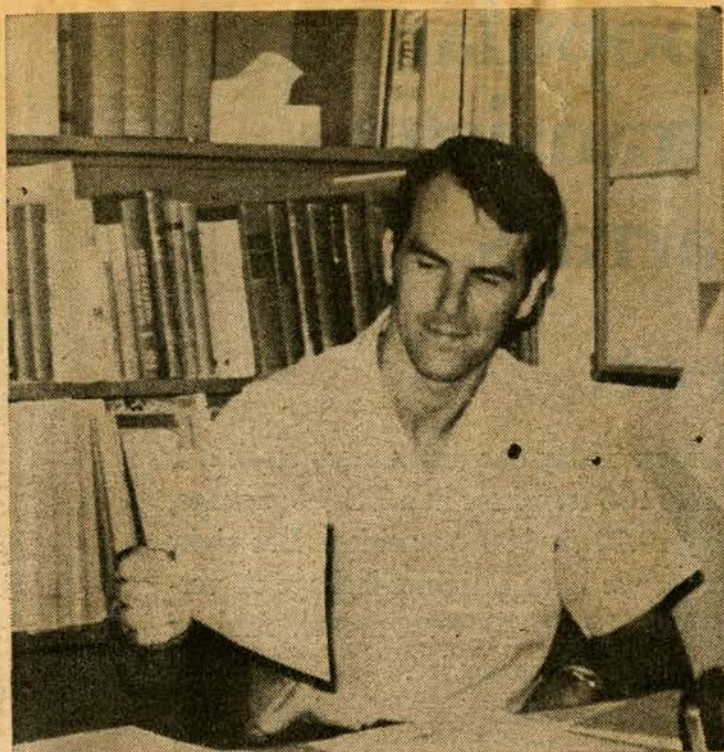
The airglow was one of the most striking phenomena observed by America's astronauts. Space scientists at Rice will seek data on the origin of the airglow and aurorae by sending instrument packages into space in a series of rocket launches.

The space probe series will be called "Sammy I, II, III, and IV," after the Rice Mascot, Sammy the Owl.

The first probe will be launched 100 miles into space in December from Wallops Island, Va. The other three will be launched from Fort Churchill, Canada, early next year.

NASA's Nike Apache rockets will carry the instrument payloads into space.

September 1, 1969



SCIENCE SUPPORTER: Former NASA scientist-astronaut Curtis Michel thinks science experiments will be slighted in the Apollo Applications Orbital Laboratory.

NASA's AAP Program Slated For Military Reorientation

By JACK ROBERTSON

WASHINGTON. — NASA's civil Apollo Applications Orbital Laboratory may take on a more military hue should the Pentagon implement defense experiments under consideration for the embryonic space station.

The military Manned Orbiting Laboratory (MOL) space station was canceled in June. Since then, eight of the Air Force MOL astronauts have been transferred to NASA—and space sources claim some of the MOL experiments may follow.

Former NASA scientist-astronaut Curtis Michel, now at Rice University Space Sciences Center, believes the military shift will diminish even further science experiments in AAP.

He believes it likely that several of the new Air Force MOL astronauts will fly on the AAP orbiting workshop—bumping off more scientist-astronauts.

Scientific features already are ruffled over the latest turn in the AAP workshop — now pushing the first flight back to 1972 at the earliest. Originally the first flight was time-tabled for the end of 1968.

Now scientist-astronauts will be in training an additional 3-4 years — 7 years after some entered the program. Astronaut alumnus Michel expects more spacemen scientists to become disillusioned and leave the program.

To their credit, at least eight of the scientific space corps are toughing it out, for the time being. They are in jungle survival training in Panama — rated by the military types as one of the roughest parts of astronaut training. Another physician-astronaut, William Thornton, flunked his jet flying test last week—but wants to stay in badly enough to return to flying school.

A mounting public clamor also calls for greater science in the

Apollo moon landing program itself. The next three landings—Apollo 12 through 14—will remain essentially test missions, with the Apollo Lunar Surface Experiments Package (ALSEP) the largest scientific part of the flight.

Demanding Dividends.

Sen. Charles Goodell (R., N.Y.) and Rep. Leonard Farbstein, (D., N.Y.) are seeking Congressional probes of the lack of scientific effort in future manned flights. Representative Farbstein said the U.S. should start getting a payoff from its \$24 billion investment — not just send more test pilots to the moon for TV spectacles.

The AAP orbital workshop long has been a subject of dispute—from the Presidential Science Advisory Committee (PSAC) report challenging the original concept of using a spent-stage Saturn S4 booster.

After 2 years, NASA came around to PSAC thinking, and in the middle of the Apollo 11 historic mission scrapped the spent-stage approach. NASA now will construct the workshop inside the empty booster shell on the ground and launch the quasi-space station intact.

The Defense Department long has had medical experiments on the AAP workshop—to learn how astronauts can maneuver and live in space. These are believed still in the program — though with its own space station scrapped, the Air Force has little for the astronaut data now.

Rice Scientists To Try Charting Exploding Star

BY ARTHUR HILL
Chronicle Science Editor

Scientists from Rice University plan to leave next month for Argentina, hoping to chart for the first time the awesome release of energy from a star in the process of exploding.

The group, under leadership of Dr. Robert Haymes, associate professor of space science, will fly a gamma ray detector in an unmanned balloon 130,000 feet over a desert in northwest Argentina.

Haymes has, in only two weeks, obtained permission from the Argentine government and the U.S. Air Force, which sponsors the gamma ray balloon program, to conduct the experiment.

The detector is the one Haymes used to find gamma rays in the remnant of a star, now known as the Crab nebula, that exploded about 1000 years ago, as seen from Earth.

High Speed

Gamma rays are very high-speed, high-energy atomic particles which such a fierce explosion might be expected to generate. Radiation of lower energies, such as X-rays, visible light and radio waves, has also been found in the Crab nebula.

The excitement in Argentina is caused by the sudden appear-

ance of a strong X-ray source, as if a searchlight had been turned on, near a constellation known as Lupus, the wolf, visible only in the Southern Hemisphere.

The appearance of the source was seen by two Vela satellites July 6, and they recorded its rise in intensity over several days, as it became more intense than any of the 40 X-ray sources that have been discovered in the last several years.

Latest reports, Haymes said, indicate that the object is losing intensity at the rate of about 50 percent in a four to six-week period. In theory, where there are X-rays of this intensity, gamma rays may well be present and possibly stronger than the X-rays being produced.

The satellites that detected the X-ray source were launched from Cape Kennedy May 23 to watch for nuclear explosions in space. The existence of the source was reported to the International Astronomical Union July 29 by Dr. J. P. Connor, Dr. W. D. Evans and R. D. Helian of the Los Alamos Scientific Laboratory in New Mexico.

the HOUSTON CHRONICLE
September 10, 1969

Range of Energy

Participating in the gamma ray experiment will be Haymes, Dr. Alfred Shipley of the National Center for Atmospheric Research, Boulder, Colo., and the program manager, Albert C. Heath, an engineer at Rice.

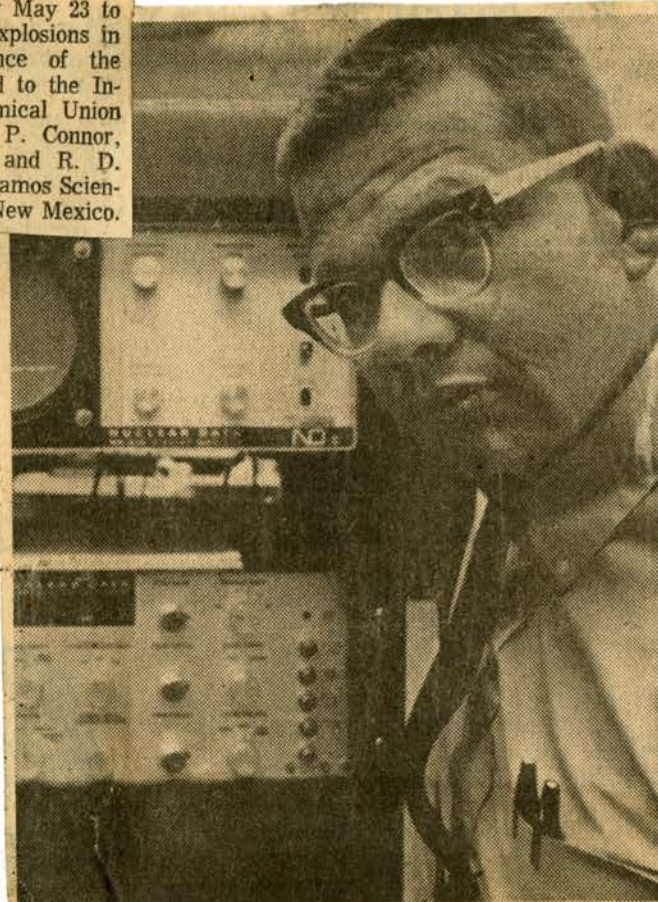
Haymes said the range of energy to which his detector is sensitive has been nearly doubled since the Crab nebula experiment.

No one knows what the new X-ray source is, or how far away it is. If it does prove to be an exploding star, however, and in the same galaxy as our Sun, it would be the first such discovery in three centuries, Haymes said, and it would hold immense scientific importance.

The source could be a nova, where perhaps part of a star explodes, or a 100,000 times more powerful supernova, where the entire star erupts, Haymes said.

92 Elements

"No one has previously been able to observe a star explode in gamma ray wavelengths. Virtually all astrophysical theories predict that a tremendous intensity of gamma rays will be given off by such an explosion. You might even see evidence for the 92 elements being produced through radioactivity," he said.



RICE SCIENTIST TO PROBE MYSTERIOUS X-RAY
Dr. Robert Haymes Seeks Star's Secrets

September 13, 1969

Rice Scientist Gets 1st Sample Of Moon Rock

A Rice University scientist was the first person to receive a sample of the Moon for outside experimentation.

The Manned Spacecraft Center's Lunar Receiving Laboratory turned over the sample Friday afternoon to Dr. Dieter Heymann, associate professor of geology and space science at Rice. Five other scientists also received samples.

The samples, packaged in plastic cylinders with screw caps, are protected inside by a foil wrapping that encloses a second plastic container.

Dr. Heymann said he would attempt to measure the amounts of inert gases—helium, argon, neon, krypton and xenon—in the rock.

"If we are lucky, we hope we

may find gases that were trapped inside the minerals when the Moon was formed," Dr. Heymann added.

Over the next three weeks, the lunar laboratory will be distributing about 18 pounds of lunar material to 106 teams of scientists in the United States and 36 in eight other countries.

In addition to Dr. Heymann, those who received samples were:

Dr. David McKay, Manned Spacecraft Center; Dr. K. Fredrickson, Smithsonian Institution; Dr. S. O. Agrell, Cambridge University, England; Dr. E. L. Fireman, Smithsonian Institution; and Dr. G. W. Reed, Argonne National Laboratory.

A conference on the results of the experiments will be held in January.



RICE SCIENTIST DR. DIETER HEYMANN
Gets Moon Sample for Study

Rice Space Prof Named to NASA Council in D.C.

Dr. Alexander J. Dessler, professor of space science at Rice University, has been named science adviser to the National Aeronautics and Space Council in Washington.

He gets a year's leave from Rice to take the \$32,000-a-year post, effective Sept. 15.

The council, part of the executive branch, advises the President on space and aeronautical matters. Vice-President Spiro T. Agnew is nominal head of the council.

Dessler said he will help the council to suggest the nation's space projects over the next decade.

The council, he says, is an ideal forum to debate military and civilian space goals before they are carried out by Defense Department and NASA.

Dessler said the council will need a year to make its post-Apollo Moon shot recommendations.

"This next year will be the year in which most of the long-term decisions will be made. Not making these decisions will be tantamount to allowing the space program to wither," he said.

Dessler said an underlying theme to the nation's future space activity "has got to be exploration of the solar system. We have the opportunity to really understand the solar system and what makes it tick."

Obtaining this knowledge will require the use of both unmanned and manned vehicles plying the vastness of space, he added.

A manned mission to Mars will certainly take place, Dessler said, but not until robot probes have first answered the questions man needs to know about the planet.

Dessler served as chairman of the Department of Space



DR. ALEXANDER DESSLER
Gets Government Post

Science at Rice from its creation in 1963 until last July 1.

Prior to that, he was a professor of atmospheric and space sciences at the Graduate Research Center of the Southwest, Dallas.

He holds a doctorate in physics from Duke University.

the HOUSTON CHRONICLE
September 16, 1969

a Summer Faculty Systems Engineering Institute will be sponsored by MSC for the benefit of faculty members of colleges and universities throughout the nation.

RICE PROFESSORS will lecture at the institute to be held at the University of Houston.

The University of Houston also is engaged in research for the Manned Spacecraft Center. There are 14 research projects totalling \$1,353,915 and funded by NASA-MSC underway at UH.

Typical of these are projects involving "In Situ Organic Analysis of the Lunar Surface," a \$195,943 research program being conducted by three UH chemistry professors, Dr John Oro, Dr Ralph Becker, and Dr Alberter Zlatkis.

Dr Daniel Sheer, UH professor of psychology, is conducting a \$210,068 MSC research project entitled "Study of Methods for Experimental Induction and Measurement of Emotional Stress."

THE RELATIONSHIP between MSC and local schools is a two-way street. At the request of MSC, UH began offering credit courses at MSC in the fall of 1964. Seven classes were conducted with 125 students.

The program was formalized in the summer of 1965 with the establishment of the Clear Lake Center. Graduate-level courses in engineering, public administration, and the sciences make up the curriculum.

Classroom space is provided by MSC, and selected UH professors commute to the center. By the fall of 1966 the number of courses offered had grown to 16, and 223 students were registered.

A permanent facility on 50 acres of the land in the Clear

Lake area is being planned. The Humble Oil & Refining Company gave the property and is reserving another 60 acres for university use. The land adjoins the MSC property.

IT IS ESTIMATED that another 200 employees of MSC are taking undergraduate and graduate courses on the main campus of UH.

A number of seminars and symposiums have been conducted by the University of Houston in co-operation with and in behalf of MSC. The specialized summer programs of research and study for talented young college and university faculty members in engineering and science is typical of these.

NASA pre-doctoral traineeships have been available at UH for several years. Thirty traineeships are in effect now, and six trainees have completed the program with earned Ph D's.

THE UH placement center is playing a key role in pro-

viding talent for MSC. A large number of UH graduates has been hired by MSC. Outstanding UH graduates are referred to MSC, which also actively recruits on the UH campus.

Since its beginning MSC has utilized the physical facilities of UH for various purposes.

San Jacinto College, which is less than 10 miles away from MSC, has from 350 to 400 NASA employees enrolled in night courses ranging from English to business to technology. In many instances these courses affect the employee's ratings for pay scales.

In addition several hundred of the regular students at San Jacinto came to the area when their parents began working for NASA or related industries.

A BLOCK OF 25 students has come from the Lockheed Management Association, a group affiliated with a NASA related industry. The association has about 300 members,

and one of its ideals is to further education. Most of the 25 students now enrolled in the evening school at San Jacinto College are taking business courses related to their jobs.

NASA also had 15 students attending San Jacinto College last semester on contract. These contracts provided for the students' tuition and costs to be paid by NASA.

Dr Dessler: 'A lot more study' Rice space science chief to help Nixon draft goals

Dr Alexander J. Dessler, chairman of the Rice University space science department, will help draft President Nixon's proposals for future space exploration.

He will serve as science adviser to the National Aeronautics and Space Council headed by Vice President Spiro T. Agnew. Astronaut William Anders, a member of the Apollo 8 lunar mission crew, has been named executive director of the panel.

Dr Dessler, taking a one-year leave from Rice for the \$32,000-a-year assignment, refused to speculate on what he thinks the space goals should include.

"Before a final commitment can be made," he said, "a lot

more study will have to be done.'

"But," he warned, "not making a decision within a year will be tantamount to letting the space program wither away."

He said the momentum and manpower that enabled the U. S. to reach the moon can stay together no more than a year without a new goal.

He said a year is sufficient to complete a proposal President Nixon can present to Congress.

Dr Dessler advocates a space program balanced between manned and unmanned flights.

He came to Rice in 1963 to become chairman of the new space science department,

that gives broad coverage of the major fields in space research.

In 1968 it conferred more doctorate degrees in space science than all other university space departments combined. It now has 18 faculty members and seven research associates.

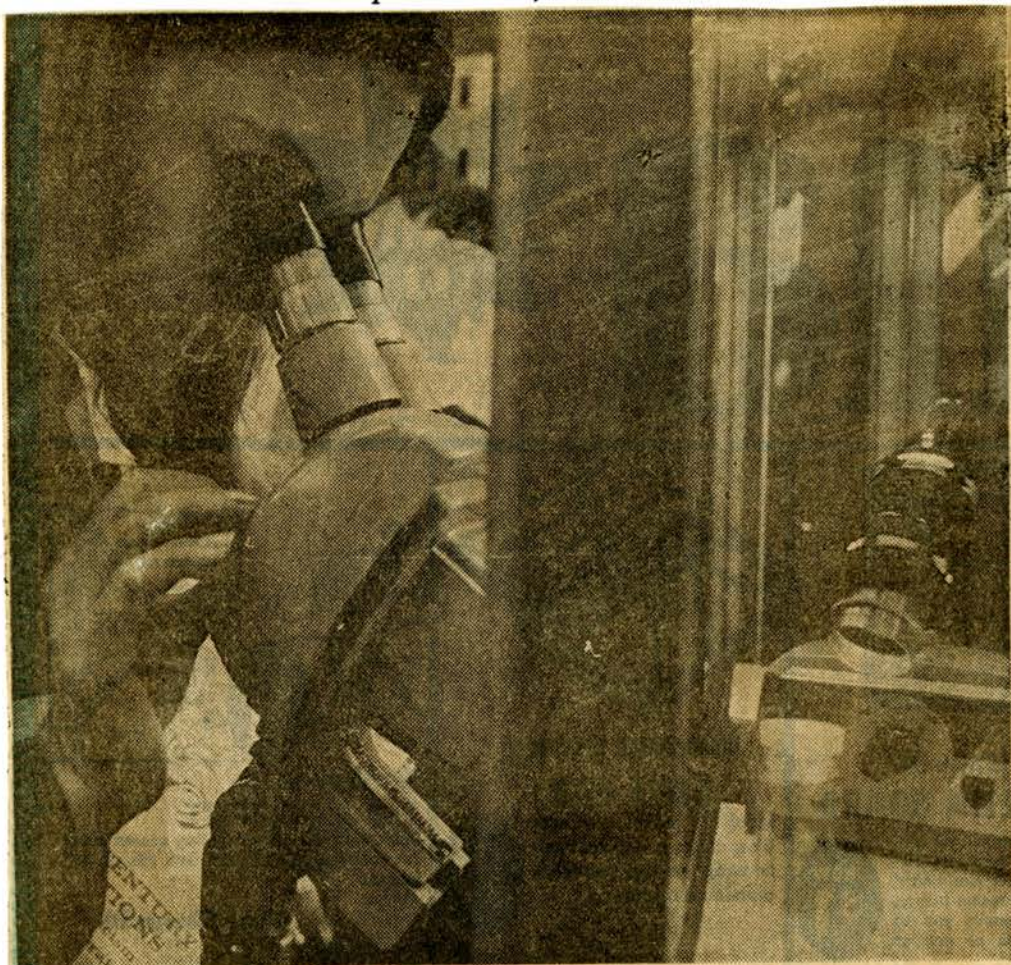
Space research expenditures at Rice reached a peak of more than \$3 million in 1967.

Dessler, 41, is a native of San Francisco. He formerly taught at the Graduate Research Center of the Southwest in Dallas and worked in the space physics department of Lockheed Missiles and Space Co. He was a technical adviser to the space program in India in 1961.



ALEXANDER J. DESSLER

THE HOUSTON POST
TUESDAY, SEPTEMBER 16, 1969



Trudy Butschek, Rice junior, studies lunar sample

—Post Photo by Jerry Click

Rice students see moon rock, receive preview of Apollo test

Rice University students got their first glimpse of moon rock and a preview of an experiment to be used on the next Apollo lunar mission at a special exhibit Wednesday.

Dr Dieter Heymann, one of the principal investigators of the Apollo 11 lunar sample, displayed the tiny portion of moon dust he will begin testing Friday.

His assignments will be to learn the age of the sample and gain clues to the conditions under which it formed.

Dr Hans Balsiger displayed a lunar ion detector (which space experts will call the LID), like the one Apollo 12 astronauts will leave on the moon this fall.

Dr Balsiger is a research associate to Dr

John W. Freeman Jr, the principal investigator on the experiment. The detector will measure the ionized particles originating on the sun — sometimes called “solar wind.”

It will also measure ionized constituents of the lunar atmosphere, the lunar surface potential and residual from the lunar ascent vehicle exhaust gases. Data from these experiments will be sent back to earth for one year, Dr Balsiger said.

Three units like the one displayed Wednesday are scheduled to be left on the moon.

Only a limited number of students and faculty members were allowed to view the exhibit, under space agency rules.

the HOUSTON POST
October 12, 1969

Rice prof's scope will seek x-ray

A balloon carrying a gamma-ray telescope will be launched in Argentina late this month by a Rice University space scientist seeking to determine the nature of a new x-ray source in the heavens.

Dr Robert C. Haymes, associate professor of space science, hopes to discover if the x-rays are coming from an ex-

ploding star in the constellation Scorpius or from anti-matter. Each emits a characteristic type of x-ray.

Rice scientists found x-rays and a gamma ray pulsar coming from the Crab Nebula, remnants of a star that exploded in 1054.

That scientific detective work was the result of a tele-

scope-carrying balloon launched at Palestine, Texas, in 1967 and two years of computations of the findings.

The Argentina-launched balloon will go to about 130,000 feet for about 12 hours and will carry a 300-pound payload.

It will investigate an x-ray source positioned over that

country that was discovered by scientists at Los Alamos Scientific Laboratories when two Vela satellites began picking up x-rays from a new source on July 6.

Vela satellites are used to detect nuclear explosions.

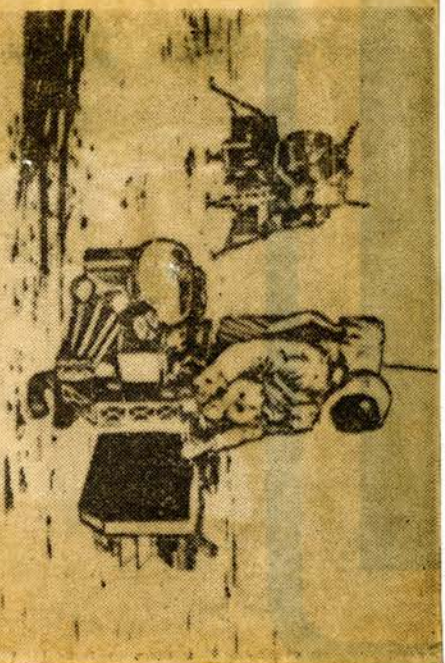
All through July, the x-ray intensity increased until it was the strongest of about 30 such

sources. Then it began to weaken.

If the scientists find that the source is an exploding star, it will allow the first chance to observe such a phenomenon through an x-ray telescope.

It would also help to confirm another Rice space scientist's theory that elements — such as carbon, iron or oxygen — are formed by exploding stars.

the HOUSTON POST
November 11, 1969



NASA drawing
shows astronaut
deploying ALSEP

Astronauts to plant wide range of experiments

By JIM MALONEY
Post Reporter

An octopus-like set of experiments the Apollo 12 astronauts will set up on the moon should provide a wealth of information for scientists.

The experiments are designed to return information on such things as the composition of radiation that blows from the sun, the movements of the moon's crust and interior and the slight lunar magnetic field.

Apollo 12 is scheduled to lift off from Cape Kennedy at 10:22 AM Nov. 14 with Cdr. Charles (Pete) Conrad Jr., Richard F. Gordon and Alan L. Bean aboard.

Conrad, the Apollo 12 commander and Bean are to be the third and fourth men to walk on the moon.

While these astronauts are spending about 32 hours on the lunar surface, Gordon will await their return in lunar orbit.

Conrad and Bean may spend as much as eight hours outside of their landing craft exploring the moon.

One of their first tasks during the first of two moon walks will be to unpack and set up a package of experiments called ALSEP.

ALSEP means Apollo Lunar Surface Experiments Package.

A study by the Bendix Corporation's Aerospace Systems Division has shown that the astronauts can set up the six experiments, a central station and a power source in less than 30 minutes.

The central station, which collects information from the experiments for transmission to earth and receives commands from earth for the experiments will be set up about 300 feet from the Apollo 12 landing craft, the Intrepid.

The experiments and their power source will all be connected to the central station by flat, ribbon like electrical connections, much as the arms of an octopus spread out from its

body.

A nuclear generator, the first to operate on the moon, will supply power to the central station. It will be about 10 feet from the station.

The experimental equipment includes a passive seismometer, a magnetometer, a solar wind spectrometer, a lunar ionosphere detector and a lunar atmospheric detector.

The seismometer is designed to return information about the possibility of moonquakes and the frequency of meteorites smashing into the moon surface.

This instrument will be some 50 feet away from the central station.

Farthest from the central station will be the ionosphere detector — an experiment devised by Rice University's Dr. John Freeman Jr. and Dr. F. Curtis Michel. It will be about 60 feet from the station.

It will attempt to measure the velocity, energy, flux and number density of positive

ions in the vicinity of the moon's surface.

This will provide information about the nature of the area just above the lunar surface.

The magnetometer will be about 50 feet from the central station. It will measure the direction, time and magnitude of the lunar surface magnetic field.

Such information may tell scientists about the electrical properties of the interior of the moon and the interplanetary magnetic field that diffuses through the moon.

The solar wind spectrometer will be set up about 15 feet from the central station to measure the energies, angles, variations and densities of the electron and proton components of the solar wind.

Finally, the lunar atmosphere detector, some 20 feet from the central station, will measure the density and temperature of the lunar atmosphere. This data may contribute a better understanding of the early history of the moon.

After NASA slowdown

Ex-astronaut Michel returns to Rice teaching post

What does a thirty-five year old ex-astronaut do?

In the case of F. Curtis Michel, he returns to teaching and research at Rice University. And wins the title of Professor of Space Science and Physics.

Michel, who was with the space program from 1965 to 1969 but who never left earth, started his academic career at Rice in 1963 as Assistant Professor of Space Science. Two years later, he took leave to become one of five scientist-astronauts appointed by the National Aeronautics and Space Administration.

Sitting in his paper-cluttered office, Michel spoke of his entrance into one of the most elite

clubs in the world, the astronaut corps:

"They really didn't know what to expect from us and we didn't know what to expect from them," said Michel. "We actually had to write a 50-word essay on what we would do if we were landed on the moon."

Put in charge of experiments, Michel tested feasibility of the inclusion of specific experiments on the manned lunar flights.

"It was kind of a frustrating job," he said. "They really needed an experience regular astronaut and I was just a novice."

"Also, 'feasibility' was narrowly defined—and we couldn't make any sort of judgement

on whether or not we thought the experiment was worthwhile."

No special "astronaut training" confronted the five scientists for a year after they became civil servants. Since only Michel and one other were pilots, however, the other three were sent to pilot school.

"Then, in 1964, a group of pilot-astronauts came in and we went through regular training with them," Michel explained.

Michel, who at 39 shows no signs of a pot-belly, remains physically fit.

"The training wasn't that difficult," he said. "I had passed most of the medical tests in the Air Force, anyway."



Bill Fulton

Rice professor and ex-astronaut Curt Michel.

the rice thresher