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‘An incurable knowledge junkie’

GENTRY LEE’S ADVENTURES IN VIKING, SCIENCE FICTION, TRANSCENDENTAL NUMBERS AND FATHERHOOD

By Frank O’Donnell

In the summer of 1947, a psychologist at New York’s Columbia University discovered among the children playing street ball outside the row-houses of Queens a 5-year-old with an uncanny skill. The boy knew all the batting averages of all the players on all three of the teams—the Dodgers, the Giants and the Yankees—that called the Big Apple home at the time.

Testing proved that the boy—who was not just memorizing stats, but computing them on a daily basis in his head—was unusually gifted. After a consultation with the local school district the boy, who normally would have entered kindergarten that fall, was placed in a fifth grade class.

“It was a total disaster,” recalled B. Gentry Lee, the one-time 5-year-old. “Terrible things happened. I was in fifth grade, but I didn’t know how to tie my shoes. Needless to say, it didn’t last long.”

Inauspicious though that experiment may have been, it was one early signpost on what for Gentry Lee has been a remarkable life. A self-described “incurable knowledge junkie,” he mixed literature and languages, science and math and sports in college, graduating summa cum laude and attracting top fellowships. As a young engineer at a NASA contractor, he caught the eye of the project manager for the Viking mission to Mars and achieved a leadership role at an early age. That resulted in what he recalls as “the experience of a lifetime”—shepherding the science for the four Viking spacecraft and choosing the landing sites for its two landers when they made the first successful descent to the surface of another planet.

Lee is in the news on two fronts — with Viking’s 30th anniversary, and as recipient of the Harold Masursky Award.

Moving to JPL, he became chief engineer on the flagship Galileo mission to Jupiter. He collaborated with Carl Sagan on the “Cosmos” television series, playing a key role in organizing and moving forward one of the most highly watched documentary series on public TV. A trip to Sri Lanka to discuss a movie deal resulted in a partnership with famed science fiction writer Arthur C. Clarke, producing four novels as co-authors.

Returning to JPL as the 21st century began, he now serves as part guru, part gadfly in his role as chief engineer for the laboratory’s Solar System Exploration Directorate—helping to shepherd flight projects from concept to success. “I have the best job anybody ever had,” says Lee, now 64.

“Of all the things I’ve done in life, this is probably what I do best—and what in the long run is the most important.”

Lee is in the news on a pair of fronts this month. As the Viking team celebrates the 30th anniversary of the first Martian landing July 20, Lee has been a featured speaker at gatherings. In addition, the American Astronomical Society’s Division for Planetary Sciences just announced it is bestowing on him its Harold Masursky Award given for outstanding service to planetary science and exploration.

His success no doubt is attributable to a combination of his uncanny intellectual abilities and seemingly boundless energy. “For the past 35 years I’ve worked out an hour every day in the morning,” says Lee. “It’s the only way I can keep my energy under control—I have too much energy.”

The intellectual gifts surfaced early. Though late to talk, when he did so it was in complete sentences. Then his mother discovered that she didn’t need to read to him—when he was sitting in her lap, he was reading the pages of the book in front of them.

After the abortive experiment with advancing him five years in school, it was decided that Lee could skip no more than two grades. After working as an editor at the Associated Press in New York City, Lee’s father took a job teaching journalism at the University of Texas at Austin and moved the family to the Lone Star State. In high school Gentry took a shine to languages, studying Latin, “which I loved because of the discipline that it brought to the mind.” He played all sports but, because he was two years younger than his peers, the only one he made varsity in was track and field.

As a high school senior, he heard about a competition called Number Sense in which contestants work rapid-fire math problems in their heads and just write down the answer—“What is 12 1/2 percent of 206?” or “Fill in the next number in this sequence—2, 3, 5, 8.” On a lark, Lee asked the faculty advisor if he could join his school’s team, despite the fact that the others had practiced for years and he was coming into it cold. His score was greater than the scores of all four of his teammates put together. He went on to win the state championship.

In college at the University of Texas at Austin, “I had a wonderful undergraduate curriculum,” Lee recalls. “I went there very young, at 14 or 15, and was selected as a Junior Fellow. This was a program that gave the best and brightest undergrads the same interaction with faculty as at a small Ivy League school. I was spoiled. Each semester I’d have three or four courses and one or two professors that I would go and do independent study with. That was wonderful. I was all over the place and had a wonderful time.” He went from French and Russian literature and the modern British novel to philosophy, with some math and science mixed in.

Graduating summa cum laude from Austin, Lee was awarded a Woodrow Wilson Fellowship, “which was basically a blank check to go anywhere I wanted to

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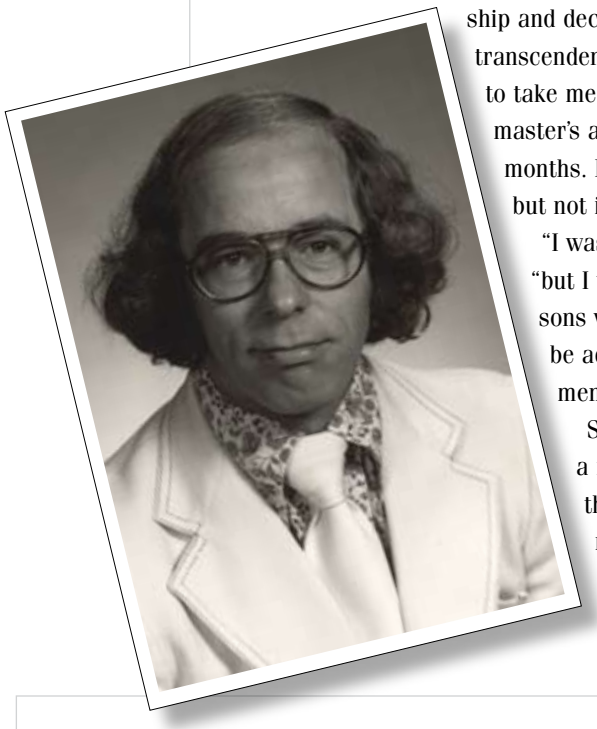
go and study whatever I wanted to study." He decided to pursue a master's degree in physics and aerospace engineering at the Massachusetts Institute of Technology—"one of the last master's programs in general science."

"I was fascinated by what I called the creative edge in science and engineering," Lee says now. "It seemed to me that at the edge, all disciplines were essentially the same in that they invoked some sort of an ability to go beyond what I would call deductive reasoning and to be inductive or intuitive. I believe that's the realm in which creativity lies.

"Of course, I was ill-prepared to go to graduate school at MIT. They informed me that, while they accepted me, my background was sadly lacking in hard sciences. Then I won a Marshall Fellowship and decided to go to the University of Glasgow to study higher transcendental functions with Ian Sneddon. That was supposed to take me through a Ph.D. But I figured that I'd better finish my master's at MIT, so I had to take seven graduate courses in nine months. My grades were horrible—I got the master's degree, but not in the style to which I was accustomed.



"I was 22 when I finished my master's at MIT," says Lee, "but I was probably emotionally 8 or 9. It's one of the reasons why, as a parent, I've refused to allow my children to be advanced farther than their perceived social development level."

Showing up in Scotland in the fall of 1964, Lee found a rude awakening. "I discovered to my horror that in the wintertime it was dark and foggy all the time," he recalls. "And so, I didn't stick it out."

Instead, he spent a year wandering around Europe, learning more languages. Having won a couple of short story contests as an undergraduate, he turned again to writing. "I wrote a first interlocking set of six novellas which, when I read them now, make me just cringe," he says. "They are what you would expect a 22-year-old who doesn't have a whole lot of experience in life to write." Along the way he served as a guide taking visitors through the art holdings at the Peggy Guggenheim Collection in Venice.

"I remember when I was called in to the offices of the top echelon people at Martin Marietta—I think I was 28. Here I was, I have on a pink shirt and these white pants with strawberries on them, and I'm in a room with eight people with absolutely no variation in their black or blue suits, white shirts and solid ties . . ."

That lifestyle came to a screeching halt when Lee faced the prospect of being drafted in the U.S. Army to go to Vietnam. "I was philosophically opposed to the war, but didn't want to embarrass my family," he says. "For most Americans, the only choices were to go or to go away"—to serve in the war, or leave the country. "In my case, because of my master's degree, I had another choice—to go to work in aerospace. This would give me a deferral and allow me to avoid having to make that decision.

"I remember walking on the Adriatic Coast in Italy, looking at the list of career areas and asking myself which of them met the following two criteria. Number one, which were intellectually challenging, and number two, which of them had some historical significance. In other words, in the 25th century what would I think if I could look back and say what did I do. I decided that I wanted to be part of the only generation that would ever explore the solar system for the first time."

Between the University of Texas and MIT, Lee had worked a few months in Southern California at North American Aviation, which would later become Rockwell International, running orbit transfer calculations supporting the company's work for the Apollo program. He sent out a raft of application letters and was accepted by every aerospace company he wrote to. He decided on Martin Marietta (later Lockheed Martin) near Denver, in part because of his love for downhill skiing.

Feeling inadequately challenged by his initial assignments—"that's the way it is in entry-level jobs"—Lee began writing proposals in response to published announcements. Early on he won one for interplanetary orbit determination—"At first I was told at Martin Marietta that I wasn't senior enough to do the job, but we worked that out."

Eventually Lee met people "who were involved in what I really wanted to do—exploring the solar system. I got to participate in the writing of Martin Marietta's proposal for Viking. I was 24 or 25 years old. Then, we won. I did one job, then another job, then another job. It was absolutely wonderful."

He also caught the eye of Jim Martin, the legendary project-wide manager for Viking based at NASA's Langley Research Center in Virginia. Martin, who passed away in 2002 and who Lee remembers as his "mentor in life," encouraged Lee's employer to give the young engineer positions of progressively greater responsibility. But it was not without culture shock.

"At that time in my life, I looked strange to most people in the middle of society," says Lee with a grin. "My hair was down on my shoulders. I wore outlandish clothing—I had a pair of white pants with strawberries all over them that I wore from time to time. As difficult as it may be to believe, my arrogance coefficient now is down at least two orders of magnitude from what it was in those days. I was—cocky would be an understatement."

Jim Martin, who ran what Lee recalls as a "badgeless flight project" with NASA civil servants, JPLers and contractors thoroughly intermixed, wanted Lee to head all mission operations for the landers—an unprecedented role for a contractor. "I remember when I was called in to the offices of the top echelon people at Martin Marietta—I think I was 28. Here I was, I have on a pink shirt and these white pants with strawberries on them, and I'm in a room with eight people with absolutely no variation in their black or blue suits, white shirts and solid ties. Now the top guy had started to appreciate me, but one of his cohorts got angry with my attitude. I was very enthusiastic and had a lot of sweeping ideas—first thing, I'd get rid of two-thirds of the people, then I'd travel around and recruit the best and brightest. This fellow told me, 'You know, we didn't want you in this position. In fact, if you want to keep it, you'd better be 20 percent better than anybody else who's ever done a job like this.' I looked him straight in the eye and said, 'If I'm not 25 percent better than the people who preceded me, I want to be fired.'"

Lee not only kept the job, but was promoted again to become Viking's director of science analysis and mission planning—organizing all of the science activities for the two orbiters and two landers. In addition, he was also responsible for certifying choices of landing sites.

It was through his interactions with the science team that he got to know Carl Sagan, the Cornell University astronomer who passed away in 1996. Lee needed to convince 100 engineers from Colorado to move to California for 18 months as the Viking mission achieved its crescendo, and called upon Sagan to give them a motivational talk.

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Sagan "was wonderful," recalls Lee. "I learned a lot of technique from watching Carl—he was a superb public speaker. He knew how to push all the right buttons. My appreciation of him has continued all my life, because he was the most felicitous user of the English language that I have ever encountered. Some of his sentences would almost drive me to tears, they were so perfect. He came and made the speech for me, and that was the beginning of our friendship."

When the Viking spacecraft arrived at Mars, orbiter photos disclosed that the landing sites tentatively singled out were not as benign as once thought. That precipitated a breakneck effort to pick new sites. The first landing, originally planned for the nation's bicentennial on July 4, 1976, was reluctantly delayed a couple of weeks in the interest of mission success. "That period, leading up to the first landing, was the greatest experience of my life," says Lee. "It was the biggest adrenaline rush I've had in my career, with the possible exception of the last year before the landings of the Mars Exploration Rovers."

After the second Viking landing, Lee remembers that he and Sagan were sitting outside von Kármán Auditorium one day, bemoaning the fickleness of coverage by the U.S. news media. "Why is it that Viking is on the front page of [Japan's] Asahi Shimbun for 30 days straight, and a week after the landing no one in the United States is paying any attention?" they wondered. "After an hour conversation, we concluded that scientists can't communicate, and reporters don't know enough to amplify the message. We had to have scientists that could communicate and get rid of the middleman. So we thought of making a TV series." Initially the working title was "Man and the Cosmos"; later it was shortened to "Cosmos."

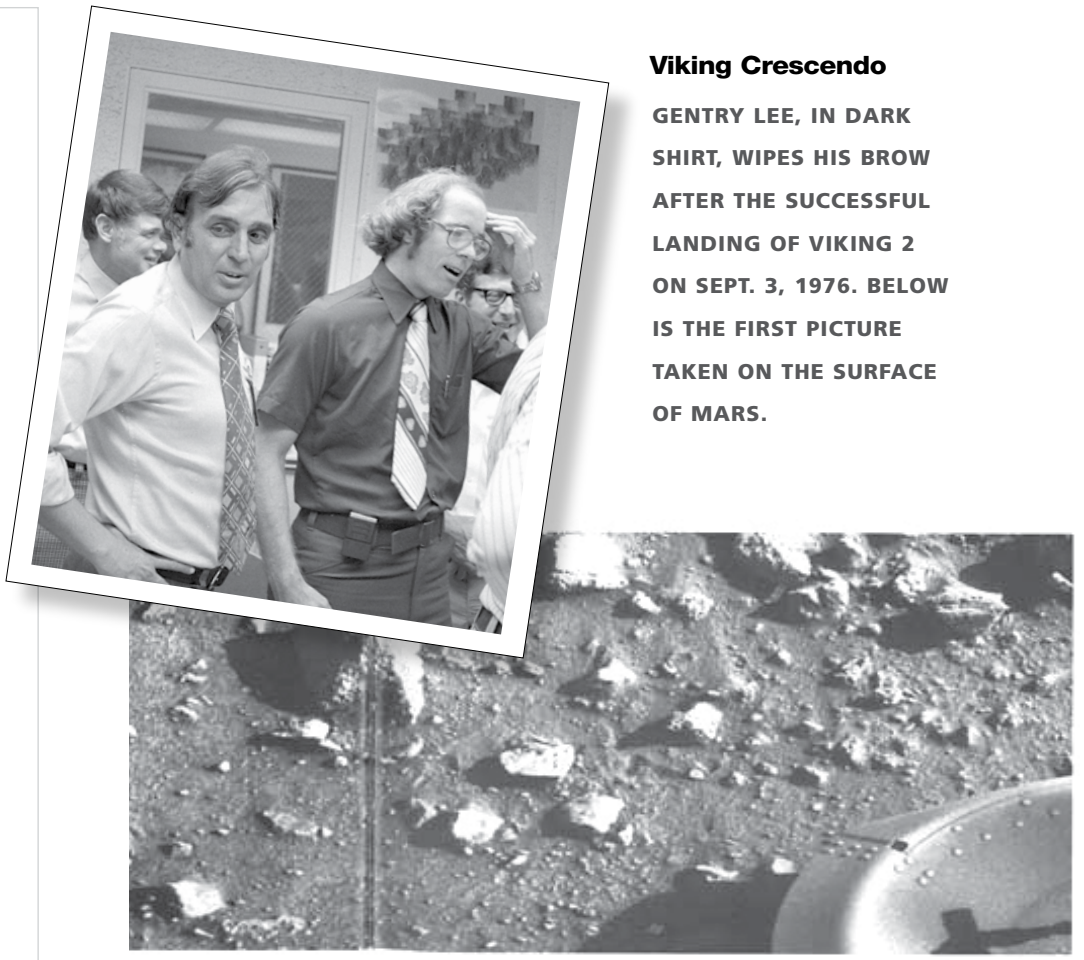
According to Lee, he and Sagan agreed that they would work on the show together, with Lee "taking care of what you might call the system engineering." In December 1976, Lee accepted a job offer from JPL. The day after Christmas of that year, he and Sagan "sat in my backyard in La Cañada with a giant sheet of paper and outlined 13 episodes of the series."

Thanks to Sagan's increasing name recognition after his famous "billions and billions" line on Johnny Carson's "Tonight Show," "Cosmos" quickly attracted the interest of PBS stations and sponsors. In 1980, it debuted to wide acclaim.

Lee, meanwhile, settled in at JPL. At first he served as manager of what was then Section 312, overseeing 145 people involved in mission analysis and design. Before long, realizing that his first love was working for flight projects, he joined John Casani's team creating the Galileo mission to Jupiter. Lee initially served as science and mission design manager, later becoming Galileo's chief engineer.

In December 1985, Galileo shipped to Florida to prepare for launch the following May on the space shuttle. But a tragedy intervened—on Jan. 28, 1986, the Challenger broke up during launch.

A week later, Lee received a phone call from Peter Guber, a Hollywood producer he had met while working on "Cosmos." Guber, who later went on to head Sony Pictures Entertainment, had seen Lee quoted in the New York Times predicting that the shuttle would be grounded for two to three years (prompting "nasty mail" from around the country calling him a "negativist"—though his estimate later proved true). "Peter wanted to get Arthur C. Clarke involved in an idea that Peter and I had discussed," Lee says. "He told me, 'Since Galileo isn't going to be flying for a while, why not work on this?'"



Viking Crescendo

GENTRY LEE, IN DARK SHIRT, WIPES HIS BROW AFTER THE SUCCESSFUL LANDING OF VIKING 2 ON SEPT. 3, 1976. BELOW IS THE FIRST PICTURE TAKEN ON THE SURFACE OF MARS.

"It was the biggest adrenaline rush I've had in my career, with the possible exception of the last year before the landings of the Mars Exploration Rovers."

Lee and Guber flew off to Sri Lanka, where the science fiction writer famous for "2001: A Space Odyssey" had lived since the 1950s. "Arthur wasn't particularly interested in what Peter had to say," Lee recalls. "But late one afternoon, when Peter went back to the hotel to have phone calls with Hollywood, Arthur said to me, 'You have a certain excitement or passion for what you do, have you ever thought of writing fiction?' I said, yes, I have. 'Ah, tell me your ideas.' So I gave him an idea—actually it was the idea for the story that Peter and I never got around to telling him. Arthur said, 'I had an idea like that once, but I had three problems.' He told me what the problems were. I'd already solved two of them, and he loved that.

"At that time, he felt he probably wasn't going to write any more books by himself, and he was looking around for—I'm trying to remember exactly what he said—a 'clever young collaborator who was not poisoned by a lifetime in the publishing world.'"

Clarke suggested that Lee go off and later "come back and we'll talk about these ideas in more details. And if it all works out—he was very careful—we could consider collaboration. When I returned to the United States from that trip, I was pretty close to broke. I used 60 to 70 percent of my emergency money to fly back to Sri Lanka. Arthur and I went up into the hills to a tea and cardamom plantation. During the day we'd discuss this idea. Arthur could only work six to seven hours a day, so at night I'd write up everything we had discussed. Arthur knew my mind worked fine, and he knew that I could develop a plot, but what he didn't know was whether or not I could write.

"He hadn't told me yet that the plan would be that, if we collaborated, I would write everything. So after three to four days of this process, one day at breakfast after reading the notes from the day before he said, 'OK! We have a deal. Let's go to work. We're going to talk and exchange faxes, and you're going to write.'"

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Spitzer

A COOL TELESCOPE FOR THE AGES

Photo by Bartholomew Cooke

By Mark Whalen

THE SPITZER SPACE TELESCOPE RECENTLY PASSED its 2 1/2 year lifetime requirement. Project Scientist Dr. Michael Werner discusses the mission's current status and future possibilities.

Why is this 2 1/2 year requirement such a big milestone?

The cryogenic system was so novel and uncertain and hard to test. We designed it all along for five years, and we've known for quite a while—since we've been in orbit—that we'd do better than five years.

How long will Spitzer go?

This phase, the cryogenic mission, should go into 2009. And when that's over, we hope to have an extended mission, using only our two shortest wavelength channels. We can't use the whole system, because most of it will have warmed up some. At that point, it will be very effective and powerful in these short wavelength channels, which have very important scientific applicability.

We will then reprocess all of the data from the cryogenic mission with a common calibration and data pipeline, and continue to maintain and augment an archive that is publicly accessible.

The current budget planning calls for two years of this extended mission; we hope to be approved for an additional three.

What are you looking forward to next?

We just initiated our cycle 3 general observer program, which is marked by a resurgence of our legacy science program. Prior to launch in August 2003, we selected six teams to carry out legacy projects, which meant no proprietary period, value-added data products being returned to the community via the Spitzer Science Center on campus and a project with a substantial science focus but a data set with broad applicability. We just approved about a half-dozen more of those. It's an increasingly popular way of doing science.

Why is it so popular?

Because for a lot of the science we're trying to do involving the three great observatories—Spitzer, the Hubble Space Telescope and the Chandra X-Ray Observatory—you need to pull data from all of these facilities. A way to do that is to develop large groups and share the data fairly openly. Then you can apply for extra resources to do some additional processing after the fact, or to do further observations.

The further observations might be surveys of areas of the sky that have been studied by Hubble or Chandra, or even by Spitzer for that matter, but with a different instrument configuration. They might be systematic spectroscopic follow-up; that is, detailed study of classes of objects found in previous generations of surveys.

Our first group of legacy projects included three that were focused mainly on targets and science within our galaxy and three aimed at extragalactic studies. Five more legacy projects were selected in cycle 2 and eight in cycle 3, again spread across the range of astrophysical problems and targets. Several of the second- and third-generation legacy projects follow up on the initial programs as envisioned above; others attack new science questions.

What is Spitzer's most exciting discovery thus far?

Probably our biggest discovery, our most surprising result to date, has been the first detection of light from an extrasolar planet—where Spitzer watched the planet go behind the star—which we announced last year. There is a great interest in that type of science as well, and I'm sure, particularly as more candidates for that type of observation are discovered, people will be jumping on them with Spitzer.

Is there a JPL presence in the Spitzer science program?

Yes. In fact, some of the most exciting work that's been done on Spitzer in the last six months or so has been done on galaxy clusters by Spitzer Science Office members Peter Eisenhardt, Marc Brodwin and Dan Stern. Their team discovered nearly 300 clusters of galaxies, almost 100 of which are as far as 10 billion light-years away. A single galaxy cluster can contain hundreds of galaxies like our own Milky Way. The deputy project scientist, Charles Lawrence, and I have participated in the science program as guaranteed time observers, and eight to 10 proposals with JPL principal investigators are selected in each annual general observer cycle.

How does the public use Spitzer data?

In terms of pretty pictures, you can get them right now at the Spitzer Science Center website, *www.spitzer.caltech.edu*, which is operated by the joint JPL/Caltech public affairs team. You can also find a lot more information about the mission, the instruments, the legacy science program, etc. Every couple of weeks we post something new there. Spitzer is also used as a resource for a lot of educational material in websites that are developed by the Infrared Processing and Analysis Center (IPAC) at Caltech, *www.ipac.caltech.edu*.

At this stage, can you point to how Spitzer will pave the way for future missions?

Well, Spitzer has done pioneering and very exciting scientific work that all of us would like to see perpetuated. There's no doubt that the Spitzer data will be used to plan future scientific observations.

As for technical matters, we showed the importance of getting away from the Earth and using deep space as a refrigerator—we demonstrated the power, feasibility and effectiveness of radiative cooling in a cryogenic observatory, and all forthcoming observatories are going to use that.

Also, we have pioneered a new generation of beryllium mirrors, which is part of the technology incorporated in the James Webb Space Telescope.

And probably the most important thing is the use of large detector arrays. In terms of advancing the technology, working with the few companies that make infrared detector arrays, understanding how to operate these things and demonstrating the effectiveness of these devices, we've made a very important step toward still larger arrays.

What are the major challenges coming up?

The end of the cryogenic mission in 2009, by itself, poses some interesting challenges, because Spitzer has many capabilities that will be unmatched until the launch of the Webb telescope, which is nominally set for 2013 but may slip as these things often do. Others of Spitzer's capabilities will be matched by those of the European Space Agency/NASA Herschel mission, operating at the longer wavelengths, set for launch in 2008. JPL is managing the NASA portion of this mission.

Just like you don't want to die with a silver bullet in your holster, we don't want to run out of cryogen just before we do the last critical observation. So the selection and implementation of the science program in 2008/2009 is going to raise some interesting opportunities. Tom Soifer and his crew at the Spitzer Science Center are already considering the scheduling for that period of time.

Also, there have been discussions in the science community about how to maximize the combination of the scientific output of the three great observatories (Hubble, Spitzer and Chandra) during the upcoming years when the missions' lifetimes begin to become an issue.

What are you most proud of?

So much of my life has been tied up in Spitzer—it's almost asking me what my own personal legacy could be. I am very proud of the unqualified scientific and technical success of Spitzer, and of the unique way all project elements worked together to make this happen.

One very significant thing has been the scientific productivity and the technical advances we discussed above. I'm quite certain that users of future missions—the Webb telescope might be the first—will continue to delve into the Spitzer archives for inspiration and targets. Other astronomers will mine the scientific content of the many terabytes of data in the Spitzer archive. Both the Infrared Astronomical Satellite (IRAS) and the Two-Micron All-Sky Survey (2MASS) were particularly rewarding and useful for this type of work.

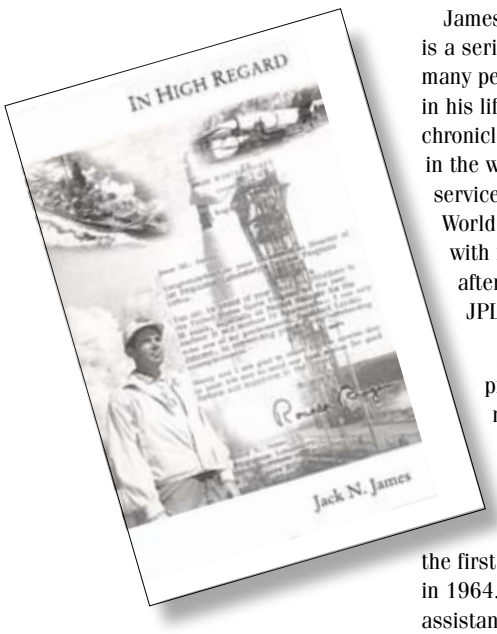
"Just like you don't want to die with a silver bullet in your holster, we don't want to run out of cryogen just before we do the last critical observation."

Also, there's a movement now toward a national virtual observatory, where any astronomer with a workstation can access a variety of observations. We can play a major role there as well.

Another important factor is how we organized the project. Through our management teaming arrangements, under the direction of project managers Larry Simmons, Dave Gallagher and Bob Wilson, we've formed very close relationships between the managers, the engineers, the JPL scientists and the university scientists. We have had an open-book policy so everyone knew how much money everyone else was getting; we didn't make the mistake of treating adults like children, telling them what information they couldn't have.

The flexibility and ability of the science team to adapt to changing environments, to distinguish the options in meeting the requirements, minimizing the complexity of the instruments and reducing the number of operating modes, all make Spitzer extraordinarily cost-effective and extremely efficient, and that's not an accident. ■

News Briefs



James' book available free

A book written by the late JACK JAMES, who managed the first two JPL missions to fly by other planets, has just been published by his family trust and has been made available free of charge.

James' book, "In High Regard," is a series of stories about the many people who were significant in his life. In the process, James chronicles his life from working in the west Texas oil fields, to his service in the U.S. Navy during World War II, to his early work with radar both during and after the war, to his joining JPL in the 1950s.

At JPL, James was the project manager for Mariner 2, which in 1962 flew by Venus and became the first spacecraft to fly by another planet, and then managed Mariner 4, the first spacecraft to fly by Mars, in 1964. James later became assistant laboratory director for technical divisions. He went on to form and manage the Defense Programs Office, which subsequently became Technology and Applications Programs (TAP), for which he also served as assistant laboratory director. James died in August 2001.

JPL retiree TIM SCHECK, formerly James' Technology and Applications Programs business manager, has copies for distribution. If you would like to receive a copy of the book, please send your name, address and e-mail address to him at *tscheck1@mac.com* or 725 Craig Avenue, La Cañada, 91011.

Student career week coming up

Student Career Week will be offered to JPL's summer students and academic part time workers from Monday through Thursday, July 24 to 27. All events will take place in von Kármán Auditorium.

On Monday, TERESA BEAUDINE and SUSAN ANDROVICH, human resources university relations recruiters, will present a résumé writing workshop at noon. On Tuesday and Wednesday, the technical and business divisions will present brief overviews of their organizations, including core competencies and available opportunities. On Thursday, the Human Resources University Relations Team will host a career fair from 11 a.m. to 2 p.m. to provide an opportunity for students to show their résumés to and speak with representatives from all of JPL's technical and business organizations.

Blood, bone marrow drive in August

Next month's JPL/Red Cross blood drive will also include the opportunity to register for bone marrow donations.

The blood drive will be held in von Kármán Auditorium on Tuesday, Aug. 15, from 9 a.m. to 4 p.m. and Wednesday, Aug. 16, from 7 a.m. to 1 p.m.

JPL's Occupational Health Services Office says blood supplies are critically low, with a high demand for type O blood.

To sign up, log on to *www.givelife.org/index.cfm?hcl=JPL*. Click "Search" and the JPL blood drive dates will come up. Appointments will be confirmed via e-mail. Advance signup sheets will also be available at Occupational Health Services, Building 310-202, prior to the blood drive. For last-minute signups, or to change your appointment, please call the Red Cross at (213) 400-0140.

Blood donors must:

- be at least 17 years old
- weigh no less than 110 pounds
- have lived in the United States for no less than three years
- be in good health

You must wait 56 days between blood donations.

For more information, visit *www.redcross.org/services/biomed/blood/supply/tse.html*.

A representative from the National Marrow Donor Program will be at the blood drive. To become a registered marrow donor, a consent form must be completed, and an additional small sample of saliva will be taken at the time of your blood donation. Your name will remain on the registry until your 61st birthday. If a potential match occurs, you will be contacted and given the opportunity to give a patient a second chance at life. For more information, visit *www.marrow.org* or call (714) 800-1611.

Photos by Dutch Slager / JPL Photolab

Systems engineers

THE NEXT GENERATION

By Mark Whalen

JPL is looking for a few good systems engineers. Actually, about 50 of them over the next five years, to be precise.

So says Ross Jones, assistant manager for systems engineering for the Systems and Software Division (31). Jones leads a program that develops the coming generations of systems engineers, the folks whose critical job it is to understand the big picture and know how all technical aspects of a system are tied together.

Systems engineers are charged with assuring that the multitude of tasks on a flight project—from propulsion and avionics to instruments and software, and everything in between—are working as intended. Through their problem-solving, communication and leadership skills, as well as their intellectual curiosity and healthy skepticism, they set the tone throughout the system.

And with the approximately 20 projects the Laboratory is currently responsible for, Jones said, "We have a need for more capable systems engineers. Not just more, but better trained, better skilled and more capable."

However, it wasn't always this way. In the early years of JPL, Jones said, new systems engineers were trained as apprentices. They learned the craft from watching and working with the experienced people. Until the early 1990s, the few systems engineers on Lab moved from one project to the next.

"We have so many more projects now," Jones said. "With only a few 'masters' of systems engineering and the proliferation of projects, the apprentice approach is no longer sufficient. We needed to find another way."

Successful systems engineers possess special skills; thus the challenge in finding those best qualified for the job.

"Not everyone is suited for this. If you like nice, tidy work packages, this is not for you," noted Gentry Lee, chief engineer of the Solar System Exploration Directorate. "One of the key characteristics of a good systems engineer is a personality such that when they go home they'll have a 'things to do' list that is not complete."

Lee also pointed to the need for "proper paranoia," or considering "what bad things can happen."

"You stick your nose in everything," he added. "You're guaranteed to learn something new every day."

Indeed, besides the requisite technical know-how, positive, influential behavior and an objective attitude are critical to the successful systems engineer. Key attributes include self-confidence and the ability to work with a team and manage change.

"The training will help the people on projects now, in their current roles, by increasing their skills and competencies and enhancing their leadership ability," Jones said. "Because the Laboratory carefully selects and invests time and resources in these people, we expect them to be capable of and to be placed in positions of systems engineering leadership in the future."

Due to the trainees' different skills, backgrounds and experience, the training is personalized to individuals in the program, Jones added.

Currently, 10 JPL systems engineers are involved in on-the-job training to better hone their craft. The program pairs trainees with mentors, who pass on their skills and experience to the new recruits. Trainees spend about one day per week on training activities personalized for them, including conversations with their mentors.

"The mentors expend a lot of time and effort," Jones said. "Each of them understands it's important they pass on to the next generation what they know."

Rob Manning, chief engineer for the Mars Exploration Program Office, mentors two systems engineers working on the Mars Science Laboratory. Just as JPL veterans helped him early in his career, he counsels protégés by recounting first-hand stories of what really happened in the Lab's recent history. His advice? "Trust yourself and be a thoughtful and critical thinker," he said.

Cece Guiar, project systems engineer for the Space Interferometry Mission, mentors two protégés on the project. She stresses the importance of their understanding the critical behaviors required of them as systems engineers. By example, "I have them watch my behaviors at meetings, then later they ask why I reacted or did something in a certain way," she said.

Charles Whetsel, the project systems engineer for the Mars Science Laboratory, mentors three protégés who also work on the mission. The four meet for lunch once a week, and Whetsel is also available for one-on-one sessions to offer further counsel. "They challenge me and are not shy about asking unconventional questions," he said. "It forces me to think more about why we do something the way we do it."

Julia Bell, payload accommodations systems engineer for the Mars Science Laboratory and a Whetsel protégé, said she was pleased when the Lab adopted the program and finds it "very valuable for me personally. The key is that protégés can help develop their own training."

The training lasts for about a year. When their stint is completed by next winter, the current trainees are intended to be leaders in their particular systems engineering domain, Jones noted. Four of the trainees work in the flight systems domain, while the others account for instruments, project, science and formulation, power and avionics, controls and software, and propulsion.

"It's great that JPL gives the trainees 20 percent of their time for this program," Lee said. "It's a good sign that JPL is investing in its future."

Jones said a call for the next class of 10 systems engineer trainees will be announced in the late fall. For more information, call him at ext. 4-7769 or visit the systems engineering website at *http://syseng*. ■

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Above: Protégés Jessica Collisson, left, and Jennifer Rocca.

Their first joint project, "Cradle," appeared in 1988. The following year it was followed by "Rama II," a sequel to Clarke's 1973 "Rendezvous with Rama" that had swept science fiction's Campbell, Hugo, Jupiter and Nebula awards. In 1991 the pair produced "The Garden of Rama," followed by a final sequel, "Rama Revealed" in 1993. While some longtime Clarke readers found Lee's prose saltier than the master's elegiac phrasing, the books all made the bestseller lists.

As the writing projects took off Lee left JPL and, in 1990, moved back to Texas. After the collaborations with Clarke, he went on to write three additional science fiction novels on his own. Along the way he designed an adventure game based on them for Sierra Online. He filled in his time with other freelance projects ranging from writing a column for Space.com to public speaking. "If somebody offered me an interesting job, I'd consult," he says. "I was overwhelmed when I was very young that life was so short, there was not enough time to do all the things you wanted to do. So I was just trying a lot of different things."

Photos by Tom Wynne / JPL Photolab

Toward the end of the 1990s, Lee accepted a consulting assignment from Scott Hubbard at NASA's Ames Research Center on the Lunar Prospector mission that launched in 1998. After the failure of the Mars Climate Orbiter and Mars Polar Lander missions a year later, NASA reorganized its Mars program and Hubbard headed to Washington to lead it. Hubbard invited Lee to do more consulting work, this time helping to rearchitect the Mars effort.

And, in turn, Lee fell back closer to JPL's orbit. "Starting in 2001, when I was serving on a review board early in the Mars Exploration Rover project, Tom Gavin and others started moving toward an offer I could not refuse," says Lee. "I was here almost full time as a consultant the second half of 2001 to see whether or not it was a fit. This was another big change in my life. I liked the people at JPL, I liked Charles [Elachi]. I liked the new thrust for Mars."

By 2002 Lee was back on the JPL payroll, serving as chief engineer for the Solar System Exploration Directorate. The pace of the job suits Lee's wide-ranging interests. "A typical week?" he says. "I'll probably work on six to eight different flight projects. Tomorrow I'm chairing a review for deployment of the radar instrument on Mars Reconnaissance Orbiter. The day after that it's the Dawn fault protection review. Then the next day, the Phoenix radar report. I go from project to project."

Since returning to the Lab, Lee has developed a reputation as the fellow who always asks what can go wrong. "I'm probably best characterized as a risk engineer, but across the entire system," he says. "Young people, when they start doing engineering, focus their energies on 'How do you make things work?' They don't ask themselves the question 'What bad things can happen?' Everybody laughs about it, because they know this is coming if I'm somewhere with a group. What's amazing is that if you don't think about those things when you do the design and when you do the operations, you don't realize there are ways to design things and fly missions to reduce the possibility of bad things happening.

"If I have a legacy, it's in teaching people how to think like what I call a proper paranoid. In other words, you look at the obverse side of the coin. 'Design A' may be better in some optimal sense, but may have weaknesses to allow a lot of bad things to happen. 'Design B' may not be as perfect if everything goes well, but it's more robust. That really is the better design for the kind of work we're doing, provided that Design B meets the requirements."

Lee says his tendency to look at what can go wrong is not necessarily a native instinct, but rather has been "forged out of my experiences. I'm actually by nature a very optimistic person. I've found out the hard way when I didn't ask in advance what bad things can happen."

Among the many flight projects Lee has helped along since his return to JPL, he treasures two particular high points. "One would have to be the success of the second Mars Exploration Rover and the appearance of the rock outcrop after we landed," he says. "This was a very important discovery—that there was a Mars other than the Mars of Viking and Pathfinder. As the team will tell you, I lived MER for the last year to 18 months before the landings. The Laboratory and NASA had everything riding on it. The thrill of that success was wonderful."

The other high point was Deep Impact. "I was the head of the red team"—the group traditionally assembled to size up a project's vulnerabilities. "It would be an understatement to say there were a lot of dicey things before launch. It's not the way we ought to learn. But an incredibly talented team of people, on the project and on my red team, asked all the questions and worked themselves to the bone to make that mission a success. They did a fantastic job.

"But that's not to say that there haven't been great memories with other flight projects. I was really delighted with Stardust. I had the opportunity to work with a bunch of really smart young people."

Besides JPL, Lee's other principal role in life is as a father. He has seven sons, ranging in age from 12 to 29. The highlights of his year include two traditional vacation trips with as many sons as can be assembled—skiing in the winter, and a Florida beach in the summer.

"I view my job in life is to make as comprehensive a menu for them as possible," says Lee, "and it's their job to make the selections. They're all over the place, they're all different. They all have a certain amount of native intelligence, but what they do with it and how they apply it is different from boy to boy.

"I've tried very, very hard not to have my expectations for my children become a burden to them. I'm not sure I have succeeded—apparently the father doesn't necessarily need to say anything for the children to feel like they have to achieve. But I hang in there, and do the best I can with them." ■

Clockwise from bottom left: Gentry Lee with sons Travis, Michael, Patrick, Cooper and Robert.

What's up with the Universe?

THIS ISSUE OF UNIVERSE MARKS the publication's transition to a new format publishing monthly. Some of the newspaper's content, including the calendar of coming events and the classified ads, has moved to the online, web-based Daily Planet.

In the more than half a century of its history, Universe—first known for many years by the name Lab-Oratory—has published on different schedules. In the 1950s and 1960s it was a monthly, magazine-like publication. In the 1970s it went to a biweekly newspaper format.

"The reason for going back to the monthly schedule is that, in today's Internet era, we're finding that a biweekly print publication isn't the best way to get out breaking news," said Frank O"Donnell, manager of JPL's Institutional Communications Office, which publishes Universe. "In many cases, the mission news that we're reporting is many days to weeks old by the time the paper goes to print. By moving the 'breaking news' content to the online Daily Planet, it frees us up to build a monthly publication with longer, more in-depth feature stories and profiles."

According to O'Donnell, the staff is keen on hearing ideas from JPLers for background features and human interest profiles. "Generally the profiles won't be as long as this issue's cover story, but we're very interested in spotlighting people as a way of building community," he said.

Along with Universe's format change, the Daily Planet this week goes to a new look, offering more news coverage of Lab events and summaries of outside news media coverage of JPL.

Currently active JPL employees and on-site contractors may access Daily Planet from on-lab by visiting *dailyplanet.jpl.nasa.gov.* Current employees may access Daily Planet from off-lab by using a JPL remote access account to log on at *intranet.jpl.nasa.gov.*

JPL retirees are invited to obtain a username and password that will allow them to access Daily Planet from off-Lab at *dailyplanet.jpl.nasa.gov.* To do so, retirees should send their name, address, phone number and a preferred username by e-mail to *universe@jpl.nasa.gov,* or by U.S. mail to Daily Planet, Mail Stop 186-120, Jet Propulsion Laboratory, Pasadena CA 91109. After their retiree status is verified, a password will be returned to them by U.S. mail.

American Heritage Day

Photos by Dutch Slager / JPL Photolab

Hundreds crowded the mall in celebration of American Heritage Day on June 28. Clockwise from left: Rich Alvidrez prepares to serve hungry JPLers; Todd Barber and Debbi Dachinger-Llata belt out tunes while fronting for the Big Band Theory; a visitor samples Chinese food; and the crowd makes its way to the food booths.

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Bill Goss

Jim Stephens

Passings

DR. ROMAN GLAZMAN, 57, died April 24.

Glazman had worked at the Lab since 1985. He worked as a research scientist in Division 32 and was internationally respected for his pioneering research in oceanography.

He is survived by daughters Anna Betelman, Marina Glazman and Rochelle Glazman.

Services were held April 28 at Forest Lawn, Hollywood Hills.

WILLIS (BILL) GOSS, 75, retired from Section 3020, died May 5.

Goss worked at JPL from 1966 to 2006. He is survived by his wife, Anita; sons Bruce and Rick; daughters Sharon and Terri; stepchildren David, Shirley, Daniel and Kelton; and eight grandchildren.

Services were held May 20 at Dead Horse Ranch State Park in Cottonwood, Ariz.

JAMES STEPHENS, 72, a retired engineer, died June 29.

Stephens joined the Lab in 1961 and retired in 2001. Among the positions he held was principal investigator of planet surface research and development, and he was a member of the technical staff for radiation cooler design and cryogentic spacecraft. He was the science coordinator of the Comet Penetrator Lander on the Comet Rendezvous Asteroid Flyby spacecraft, and was one of the founding members and liaison officer of the Technology Affiliates Program.

He is survived by his wife, Anne; children Jessica, Rache, and Jeff; grandson Wesley; and brother Tim.

Letters

Heartfelt thanks to my friends and co-workers following the recent illness and passing of my dear mother. Thanks to IND for allowing me the opportunity to telecommute, so I could care for my mom and spend what valuable time I had left with her these last few months. I will be forever grateful and will never forget your kindness and understanding. Your cards and kind words of encouragement were of great comfort to me and my family. Thanks also to JPL and the DSN O&M Group for the beautiful plants. I will miss my mom dearly, but the plants are a beautiful living tribute and I will think of her and your kindness when I look at them. Special thanks to those of you who attended my mom's memorial service. Having you there meant more to me than you could ever know.

Mona Witkowski and family

We would like to thank Section 374 for the surprise baby shower. We are very grateful for your support and generosity. Thank you all for the wonderful things we have received for the baby. Special thanks to Ana for her planning and hard work.

Heather and Mike Stefanini

Retirees

The following JPL employees retired in July:

Gary Kunstmann, 44 years, Section 8870; Krishna Koliwad, 31 years, Section 3000; Jules Benada III, 23 years, Section 3871; Jean Rinderle, 10 years, Section 9300.

Correction: NASA Honor Awards

Due to incorrect information provided to Universe, the June 16 issue should have included Wayne Nishioka among the recipients of the Exceptional Service Medal.