Reach for the Stars

By Dwayne O'Brien
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7:02 a.m.

Beneath the Nashville skyline, a steady stream of morning commuters have already begun to spill off of the main arteries of I-40 and I-65, filling the streets of the busy downtown area with a noisy din. Over on the west side, the tree-lined campus of Vanderbilt University sits in quiet contrast to its surroundings. The arboreal foliage is just beginning to take on the fall hues of red and gold, and the maze of walkways crisscrossing the manicured grounds lie mostly undisturbed, save for the rustling of leaves and the bustling of squirrels.

On the short walk to his campus office, Professor C. R. O'Dell encounters few if any passers-by on this crisp morning as he takes notice of the blue and ever-brightening October sky. He always notices. He likes the sky.

As usual, he is the first to arrive. On the ninth floor of the Stevenson Center, keys rattle, locks click open, and lights come on in a small, unassuming and immaculate office. O'Dell is the consummate organizer. He has to be.

A few strides from the door, he sits in front of the first and fastest of two computers which occupy the long left wall of the rectangular room to check his e-mail. This morning, he is pleased to see a message and the latest photos from an old friend far away. The same scene could be played out on a thousand computer screens in a thousand offices in a thousand different cities. But this scene, on this screen, in this office, is different.

You see, Professor C. R. "Bob" O'Dell is a research astronomer, and the old friend is the Hubble Space Telescope on which he served as chief scientist during its conception, development, and construction from 1972 to 1982. The latest photos are of the Orion Nebula, an interstellar cloud of gas and dust, and a cosmic hotbed of star formation and possible planetary development.

It lies some 1,500 light years away from Earth, and a world away from East St. Louis, Illinois.

Like so many other rural families in the 1930's, the O'Dells and their small farm in Hamilton County, Illinois were caught in the dusty, merciless grip of the Great Depression.

Not long after Bob was born in '37, they hit bottom. "Dad lost the farm and sold the mule" as he puts it. The family moved to the nearby manufacturing town of East St. Louis. Dad found factory work with Monsanto, first as a laborer then eventually as a foreman. They lived alongside the other employees' families in company-owned row houses, now long since torn down. The work was hard, but hard work was good. He learned that in East St. Louis.
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Fortunately, growing up in a booming blue collar industrial town meant that there was a huge tax base and a small number of people. This brought in an abundance of money for schools, and teacher pay was excellent. Highly skilled teachers who would have normally gone elsewhere were drawn to the area by the high salaries.

So, some very good teachers were teaching a bunch of “redneck’s” kids. A few responded to the environment, most did not. Out of Bob’s high school graduating class of one hundred, only two would go on to finish college, and only a handful more even went to college at all. Most of the teachers eventually left or quit teaching altogether. They didn’t think that they were making a difference.

One day in 1948, one of these teachers, Mrs. Chartrand, asked her fifth grade class to write a one-page essay entitled, “What I Want to be Doing in 25 Years”. An eleven year old Bob wrote that he wanted to be an astronomer observing with the 200-inch (the diameter of the primary mirror) telescope at the Palomar Observatory in California.

Where did this inspiration come from? It certainly didn’t come from his home. His father didn’t complete the fifth grade; his mother didn’t finish high school. There were no books in the house other than the Bible. “It must have been the Weekly Reader,” he remembers.

“My Weekly Reader” was a classroom newspaper for kids and it was giving a lot of attention to the 200-inch (the world’s largest at that time) telescope at Palomar which was then just getting into operation.

The stories and the photographs - especially the photographs - piqued the young boy’s interest. He asked his parents to buy him a set of optics (lenses) for a small telescope, and while in the seventh grade, used them to build his own telescope.

_The Orion Nebula was one of the first objects that he looked at in the night sky. He’s still looking more than fifty years later. Bob is now a world authority on the Orion Nebula and has been instrumental in mapping its polychrome features._

9:34 a.m.

The datasets and crude images from the Space Telescope are now downloaded. The images arrive in small sections which have to be spliced together in order to see the entire observational field. Also visible are random cosmic ray hits which need to be mathematically canceled out of the final image of the object.

Piece by piece, the familiar features and contours of the nebula are assembled into one composite image for in-depth analysis. These images will help O’Dell to solve a physics problem that has been around since 1967.

“Something is going on in the Orion and other nebulae that we don’t understand from ground-based observations,” O’Dell says...” It is causing small-scale temperature variations which cause the measurements of the abundance of the heavy elements in the nebula to be off by a factor of three. If we can determine an accurate temperature of the nebula, then we can measure the abundance of the heavy elements and we will be better able to trace the development of stars in our galaxy and others like it.”
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Exactly what physics is occurring in these strange new worlds remains a mystery, but he is confident that the thrill of discovery awaits. After all, to him, new worlds are nothing new.

Coming from O’Dell’s background, a boy doesn’t think about going to the big colleges. Bob went to Illinois State Normal University (now Illinois State) because it was a teacher’s college. Teachers were the only educated people that he had ever known. They went to doctors. He had only seen a doctor once in his life.

Once there, a whole new world opened up. He studied physics and chemistry. In the autumn of his junior year, Sputnik was launched and the United States was thrust into the Space Race.

Suddenly and fortunately, a great deal of the nation’s resources was steered toward the space and physical sciences. The road to the stars was beginning to take shape.

After Illinois State came graduate school at the University of Wisconsin. With his doctorate in astronomy, Bob went to CalTech as a post-doc and then on to Berkeley as an assistant professor. Two years later, he moved on to the University of Chicago and the Yerkes Observatory where he eventually became the department chair and the director of Yerkes for five years. Along the way, the boy from East St. Louis had the opportunity to observe with the 200-inch telescope at Palomar.

*It had taken less than twenty-five years from Mrs. Chartrand’s class to achieve his childhood goal.*

1:14 p.m.

O’Dell has been at the keyboard for over two hours working on one of the six or so research papers that he will publish this year. He’s never felt any pressure to publish. He enjoys the work. But the body and the mind have their limits, and with a stretch he rises from the chair. “I just can’t sit in front of that damn machine all day long,” he says. Time to go to the gym. He tries to get away from the computer and out of the office at least once every day, sometimes at mid-day, sometimes later. He likes to stay in shape. At 65 he feels that there is so much more to be done. But he has done quite a lot already.

In 1972, Bob took the biggest gamble of his professional life. He left the security of his tenured position at the University of Chicago, and moved to the Marshall Space Flight Center in Huntsville, Alabama to become NASA’s Project Scientist for what is now known as the Hubble Space Telescope (HST).

It was a difficult decision to make,” Bob remembers, “but the thought of having such an incredible telescope to use for research was too good to pass up.” The project was not without its detractors. “It was difficult in the beginning to get the support of the astronomical community”, Bob says. “Many were skeptical of the idea of spending half a billion dollars on building one medium-sized telescope.”

“The early years were spent persuading colleagues, securing funding from Congress and coming up with a preliminary design. It is a measure of great success that I was able to get people from all of the major institutions to come on board and get involved in the planning. Funding was finally appropriated and we entered the construction phase in 1978.” From the beginning in 1972, it was decided that the HST would be carried into orbit by the space shuttle, which was also in
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development at the time. This meant that the telescope had to fit into the shuttle’s payload bay and not exceed set weight requirements.

The dance between the scientists and the engineers was lively but fruitful, and by the proposed launch date of 1985, the HST was essentially built. Delays in the shuttle program and the Challenger disaster pushed that back and the HST was finally launched in 1990.

In order to make the make the maximum use of the instrument that he had helped to create, Bob left NASA in 1982 and joined the faculty at Rice University in Houston, Texas where he fulfilled his desire to return to research astronomy.

3:20 p.m.

O’Dell is back in the office finalizing travel plans for next week’s trip to a mountain top in Baja. He is going to observe with the ground-based San Pedro Martir telescope southeast of Ensenada, Mexico. Getting there and back will require most of a week for just two nights of observations. Travel is an integral part of a research astronomers life. There are fewer than 10,000 members of the American Astronomical Society and less than a third of those are active in research. Half of the research astronomers in the world are in the United States, so face-to-face interaction requires an extensive amount of travel.

Ground-based telescopes tend to be located where viewing conditions are the best, so trips to far-flung places like Baja, Hawaii, and Chile are essential. It was in Chile that Bob ran up what seemed to be a blind alley.

He was making observations of the Helix Nebula using one yellow and one blue light filter to determine the color of the nebular cloud. His results just weren’t making any sense. He had chosen the filters by referring to the published spectra of the emission lines (the bands of light at specific wavelengths that are signatures of the elements present) in order to avoid those wavelengths.

It turned out that the published spectra were wrong, and an unknown blue emission line was throwing off his results. Bob had the wherewithal to question the original data and it paid off. He realized that the unknown emission line was the result of high levels of ionization. “If I had been trying to find strong ionization, that’s exactly how I would have done it,” Bob says.

Absolute blind alleys are rare in his field. You have to have some idea of how an observation will turn out or they won’t give you the use of the telescope. That doesn’t mean that there aren’t surprises.

“I remember the excitement when we discovered the proplyds in Orion,” he says. “These images started coming in, and we knew we were looking at something extraordinary. We checked and rechecked the instrumentation to make sure that we were seeing what we thought that we were seeing. Sure enough, there they were.”

Proplyds (a term Bob coined for proto-planetary disks) are flattened disks of dust and gas surrounding a newly formed star, and are made of material left over from the formation of the star itself. Over millions of years, gravitational forces bind the material together into planets orbiting in a plane around the star.
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“We should have been looking for them’, he says. “Our sun is an indication that this is the mechanism for planetary formation. The planets orbit the sun in a plane called the Zodiac. It was very exciting to have seen this in the Orion images.”

4:45 p.m.

An e-mail arrives from a potential buyer, and the astronomer’s thoughts turn to another concern. He’s selling his airplane.

The company house that Bob lived in back in East St. Louis was right next to an airfield that was home to the Parks College of Aviation. Bob would spend hours just watching the planes take off and land. He would work all day on Saturday at the grocery store, pump gas on Sunday morning, and then blow all the money that afternoon on flying lessons. He soloed at 17 in a two-seater Luscombe. His love of flight eventually led him to take up the sport of aerobatics in a single-seat Pitts biplane.

He competed in the most difficult "unlimited" category, and would finish in the middle of the pack. In Houston, he found that glider aerobatics was a smaller pond, and traded in the Pitts for a German-built Salto sailplane. He did well, making the U.S. Glider Aerobatic Team four times, and finishing second nationally three times.

Bob left competition after that, and now flies a beautiful red Globe Swift built in 1946. It’s about the same age as he is, and older than the 200-inch telescope.

To fly and to love flight – he learned these in East St. Louis.

5:34 p.m.

Time to call it a day. The data gathered today is another piece of the puzzle of the universe. Lights off, locks turned, keys rattled. On the short walk back, Professor C.R. O’Dell takes note of the clear and darkening sky. He likes the sky.

How do you build the world’s first space telescope? You start with a boy and a dream, and a story about a telescope in a “Weekly Reader,” in a row house... in East St. Louis