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Early History of Rice University Space Science Department

An Autobiographical Account

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Why a Space Science Department at Rice?

A one sentence answer: Because President Kennedy came to Rice University to give a speech about the US going to the Moon, and Rice's President decided that Rice should show a response.

The Soviet Union had put a satellite into orbit before we did. For several years afterwards they launched significantly heavier payloads than the US and scored a number of impressive firsts. The international ramifications were severe. The Soviets had defeated us in a race where we supposed ourselves superior, and they were claiming that their achievements in space demonstrated the advantage of their political system. I personally witnessed this sales pitch while I was working in India in 1961-62.

President Kennedy made his initial declaration that we should go to the Moon to a special joint session of Congress in May 1961. He later upgraded the lunar landing to the status of a national objective because it put a bright spotlight on the race to the Moon. (Although it may not sound important, this upgrade to national objective was a big deal.) The reason for choosing a lunar landing and return was because we had been so badly outclassed in early space endeavors. A lunar mission was so formidable that the Soviets' experience afforded them no advantage. It was a new contest on a level playing field.

The reaction to Kennedy's upgrade of the project to a national objective makes clear how formidable it seemed. The decision went against firm technical advice from all of the leadership of NASA and all of his own science/technology advisors. To hear a revealing, I thought almost alarming, discussion between JFK and his advisors in Nov. 1962, go to: http://millercenter.org/presidentialclassroom/exhibits/fly-me-to-the-moon A public display of how questionable a Moon mission was regarded was shown in a presentation by one of the participants in the priority discussion. Hugh Dryden, Deputy NASA Administrator, spoke at an APS meeting in Mexico City. Dryden conspicuously avoided saying that we would land anyone on the Moon. Instead, he said that we would get a man to the vicinity of the Moon. In those early days of spaceflight, no technical person with responsibility would say a lunar landing and return was realizable. Kennedy was knowingly taking a significant risk, but obviously it was one that he was convinced was warranted.

A month after the discussion about the lunar landing as a national objective, President Kennedy gave a speech in Rice Stadium (Sept. 1962) to a crowd of about 10,000, mainly high-school students, some with bands in full uniform plus about 400 Rice undergraduates. Rice University was prominently mentioned in Kennedy's description of Houston's role in the lunar adventure. Rice's President Kenneth Pitzer wanted to show an appropriate Rice involvement, and he moved quickly. Pitzer first tried to obtain a suitable Rice response by offering new faculty positions to

the Physics and the Geology Departments so they could hire faculty interested in space physics and lunar geology. Both departments turned him down.

Later, in conversations with Chairs of Physics and Geology, Gerry Phillips and John Adams, I learned why they did not want the new faculty positions. Phillips said space physics was not fundamental enough. Physicists were interested in things like why electrons had spin. Adams said his department was interested in petroleum geology, and there was no oil in the Moon. (These are not direct quotes but they contain the sense of what was said.) Such insular attitudes may be hard to believe, but they were prevalent. For example, ask yourself why space physics ended up in what was then the ATM (Atmospheric Science) Division of NSF and not in Physics and Astronomy. Also, look in David Cumming's book, *The Formation of USRA A Documentary History*, to read of repeated failed efforts, principally by Universities Research Association (URA) President Norman Ramsey, to allow space research to become a branch of URA. Although physicists did not say in writing that it was their dislike of space physics that caused it to be rejected, I had heard enough in other conversations to cause me to believe that was the basic reason. University space research had to go it alone, accomplished by forming an independent consortium USRA (Universities Space Research Association), which David Cummings later led as its Executive Director.

After failing to get the Physics and the Geology Departments involved, President Pitzer went outside the university. He got word out that Rice was looking for a space scientist. I do not remember how I heard, but it was definite enough that I wrote expressing interest. I have the impression that mine may have been the only response. He wrote back that he was going to be in Austin in a few days and asked that I come there to talk to him. Then I was invited to come to Houston to talk some more and have dinner at the River Oaks Country Club with him and Board member Dell Butcher. As I recall, the conversation had a substantial space component. NASA had recently developed the first liquid-hydrogen-burning rocket engine (!), which gave me grounds for feeling positive about the Apollo project and beating the Soviets to the Moon. My confidence impressed Butcher who said to Pitzer, "He sounds just like Von Braun." That visit apparently clinched it for Pitzer and I was offered a job. Note the absence of faculty committees and formal searches. The contrast between how ponderously such things are done now in academia and how easily and quickly they could be done in those days, now seems unreal.

Soon after I arrived at Rice, Pitzer asked if I wanted to go to what was the last faculty meeting of the academic year. I declined. Afterwards he told me that it was probably good I had not gone, but he did not say why. Later I learned that Pitzer had announced at the meeting that he had created a Space Science Department. There were objections, even a motion by Frank Vandiver (acting President of Rice 1969-70 and later president of Texas A&M) that the Space Science Department be tabled.

Getting Started

First a bit of personal explanatory background. I started working professionally in space physics at Lockheed Aircraft Co. in mid-1956, over a year before the launch of Sputnik. Thus, when I got to Rice I had about 8 years of experience in space research. At that time there were few with more experience. Also, I had what I now see was an unwarranted confidence in my ideas of what should be done. My image of how the field would develop and how it would fit into and contribute many bright threads to the tapestry of science was no doubt influenced by my boyhood fascination with astronomy and the realm of the universe. I wrote out these ideas in *The Role of Space Science in Graduate Education* (Vol. 49, No. 3, Transactions, American Geophysical Union, Sept 1968).

President Pitzer had no specific details in mind beyond a visible Rice response to Kennedy's announcement in Rice Stadium. As improbable or odd as it may seem, I was to supply the details. For example, Pitzer asked some key questions: Did I want to be on campus or off? Did I want a center, institute, or department? I was a bit surprised to realize that I had such latitude in deciding how things were to go.

I had ready answers to President Pitzer's questions. Space Science should be an academic department, located on campus, and focused in physics and astrophysics. Further, because the Physics Dept. was not yet interested in a full association, we agreed that the Space Science Dept. should be graduate-only, grow to a (never defined) critical mass of faculty, and then be incorporated into the Physics Dept. This plan is mentioned in *The Role of Space Science in Graduate Education*.

One could move quickly in those days. It was nothing like today with rules, regulations, and committees. Kennedy's speech at Rice was in September 1962. By May 1963 I was in Houston full time, a 34-year-old Professor with no academic experience (except as a student), and Chairman of a non-existent Department of Space Science at Rice University. I remember being pleased, confident, and eager. I do not recall any doubt or worry. Now, with insight afforded by experience, I find this mindset astounding.

Immediate tasks were obvious: hire faculty and recruit students. This involved phone calls, letter writing, printing and distributing posters, giving recruiting talks in some of the Rice Colleges, etc. It was easier then than it would be now. Even though means of communications were relatively primitive, I will argue that it was an advantage not having Internet, Xerox machines, FedEx, cell phones, and personal computers. It was as though there was less noise in the system. Mail arrived once a day so correspondence was concentrated in time and, because the communication in a mailed letter was already several days old, instant replies were not expected. Long-distance phone calls went through an operator, which erected a sort of minibarrier. Less multitasking allowed blocks of time to think, and thinking generated motivation to reflect on options. In 1963 the lack of instant communications, committee meetings, and rules and regulations made it easier to focus and to move swiftly. There was no Dean or Provost separating science departments from the president. A faculty appointment needed only a one-paragraph memo from me to President Pitzer, the candidate's CV attached, asking that an offer be made. Pitzer was wonderfully supportive. There were no federal requirements concerning things such as advertising or equal opportunity (an uncomfortable example: at that time Rice was segregated and it was legal).

A side note: The department name Space Science is in the singular. One reason is that it is easier to say without the final "S". But in my mind the basic reason was that the goal of space science was the unification of science, not the creation of many minimally connected areas of understanding.

Regarding the curriculum, our students were to be exposed to the broad expanse of physics so they could feel confident in their ability to work outside the topic of their thesis research. The curriculum was heavy in courses taught in the Physics Dept. I believe the results justified the extra course-load the students endured. Our early graduates were, in my opinion, comfortably versatile because their courses were not tailored to their thesis interests.

Because our students took physics courses, and because professors ought to profess, we offered to help the Physics Department with their teaching. Initially they were cautious, but they wanted help. They quickly relaxed when they found our faculty totally qualified. In addition, graduate students were assigned for one year as Teaching Assistants. Al-though the Physics Department may not have had warm feelings about our areas of research, they welcomed our compe-

tent faculty and graduate-student TAs. Also, because our department was a stealth physics department, the relationship established by our providing teaching faculty and TAs was necessary. In my mind it was vital.

The time between Kennedy's Moon speech at Rice to the beginning of classes was less than one year. The Space Science Department at the beginning of the academic year consisted of four faculty members: Don Clayton (stellar evolution), Curt Michel (astrophysics), Brian O'Brien (experimental magnetospheric physics), and me (magnetospheric theory). Bob Haymes (gamma-ray astronomy) arrived April 1964. There were seven graduate students enrolled: Wade Craddock, David Criswell, David Cummings, Hal Goldwire, Jerry Modisette, Bill Sorenson, and Mickey Trichel. Note our fine student-to-faculty ratio.

Subsequent Developments

Good things kept happening because space research was on the upslope in what can be seen in retrospect as a glorious golden age of space exploration -- hero astronauts, headline discoveries, and lavish funding. Houston was Space City USA and the existence of the Rice Space Science Department was widely known, especially to the Houston public. Our new department attracted meaningful attention. We had fulfilled Pitzer's wish that Rice show a response to Kennedy's speech. Word had gotten out. Students were being referred to our department, and those who applied could be enrolled in a few days. We were having great fun in research and education. Space science was at a peak of excitement. It seemed that almost every rocket payload, carrying any sort of instrument, launched in just about any direction, made an interesting measurement or a discovery. Money for research, graduate students, and faculty positions was available. Under those conditions, it would have been hard not to have a good year.

Growth in number of faculty and students was an obvious priority. Recruiting became easier because of our growing reputation. We added faculty: Hugh Anderson (cosmic rays) and John Freeman (magnetospheric physics), and the number of graduate students grew. We had good balance between experimental and theoretical space physics. We were on track to connect the solar system to the rest of the universe.

Some recruiting tools were not effective. An amusing example: To aid in recruiting faculty, I asked grad student David Cummings to draw a graph of monthly-mean temperatures in Houston and Acapulco. In summer Houston is like Acapulco — hot, sticky, and humid. At that time Acapulco was the most desirable beach-vacation spot in Mexico. I felt that an objective comparison might make our climate seem a bit less intimidating. I used Cummings' graph a few times, but it was soon clear that no one who saw it was taken in, and it was giggle-producing and thus counterproductive. Houston weather had to be accepted as a recruiting liability.

Another priority was getting funding from NASA for a building. We were initially all housed in the carpenter shop of Buildings and Grounds (now called Physical Plant). This was a one-story building near the A/C cooling towers off Sunset Blvd. When classes started in Fall 1963, the faculty members got offices in the Geology Building, and our students unofficially moved into the otherwise unoccupied Geology departmental library. Geology had space that was obviously surplus although its disuse was thinly disguised by piles of rocks. Geology was gracious, but also a bit worried that we might not move out and would declare squatter's rights thereby acquiring some of their space. O'Brien and his students worked in the carpenter shop space to build a rocket payload that was launched from the NASA facility at Wallops Island VA in July1964. The experiment worked and the resulting data were published in a paper on midlatitude airglow. I can't imagine doing anything involving NASA that quickly today.

NASA had money for university buildings to support space science and technology. From a friend at UCLA (Gordon McDonald), I got a copy of their successful proposal. This helped a lot. With a bit of writing, plagiarism, and vital input from the School of Engineering (provided by Franz Brotzen and Alan Chapman), a proposal was assembled and submitted in a matter of weeks. Although I did not realize it at the time, having Congressman Albert Thomas representing the interests of Harris County and Rice University, assured that the proposal would be funded. Look at Thomas' impressive biography to see how important he was to Houston-NASA relations: http://en.wikipedia.org/wiki/Albert_Richard_Thomas

An event related to the building turned out to warn of a problem that I did not recognize. I accompanied President Pitzer to meet with NASA Administrator James Webb and Associate Administrator Homer Newell. This was before final approval of our building proposal. NASA had earlier made statements that they did not want universities to set up separate space departments. Rather, they wanted to support broad interdisciplinary efforts. As discussed earlier, what NASA wanted had been attempted by Pitzer and would not work at Rice. After some discussion, just as the meeting was ending, Newell prodded Webb to ask, "I hear you are going to set up a space science department. What about that?" Pitzer said, with a bit of emphasis, "That's my business." It seemed to me that Webb momentarily flinched, but quickly responded, "Of course." He turned to Newell and said, "You and him [meaning me] work everything out." The meeting was over. Newell looked upset. He had nothing to say to me then or later. Sadly, I did not realize this exchange had identified a problem that required attention. Here I am reminded of the saying, "We get too soon old and too late smart."

Before proffering any additional analysis, a caution. First, I was totally naïve on matters of diplomacy and organizational politics. Further, I was disinterested. Only recently have I been disabused of my notion that quality alone, i.e., a superior space science activity, would win the day. Oh my. Now I dearly wish I had asked Pitzer why he did not explain to Webb the reason Rice was forced to create a Space Science Department and the vaporous plans for a subsequent departmental merger.

I now think that Newell may have been trying to derail the formation of a Space Science Department by arranging the meeting with Webb. NASA had been successful in discouraging similar academic departments elsewhere. This explains why, six years after NASA was formed, we had the distinction of being the first and only such department in the nation. Pitzer's curt response to Webb, "That's my business." was uncharacteristic. Pitzer was the acme of logical, statesmanlike debate. In writing this history I have developed the following hypothesis. Congressman Thomas was engaged in matters that affected Rice. Pitzer's secretary, long after she retired, told me how Thomas would call her almost daily, around 6:00 am, with briefings for President Pitzer. Thomas would first check that she had her notebook at the ready and then he would give her the information of the day. I wonder if the NASA objection to a stand-alone space science department had been a topic discussed between Newell, Thomas, and Pitzer? With Thomas involved, Newell could not turn down the building proposal. His only chance was to get Webb to talk Pitzer out of forming a department, and that had failed. If my speculation is correct, the Webb/Pitzer interchange makes sense. Otherwise I don't understand it.

Such events are not without cost. Newell's displeasure I believe trickled down to the level of program director for space physics with whom we dealt for much of our research funding. Although our funding was not affected that I could notice, I was aware that faculty from our department were not being appointed to the most influential NASA committees. These committees were important because they came up with recommendations for future space missions. If you were on such a committee, you would argue for what you thought best, which, quite naturally,

would coincide with your research interests. This is normal and expected. I asked a program director why no one from Rice was being appointed to these committees and was told that they were saving us for something better. I should have pursued this, but I did not.

Whatever influence Newell had on NASA program directors was, I believe, intensified when NASA program director Al Schardt came to Rice in Nov 1963 for a site visit. We met in the morning and he was shown what we were up to. Then we went to lunch with President Pitzer in Cohen House. We had just finished eating when the terrible news that President Kennedy had been assassinated in nearby Dallas spread through the room. All were stunned. Schardt and I returned to the offices in the Geology building where he picked up his briefcase and returned to Washington.

On the matter of merging the Space Science Department into Physics, there were some transient events. When Bill Gordon came to Rice as Dean, I asked him about it, and he put me off. I mentioned this to Pitzer, and he said that Gordon told him it was too soon. When King Walters became Dean, I brought the matter up again. Walters had a wonderful low-key convincing style. His argued that a merger was not only unwise, it was dangerous because the combined faculty would comprise by far the largest department at Rice with a correspondingly large payroll. It would stand out as a budgetary target and thus be untenable. Walters convinced me that a merger was no longer possible.

The direction of the department changed with time. One change that could have been (but was not) foretold involved a predictable pattern in research funding. It is a truism that research follows money. Scientists can influence where funding goes by various means, the most common being advisory committees. But in the case of funding space physics research, some insurmountable obstacles had inadvertently been put in place by the very organizational structure of the funding agencies. I earlier pointed out that space physics was in the Atmospheric Sciences Division (ATM, now Atmospheric and Geospace Sciences) of NSF. This space physics funding source was and still is separated from physics and astronomy by wide, fortified moats. Similarly NASA was organized by the size of rocket used for payload launching. Thus Earth-space launches, needing relatively small rockets, are separated from the other planets, and both are separated from astronomy. Getting funding for a single grant to explore the connection between the Earth, the rest of the solar system and astrophysics, turned out, at best, to be impractical. This injured the generalization of theory from, say, plasma phenomena in planetary magnetospheres to related astrophysical phenomena. For example, we found from direct measurements that plasmas do not lie docile doing nothing. I was able to point out that the only place one could find plasmas in thermodynamic equilibrium was in the pages of the Astrophysical Journal. The transfer to astrophysics of theoretical understanding of space plasmas and associated phenomena learned in the exploration of the solar system was slow and indirect. Funding barriers caused by NSF and NASA organizational structures cost space physics an exciting, expanding playing field.

Another factor was the effect of the Vietnam War on public support for pure research. Starting around the time of the first Apollo landing (1969), the priority for basic research was questioned. Why look at plasmas and magnetic fields in space when on Earth we had pollution, poverty, disease, and social injustice? Research fields reacted as well as they could because it was felt that funding was at stake. Astronomers had no response to these pressures; they had no choice but to simply ignore them. In contrast, space research found a positive response in the NSF ATM Division. A solar astronomer, Walter Orr Roberts, collected data that he argued demonstrated a correlation between solar flares and terrestrial weather. His findings were one of the justifications for the creation of the National Center for Atmospheric Research (NCAR). Roberts was its first director. Meteorologists were briefly sold on the idea that errors in their

weather forecasts were caused by not including solar influences such as solar flares and sunspots. Thus was born the field of Sun-Weather coupling. The paper, *The Role of Basic Research in Universities* (EOS, Vol 50, No.9, 508-511, Sept 1969) defends basic research, arguing that research is the primary tool for graduate education, and these students are the problem-solvers of tomorrow. This claim had a confirmation in the minds of all who heard the array of papers given at the symposium that was part of the 50th anniversary celebration of Space Science at Rice.

Research follows funding. Within the solar-system space physics community, astrophysics interests were not pursued because they were not funded. Similarly within NASA, there was an isolated source of funding for Earth-oriented space research. It was natural that the Earth space community and NASA followed the pressure for doing "relevant" research, and they did so with enthusiasm. Because no Sun-Weather coupling could be found, there were decadal name changes that retreated from meteorology. Its present name, "Space Weather," acknowledges its funding source, but the research supported now has no meteorological content. To get NASA and NSF funding that encouraged connections between, say, magnetospheric physics and astrophysics would require revolutionary agency reorganizations. It is what would be needed to allow easy funding of the science connections that I had envisioned in *The Role of Space Science in Graduate Education*.

On the matter of having a flight experimental space physics program in the department, we started quickly with sounding rockets, even building a small satellite payload that was put into orbit, its radio transmission picked up with a modest rooftop antenna. We had several experiments by Freeman and O'Brien placed on the lunar surface by Apollo astronauts, contributing to lunar studies. Haymes launched gamma-ray telescopes on high-altitude balloons, discovering positron-electron annihilation radiation coming from the center of our galaxy. The Space Science and Technology Building was designed with a deep basement so that large rocket payloads could be assembled there. Our building had a platform on the roof that was designed for mounting a large dish antenna that could survive hurricane-force winds. But after a potentially important, well-designed but complicated and expensive twin-satellites mission ran into trouble and was canceled, our orbital-payload activity ended. While Bob Haymes was at NASA headquarters (1988-90) serving as Chief Scientist for Astrophysics, he personally heard of reputational damage to our department within NASA caused by this failed effort. We flew sounding rocket and balloon payloads that were built in-house for only a few more years. It is somewhat comforting to note that the ending of building flight hardware would likely have happened anyway because payloads become so complex and expensive.

Not surprisingly, my specific expectations for how the department would evolve were not accurate. For example, I expected the golden age of space exploration to continue forever. But my incorrect prediction of the future direction of space physics has not mattered. Through iteration and evolution, the department has been remarkably successful. The major goals of quality space research supporting a superior program of graduate education have been gratifyingly realized. Research papers published by department faculty and students have added notably to our understanding of space physics. For example, the department has granted some 248 PhDs. The successful careers of our graduates within the space science and other scientific communities, academia, and national organizations are a proud outcome.

Our achievements were visually and viscerally demonstrated by the 50th Department Reunion attended by so many of our graduates – they are the ultimate justification for our place within a university and for our research and education endeavors.

A Note and Acknowledgments

Much of what I have written is from memory. I confidently expect there are mistakes and omissions. Please bring them to my attention (alex.dessler@gmail.com) and I will make corrections.

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