Editor / David Steen

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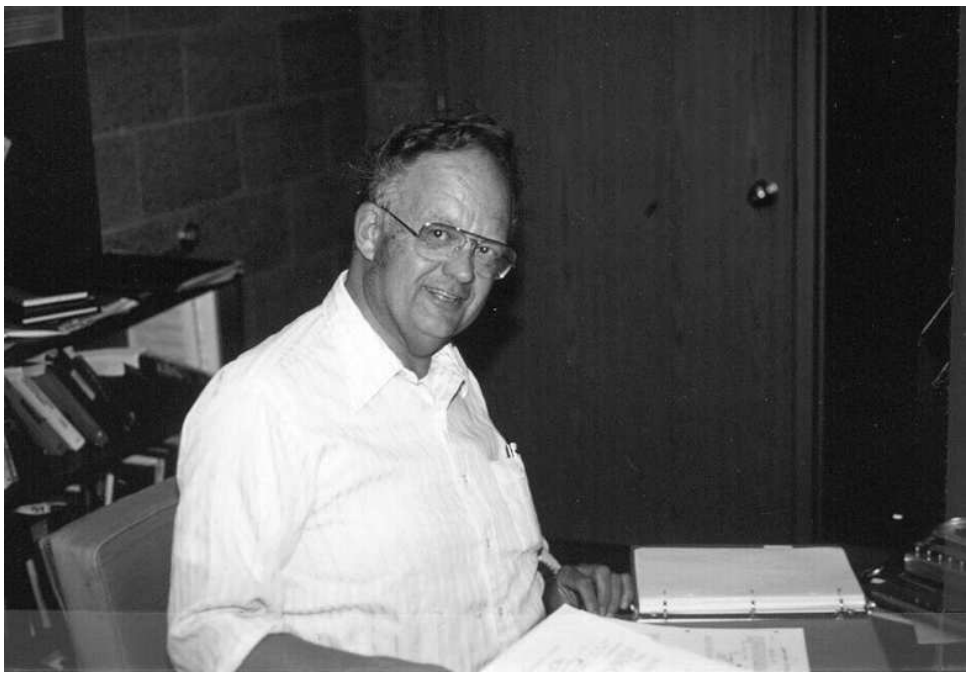
PhysicsFocus

Bethel University Physics & Engineering Newsletter

In this edition of the Physics Focus we take time to recognize a great loss to the Bethel Community and particularly to the Physics Department. R.A. Carlsen was a great man in so many ways and it is hoped this compilation will celebrate his time with us and serve as a tribute to him.



A Memorial Service Tribute from the Department

by Professor Dick Peterson

Many from the Bethel community could share the delightful stories and times of Bob Carlsen, this unique friend of ours known by many students and colleagues simply as "R.A." Those stories would include the many trips to the boundary waters, fishing trips, breakfast and luncheon excursions—complete with equations on napkins, and trips with students. But here we will most reflect on his day and night presence around the physics area at Bethel—both in the past and up to the present. Many of you at this memorial service would surely enjoy sharing those stories, and indeed Bob suggested to his close physics colleague Tom Greenlee that he really wanted a generous touch of humor in these memorial reflections.

I would like to start by remembering some of his last years and months at Bethel. Gradually his passion for wrestling with physics, math, engineering, and computer science was coming down to an hour or two each day, and much of the rest of his time at Bethel was spent in the so-called faculty lounge—a venerable mixing pot for ideas on campus. There he would read quite a bit and listen to the noon hour conversations and often inject a comment or two—but he was a good listener. Now many noon hour lounge inhabitants have often been a tad to the left of Bob on the political spectrum, but he really enjoyed this stimulus and challenge, even though he might quietly proclaim in the aftermath that it was just about too much liberal stuff for him to take.

However, taking all this in good humor in fact followed from his deep respect for his Christian colleagues and their ideas, and he would sometimes even suggest they had him (as in the old invitation hymn) "almost persuaded, now to believe..." Plus we would often hear, "And who are you...?" as he sought out the newer folks on campus and inevitably found out about their work and ideas. Clearly in his later days he enjoyed being increasingly stimulated by a wide range of creative people and their ideas. Would that we all could do as well.

R.A. and class giving thanks over newly arrived equipment.

Many of us coming to Bethel over the years became better acquainted with this electronics and computer science professor who was academically a rather peculiar fellow, in many ways ahead of most of us. To Bob the most sacred, profound, and beautiful parts of science were reflected in its mathematical description! Reading from his published junior/senior level notes, called *Instrumentation*,

> "There are two basic ways of learning physics: the inductive and the deductive (mathematical) method. We take the latter approach which means that we start with a set of axioms for circuit theory, electromagnetic field theory, and quantum mechanics. The approach works well with students that are mathematically sensitive and being Christians, have an added advantage because they are used to an axiomatic structure for living which, clearly, is modified by the concept of grace in the New Testament.
>
> I used to tell my students at Michigan that Moses not only brought down the ten commandments from Sinai but that Maxwell's equations were written on the back! The remark always got a good laugh, and it gave me the opportunity to identify myself as a Christian, and then provided an opportunity to say that physics is best at describing the physical world rather than explaining it."

He was insistent on the clarity and elegance of mathematical physics, and Greenlee recalls the case of a student stopping by to ask R.A. why he took off points for just leaving off those vector arrows from the equations of dynamics, and he replied, "Because, you are worth it!" And even in his toughest times, he was known to compare the sustenance and elegance of Maxwell's equations to those steady promises of hope we find in the scriptures.

But that is not all he was as a teacher, not at all. Most importantly he wanted his students to take the results of their mathematics, and make them spring alive in the lab. His goal, in one of his common phrases was to help the student "turn the corner" - meaning they would begin to see what a life in science and engineering could really entail by diving in with a dedicated passion to really understand some beautiful phenomenon with mathematics, computation, and measurement. It is still his spirit of disciplined and in-depth inquiry that we hope most characterizes the national reputation of Bethel physics, and in this way he sought to bring light to beautiful physics but also inspiration and vision for the lives and continuing discipleship of his students.

We conclude with the I Corinthians 13:12 passage he quotes at the beginning of *Instrumentation* that reflects both his teaching vision but also the ultimate hope that we celebrate today, "For now we see through a glass darkly; but then face to face; now I know in part; but then shall I know even as I am known." Peace to his memory.

Remembering Bob and Mary Ellen Carlsen

Bethel's mathematics department and science division welcomed us into the fold in the fall of 1975, a newly minted Ph.D. but, more importantly, a family of new Christians (my second birthday was on or about April 1, 1974; Kathryn's a few months later). Like any other babies we had barely a clue what resources our new households of faith could offer, but we were immediately "encompassed about" by several elders in the faith, Erv and Helen Carlson in our local congregation, and then Bob and Mary Ellen Carlsen and the members of my department in our academic family at Bethel.

Mary Ellen was already engaged in her struggle with MS, to which was later added cancer, and the challenges of this struggle naturally absorbed much of her energy and attention, and Bob's. I know I didn't really grasp at the time how much the hours they invested in making us feel "at home" at Bethel cost them. For example, at a very busy time, Bob was in the small group (mostly my family members) who witnessed the formal completion of my degree program in December, after defending the thesis in July.

As the academic year progressed, Bob was very generous in his investment of time and attention, orienting me to the role of the mathematics curriculum in supporting the efforts of physics and the other "natural science" curricula, giving me early warning of the challenge of maintaining "pre-requisite structures" in an institution which was still in the process of developing a strong academic program. The maintenance effort was much lighter within the division than elsewhere, and Bob's support for that effort was a large factor in making it so.

An important part of the growing process was Bob's huge investment in time and effort to write and continually improve the "study notes" for all of his courses. At the time, it seemed to me a quixotic effort: why not build the curriculum around a selection of "standard undergraduate texts" after all, and invest the effort in adding to that foundation? But his extended labors perfectly reflected the seriousness of his commitment to what he believed his Master had called him to do. And time and further experience in the importance of carefully laid foundations consistent with one's own world view have helped to illuminate the value of what Bob sought to accomplish. After careful thought, I cannot improve on Dick Peterson's description of Bob's commitment to excellence in facilitating his student's growth as both Christians and active contributors to the scientific enterprise into which he was inducting them, so I refer the interested reader to that description in the tribute Dr. Peterson prepared for Bob's memorial service.

Soon after Mary Ellen's funeral, Bob and I had a long talk about our respective plans. I do not recall any of the details of the topics we covered, however. The only memory that remains is of the sense of shock I felt at the time as I finally began to appreciate the strain he had been living under in the last months of caring for Mary Ellen. It is probably more an indication of my social blindness than Bob's poise under pressure, but to that point I truly had been oblivious to the reality of his suffering. He was sharing with me for the first time some of the harrowing events of those days (again, I don't recall the details, but just the impact his sharing had on me) by way of giving his testimony that God's promise of "grace sufficient for the need" was true. In later years, seeking better understanding of texts like Psalm 90, and Paul's testimonies at 2 Corinthians 1:8-10, and 2 Corinthians 12:7-9, recollection of that discussion was always a good starting point for further reflection on the sureness of the grace of God, a key personal embellishment or marker on my set of the Ephesians 6:11 "whole armor." Thanks for these foundational memories, Bob. Shalom.

–Frank and Kathryn Meyer

Carlsen and Holmes bring Bethel into the National Physics/Engineering Arena

Carlsen, Robert A. and Holmes, James T., "Microprocessors in Preengineering", *IEEE Transactions on Education*, Vol. 24, No. 2 (1981) 146-149.

Abstract:
The use of microcomputer systems for an elective sequence in our pre-engineering program at a liberal arts college was motivated by student requests for assembly language programming and for computer courses oriented more toward the sciences. We describe a very modestly priced system and two courses which are based on the Intel 8080A.

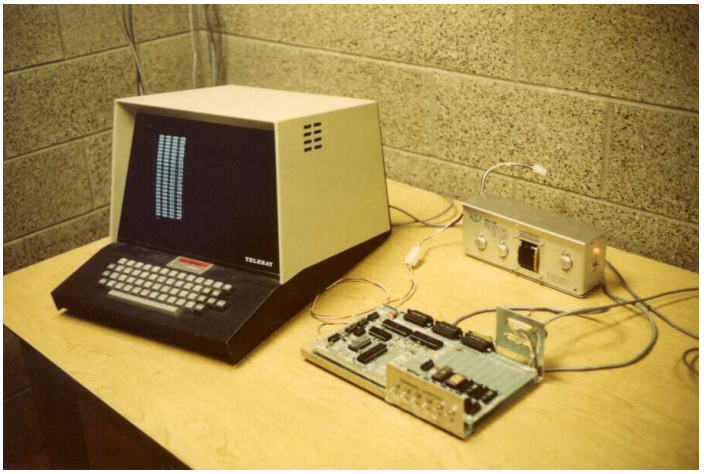


Photo of the early SDK-80 microprocessor system first applied in physics and engineering education by Professors Carlsen and Holmes at Bethel around 1980. This resulted in their publication which was the first national refereed publication to come out of the rapidly developing physics and engineering area at Bethel.

Robert A. Carlsen, Colleague and Friend

Some of the things I remember about Bob Carlsen are his deep faith, his love of mathematics and physics, his friendship and hospitality, his strong support of our

department, his sense of humor, and his care about students. Many of these characteristics are well-covered in Richard Peterson's fine tribute to Bob, but perhaps I can illustrate a couple of them.

Bob knew how hard life can be in a fallen world; he witnessed his first wife, Mary Ellen, lose a long battle with cancer. He was no Pollyanna. But even through the hardest time his faith in God's truth and love remained solid. I heard him say more than once that Philippians 4:6-7 were like Maxwell's equations: you could use them again and again, and they never wore out.

Even in his times of emotional turmoil Bob was thoughtful about me and hospitable to me. I stayed with him in the summer of 1979 before getting my first apartment here, while Mary Ellen was visiting her mother, and through most of the summer of 1980, after Mary Ellen had died. Even in those times, Bob kept his sense of humor. In those days I ran regularly, and when he heard that I was planning to run 15 miles with another faculty member, he said he wanted to take out a term life insurance policy on me. Another time, he came home and found my running clothes laid out to dry on the porch. He said later that he was afraid the rapture had come and he was left behind. And he credited that summer with much of the happiness he later found as Judy's husband: when he saw my bachelor lifestyle and my cooking, he knew he couldn't take being a bachelor very long, so he'd better remarry quickly!

It was during that time that I picked up a good life lesson from Bob. I let a pot of water boil away on the stove, and the pot was wrecked. When I apologized he just said, "Well, that's the price of doing business." That phrase has stuck with me; the price of doing business, of helping people, of accomplishing most things is that things get broken, wear out, burn out, and I shouldn't get upset about that.

In spite of Bob's having some hard times at Bethel and some tensions with the administration, Bob strongly supported our department. Some students may be aware of the Carlsen-Physics Faculty Scholarship, which was started at his initiative and has been a stimulus for the rest of us faculty to contribute. But the Carlsen Fund has also paid for much summer research by faculty and students, as well as, sometimes, the annual dinner and other projects. It was through a gift by Bob that we faculty got the first computers in our offices. Bob's gift also started the annual Science Division professional advancement grants.

Bob cared about me and was concerned about my well-being and my feelings. In my first year at Bethel, one day in the faculty lounge a faculty member who was known for stirring things up made some comments that made smoke come out of my ears. Bob saw my distress and came into my office to talk with me. He told me that the faculty member had helped many mission agencies and had done much to advance God's kingdom, so I needed to keep that in mind and not let the guy's off-the-wall comments bother me too much. Bob's comments helped me to get a more complete view of that faculty member and did calm me down.

The motto that showed Bob's love of mathematics and his desire to apply math to real physical measurements and apparatus was "analyze, then build." That, too, is a good lesson for me to remember, and it can be extrapolated to other areas of life: thought, then action.

It's hard to put into writing the cumulative effect of so many office conversations, reminiscences, jokes, lunches, laughs. I'll miss Bob, but I am comforted that we do not need to "grieve, as do the rest who have no hope (I Thessalonians 4:13)." He is rejoicing with Christ now, free of his weakened, tired body. And we'll see him again and join him in worshiping our Lord.

–Professor Thomas Greenlee

Greenlee, Carlsen, and Peterson during 3M work of the 1980's.

The R.A. Carlsen Analysis Center

In 1995, the new physics/engineering laboratory was named the Carlsen Analysis in honor of R.A. The Carlsen Analysis Center is primarily devoted to computational and applied physics. The center includes multiple student work stations with computers, running Mathematica, MATLAB and other analysis software. The center is also equipped with a new supersonic wind tunnel for student/faculty projects and research. Students often gather here for study sessions, and some have their own

desk in the room. Depending on the time of year, the Analysis Center may be the center of activity for a senior research project or two. Student research projects are conducted under the mentorship of one of the physics faculty members.

Carlsen Analysis Center.

To the students, he was simply R.A.

Early in the morning on Leap Day, February 29, 1988, I was in a motel room waiting for a phone call. It was my interview day at Bethel, and Bob Carlsen was to pick me up at the motel, take me to breakfast, and then to Bethel. The phone rang and the voice on the other end said, "This is R. A." Expecting someone named Bob, I was confused, but Bob explained, "R. A. is what the students call me." At that moment, even though I had not yet been interviewed, I knew that my education had begun.

Bob Carlsen was the professor who was retiring. It was my job to replace him, and the task was daunting. At Bethel, Bob was nearly iconic. He essentially founded the Physics Department, nurtured it in isolation for years, struggled with meager budgets, and then donated most of his life-savings to establish a trust fund to advance Physics at Bethel. Bob had been at Bethel twenty years – which to a 29-year-old seeking a position sounds like a lifetime. In fact, the first question I heard from a student upon arriving at Bethel was "Dr. Beecken, are you going to be here your whole life like R.A. was?" Wow, that was intimidating! I was just hoping to survive my first week as a professor. It was then that I decided to lean on Bob for advice whenever possible. We had many lunches over the years, and my fondest memories of R.A. are his little truisms on all things related to teaching, research, and Bethel.

Bob believed that you "almost have to make the students your colleagues." Certainly Bob's students appreciated this approach; I have found that alumni from his era testify to the life-changing, mentoring relationships that Bob established with them. At the same time, however, Bob truly understood the difficulty of such an approach. He often said, "Just when the students become useful, they graduate... every year is starting over," and "if you teach undergraduates long enough, you become one." These were sobering words for a very young professor, but they were also fair warning.

I was tempted to pour my time and energy into developing better courses, but Bob knew that it was important for young faculty members to develop meaningful avenues of research – both for the students and for the faculty member. Bob warned me that the "students test you, they want to see if you really can do this stuff that you teach." He thought that I should concentrate on developing a research track record while I still had the opportunity. Sure enough, I found that doing research strengthened my self-confidence and enhanced my credibility with students. Bob didn't merely suggest this direction, he had already given generously to establish an endowment for physics research.

But more importantly for me, Bob was a great source of personal encouragement. During my first summer of research at Bethel, I had an Air Force grant. However, I was working by myself, and I found the difficulty of the research overwhelming. Bob realized that I was struggling, and I clearly remember a day that summer when he sat and listened to me and encouraged me. Together we outlined on the blackboard an approach and a plan for moving forward with the research. That day was pivotal for me. The work ended well that summer, and it led me into many more productive summers doing research. I am deeply grateful.

Bob understood people, and his thoughts on how to get things done have been particularly helpful. He told me that it is always best to "solve problems at the lowest level." In other words, when something isn't working right, try to work directly with the individual rather than going over their heads to a supervisor. He also advised that it was important to build relationships with people so that later, sometime even years later, they will have a natural desire to help you when you need it. I have now been chair of the Physics Department for over twelve years, and I still find this advice fundamental to how I carry out my responsibilities. During my entire time at Bethel, I have been honored to work in the same office that was once Bob's. His legacy is ever present, and his influence has greatly shaped our department.

–Professor Brian Beecken

My Carlsen Number is 3 – What is Yours?
A Tribute to R.A. Carlsen – Teacher, Mentor, Friend

Bob Carlsen started teaching Physics at Bethel in 1968. He taught until 1987, but he was a presence on campus until 2008. He used to say that every day was a Saturday for him. He loved nothing better than to come to campus and interact with faculty. Eleven days before he passed away, he was on campus, and asked me how my research on my textbook was doing.

I had the pleasure of taking *General Physics* from him in the fall of 1971 - my sophomore year as a student at Bethel. I can remember him writing in his handouts that, "In the beginning, God created the rectangular coordinate system," and other similar statements. Integration of faith and learning was important. I recall the verse, "STUDY to show thyself approved unto God,. . . ." I had a total of three courses from him. *What is your Carlsen Number?* I learned Differential Equations from him in that course. Later there were *Delta Functions, Fourier Transforms, and "The Moment of Inertia as a Matrix"*.

Connie Larson was one of his first student workers. She would help him type his handouts for his courses. Connie would later become my wife. Whenever there was a typographic error, I would get blamed for it. "Dave must have gone by when she was typing that one! (LOL)" Connie and I were married at the end of our junior year. I still have and use Bobs wedding present a mathematics dictionary.

R.A. was one of the major reasons that I returned to Bethel as a math professor in 1985. He served as a mentor and friend right up to his death. I shall miss him greatly, but I shall not forget him. Indeed, his memory is still with me.

–Professor David Wetzell

R.A. Carlsen and David Wetzell (1972).