Virginia Tech Department of Statistics

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The Department of Statistics at Virginia Tech celebrated 60 years of teaching, research, and service in 2009. Since the first Master's student, James Henry Davidson, graduated in 1945 we have granted over 507 B.S. degrees, 723 M.S. degrees, and 311 Ph.Ds. Our success is due to the foundation that was laid by Boyd Harshbarger starting in 1935 and the continued efforts of department heads and our faculty to maintain and enhance our programs. A brief history of the department is provided below. The departmental webpage (www.stat.vt.edu) contains other articles on the history as well as some interviews with selected faculty and graduates.

The Beginning of the Department at VPI

Boyd Harshbarger was one of the early pioneers in Statistics in the United States. He founded one of the earliest Departments of Statistics in the country at Virginia Polytechnic Institute, popularly known in those days as VPI. In 1935, he organized and taught the first courses in Statistics through the Department of Mathematics. He received a Rockefeller Fellowship and left to pursue a PhD degree in 1940. He wrote his doctoral dissertation under the direction of the distinguished Professor W.G. Cochran at Iowa State College and George Washington University and returned to VPI in 1942.

After returning to VPI, Dr. Harshbarger organized mathematical statistics courses for the Mathematics Department and applied statistics courses for the

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Fig. 1 1947 Regional Summer Session

Agricultural Economics Department. A Statistics option was soon offered jointly by the two departments.

1947 Regional Summer Session

During those early years Dr. Harshbarger aggressively started working toward a degree-granting Department of Statistics. A major happening towards that goal was one of which he was very proud. It was the 1947 Summer Session in Statistics, a joint effort of VPI, The Iowa State College, The Survey Center of the University of Michigan, The University of North Carolina, and the US Department of Agriculture (Fig. 1). This was the first such session in Statistics in the United States. It was a huge success with over 100 students from 37 states and six foreign countries. There was a very distinguished faculty which included Raymond Jessen of Iowa State College, Maurice Kendall of the University of London, Renis Likert of the Survey Research Center, George Snedecor of Iowa State College, R.C. Bose of the Indian Statistical Institute, and of course, Boyd Harshbarger of Virginia Polytechnic Institute.

In addition to the distinguished faculty, the list of seminar speakers included Maurice Kendall, George Snedecor, Gertrude Cox, W. E. Deming, and Harold Hotelling. Although separated by great distances, these scientists supported the department by attending the summer sessions and supporting the department in other ways. One contribution was the establishment of the Kendall Library which holds many of the books and journals from Sir Maurice Kendall's personal library. Kendall had a long-standing close connection to the department which he visited several times.

1948 Statistics Section and Statistical Laboratory Forms a Separate Department of Statistics

After the successful Summer Session, momentum towards a formal department of statistics picked up dramatically. Boyd Harshbarger was able to convince the President of VPI that, although the Ivy League Schools did not yet have statistics departments, VPI should have one. A Statistics Section and Statistical Laboratory were organized in 1948 with a separate budget in the college's Agricultural Experiment Station. The laboratory was organized to offer statistical consulting for the Agricultural Experiment Station as well as the entire college. It still serves that purpose as the Laboratory for Interdisciplinary Statistical Analysis (LISA) for the entire university and also serves to train the department's graduate students.

Courses in Statistics were taught as far back as 1927 at Virginia Tech and M.S. degrees in statistical topics date back to 1945 (James Henry Davidson, The Estimation of a Missing Value in a Lattice Design Using Inter-and Intra-Block Information.). However, it was in 1949 that a separate Department of Statistics was approved, offering a Master of Science degree in Statistics. This was one of the first degree-granting statistics departments in the United States. The Department was housed administratively in the College of Arts and Sciences. Milton Terry was hired in 1949 and then in 1950 Ralph Bradley and David Duncan were hired, bringing the faculty size to four.

PhD Program Approved in 1951

The formal approval of the PhD program came in 1951. The faculty size grew to seven in 1953; it included Ralph Bradley, David Duncan, M.C.K. Tweedie, P. G. Sanders, C. Y. Kramer, Tom Russell, and Boyd Harshbarger. The faculty size grew rapidly to ten in 1955 as shown in Fig. 2.

All of these gentlemen had distinguished careers. Ralph Bradley later founded and developed the Department of Statistics at Florida State University. David Duncan was a prolific researcher and gained fame through the wide use of his multiple comparison test. Clyde Kramer extended Duncan's procedure and this new procedure was also extensively used worldwide. During the early years, there were many outstanding faculty members in the department at various times, including Paul Minton, who founded the Department of Statistics at Southern Methodist University, H. A. David, Rolf Bargmann, John Saw, and Leonard Shenton.

One of Harshbarger's significant hires was I. J. Good in 1967. Jack came to the Department of Statistics from Oxford University and was fond of telling us that he arrived on the 7th hour of the 7th day of the 7th month of year 7 in of the 7th decade (1967) and was put in apartment seven of block seven of Terrace View Apartments, all by chance. He served the department and greater community until his first retirement in 1987 at age 70. Following a conference to honor his retirement, the state



Fig. 2 1955 Statistics Department Faculty. Pictured are from left to right: Ralph Bradley, Lowell Wine, Hale Sweeny, Thomas Russell, William Thompson, John Freund, Kenneth Tweedie, Clyde Kramer, Paul Somerville, and Boyd Harshbarger

overturned the mandatory retirement, and Jack overturned his retirement request. He retired for a second time in 1994. Jack was fond of debating the value of Bayesian statistics and is pictured in Fig. 3 with Oscar Kempthorne in a quiet moment.

1957 B.S. Program Approved

The Bachelor of Science degree in Statistics was approved in 1957. The department at Virginia Tech was one of the earlier programs in Statistics to place an emphasis on the B.S. degree program. Undergraduate programs in Statistics were not typical in those days. The first undergraduate coordinator was Whitfield Cobb, who was followed by Professors Clyde Kramer and Walt Pirie.

Leadership of Department with SREB Committee on Statistics

The Statistics Department at Virginia Tech was instrumental in the development of Statistics in the South. A Committee on Statistics was coordinated through the Southern Region Education Board (SREB), and consisted of representatives from 14 southern states from Maryland to Texas. Their charge was to promote statistics graduate programs in southern colleges and universities. Boyd Harshbarger was the first chairman of this committee, and other members at that time included



Fig. 3 Jack Good (right) with Oscar Kempthorne

Gerrtude Cox (N. C. State), E. B. Brown (Georgia), G. E. Albert (Tennessee), Dana Card (Kentucky), T. W. Hildebrant (Oak Ridge Labs), Carl Marshall (Oklahoma A&M), Herbert Myer (Florida), George Nicholson (North Carolina), John Stockton (Texas), and Rutledge Vining (Virginia).

After the Boyd Harshbarger Era

Dr. Harshbarger resigned as Department Head in 1972 (and retired in 1976) and following a 1-year interim by Clyde Kramer, Jesse Arnold was elected as the second Department Head in 1973 (Fig. 4). During those almost 10 years of Arnold's tenure, the faculty size increased, and more structure was added to the graduate program. A major change was initiated in the governance of the department as faculty committees were utilized more than during the Harshbarger years. Departmental administration began to operate in the fashion of a chairmanship rather than a headship.

During those years, the Department greatly expanded the Statistical Consulting Center to offer statistical assistance to the entire university. Professor Raymond Myers took over the administration of the Center and changed it from a model based on a single faculty member with two to three clerks with desktop rotary calculators to a modern computer-based program with a statistical programmer and graduate student support. A major change that Myers implemented was the focus of the Consulting Center to emphasize the training of graduate students in statistical consulting and the support and involvement of the entire faculty in consulting activities. The photo of the faculty in 1976–1977 is given in Fig. 5.

In 1982, the reins of the department turned over to Klaus Hinkelmann. Klaus was widely recognized for his work on experimental design and continued the focus of the department on applied statistics.



Fig. 4 Maurice Kendall, Boyd Harshbarger, and Jesse Arnold



Fig. 5 1976–1977 Statistics Faculty. Standing is Clyde Kramer, Jerry Mann, Jack Good, Marvin Lentner, Larry Lee, Jesse Arnold, Marion Reynolds, Don Jensen, Ray Myers, Dick Krutchkoff, Klaus Hinkelmann and Ray Gaskins. Seated are Walt Pirie, A. Katiyar, Tom Bishop, S.K. Lee, Bob Schulman, and Eugene Seneta

The department kept a position open for visiting faculty who taught specialty courses for graduate students, presented several colloquia throughout their tenure, and interacted on research with faculty members and students. Among the visitors were: Eugene Seneta (Australian National University, 1976–1977), B.K. Ghosh (1978–1980), Oscar Kempthorne (Iowa State, 1983–1984), Sudhakar Dharmadikari (Northern Illinois University, 1984–1985), Donald Burdick (Duke University, 1985–1986), Charles McGilchrist (University of New South Wales, 1986–1987), Klaus Daniel (University of Bern, Summer 1988), Madan L. Puri (Indiana University, 1987–1988), Murari Singh (India, 1988–1989), Arijit Chaudhuri (Indian Statistical Institute, 1989–1990), Don Ramirez (University of Virginia, 1990), Steven Durham (University of South Carolina, 1990), Donald Michie (Turing Institute, Spring 1992), and Nozer Singpurwalla (George Washington University, Fall 1991). The visiting position was sadly lost to the budget cuts in the 1990s.

During these years, the number of graduate students varied from 50 and 70 per year, and the department awarded approximately 6 Ph.Ds and 20 M.S. degrees per year. This number is small compared to the number of PhD graduates in the 1960s and early 1970s when a large National Institute of Health (NIH) Training Grant supported most of our graduate students and the department graduated approximately 15 Ph.Ds per year. The course requirements for the graduate degrees were changed with the university wide change from the quarter to the semester system in 1988, but still focused on a solid program in experimental design and applied statistics.

Also, during these years, the conscientious effort to recruit undergraduates directly from high school or other quantitative programs at the university led the department to have one of the Clyde Kramer and largest undergraduate statistics programs in the country. Under the guidance of Walt Pirie, the number of undergraduate students grew from about 50 to between 80 and 90. This resulted in graduating between 12 and 25 students annually.

The Department, additionally, increased its course offerings (mainly service courses) at the Northern Virginia Graduate Center with regular and adjunct faculty. The plan was to offer a graduate program leading to the M.S. degree, but those plans never materialized when the budget cuts in the early 1990s took place, leading to a reduction of regular faculty there, and later to the demise of the program.

Although retired, Boyd Harshbarger was a common visitor to the department and frequently gave advice to faculty and the Department Head. His advice often indicated that the University of the 1940s had changed quite a bit (VPI had become Virginia Polytechnic Institute and State University, or VPI & SU, in 1970s). Klaus Hinkelmann recounted the following story: "Boyd Harshbarger came by the office occasionally to inquire about things. When I started to complain about budget cuts and reduction of funding, he invariably gave me the advice to 'go to the president (of the university) and/or to the general at Ft. Lee.' This is, of course, what he did—quite successfully—when he was department head. He did not understand or appreciate that this no longer worked, mainly because of a much more structured university (and military) bureaucracy with deans, vice presidents, provosts, etc."

On the occasion of I. J. Good's seventieth birthday, the Department organized and hosted a conference in 1987 on "Foundations and Philosophy of Probability and Statistics." Speakers included Jim Berger, David Brillinger, Arthur Dempster, Persi Diaconis, I. J. Good, Joseph Kadane, Terry Seidenfeld, Oscar Kempthorne, David Kendall, Isaac Levi, Donald Michie, Donald Rubin, Mark Shervish, Jagdish Srivastava, Patrick Suppes, and Shelley Zacks. The proceedings were published as a special issue of the *Journal of Statistical Planning and Inference*. An interview with Jack was published in *Statistical Science* in 1996 (Banks 1996). The conference was originally intended to celebrate Jack's retirement as well as his contributions. At the time there was a mandatory state retirement at age 70. A change in the law occurred after his announcement but before his retirement date, so he was able to have the celebration without the retirement (Jack officially retired in 1994).

Other colloquia also flourished: from 1984 to 1986 Yash Mittal organized, in addition to the weekly colloquia, the "Lecture Series in Probability and Its Applications" with national, and international speakers.

In the late 1980s, the Department began to develop a departmental computer laboratory and introduced the use of computer software, such as Minitab, and SAS in the classroom. This proved to be appreciated by the students as it made the subject of statistics a bit more interesting.

The Department currently has a very active Mu Sigma Rho chapter, which was initiated in 1976 by Oscar Kempthorne, one of the founders of the national organization. The chapter is run by student officers and sponsors two colloquia each year. Since 1976, its initiated membership has grown to 78 faculty and honorary members, 267 graduate students, and 148 undergraduate students.

Jack Good continued to be a keystone of the department during these years and in the 1990s there were numerous awards and videos commemorating his work. These include the video tapes "I. J. Good and Donald Michie in conversation with David Kahn and Karen Frenkel, Part 1: From codebreaking to computing: Remembrances of Bletchley Park fifty years later; Part 2: From wartime to peacetime, the years of development of computing and artificial intelligence" and "Good talking—I. J. Good conversation with Persi Diaconis" (for ASA film series of distinguished statisticians) were produced (see Banks, 1996 for more on Jack Good).

In 1993, the Department appointed Marvin Lentner as Head of the department. Six years later, the Department celebrated its fiftieth anniversary by holding a conference that brought in a number of alumni and speakers. The proceedings were published as special issues in the *Journal of Statistical Computation and Simulation* (a journal founded by one of our faculty members, R.G. Krutchkoff).

New Directions

Geoff Vining took over as department head in 1999 and was head until 2006. At the time of his hiring, the department had lost several faculty members to early retirements, and budget cuts created difficulties for the department. A major focus of his attention was the reinvigoration of the department and its continued emphasis on applied statistics, especially industrial statistics.

Under Vining, the department grew both in numbers and vision as a strong applied statistics program with an emphasis on industrial statistics. Two new senior hires, John Morgan and Bill Woodall strengthened our program in experimental design and industrial statistics. With Ray Myers, our program in industrial statistics was widely recognized as the strongest in the country as demonstrated by several important awards. Myers and Woodall have been honored by the American Society for Quality's (ASQ) Shewhart Medal, the society's top technical award. Marion Reynolds, Bill Woodall, and Ray Myers have twice received the ASQ Brumbaugh Award for the best paper published in a given year by an ASQ journal. Geoff Vining also has been awarded the Brumbaugh. In addition, Bill Woodall and Geoff Vining are past editors of the *Journal of Quality Technology*.

Also under Geoff the department initiated mentoring programs for new faculty. The department also improved courses for graduate and undergraduate students



Fig. 6 2009 faculty. *Bottom row*: Yili Hong, Leigh Harrell, Pang Du, Inyoung Kim, Ying Liu, Dong-Yun Kim, Marlow Lemons. Middle row: Leanna House, Feng Guo, Eric Smith, Golde Holtzman, Bill Woodall. Top row: Marion Reynolds, Scotland Leman, J.P. Morgan, Eric Vance, George Terrell, Jeff Birch. Not shown: Geoff Vining, and Ina Hoeschele

and developed mentoring programs for graduate students. Additionally, the Department developed a track system that allows students to focus on an application area as well as take a classical approach towards a degree. Current tracks include Biostatistics, Environmental Statistics, Computational Statistics, and Industrial Statistics. Another major contribution was the development of a Corporate Partners Program. These partners consists of statisticians from major companies that serve as an advisory group to the department and students, help students with financial support, and teach short courses.

The Department saw a decline in faculty numbers starting in 2004. This decline was due in part to retirements and a drop in the state budget which resulted in reductions at the university. Additionally, several faculty members left the department and new appointments were not made. In addition, the Statistical Consulting Center was closed due to budget issues.

Eric Smith replaced Geoff Vining in 2006. With the aid of a report by outside reviewers, a number of changes were made that led to several new faculty hires (the 2009 faculty are in Fig. 6). One of the major changes was a rebirth of the consulting program which was renamed as the LISA. The department was able to hire a director (Eric Vance) and an assistant director (Chris Franck) as well as support several graduate students. The program provides free support to staff, students and faculty throughout the University and is an excellent opportunity for students in statistics to develop communication skills and experience with real data.

The Department also made major changes to improve the quality of both the undergraduate and graduate programs. New graduate classes were added to provide students with a greater diversity of classes. The undergraduate program was revitalized by the addition of two instructors who have developed new courses and programs to enhance the undergraduate experience. Changes to the program include a new focus on computational statistics including Bayesian and non-Bayesian methods and simulation methods.

Summary and Outlook

Virginia Tech's Statistics department has a rich history and tradition that cannot be easily summarized in this short paper. The number of graduates continues to grow and graduates hold or held positions in prominent companies, universities, and government agencies. Our faculty and students have published numerous papers, received too many awards to mention, and have written many books. A few of the titles are given in the reference section.

The Department of Statistics has undergone many changes over its 60 years of history, and yet it has preserved its original core values in many ways. The department found its origins in collaboration and continues to this day to be a model of collaborative endeavor for scholars and their departments throughout the university. Our students receive the highest order of training to become professional collaborators while department research programs are predicated on the interface between scientific application, and collaboration and our faculty and students are not constrained to work in any single area. This was not only the philosophy of Boyd Harshbarger, but also that of Jack Good, Jesse Arnold, and so many other notables who followed in Harshbarger's footsteps. The Department of Statistics at Virginia Tech has a bright future, providing opportunities for every student, and faculty member to invent the future.

References and a Small Sampling of Relevant Books and Papers

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