Computer Simulation Archive
Video Oral History Project
Written Interview Record (Documentation)

Date: May 20, 2013

Location: Campus of the National Institutes of Health in Bethesda, Maryland

Pioneer(s) Interviewed: Dr. Thomas J. Schriber of the University of Michigan

Interviewer(s): Robert G. Sargent of Syracuse University

Project Description and Explanation:

The history video interviews are produced by funding from the National Science Foundation. The accompanying video has been added to the Computer Simulation Archive located at the North Carolina State University Libraries.

Introduction of Pioneer(s):

Since 1967 Tom Schriber has directly and indirectly educated tens of thousands of individuals in the General Purpose Simulation System, commonly known as GPSS, through his tutorials, short courses, regular academic courses, and famous "Red Book," titled Simulation Using GPSS. Tom's contributions to the Winter Simulation Conference are well known and include giving at least one paper in every conference starting from the second conference in 1968, serving on the Board of Directors, being Program Chair in 1976, and giving tutorials on GPSS and also "How Simulation Software Works." He has received several awards for his work including the INFORMS Simulation Society's Lifetime Professional Achievement Award. Tom also was a pioneer in educating business school faculty at the national level about computers in the 1960's and 1970's.

Questions:

--Tom, how did you come to be introduce to computers so early in their development?

After finishing my bachelor's degree in chemical engineering at the University of Notre Dame in 1957, I came to the University of Michigan as a National Science Foundation Fellow that Fall to do graduate work in chemical engineering. In my first semester at Michigan I decided to take an elective course in computing in which we studied algorithms

and their computer implementation using the Symbolic Assembly Programming (SAP) language and the Symbolic Optimal Assembly Programming (SOAP) language on an IBM 650 computer. I found it interesting and exciting to study and work with material of this type.

--Were you exposed to simulation during your PhD program?

During my continuing graduate studies at Michigan as an NSF Fellow over a three-year period, I took a course in computer-implemented numeric methods (using FORTRAN) in which one of the assigned projects was to model a tubular chemical reactor. We used numeric integration and trial-and-error techniques to determine the input composition, temperature, and pressure needed to arrive at specified characteristics in the reactor's effluent. That is an example of continuous simulation. (In continuous simulation, the state of a system changes continuously over time. This contrasts of course with discrete-event simulation, in which the state of a system changes only at discrete time points.)

My first exposure to discrete-event simulation also took place during my graduate studies at Michigan. Michigan was on the cutting edge of computing, and the National Science Foundation provided funding for Michigan to bring engineering faculty from around the country to Ann Arbor to receive intensive training in computing. Working as a graduate student assistant in those programs, at one point I was assigned to sit in on a lecture given by Industrial Engineering Professor Dick Wilson (R. C. Wilson) on the topic of discrete-event simulation using GPSS, and then write up a set of notes for distribution to program attendees. But did I ever take a course in discrete-event simulation? No. Such courses might not have as yet existed.

--While you were finishing up your PhD you joined the faculty at Eastern Michigan University and then you joined the faculty of the Graduate School of Business at the University of Michigan. How did these appointments come about?

Well, it was quite a chain of events that led to those developments. In the Ph.D. program I had spent three years as an NSF Fellow and then one year as an International Nickel fellow. Expecting to finish the Ph.D. by the end of that fourth year, I applied for and won a Fulbright Fellowship to spend the following year (the 1961-62 academic years) in Germany. My experimental work for the Ph.D. was finished by the end of the four years, but I fell short on evaluating and writing up the results. I decided to go to Germany on the Fulbright anyway, and then returned to Ann Arbor to finish the dissertation. I have a Masters degree in mathematics and, to support myself that year when back from Germany, took a half-time position as an Instructor in the Department of Mathematics at Eastern Michigan University (EMU), which is conveniently located about 10 or 12 miles east of Ann Arbor.

Part way through my first year at EMU, the Provost called me in to invite me to join the full-time faculty there, develop and run an academic computing center, and introduce computing courses into the curriculum. I decided to accept that challenge, and then spent the next three years at EMU as an Assistant Professor of Mathematics and Director of EMU's first academic computing center. The program flourished, and the Provost then wanted me to become full-time Director of an expanded academic computing center. But that was not of interest to me, because I was intrigued by teaching, and that move would take me out of the classroom.

And so I decided it was probably time to return to my chemical engineering roots, and began to prepare my resume' accordingly. But before sending out the resume, I received a phone call from Allen Spivey (W. Allen Spivey), a Professor and Chair of Statistics and Management Science in the UM Graduate School of Business (now known as the Stephen M. Ross School of Business). Professor Spivey invited me to meet with him to discuss the possibility of my joining the UM Graduate Business School faculty to create and teach computing-related courses in the MBA curriculum. The possibilities Professor Spivey described sounded intriguing. And so I made the decision to take Professor Spivey up on his proposal, joining the UM Graduate Business School faculty in 1966 with the thought that if it things didn't work out well, I still had time to return to my chemical engineering roots. But then I never looked back. It's 2013 now, and I'm in my 47th year as a faculty member at the Stephen M. Ross School of Business.

--Early in your professional career you started educating business school faculty to computers at the national level; please tell us about that activity.

As mentioned earlier, as an NSF Fellow I worked as a graduate student assistant in NSF-funded summer programs bringing engineering faculty from around the country to Ann Arbor to give them intensive training in computing. If engineering faculty were needy in that regard, so was business-school faculty. And so using the NSF-funded programs as a model and working with Professor Allen Spivey and the Dean, Floyd A. Bond, I proposed a two-week program for business school faculty at the national level and we successfully received program sponsorship from the American Association of Collegiate Schools of Business and program funding from IBM. Named the "Business Faculty Summer Programs in Computing," the program's initial offering took place in Ann Arbor in the summer of 1969. Subsequent offerings then took place in Ann Arbor in 1970, and in Ann Arbor and in Boulder, Colorado (at the University of Colorado), in 1971. There was no program offering in 1972. The final program offerings took place in 1973 in Ann Arbor and in Boulder. In

summary, there were five two-week program offerings, with about 250 business school faculty in total participating from a broad range of universities.

--You wrote some books about computing in addition to your simulation books, please tell us about those.

Well, the first three “Business Faculty Summer Programs in Computing” in Ann Arbor resulted in the publication of a three-volume set of books entitled “FORTRAN Applications in Business Administration.” These volumes were co-edited by my Ph.D. student, Larry Madeo, and me, and consisted of well documented computing applications developed by program participants to illustrate the computing skills they had developed. The IBM funding included printing hundreds of copies of each of the three volumes and distributing copies to business school libraries all around the United States.

Prior to the “Business Faculty Summer Programs in Computing,” I had authored two Wiley books in 1969 entitled “Fundamentals of Flowcharting” and “FORTRAN Case Studies for Business Applications.” Both of these books were used in the Business Faculty Summer Programs in Computing. (“Fundamentals of Flowcharting” was also published in a Spanish translation in 1971.) I also authored a Wiley publication entitled “Overhead Projector Lectures for Fundamentals of Flowcharting” in 1970 that was used in the Business Faculty Summer Programs.

--Let’s turn our discussion to simulation
--How did you become involved with discrete event simulation and how did you come to use it?

As mentioned earlier, I had a brief exposure to discrete event simulation while working as a graduate student assistant in the NSF-funded summer programs for engineering faculty. But that was then. In the “now” of my first year (1966/67) as an Assistant Professor at the UM, Department Chair Allen Spivey told me he sensed that a methodology known as discrete-event simulation was coming on strong and suggested that I introduce a simulation course into the MBA curriculum. In the summer of 1967 I reviewed three principal simulation languages, GASP, SIMSCRIPT, and GPSS, and decided that GPSS was the best choice of a language for the MBA curriculum, because it was syntactically sparse and featured a block diagramming approach. In the Fall of 1967 I then taught a course on GPSS-based simulation, taught that course again in the Winter of 1968, and continued to teach that course Fall and Winter each academic year (with the exception of sabbatical years) through the Fall of 1995.

--How did you come to write your classical "Red Book" on GPSS? (mention number of copies, Russian version, show copies)

In my opinion there was no satisfactory textbook for the simulation course, so I developed my own notes for the first two course offerings. I wrote the notes out on sheets of acetate and projected them in class, giving the students copies of the notes for their convenience. In the summer of 1968 I refined the notes, had them printed and bound, and put them on consignment in an Ann Arbor bookstore for the 1968/69 academic year course offerings. This started a cycle of successive refinement of the bound notes for use in the course. Meanwhile, the bound notes came to the attention of publishers' representatives, and three publishers, John Wiley & Sons, McGraw-Hill, and Prentice Hall, offered me contracts to write a textbook based on the notes. I contracted with John Wiley & Sons, and the eventual result was published in 1974 as a hardbound 532 page 8-1/2 by 11 inch book with a red cover. Over time, the book then became known as the "Red Book."

The "Red Book" met with success, remaining in print for 21 years. There were over 40 print runs of the book, with an estimated 40,000 copies of the English version printed during its lifetime. This set a record for a simulation book in its day. In addition to the English version, a Russian publisher (Mashinostroenie Press, Moscow) contracted with John Wiley & Sons to translate the book into Russian and produce 10,000 copies in a single print run. The Russian version of the book was published in 1980. That book also had a red cover, and became known as the "Red Red Book."

--Having used your GPSS text, I know that you prepared and gave additional material to aid in teaching and learning. Please comment on this.

In 1975 I prepared a Solutions Manual for the Red Book that John Wiley & Sons made available for adopters of the Red Book, and I also prepared a set of Transparency Masters that could be used as the basis for lecturing on GPSS.

--What motivated you to give tutorials and short courses on GPSS?

Starting in the 1950's, for many years the UM College of Engineering staged a series of conferences each summer called the Engineering Summer Conferences. These "conferences" took the form of intensive short courses, usually of one-week duration, on a wide-ranging set of topics of interest in engineering. It occurred to me after I became a UM faculty member that a one-week short course on "Simulation Using GPSS" would fit nicely into the UM's Engineering Summer Conferences, and so I created such a course and taught it each summer for 24 years, from 1969 through 1992. There was also an extra

offering of the Summer Conference course in the summers of 1973 and 1974 targeted specifically for faculty at the national level.

The intensive one-week Engineering Summer Conference course was eventually taught more frequently than just once per summer. That came about as follows. A former UM student of mine who had taken the Winter 1968 credit-course, Jim Henriksen (James O. Henriksen), had developed and gone commercial with a superior implementation of GPSS named GPSS/H. (An aside: Jim is being separately interviewed and video-recorded for the Simulation Archives at North Carolina State University.) I began teaching GPSS/H instead of IBM's GPSS V in the Summer Conference course, and Jim began suggesting to his clients that they attend the Summer Conference course for education in GPSS/H. But as the use of GPSS/H grew, the need also grew for educational opportunities offered more than just once a year. And so I also began teaching intensive one-week GPSS/H courses under the auspices of the company Jim founded, Wolverine Software, in locations such as Annandale Virginia, San Francisco and San Diego California, and Seattle Washington. These offerings took place in various forms starting in 1982, and lasting through the summer of 1995.

--How many students do you estimate you have taught in short courses? in academic courses?

There were an estimated 40 offerings of the short courses just described. The 26 offerings in the Engineering Summer Conferences averaged 45-50 students per offering, and the 14 offerings under the auspices of Wolverine Software averaged 15 to 20 students per offering. And so approximately 1,500 participants attended those short courses.

There were an estimated 115 sections of the 3-credit simulation course taught over a 29 years in Michigan's MBA program, with an average enrollment of 50 students per section, and so about 5,750 students took those courses.

Those numbers are small, of course, compared with the estimated number of students who studied GPSS from the "Red Book." If we assume each copy of the "Red Book" was used in new/used form by 3 students, and that 50,000 copies of the book (including the 10,000 Russian-language copies) were published, that means about 150,000 students studied GPSS from the Red Book.

--Tell us about your involvement with the Winter Simulation Conference. You have set a record in terms of length of time of involvement with this conference. (Tutorials, program chair, board of directors, length, 25th ann., foundation, titan talk)

What is now known as the Winter Simulation Conference first took place in the Fall of 1967 and was called the “Conference on the Applications of GPSS.” The conference took place again in December of 1968 and was called “The Conference on the Applications of Simulation,” a name it kept until the December 1971 conference, when it became known as the “Winter Simulation Conference.”

I first attended the 1968 conference and presented a co-authored GPSS-based job-shop application paper. And as you’ve pointed out, I’ve not missed a “Winter Simulation Conference” since then, and have always presented at least one paper at each of those conferences. Overall conference involvement has included:

· Giving repeated introductory GPSS tutorials over the years
· Giving repeated advanced tutorials over the years on the topic of “How Simulation Software Works”
· Serving as Program Chair for the 1976 conference
· Receiving the INFORMS Simulation Society’s Distinguished Service Award in 1996
· Serving on the Board of Directors for ten years (1978-86), chairing the Board for two of those years (1982-83)
· Summarizing selected features of the history of the conference in a talk given at the conference’s Silver Anniversary in 1992
· Receiving the Winter Simulation Conference Board of Directors’ Award for Distinguished Service in 2007
· Receiving a “Landmark Paper Award” at the 40th Anniversary of the conference in 2007
· Serving on the Board of the WSC Foundation from 2004 to 2008, chairing the board in 2007
· Giving a “Titan of Simulation” talk at the 2009 conference (“Simulation for the Masses: Spreadsheet-Based Monte Carlo Simulation”)

--For many years you gave an “Introduction to GPSS” tutorial at the Winter Simulation Conferences. What years did you give your GPSS tutorial?

Prior to 1976, I gave several GPSS tutorials at the Winter Simulation Conferences based on handouts not included in the proceedings. Then, at the 1976 WSC, I gave a GPSS tutorial for which there was a proceeding’s entry. The GPSS tutorials then continued in consecutive conferences, backed by proceedings’ entries, until the last GPSS tutorial was given at the 1995 WSC. The sequence ended because, separately, vendor tutorials had

become part of the WSC's, and these included a tutorial for GPSS/H given by Wolverine Software personnel such as Jim Henriksen and Bob Crain (Robert C. Crain).

--You have been giving a WSC tutorial on "How Discrete-Event Simulation Software Works" since you terminated giving the GPSS tutorial. Tell us about that tutorial.

At the 1995 conference, my former MBA student Dan Brunner (Daniel T. Brunner) and I initiated the offering in the Advanced Practitioners' Track of a tutorial entitled "Inside Simulation Software: How It Works and Why It Matters." The supporting proceedings paper won a Landmark Paper award at the WSC fortieth anniversary conference in 2007. That tutorial has been repeated annually at the WSC's since then, and will be presented again at the 2013 WSC. In 2012, Professor Jeff Smith (Jeffrey S. Smith, of Auburn) joined Dan Brunner and me in this effort.

The "Inside Simulation Software" topic has also been written up by Dan Brunner and me as Chapter 24 in the "Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice," edited by now-deceased Professor Jerry Banks and published by John Wiley & Sons in 1998. Whereas the paper in the WSC proceedings is limited to 15 pages, the entry in the handbook chapter spans 47 pages and includes figures and material that expand on the WSC proceedings entry.

--Please tell us about being an ACM lecturer.

In 1969 I became a Lecturer for three years in the ACM (Association for Computing Machinery) National Lectureship Series, visiting various ACM Chapters around the country on request to lecture on the topic of discrete-event simulation using GPSS. During 1970-72 I co-chaired the Lectureship Series while continuing to serve as a Lecturer in the series.

--Tell us about your U.S.-U.S.S.R. exchange in 1977.

The U.S. and the U.S.S.R. entered into a Joint Science and Technology Exchange Agreement in the mid 1970's. Under the auspices of that program, I was invited to be a member of a six-person delegation that spent two weeks in February of 1977 giving seminars and holding workshops in various parts of the U.S.S.R. The six of us were from Harvard (a professor and a program director), MIT, Stanford, UCLA, and the University of Michigan. We visited Moscow, Estonia, Azerbaijan, and Uzbekistan. In 1978 each of us then hosted a visiting delegation from the U.S.S.R. for meetings and seminars at our respective universities.

The seminars I gave in the U.S.S.R. in February, 1977, are very likely what led to the translation of the “Red Book” into Russian.

--You interacted with Peter Lorenz in Germany. Please tell us about this.

Peter Lorenz is a Professor (now Emeritus) at the Otto von Guericke University in Magdeburg, Germany, which is located in former East Germany. Peter’s professional interests include discrete-event simulation, which used GPSS look-alike software (named SimDis) in East Germany and, more broadly, in the U.S.S.R. Peter became aware of me because of the “Red Red Book,” and over the years we exchanged some professional correspondence. After the collapse of the U.S.S.R. in 1989, I invited Peter to come to the 1991 Winter Simulation Conference. He was not able to attend, but sent two of his co-workers (Henry Herper and Volkmar Hinz) in his place. In turn, Peter invited me to attend the initial offering in 1992 of a conference (named “Visualization and Presentation of Simulation Models and Results”) taking place in Magdeburg. I attended that conference and gave a paper on the use of animation in simulation. In the following years, Peter sometimes attended and presented at the Winter Simulation Conference, and I sometimes attended the annual conference in Magdeburg (which has now come to an end). Peter and I have become close professional and personal friends over the years, a friendship that continues to this day.

--Please tell us about your simulation research. I know that you had an Office of Naval Research Grant regarding output analysis.

My UM colleague Professor Andy Andrews (Richard W. Andrews) and I worked together in simulation research for a number of years, with emphasis on the analysis of simulation output. We published a 1981 paper in the Communications of the ACM (Association for Computing Machinery) entitled “A Conceptual Framework for Research in the Analysis of Simulation Output.” We also obtained an Office of Naval Research grant in 1981-83 to do research in the use of Auto Regressive Moving Average (ARMA) methodology for the analysis of simulation output, publishing our work in the American Journal of Mathematical and Management Sciences in 1984. In 1988 we co-authored an entry on statistical analysis of simulation output in a Systems & Control Encyclopedia published by Pergamon Press. And in 1994 I wrote a paper titled “Spreadsheet-Based Analysis of Simulation Output.”

In general, however, my preference over the years has been toward the applications of simulation and the education of simulation practitioners. Examples of application papers include:

· "Computer Simulation of the Cellular Immune Response to Malignant Lymphoic Cells: Logic of Approach, Model Design, and Laboratory Verification" (with A. Thomas Look), 1981, published in Immunology.
· "A GPSS/H Model for a Hypothetical Flexible Manufacturing System," 1985, published in Annals of Operations Research (and re-published in Flexible Manufacturing Systems: Current Issues and Models, 1986, Industrial Engineering and Management Press).
· "Scheduling with Sequencing Flexibility" (with Ram Rachamadugu and Udayan Nandkeolyar), 1994, published in Decision Sciences.

--Please tell us about your editorial service work. I know that you have been involved with several journals over the years.

It's true that in the spirit of service, I've been on a number of editorial boards over the years. These have included:

· Associate Editor, ACM/SIGSIM Simuletter, 1973-84
· Associate Editor, Decision Sciences, 1974-84
· Guest Co-editor, Annals of Operations Research, 1985
· Associate Editor, Simulation, 1982-94
· Associate Editor, International Journal of Flexible Manufacturing Systems, 1986-2006

--I note that you are a fellow of the Decision Sciences Institute. Please tell us about being selected as a fellow and your service with this Institute.

What is now known as the Decision Sciences Institute (initially known as AIDS: the American Institute of Decision Sciences) started with a national conference of quantitatively oriented business school faculty held in New Orleans in 1967. At that conference I gave a tutorial on the topic of Monte Carlo simulation, which at the time was still relatively novel, and became a Charter Member of the Institute. I was a National Vice President of the Institute in 1977-79 and was an Associate Editor of the Decision Sciences journal from 1974-84. The designation of Fellow came in 1979 in recognition of my work in the area of simulation.

--Please tell us about any people who had a major effect on your career.

UM Professor Allen Spivey (RIP) had a more major effect on my professional career than any other single person. His compelling and persuasive personality led to my decision to take a position as an Assistant Professor in Michigan's Graduate School of Business in the first place, a decision that I made very cautiously. His invitation to introduce a course in simulation in Michigan's MBA program then launched me into a detailed study of discrete-event simulation and GPSS, with many follow-on consequences. And his support in establishing the UM Summer Programs in Computing for Business School Faculty was invaluable.

Jim Henriksen also has had an interesting early and continuing effect on me over the years. Jim had majored in Mathematics as an undergrad at Michigan and was an MBA student in the Winter of 1968 offering of the simulation course. Whenever his hand went up during class, I knew a good question was about to be asked. Jim was not only a student in the course; he also worked part time at Michigan's academic computing center and was in charge of maintaining simulation languages in the operating system. And so when alleged GPSS bugs surfaced in the course, Jim was my go-to person. Jim was drafted out of the MBA program in the summer of 1968, but we remained in contact. After finishing with his two-year stint in the Army, Jim developed GPSS/H (which very favorably influenced the continuing popularity of GPSS over the years), formed Wolverine Software Corporation, engaged me to teach intensive short courses on GPSS/H, and motivated me to write a 1991 book ("An Introduction to Simulation Using GPSS/H"). Jim and I have also collaborated in various other professional activities over the years, including being invited speakers in 2012 at the celebration of the 20th anniversary of the establishing of a Fraunhofer Institute in Magdeburg, Germany.

Finally, Bob Sargent (Professor Robert G. Sargent, Syracuse University, now Emeritus) has been an inspiration for me for the past circa 35 years. Bob and I first came to know each other in the context of working to save the WSC conference series from extinction by stepping in and helping to stage a 1976 WSC, with Bob as Associate Program Chair and me as Program Chair. My admiration of Bob runs deep because of his research abilities, his high energy level, his dedication, his work ethic, his good natured way, and his numerous contributions to the field of simulation in research and service roles that continue to this day. Those entering the field of simulation would be well advised to take Bob as a role model.

--Your love of teaching is well known. You have to date taught for over 50 years: 4 years at Eastern Michigan and 47 years at the University of Michigan. What have you been teaching recently and what are your teaching plans for the future?

My favorite course now is an elective MBA course in the building and use of decision-support models using commercial third-party add-ins on Excel. In the course, we work with Monte Carlo simulation on spreadsheets (risk analysis), probability trees on spreadsheets (decision analysis), and optimization. Many of the students who take the course come away singing the praises of Excel-based modeling.

This Fall I am entering a three-year glide path ending in retirement: full time in academic year 2013-2014, then half time in each of the next two academic years. Retirement will take place in the summer of 2016, after a 50 year career as a faculty member at the University of Michigan.

--I believe you have received some teaching awards. Please tell us about them.
--Looking back over the past 50 plus years of your professional work, what part of your work do you regard as having had the greatest impact?

My sense is that the Red Book has had a much greater single impact than anything else I've done professionally. As mentioned above, upwards of 150,000 students are estimated to have worked with the Red Book during its 21-year lifetime.

--What surprises did you have regarding your professional work—both negative and positive?

A positive surprise resulted from being able to leverage my familiarity and experiences with the NSF-funded Engineering Faculty Summer Programs in Computing at Michigan into equivalent IBM-funded Business Faculty Summer Programs at Michigan. Another positive surprise took the form of the follow-on consequences that came about as a result of being challenged to introduce a simulation course in the UM MBA program. A third positive surprise was the longevity of the intensive GPSS courses taught in the UM Engineering Summer Conferences and under the auspices of Wolverine Software.

A somewhat negative surprise came about when enrollment levels in the elective MBA discrete-event simulation course decreased to the point that the last offering of the course was in 1995. In my view, this resulted from the deliberately induced and well motivated changing demographics of the UM MBA students, with the average age jumping from 21 or 22 years old to 27 or 28 years old. No longer having just finished their undergrad work and being eager in many cases to continue their pursuit of relatively technical topics, students now typically enter Michigan's MBA program with three or more years of business experience behind them and in most cases with non-technical follow-on career paths in mind.

--Having taught in a Business School, what amount of simulation literacy do you believe business school graduates should have?

Your question uses the word “literacy,” which is a good choice of word here. My take is that at a minimum, MBA students should understand the nature, potential, and consequences of using Monte Carlo simulation when modeling situations that call for taking uncertain future outcomes into account. This understanding should put them in a position to be intelligent consumers of the professionals’ product. In my experience, sufficient literacy of this type can be achieved with about 6 hours of lecture and with the building and use of from four to six Monte Carlo modeling exercises.

--You have received several awards for your professional work, do you care to comment on any of them.

Easily the most satisfying award I’ve received is the “Lifetime Professional Achievement Award” given by the INFORMS (INstitute For Operations Research and Management Science) Simulation Society in 2001. What more could one hope for professionally than such an award? And it was also pleasing to be designated as a “Titan of Simulation” at the 2009 WSC, because it provided a chance to talk about “Simulation for the Masses: Spreadsheet-based Monte Carlo Simulation” to a large group of WSC participants well versed in discrete-event simulation, but not necessarily conversant with the potential of Monte Carlo simulation on spreadsheets, a methodology they could easily master.

--Where do you see the field of simulation going in the future?

Ongoing developments in computer hardware and simulation software and advances in the state of the art in such areas as data acquisition and analysis, model verification and validation, design of experiment, and analysis of output suggest to me that simulation will continue to have increasing relevance in the future. As for now, the vitality of the Winter Simulation Conferences, for example, is testimony to the current health of the field of simulation.

--What advice would you give a student today wanting to enter the simulation field?

This might be the advice: “Remember that discrete-event simulation is a methodology for building computer-based models of systems and then conducting experiments with the models to make inferences about the behavior of the systems being modeled. Simulation encompasses a broad set of activities, including the design and implementation of

modeling languages; the verification and validation of models; the visualization of systems via the animation of models; the gathering and analysis of input to models; statistical design of experiments; statistical analysis of output; the education of simulation practitioners and simulation consumers; and the effective “selling” of simulation results to high-level decision makers. In summary, simulation has many facets. As a student wanting to enter the simulation field, you should keep these facets in mind and choose your courses as carefully and comprehensively as possible.”

--Anything else you want to mention?

No.

Thanks for doing this interview.

And thank you, Bob, for planning and conducting the interview!