

**Randall Paul Shumaker**  
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### **Education**

Ph.D. (Computer Science)	1976	University of Pennsylvania
MSE (Computing Machinery)	1969	School of Engineering and Applied Science
BSEE (Electrical Engineering)	1967	Philadelphia, Pennsylvania

### **Experience**

Director, Institute for Simulation & Training and Professor of Industrial Engineering and Management Science Department (IEMS), and Electrical and Computer Engineering (ECE), University of Central Florida. March 2002-present

With a core faculty of 30 and a total staff of about 150, IST is among the largest groups in the US focusing on research and education in modeling and simulation. IST also manages the graduate program in modeling and simulation at UCF. With 120 students in seven research tracks, it the largest and most diverse graduate program in M&S in the United States. Current IST funded programs included virtual, mixed, and augmented reality research, team performance, multimodal human-computer interaction, human-agent teams, robotics, decision support and training system prototyping and evaluation, and the application of advanced technology to teaching. In the past two years contract research has grown 35% to just under \$10M. Current federal sponsors include NSF, ONR, ARL, Army RDCOM, ARI, and DARPA. IST also enjoys sponsorship from state and local government as well as industry.

Superintendent, Information Technology, Naval Research Laboratory (NRL), Mar 1989-Feb 2002

The Division staff of 300 conducts sponsored research in a wide range of computing, networking and communications disciplines. Special emphasis programs include high-assurance systems, high performance computing, networking, artificial intelligence, and human-computer interaction (HCI). Within the HCI program we have substantial efforts in virtual reality for training, scientific visualization, and decision aiding. During my tenure the Division averaged more than 100 refereed publications and two or three patent disclosures each year and grew from \$24M/year to over \$80M/year in sponsored research.

Director, Navy Center for Applied Research in Artificial Intelligence, NRL, June 1985-March 1989

This group was and remains the largest and most scientifically productive group of its kind in the Department of Defense. It conducts basic research and exploratory development in natural language understanding, case-based reasoning, neural networks, autonomous systems, human-computer interfaces, and computer vision. The machine learning, case-based reasoning, human-computer interface, and autonomous systems research efforts initiated during my tenure have become internationally recognized for their research.

Research manager, aircraft technology, Naval Air Systems Command, June 1979-June 1985

Initially I managed the exploratory development program for aircraft support, later I managed the overall aircraft technology program of about \$20M/year. This entailed interaction with major sponsors, universities, and laboratories both commercial and government in developing and managing the program. I made personal research contributions in several efforts involving automatic test and automation in aircraft support systems, although my role was primarily research advocacy. My particular research interest at that time was in special purpose programming languages, automation of software development, and adaptive control in computer-based systems.

Section head, aircraft technology research, Naval Air Engineering Center, January 1976-June 1979

I supervised 15 scientists and engineers conducting research in computer graphics, automatic test equipment, automation for aircraft systems, and launch and recovery systems for sea-based aircraft. This research supervision experience was an opportunity to learn a great deal about working with a research staff as well as how to acquire resources, deal with sponsors, plan research, and manage research programs. My personal research was in compilers and automation of software development for microcomputer-based systems.

Instrumentation and control engineer, Naval Air Test Facility, January 1969-September 1974

During this period I developed analog and digital systems for real-world applications. One of the formative experiences I had during this time was working with minicomputers and early microcomputers, incorporating them within advanced measurement and control systems. I developed several computer-based systems for aircraft testing including a jet-car controller that remained in use for more than 10 years after my departure. My work with microcomputers helped me develop a strong interest in software development methods, compilers, and the potential for automating the process of software development. This led to my return to graduate school in the field of computer science.

### **Teaching**

During the period between May 1979 and July 1992 I taught more than 50 week-long computer and software short courses throughout the US and Europe, primarily for George Washington University. This included multiple courses in assembly language programming for microcomputers, microcomputer architecture, microcomputer-base control systems, and software development methods. During this time I also taught two short courses each in software methods for senior business managers, principles of artificial intelligence, and the technology of expert systems. Preparing and delivering these short courses was excellent training for my subsequent professional life. It taught me how to determine the crucial technical issues, present those issues coherently, and deal with questions, all under heavy time constraint. I have also had three years experience at the junior college level. For five semesters during the period of September 1974 to May 1976, while I was a graduate student, I taught one or two computer science classes per semester at Ocean County Community College, Dover Township, NJ. Topics included programming in high level languages, system analysis methods, and computer architecture.

While I am not currently teaching, many of my day-to-day presentations have a significant tutorial content and I frequently give lectures on computing-related topics for Defense organizations, professional societies, and lecture series at educational institutions.

### **University advisory boards, editorial and review boards**

Carnegie Mellon University AI & Psychology URI advisory panel member, 1988-1991

Van Nostrand-Rienhold, book reviewer in Computer Science and Communication 1990-1991

Expert systems with Applications, Pergamon Press, Editorial Advisory Board member, 1990-present

University of Massachusetts Computer Science URI advisory panel member, 1993-1996

George Washington University, Continuing Engineering Education advisory board, 1993-1995

Chairman, Defense High Performance Computing Source Selection Advisory Council (1995-1996).

George Mason University Computer Engineering Advisor Panel Member, 1997-2000.

Chairman, NASA Ames Center of Excellence in Information Technology Advisory Board 1997-98

Johns Hopkins University Graduate Continuing Engineering Education advisory board 1997-1999

Vice-chairman, George Mason University CS Department Advisory Council, 1998-2002

Reviewer, IEEE Software, 2001-present.

I frequently participate in consulting, IPTs, research reviews, boards of visitor and proposal reviews for national and defense research organizations. Recent examples include DARPA, Office of Naval Research, Army Research Office, Army Research Laboratory, NSA, Institute for Defense Analysis, Office of Defense Research and Engineering (DDR&E), NASA Ames, NASA Goddard, the Defense High Performance Computing Modernization Office and the National Coordination Office for Computing, Information, and Communications.

### **Institutional Leadership**

Chairman and US National Leader for Machine Intelligence under an international cooperation program among the English-speaking nations, the Technical Cooperation Program (TTCP).  
Sept 1988-June 1992

Chief Information Officer (CIO), Naval Research Laboratory. The Laboratory operates more than 10,000 computers including some of the most advanced supercomputers in the world. NRL also maintains multiple research and production networks operating at speeds up to 80 GB/s. As CIO I am responsible for ensuring that the research and operational computing environment meets the needs of a diverse research enterprise covering a wide range of disciplines. A special interest and challenge is maintaining computer security within an open computing environment. May 1997-Feb 2002

Chairman, NRL Invention Evaluation Board (IEB). This group is responsible for managing the intellectual property program of the Laboratory. The IEB considers about 140 disclosures a year of which about 65% are approved for the patent process. NRL is awarded about 90 new patents each year and is the Defense leader in technology licensing and cooperative research agreements with academia and industry. December 1998-June 2000

US Lead Member on NATO Information Science & Technology Panel. This panel is responsible for research cooperation and technology exchange among the 19 NATO nations. Among its products are two technical symposia each year and sponsorship of technical working groups among the nations. February 1998-May 2004.

Member Computer Science, Nanotechnology, Digital Media, and Biotech searches UCF 2003-4

Chair, Florida Solar Energy Center Director search committee at UCF 2004

Member at Large, NATO Information Science & Technology Panel September 2004 - present

### **Recognition and awards**

Agustus Trask Ashton scholarship - University of Pennsylvania (1963-67)

Elected to membership in Sigma Tau and Eta Kappa Nu 1967

Research Grant - Exxon Education Foundation (1973-4)

Research Grant - Ford Foundation (1975)

Elected to Membership in Sigma Xi 1976

NRL supervisory EEO award 1993

Office of Naval Research Command EEO award 1993

I have received seven Senior Executive Service Outstanding Performance Bonus Awards and two promotions during the past ten years.

Presidential Rank of Meritorious Executive 1998

### **Professional Organizations**

Senior Member, Institute for Electrical and Electronic Engineers (IEEE)

Member, IEEE Computer Society

Member, Association for Computing Machinery (ACM)

### **Publications and presentations**

My current professional role is research advocate and technical advisor; I develop programs, create the research environment, assist in acquiring the resources, and supervise projects. Most of my recent presentations and publications reflect this role while my earlier ones are more research oriented.

### **Conferences and Symposia**

1. "Heuristic Software Methods in Military Applications", Navy Executive Symposium on Information Technology, 20-22 Oct 1986, Software Engineering Institute, Pittsburgh, PA
2. "Applied Artificial Intelligence" presentation at the Association of the US Army (AUSA) Advanced Technology Conference June 1986, Los Angeles, CA
3. "Artificial Intelligence in Military Applications", Navy Executive Symposium on Information Technology, 12 April 1988, Software Engineering Institute, Pittsburgh, PA
4. "Automation, Expert Systems and Decision Support", Naval War College course on Technology and Naval Warfare, 23 March 1989, Newport RI
5. "Control Architectures for Autonomous Vehicles", Society of Manufacturing Engineers World Conference on Robotics Research, 7-11 May 1989, Gaithersburg, MD
6. Third DoD Interoperability Testing Conference, "Software Development Requirements for DoD", 9-11 Mar 1993, Joint Interoperability Test Center, Ft. Huachuca AZ
7. Software Technology Conference (STC-94), "Research in Advanced Software Technologies: Machine Intelligence and Formal Methods", 11-14 April 1994, Salt Lake City, UT.

8. Software Technology Conference (STC-96), " Commercial-off-the-shelf Software in Critical Applications", 24 April 1996, Salt Lake City, UT.
9. Defense Simulation Internet Users Conference, Plenary session speaker "Asynchronous Transfer Mode (ATM) in High Performance Networking", 13-15 February 1996, Orlando, FL
10. "Defense Computing Research Priorities", Software Technology Conference (STC-97), 28 April-2 May 1997, Salt Lake City, UT.
11. American Association for Artificial Intelligence Conference (AAAI-97), July 27-31 1997, Providence RI, "A Perspective on the Future of AI Research."
12. "Intelligent Systems", Association of Old Crows Symposium on Intelligence Support to Electronic Warfare January 1997
13. SIAM Annual Meeting 2000, presentation: "Computational Challenge of Providing Synthetic Natural Environmental Data to Real Time Simulations", July 10-14, 2000, Westin Rio Mar, Rio Grande, PR

#### **Chapters, proceedings and articles**

1. "Intelligent Machines", Pennsylvania Triangle Magazine, vol. 54, March 1967
2. "A Highly Reliable Telemetry Link", Master's thesis, Moore School of Electrical Engineering, University of Pennsylvania 1969
3. "A Methodology For The Development Of Decision Support Systems" Ph.D. dissertation University of Pennsylvania, Philadelphia PA. 1976
4. "Software Development for Digital Control, in Advances in Information Systems, Vol. 8 Plenum, New York, NY 1981
5. "Embedded Expert Systems", in Proceedings of the IEEE- Expert Systems in Government Conference, IEEE Computer Society Press, 1986
6. "Artificial Intelligence In Military Applications", with J. Franklin, Signal Vol.40, no.10, p.29-48; June 1986.
7. "Artificial Intelligence in the Military" in the Encyclopedia of Artificial Intelligence, (with L. Davis and J. Franklin), Prentice Hall, 1986
8. "Artificial Intelligence in Military Applications" in Principles of Command and Control, Dr. S. Andriole Editor, AIP 1987 (with J. Franklin)
9. AIAA/NASA/USAF Symposium on Automation, Robotics and Advanced Computing for the National Space Program, "Navy Research Programs in Applied Artificial Intelligence", 9-11 March 1987, Arlington, VA
10. Proceedings of the IEEE Conference on Managing Expert System Programs and Projects, Ed: Liebowitz-J; Feinstein-J; Shumaker-R, IEEE Computer Society. Press, Los Alamitos, CA, USA; 1990
11. "Expert Systems Research in the Navy" in Expert Systems with Applications Journal, Vol. 1 no. 1, Pergamon Press, March 1990 (with L. Davis and A. Meyrowitz)

12. "Artificial Neural Networks and Their Application to Weapons", Naval Engineering Journal Vol. 03/4, July 1991, pp96-98
13. "DoD Software: the Role of Artificial Intelligence and Neural Networks", Proceedings of the Joint Service Data Fusion Symposium, Vol. III, Johns Hopkins University Applied Physics Laboratory, 7-11 October 1991
14. "Expert Systems Technology Development and Distribution Experiences", Proceedings of the World Congress on Expert Systems, Orlando Fla., December 1991.
15. "DoD's software technology plans: what do they mean for KBSE, and what does it mean for them?", W. Sasso; B. Boehm; M. Hirschberg; R. Jullig; R. Shumaker; D. White, in Proceedings of the Seventh Knowledge-Based Software Engineering Conference, p.243-5, IEEE Computer Society Press, Los Alamitos, CA, 1992
16. "Transitioning expert system technology: case studies at the Navy Center for Applied Research in Artificial Intelligence" (with L. Davis and A. Meyrowitz), Proceedings of the Twenty-sixth IEEE Hawaii International Conference on System Sciences, IEEE Computer Society Press, Los Alamitos, CA p.308-15, vol. 3, 1993
17. Sea Technology, Special Issue on Computers, Software and Surveillance, "Software Development: A Small Matter of Programming", Vol. 36, No. 5, May 1995.
18. Letter, Physics Today, p16, December 2003, T. Clarke, R. Shumaker, D. Kaup

#### **Program, panel and session Chairmanships**

- 1 IEEE International Automatic Testing Conference (Autotestcon 86) Integrated Diagnostics panelist, "Practical Requirements for Insertion of Integrated Diagnostics in the Support Process" Sept 1986, San Antonio, TX
- 2 Second Annual AIDA: Artificial Intelligence and ADA Conference, November 12, 1986 Fairfax, VA, panelist in session on Future of AI in Military Systems.
- 3 Joint Chiefs of Staff Symposium on Artificial Intelligence Applications for Military Logistics, Co-chair for Maintenance Diagnostics, 29-31 March 1988, Williamsburg, VA
- 4 "Artificial Neural Networks", Session on Extending AI Horizons, Federal Computer Conference, 25-28 October 1988, Washington, DC
- 5 AIAA/NASA First International Symposium on Space Automation and Robotics, Session Chairman for Evolving Capabilities/Enabling Technologies/Terrestrial Implications, 29-30 November, 1988, Arlington, VA
- 6 Society of Manufacturing Engineers Robots 13, World Conference on Robotics Research, Chair for Government Manufacturing Applications, 7-11 May 1989, Gaithersburg, MD
- 7 Joint Chiefs of Staff Symposium on Artificial Intelligence Applications for Military Logistics, Co-chair of session on Diagnostics, 28-31 March 1989, Williamsburg, VA
- 8 Joint Chiefs of Staff Symposium on Artificial Intelligence Applications for Military Logistics, Chair of session on Diagnostics, 27-30 March 1990, Williamsburg, VA
- 9 IEEE Symposium on Autonomous Underwater Vehicle Technology, Chairman for AUV Computer Architectures, 5-6 June 1990, Washington, DC

- 10 IEEE AI Systems in Government Conference (AISIG-90), Chairman of session on Laboratory Directions, 7-11 May 1990, George Washington University, Washington DC
- 11 IEEE Conference on Managing Expert Systems Programs and Projects, Program Chair, 10-12 Sept 1990, Washington, DC
- 12 ASNE Conference on Naval Engineering in the Changing Defense Structure, Panel on Emerging Technologies. July 1991
- 13 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-92), 7-10 July 1992 Raleigh, NC, Workshop member and panelist on Dynamic World Autonomous Systems.
- 14 KBSE '92, Seventh Knowledge-Based software Engineering Conference, panel member on DoD Software Technology Plans, 20-23 Sept.1992, McLean VA
- 15 NATO Symposium on Information Management Challenges in Coalition Interoperability, Quebec City CA, session Chair for Coalition Common Operating Picture, 28-30 May 2001

#### **Invited talks**

- 1 Building HAL, Conference on the future of computers, Invited speaker on "The Future of Software" Alabama A&M University, Huntsville, AL, 13-14 August 1992
- 2 Marine Technology Society Conference (MTS-94), Plenary session speaker on "The Nature of Software and How It Is Changing", 7-9 September 1994, Washington, DC.
- 3 Keynote address "Software Development - SMOP", Canadian Forces Command and Staff College, Ontario Canada, December 1994
- 4 Joint Services Software Technology Conference (STC-95), "Software Technology: A Small Matter of Programming (SMOP)", 10-14 April 1995, Salt Lake City, UT.
- 5 Future Trends and Choices in Networking", Canadian Forces Command and Staff College, Ontario Canada, October 1995
- 6 "Information Warfare Technologies", Intelligence and EW in Information Warfare Conference, 16-17 December 1996, DIAC, Washington DC
- 7 "COTS, Hacking & Security in Defense Applications", Opening address for Protecting NATO Information Systems in the 21<sup>st</sup> Century Symposium, 25-28 October 1999, Washington DC
- 8 Keynote address "Information Technology Expectations for 2025", Naval War College Strategic Studies Group, 15 December 1999, Newport RI
- 9 Keynote address "A Small Matter of Programming (SMOP)", Automatic Code Generation and Software Development Process Symposium, sponsored by Boeing and ONR, Arlington VA, 8-9 June 1999
- 10 "Software for autonomous systems" UMR Distinguished speakers series in computer engineering; Nov 30, 2000, University of Missouri – Rolla
- 11 "Networks, software and autonomous systems", Naval War College Strategic Studies Group, Newport RI, January 30, 2001
- 12 "Hacking, INFOWAR and Protection of IT Infrastructure", Keynote address at the Optical and Protocol Vulnerability Assessment in Fiber Optic Communication Networks Workshop

sponsored by the National Security Agency, Defense Information Systems Agency, and NRL; MITRE Corp, McLean VA, , 15-17 May 2001

- 13 Keynote address “Why is it taking so long?”, Conference on Computer Generated Forces and Behavioral Representation (11<sup>th</sup> CGF-BR), Orlando FL 7-9 May 2002
- 14 Keynote address “The way ahead for V&V – how to implement needed research”, at the DMSO, JANNAF, NTSA Foundations 2002 Workshop, Johns Hopkins University Applied Physics Lab, Laurel, MD, October 22-23, 2002
- 15 “Evolutionary Development and Adaptive Control of Collaborative Systems”, US ARL Tactical Behaviors Workshop,, 29-30 October 2003, US Army War College, Carlyle PA
- 16 “The information Age”, Lecture in NDU 6001, Future Technologies for National Security, National Defense University, 18 February 2004.

In addition to these more formal events I frequently present talks in speaker series and seminars. Some recent venues include Johns Hopkins University, University of Pennsylvania, George Washington University, George Mason University, National Security Agency, Office of Naval Research, Pacific Northwest National Laboratory, University of Maryland, Stanford University, US Naval Academy, National Defense University, NASA Ames, and the Naval War College.

#### **Current research contracts**

DARPA IPTO (Randall Shumaker PI) Hierarchical Adaptive Control for Robot Teams \$30K	2002-2003
DARPA IPTO (Randall Shumaker PI) Evolutionary Development and Adaptive Control of Collaborative Agents \$200K	2003-2004
Intelligent Systems Technology Inc. (ISTI) (Randall Shumaker PI) Social Control Mechanisms for Collaborative Agents \$150K	2004-2005
RDECOM Simulation Technology Center Orlando (Randall Shumaker PI) Team Formation and Optimization in Human-Agent Teams \$750K/year	2004-2006

#### **Some other information**

Professional Engineer License – Control systems

Commercial Pilot – single & multi-engine land, instrument rating-aircraft (SEL, MEL, IA)

Top Secret SBI security clearance