Richard R. Schultz, Ph.D.

Professional Preparation

University of North Dakota (Grand Forks, ND)	Electrical Engineering	B.S.E.E., 1990
University of Notre Dame (Notre Dame, IN)	Electrical Engineering	M.S.E.E., 1992
University of Notre Dame (Notre Dame, IN)	Electrical Engineering	Ph.D., 1995

Appointments

8/2005 to Present:	Interim Chair, Department of Electrical Engineering, University of North Dakota
8/2000 to Present:	Associate Professor of Electrical Engineering, University of North Dakota (Tenured, 8/2001)
1/2004 to 8/2005:	Co-Project Director, North Dakota Experimental Program to Stimulate Competitive Research (EPSCoR), University of North Dakota (0.5 FTE)
8/1995 – 8/2000:	Assistant Professor of Electrical Engineering, University of North Dakota
7/2003 – 8/2003, 5/2002 – 8/2002:	Faculty Fellow, Upper Midwest Aerospace Consortium, University of North Dakota, Grand Forks, ND
7/1998 – 8/1998:	Research Associate, Air Force Research Laboratory Summer Faculty Research Program, Rome Research Site, Rome, NY
7/1997 – 8/1997:	Visiting Scientist, Biomedical Imaging Resource, Mayo Foundation and Clinic, Rochester, MN
1/1995 – 7/1995:	Visiting Assistant Professor of Electrical Engineering, University of Notre Dame
8/1990 – 12/1994:	Graduate Research and Teaching Assistant, Department of Electrical Engineering, University of Notre Dame
1988 – 1990:	Preprofessional Development and Cooperative Education Programs, International Business Machines Corporation, Rochester, MN

Significant Publications

R. R. Schultz, W. H. Semke, A. F. Johnson, D. R. Olsen, O. Beeri, and G. A. Seielstad, "Satellites, UAVs, and Ground-Based Wireless Sensor Networks: Lessons Learned from an REU Site in Environmental Sensor Development." To appear in *Proc. 2006 American Society for Engineering Education Annual Conf. & Exposition* (on CD-ROM), Chicago, IL, June 18-21, 2006.

C. Silvernagel, R. R. Schultz, and J. Stamp, "The Evolution of an Entrepreneurship Curriculum Based on Experience and Best Practices." In *Proc. National Collegiate Inventors and Innovators Alliance (NCIIA) 10th Annual Meeting*, Portland, OR, March 23-25, 2006.

R. R. Schultz and A. F. Johnson, "Practicing Real World Design, Teamwork, and Communications through Multidisciplinary Systems Engineering Projects." In *Proc. 2005 American Society for Engineering Education Annual Conf. & Exposition* (on CD-ROM), Portland, OR, June 2005.

W. J. Wambsganss, N. E. Hulst, B. W. Scilley, R. R. Schultz, D. R. Olsen, and G. A. Seielstad, "Electronics EMI/EMC and Radiation Effects Testing for a University-Designed ISS Imaging Payload." In *Proc. 2005 IEEE Aerospace Conf.* (on CD-ROM), Big Sky, MT, March 2005.

C. Silvernagel and R. R. Schultz, "From Concept Generation to Technology Transfer within an Entrepreneurship Curriculum." In *Proc. NCIIA 9th Annual Meeting*, San Diego, CA, March 2005.

R. R. Schultz and R. L. Stevenson, "Bayesian Image and Video Enhancement Using a Non-Gaussian Prior." In *Nonlinear Signal and Image Processing: Theory, Methods, and Applications* (Kenneth Barner and Gonzalo Arce, editors), pp. 295-332, CRC Press LLC, 2004.

N. E. Hulst, J. B. Barton, J. Carpenter, C. Frey, J. Hammes, A. F. Johnson, D. R. Olsen, R. R. Schultz, B. W. Scilley, G. A. Seielstad, W. H. Semke, S. Threinen, P. Ubbi, R. Voeller, W. J. Wambsganss, A. Webster, C.-H. Won, and A. Zeller, "AgCam: Scientific Imaging for the ISS Window Observational Research Facility." In *Proc. 2004 IEEE Aerospace Conf.* (on CD-ROM), Big Sky, MT, March 2004.

N. E. Hulst, A. F. Johnson, D. R. Olsen, P. P. Osburnsen, R. R. Schultz, G. A. Seielstad, W. H. Semke, and C.-H. Won, "The Airborne Environmental Research Observational Camera (AEROCAM): A Case Study of Multidisciplinary Experiential Learning." In *Proc. 2002 Frontiers in Education Conf.* (on CD-ROM), Boston, MA, November 2002.

R. R. Schultz, "Super-Resolution Enhancement of Native Digital Video Versus Digitized NTSC Sequences." In *Proc. 2002 IEEE Southwest Symp. Image Analysis and Interpretation*, Santa Fe, NM, pp. 193-197, 2002.

R. R. Schultz, "Nonlinear Filtering of Subpixel Motion Vectors for Improved Super-Resolution Video Frame Enhancement." Invited paper in *Proc. 2001 IEEE-EURASIP Workshop on Nonlinear Signal and Image Processing* (on CD-ROM), Baltimore, MD, 2001.

D. Sale and R. R. Schultz, "Super-Resolution Enhancement of Night Vision Image Sequences." In *Proc. IEEE Systems, Man, and Cybernetics Society 2000 Meeting* (on CD-ROM), Nashville, TN, 2000.

K. J. Erickson and R. R. Schultz, "MPEG-1 Super-Resolution Decoding for the Analysis of Video Still Images." In *Proc. 2000 IEEE Southwest Symp. Image Analysis and Interpretation*, Austin, TX, pp. 13-17, 2000.

R. R. Schultz and M. G. Alford, "Multiframe Integration via the Projective Transformation with Automated Block Matching Feature Point Selection." In *Proceedings of the 1999 IEEE International Conference on Acoustics, Speech, and Signal Processing* (on CD-ROM), Phoenix, AZ, 1999.

R. R. Schultz, L. Meng, and R. L. Stevenson, "Subpixel Motion Estimation for Super-Resolution Image Sequence Enhancement," *Journal of Visual Communication and Image Representation*, vol. 9, no. 1, pp. 38-50, 1998.

R. R. Schultz and R. L. Stevenson, "Estimation of Subpixel-Resolution Motion Fields from Segmented Image Sequences." In *Proceedings of the SPIE – Sensor Fusion: Architectures, Algorithms, and Applications II (AeroSense '98)*, Orlando, FL, vol. 3376, pp. 90-101, 1998.

R. R. Schultz and R. L. Stevenson, "Extraction of High-Resolution Frames from Video Sequences," *IEEE Transactions on Image Processing*, vol. 5, no. 6, pp. 996-1011, 1996.

S.-J. Choi, R. R. Schultz, R. L. Stevenson, Y.-F. Huang, and R.-W. Liu, "Contrast Enhancement of Missile Video Sequences via Image Stabilization and Product Correlation," *Optical Engineering*, vol. 34, no. 12, pp. 3495-3507, 1995.

R. R. Schultz and R. L. Stevenson, "A Bayesian Approach to Image Expansion for Improved Definition," *IEEE Transactions on Image Processing*, vol. 3, no. 3, pp. 233-242, 1994.

Significant Grants & Contracts

DEPSCoR FY2006 Program. Project Title: "Real-Time Super-Resolution ATR of UAV-Based Reconnaissance and Surveillance Imagery"; PI: Dr. Richard R. Schultz; DoD Technical Monitor: Dr. Liyi Dai, Army Research Office; Project Location: University of North Dakota; DoD Award: $457,985; Award Period: June 2006 through May 2009.

NSF REU Site Award ECC-0139185 – Theme of aerospace payload and environmental sensor development; PI: R. R. Schultz; Award Period: July 2002 through Dec. 2005.

NSF SBIR Phase I FY2002 Program. NSF Grant Number DMI-0232274; Project Title: "SBIR Phase I: Breaking the Barriers to the Commercialization of Super-Resolution Video Enhancement Algorithms"; PI: Dr. Richard R. Schultz; NSF Program Officer: Dr. Juan E. Figueroa; Project Location: Grand Forks, ND; NSF Award: $84,071; Award Period: Jan. 2003 through June 2003.

DEPSCoR FY1996 Program. DoD Grant Number DAAH04-96-1-0449; Project Title: "Bayesian Estimation of High-Resolution Imagery from Low-Resolution Video Sequences and Multisensor Data Sets"; PI: Dr. Richard R. Schultz; DoD Technical Monitor: Dr. William A. Sander, Army Research Office; Project Location: University of North Dakota; DoD Award: $189,701; Award Period: Sept. 1996 through Aug. 2001.

NSF CAREER Award MIP-9624849 – Theme of integrating digital image and signal processing research into the B.S.E.E. curriculum; PI: R. R. Schultz; Award Period: June 1996 through December 2000.

Synergistic Activities

Environmental Payload & Sensor Development:

- **Agricultural Camera (AgCam)**, a two-band (red and near infrared) sensor with 10-meter spatial resolution to monitor vegetation health, designed by EE and ME graduate students for installation in an Earth-observing window inside the International Space Station.
- **Airborne Environmental Research Observational Camera (AEROCam)**, a four-band multispectral imager with 1- to 2-meter spatial resolution designed by EE and ME graduate students for flight on UND Aviation single-engine airplanes, with applications in precision agriculture and disaster response.
- **Unmanned Aerial Vehicle (UAV)**, an R/C airplane with 3-meter wingspan capable of lifting payloads up to 4 kilograms in mass was built during the summer of 2004 by NSF Research Experience for Undergraduates Site participants. Custom scientific payloads were designed for flight by this UAV.
- **Motes Wireless Sensor Network**, a system of portable weather stations with two levels of sensors to measure differential quantities for the estimation of evapotranspiration (ET) in a sugar beet field. ET is an indicator of sugar content, and it is of economic value to regional farmers.

Entrepreneurship & Innovation Graduate Minor/Cognate, in collaboration with the UND College of Business & Public Administration. The goal is to have business and engineering students work together to learn the synergistic value of design, manufacturing, marketing, management, and finance in the development of new products and services.