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Presently Union Oil Company Design Fellow
Professor of Engineering
Department of Engineering, Harvey Mudd College

Education **Massachusetts Institute Of Technology,** Cambridge, Massachusetts. Ph.D. degree in Chemical Engineering, January 1985.

University Of Utah, Salt Lake City, Utah. B.S. degree, magna cum laude, in Chemical Engineering, June 1981.

Academic Appointments

July 2000-Present	**Harvey Mudd College**, Department of Engineering, Professor of Engineering.
July 2010-June 2015	**Harvey Mudd College**, Department of Engineering, Director, Engineering Clinic. Responsible for annually recruiting 25 outside-sponsored engineering projects.
Sep. 2009-May 2010	**Olin College Of Engineering**, Visiting Professor of Engineering
Winter 2002	**California State Polytechnic University, Pomona,** Visiting Lecturer in Chemical Engineering
Fall 2001	**California Institute Of Technology**, Visiting Professor of Chemical Engineering
July 1992-June 2000	**Harvey Mudd College**, Department of Engineering, Associate Professor of Engineering. Center for Design Education, Associate Director for Engineering Computing.
July 1988-June 1992	**Harvey Mudd College**, Department of Engineering, Assistant Professor of Engineering.
Jan. 1985-June 1988	**Massachusetts Institute Of Technology**, Department of Materials Science and Engineering, John Chipman Assistant Professor of Chemical Process Metallurgy

Consulting

2015-Present	**Glassimetal Technology Inc.**, Pasadena, CA. Ongoing assistance with electrostatic levitator.
2004-2008	**Pacific Scientific Corporation**, Duarte, CA. Modeling of fluid flow.
2002-2004	**Caliper Technology Corporation**, Mountain View, CA. Assistance with materials and process aspects of product development.
1998-2004	**Radiant Technology Corporation**, Fullerton, CA. Assistance with optical modifications to rapid-thermal-processing furnace. Modeling of heat transfer within rapid-thermal-processing furnace.
1988-2000	**Jet Propulsion Laboratory**, Pasadena, CA. Assistance with design and construction of an electrostatic levitator. Construction of an optical pyrometer. Construction and programming of computerized data acquisition systems. Assistance with proposal and manuscript preparation.
1996-1997	**Space Systems/Loral**, Palo Alto, CA. Assistance with design and construction of small-sample high-temperature electrostatic levitator, in particular the position-detection system.
1986-1988	**Advanced Energy Dynamics**, Natick, MA. Evaluation of experimental data and recommendations for modification of a proprietary separation process. Assistance with proposal preparation.

Awards/ Honors

1985-1988	John Chipman Chair in Chemical and Process Metallurgy

Grants/Fellowships

2011-Pres.	Union Oil Company Design Fellowship (Faculty chair in Engineering)
2010-2013	CCAO-Cam: A Remote-Access, Dual-Band (Optical/NIR) Adaptive Optics System for the Table Mountain 1-meter telescope," under the direction of Philip I. Choi, Bryan E. Penprase, R. Erik Spjut, Scott A. Severson. NSF MRI.
2004	Boeing Phantomworks grant for correcting atmospheric disturbances in wireless power transmission.
1989-1995	SCE Center of Excellence grant for measurement of electrical properties of materials, with Joseph A. King
1985-1988	DOE Grant on plasma processing of materials. Multiple MIT PIs joint with INEL

Invited Lectures

2001 "Containerless Processing of Materials in an Electrostatic Levitator" Caltech Chemical Engineering Seminar, 2001.

1991 "Multi-Ratio Pyrometry" Joint N.I.S.T.–A.S.T.M. workshop on advances in non-contact temperature measurement, N.I.S.T. Headquarters, Gaithersburg MD, May 1991.

1989 "Non-Contact Temperature Measurement," Los Angeles Chapter, A.I.Ch.E., May 1989.

"Supercooling and Recalescence of Individual Metal Powder Particles," Jet Propulsion Laboratory, Pasadena CA, March 1989.

"Non-Contact Temperature Measurement," Engineering Seminar, Harvey Mudd College, March 1989.

"Advances in Multi-Color Pyrometry," NASA workshop on Non-Contact Temperature Measurement Techniques, Pasadena Hilton, Pasadena CA January 1989.

1987 "Common but Unappreciated Sources of Error in One, Two, and Multiple Color Pyrometry," NASA workshop on Non-Contact Temperature Measurement Techniques, NASA HQ, Washington DC April 1987.

1986 "High-Temperature Gas-Solid Kinetics in an Electrodynamic Thermogravimetric Analyzer," Materials Engineering and Science Seminar Series, MIT, 1986.

Teaching Experience

HMC

Engineering Design (first-year level)
Engineering Design Representation and Realization (first-year level)
Beginning Swedish (first-year level)
Introduction to Systems & Signals (second-year level)
Chemical and Thermal Principles (second-year level)
Engineering Laboratory (second-year level)
Music Fundamentals (second-year level)
Materials Engineering (third-year level)
Advanced Systems & Signals (third-year level)
Digital Logic & Computer Engineering (third-year level)
Chemical Reaction Engineering (fourth-year level)
Preliminary Design (fourth-year level)
Heat Transfer (fourth-year level)
Advanced Engineering Thermodynamics (fourth-year level)
Engineering Clinic (capstone course, fourth-year level).

Olin	Design Nature (first-year level) Modeling and Control (first-year level) Introduction to Sensors, Instrumentation and Measurement (co-developed, first-year level) Senior Capstone Program in Engineering (SCOPE, fourth-year level)
Cal-Poly	Stoichiometry Laboratory (second-year level)
Caltech	Heterogeneous Kinetics (graduate level)
MIT	Introduction to Solid-State Chemistry (first-year level) Physical Chemistry of Materials (second-year level) Chemical Metallurgy (fourth-year level) Kinetic Processes in Materials (graduate level)

Teaching Interests

I am concerned with the pedagogy of engineering and design education, particularly with unorthodox but effective classroom and laboratory methods. I have developed courses utilizing the seminar-style case-study method, just-in-time learning, web-based video, and student-led course content. I have completely restructured our second-year-level engineering laboratory to include a final field experience where the students launch a fully-instrumented rocket and report on the comparison between the flight data and the flight modeling.

In addition to the subjects listed above under courses taught I would like to develop courses in one or more of the following areas: Advanced Rocketry (third-year/fourth-year level), Critical Thinking for Engineers and Scientists (first-year/second-year level), Principles of Embodiment and Detail Design (third-year/fourth-year level), Signal Processing in Digital Audio and Video (fourth-year level), Heterogeneous Reaction Engineering (fourth-year level), Chemical Processing of Materials (fourth-year level), Temperature Sensing and Radiative Heat Transfer (advanced fourth-year or graduate level), and Numerical Methods in Process Engineering (third-year/fourth-year level).

Research Areas

As of late, I have pursued active learning as applied to engineering. To support my principal laboratory for active learning, the rocketry-based Engineering Laboratory course, I have also pursued inertial measurement and Kalman filtering, vibrational system ID, the physics of rocket flight, MEMS and other sensors, data acquisition and error analysis.

I was also recently involved in the engineering of an adaptive-optics retrofit to the Table Mountain telescope operated by Pomona College. My principal areas were the structural integrity and vibration isolation.

My previous research was principally in the area of high-temperature processing of materials — both in fundamental science and engineering applications. My primary thrust was in heterogeneous reaction kinetics and diagnostics. Specific areas of research were the intrinsic and overall kinetics of solid or liquid aerosols reacting at high temperatures with a gas, e.g.,

carbon combustion, metal-oxide formation, carburization and metal-carbide formation, gaseous reduction of metal oxides and oxidation of metal sulfides. The morphologies of the products and of the solid reactants as controlled by the reaction kinetics are also of interest.

As an adjunct to the materials research, I have pursued the areas of containerless processing of materials, non-contact temperature measurement, computer-controlled experimental design, radiative scattering, absorption and emission from metallic and non-metallic aerosols, tribocharging and charge stability on heated aerosols, and supercooling of metals and ceramics. In addition, process-sensors and feedback-control are of great interest to me.

Service

Professional Proposals reviewed for the National Science Foundation, the Department of Energy, and NASA. Referee for the following publications: *Journal of Metals*, *Review of Scientific Instruments*, *IEEE Transactions*, and *Conservation & Recycling*. The Metallurgical Society of AIME (Secretary-Treasurer, Boston Chapter '86-'87; Vice Chairman, Boston Chapter '87-'88)

Departmental/College

2010-2015	Director, Engineering Clinic – Responsible for annually recruiting 25 outside-sponsored capstone projects.
2010-2015	Departmental Professional Development Committee
2014-2015	College Curriculum Committee
2014-2015	Departmental Engineering Resources Planning Committee
2013-2014	College Safety Committee
2007-2009	College Diversity Committee
2004-2008	College Assessment Committee
2008-2009	College Computing Committee
1995-1998	College Computing Committee
1997-1999	College Scholarly Standing Committee
1999-2002	College Teaching and Learning Committee

Professional Skills Website development especially using LAMP (Linux, Apache, MySQL & PHP) and Dreamweaver, engineering numerical methods, LabVIEW, MATLAB & Simulink, Mathematica, Fortran, C (when necessary), engineering calculations using spreadsheets, Solidworks with Motion and Simulation, PCB design, PRO/II, music composition & audio production, CSound, video production.

Certifications Amateur Radio General License – KJ6ZAX
California Pyrotechnic Operator Rocket 3rd Class
Tripoli Rocketry Association Level 2
Responsible Person, Harvey Mudd BATF LEUP Permit

Languages Fluent Swedish, Rudimentary Spanish

Professional Memberships American Institute of Chemical Engineers

Publications

Refereed Journal Articles

Rhim, W.K., Ohsaka, K., Paradis, P.F., Spjut, R.E., "Noncontact Technique for Measuring Surface Tension and Viscosity of Molten Materials Using High Temperature Electrostatic Levitation ," Rev. Sci. Instrum., **70** (6), 2796-280 (1999)

Rhim, W.K., Chung, S.K., Rulison, A.J., Spjut, R.E., "Measurements of Thermophysical Properties of Molten Silicon by a High-Temperature Electrostatic Levitator," Int. J. Thermophys., **18** (2), 459-470 (1997).

Bowman, R.C., Jr., Freeman, B.D., Ryba, E.L., Spjut, R.E., Liu, E.A., Penso, J.M., Lynch, F.E., "Performance testing of a vanadium hydride compressor," Z. Phys. Chem. (Germany), **183**, pt.1-2, 245-50 (1994)

Rhim, W.K., Chung, S.K., Barber, D., Man, K.F., Gutt, G., Rulison, A., Spjut, R.E., "An electrostatic levitator for high-temperature containerless materials processing in 1-g," Rev. Sci. Instrum. **64** (10), 2961-2970 (1993).

DeVries, J., Wakisaka, S.S., and Spjut, R.E., "Measurement of the Work-Function of $Y_1Ba_2Cu_3O_{7-\delta}$ Under Ambient Conditions," J. Mater. Res. **8** (7) 1497-1500 (1993).

Spjut, R.E., "Transient Response of Least-Squares Based Multiwavelength Pyrometers," Optical Engineering, **32** (5), 1068-1072 (1993).

Bolsaitis, P.P., Spjut, R.E., and Elliott, J.F., "High-Temperature Pulses in Small Alumina Particles," High-Temp.-High Pressures **21**, 601-611 (1989).

Bar-Ziv, E., Jones, D. B., Spjut, R. E., Dudek, D. R., Sarofim, A. F., Longwell, J. P., "Measurement of combustion kinetics of a single char particle in an electrodynamic thermogravimetric analyzer," Combustion and Flame **75** (1), 81-106 (1989).

Libera, M.R., Bolsaitis, P.P., Spjut, R.E. and VanderSande, J.B., "Liquid Supercooling and Droplet Cooling rates of Remelted Argon-Atomized Fe-30Ni Powder Particles," J. Mater. Res. **3** (3) 441-452 (1988).

Fincke, J.R., Jeffery, C.L. and Spjut, R.E., "Measurement of the Emissivity of Small Particles at Elevated Temperatures," Optical Engineering, **27** (8), 684-690 (1988).

Greene, W.M., Spjut, R.E., Bar-Ziv, E., Sarofim, A.F. and Longwell, J.P., "Photophoresis of Irradiated Spheres: Absorption Centers: errata," Journal of the Optical Society of America B, **5**, 866 (1985).

Spjut, R.E., "Transient Response of One- and Two-Color Optical Pyrometry Systems," Optical Engineering, **26** (5), 467-472 (1987).

Spjut, R.E., Bar-Ziv, E., Sarofim, A.F. and Longwell, J. P., "Electrodynamic Thermogravimetric Analyzer," Rev. Sci. Instrum. **57**, 1604-1610 (1986).

Spjut, R.E., Sarofim, A.F. and Longwell, J.P., "Laser Heating and Particle Temperature Measurement in an Electrodynamic Balance," Langmuir **1**, 355-360 (1985).

Greene, W.M., Spjut, R.E., Bar-Ziv, E., Sarofim, A.F. and Longwell, J.P., "Photophoresis of Irradiated Spheres: The Complex Index of Refraction," Langmuir **1**, 361-365 (1985).

Greene, W.M., Spjut, R.E., Bar-Ziv, E., Sarofim, A.F. and Longwell, J.P., "Photophoresis of Irradiated Spheres: Absorption Centers," Journal of the Optical Society of America B, **2**, 998-1004 (1985).

Book Chapters

"Chapter 6 Design Modeling, Analysis and Optimization", *Engineering Design: A Project Based Introduction*, 3rd Ed, C. Dym, & P. Little, with E. Orwin, & R.E. Spjut, Wiley, New York (2008)

"Chapter 7 Communicating the Design Outcome (I): Building Models and Prototypes", *Engineering Design: A Project Based Introduction*, 3rd Ed, C. Dym, & P. Little, with E. Orwin, & R.E. Spjut, Wiley, New York (2008)

"Chapter 24. An Introduction to Signal Processing with Csound", *The Csound Book, Tutorials in Software Synthesis and Sound Design*, R. Boulanger Ed., MIT Press (March 2000)

"Chapter 30. Convolution: Traditional and Novel Applications", *The Csound Book, Tutorials in Software Synthesis and Sound Design*, R. Boulanger Ed., MIT Press (March 2000)

Conference Proceedings

S. A. Severson, P. I. Choi, K. E. Badham, D. Bolger, D. S. Contreras, B. N. Gilbreth, C. Guerrero, E. Littleton, J. Long, L. P. McGonigle, et al. Kapao first light: the design, construction and operation of a low-cost natural guide star adaptive optics system. In SPIE Astronomical Telescopes+ Instrumentation, pages 914839–914839. International Society for Optics and Photonics, (2014).

Severson, S.A.; Choi, P.I.; Contreras, D.S.; Gilbreth, B.N.; Littleton, E.; McGonigle, L.P.; Morrison, W.A.; Rudy, A.R.; Wong, J.R.; Xue, A.; Spjut, E.; Baranec, C.; Riddle, R. "KAPAO: a MEMS-based natural guide star adaptive optics system", SPIE MOEMS-MEMS, 861709-861709-10, International Society for Optics and Photonics (2013).

W. Rhim, K. Ohsaka, and R. E. Spjut. Undercooling limits and thermophysical properties in glass forming alloys. NASA Conference Publication, pages 547–552, (1999).

Ryba, E.L., Freeman, B.D., Bowman, R.C. Jr., Spjut, R.E., Liu, E.A., Budic, P., Okado, C.,"Assessment of a Hydrogen Joule-Thomson Expander and Vanadium Hydride Sorption Beds for 20K Cryocoolers", 7th International Cryocooler Conference Proceedings, Phillips Laboratory, Kirtland A.F.B., NM (April 1993).

Spjut, R.E., and Bolsaitis, P.P., "Three Channel Optical Temperature Measurement of Laser-Heated Reacting Particles," Materials Processing in the Reduced Gravity Environment of Space, MRS Symposia Proceedings, Vol. 87 Doremus, R.H., Nordine, P.C., *ed*., Materials Research Society (1987).

Spjut, R.E., Elliott, J.F., and Bolsaitis, P.P., "Thermogravimetric Measurements in an Electrodynamic Balance," Materials Processing in the Reduced Gravity Environment of Space, MRS Symposia Proceedings, Vol. 87 Doremus, R.H., Nordine, P.C., *ed*., Materials Research Society (1987).

Conference Presentations

"KAPAO: a MEMS-based natural guide star adaptive optics system", Scott A. Severson ; Philip I. Choi ; Daniel S. Contreras ; Blaine N. Gilbreth ; Erik Littleton, et al. , *Proc. SPIE* 8617, MEMS Adaptive Optics VII, 861709 (March 5, 2013);

"KAPAO: A natural guide star adaptive optics system for small aperture telescopes." S. A. Severson, P. Choi, E. Spjut, D. Contreras, B. Gilbreth, L. McGonigle, W. Morrison, A. Rudy, A. Xue, C. Baranec, et al., In American Astronomical Society Meeting Abstracts# 220, volume 220, (2012).

"Kapao-alpha: An on-the-sky testbed for adaptive optics on small aperture telescopes.", W. Morrison, P. Choi, S. Severson, E. Spjut, D. Contreras, B. Gilbreth, L. McGonigle, A. Rudy, A. Xue, C. Baranec, et al. In American Astronomical Society Meeting Abstracts# 220, volume 220, 2012.

"Remelting and Solidification of Individual Gas-Atomized Metal Powder Particles," with M.R. Libera, P.P. Bolsaitis, J.B.VanderSande and J.F. Elliott, AAAR Annual Meeting, Chapel Hill NC, Oct. 1988.

"Combustion Kinetics of Spherocarb as Measured In an Electrodynamic Thermogravimetric Analyzer," with D.B. Jones and A.F. Sarofim, AAAR Annual Meeting, Chapel Hill NC, Oct. 1988

"The Use of an Electrodynamic Thermogravimetric Analyzer to Measure Carbon Oxidation Kinetics," with D.B. Jones and A.F. Sarofim, Eastern Section Combustion Institute, Bethesda MD, Nov. 1987

"The Use of an Electrodynamic Thermogravimetric Analyzer to Measure Carbon Oxidation Kinetics," with D.B. Jones and A.F. Sarofim, AAAR Annual Meeting,Seattle WA, Oct. 1987

"High-Temperature Single-Particle Behavior of Alumina and Silica,"with P.P. Bolsaitis, and J.F. Elliott, TMS-AIME Annual Meeting, Denver CO, Feb. 1987.

"Design of Experiments for the Electrodynamic Thermogravimetric Analyzer," with P.P. Bolsaitis, and J.F. Elliott, TMS-AIME Annual Meeting, New Orleans LA, March 1986.

"A High-Temperature Single Particle Thermogravimetric Analyzer," with P.P. Bolsaitis, and J.F. Elliott, TMS-AIME Annual Meeting, New Orleans LA, March 1986

"The Application of an Electrodynamic Balance for measuring heterogeneous kinetics at High Temperatures," with A.F. Sarofim and J.P. Longwell, ACS Annual Meeting, Philidelphia PA, August 1984.

Manuscripts in Preparation

Spjut, R.E., and Cardenas, M., "Teaching General Engineering Through Rocketry, Assessment of Revision of a Sophomore Engineering Laboratory," (in preparation)

Other Publications

Spjut, R.E., "Report on the Multicolor Pyrometry Session," in *Proceedings of the Second NCTM Workshop* , JPL Publication 89-16 , Pasadena CA, 1989 pp. 317-318.

Spjut, R.E., "Electrodynamic Thermogravimetric Analyzer," Freshman Engineering Seminar, Harvey Mudd College, April 1989

Spjut, R.E., "Common but Unappreciated Sources of Error in One, Two, and Multiple Color Pyrometry," in *Non-Contact Temperature Measurement* , NASA Conference Publication 2503, Washington DC, 1988 pp.182-213.

Jones, D. B., Spjut, R. E., Dudek, D. R., Sarofim, A. F., "Study of Oxidation Kinetics of Submillimeter Spherocarb in an Electrodynamic Balance," Chem. Phys. Processes Combust., 23/1-23/4 (1987).

Spjut, R.E., Bolsaitis, P.P., and Elliott, J.F., "High Temperature Gas-Solid Reactions," Proceedings, Proc. Process Technol. Conf., 6th, Iron Steel Soc.,Warrendale PA, (1986).

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