MATERIALS EDUCATION
FOR THE 21ST CENTURY WORKFORCE

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UNDERGRADUATE CURRICULA IN MS&E:
CURRENT TRENDS AND FUTURE POSSIBILITIES

Linda Vanasupa, Professor and Chair
Materials Engineering Department
California Polytechnic State University

Led by developments in materials research, curricula have evolved from primarily metallurgical to highly specialized with separate material emphases (1970s-1990s). Our study of 16 of the 59 accredited materials science and engineering (MS&E) programs shows that two curricular approaches currently dominate: Studying the traditional material categories (metals, ceramics, polymers and composites); Understanding the interrelationships between a material's processing, its structure, its properties and performance. The second approach portends the next MS&E curricular evolution, brought on in part by the MS&E research in areas such as nanotechnology, biotechnology, and fuel technology. MS&E curricula are also incorporating developments from cognitive science like articulating scientific themes and interrelationships (concept maps), identifying learning objectives, employing active learning techniques, and integrating subject areas. In this talk, we will review these trends in curricular content and methodology. We will also look ahead, considering how the pressures and concerns of a global technology marketplace could reshape the MS&E curricula.

Linda Vanasupa is currently a professor and chair of Materials Engineering at the California Polytechnic State University in San Luis Obispo, California. She joined the faculty in 1991 after completing M.S. and Ph.D. degrees at Stanford University in Materials Science and Engineering. Her B.S. is in Metallurgical Engineering from Michigan Technological University.

MATERIALS SCIENCE AND ENGINEERING DESIGN: ARE WE TEACHING IT?

Emily L. Allen, Professor and Chair
Chemical and Materials Engineering Department
San Jose State University

American accredited undergraduate engineering programs must have a "curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints." In the disciplines of Materials Science and Engineering, which sit on the cusp of engineering and science, the line between research and design is not always clearly delineated. How well are we preparing our undergraduate students for engineering practice? Is design integrated throughout the curriculum or concentrated in the senior project program? Is there a forum for sharing best practices in materials design education? Should there be? This talk will ask more questions than it answers, and serve to begin a conversation as to whether there is or ought to be any commonality in the teaching of design to MS&E undergraduates.

Emily L. Allen is Professor and Chair of the Chemical and Materials Engineering Department and Director of the interdisciplinary Microelectronics Process Engineering program at San Jose State University. Her research and teaching are in the areas of electronic materials, semiconductor processing and magnetic thin films. She received a BS in Metallurgy and Materials Science from Columbia University and a PhD in Materials Science and Engineering from Stanford University and joined SJSU soon after, where she has been active in course, curriculum and laboratory design, development and assessment.

ABET AND UNDERGRADUATE MATERIALS EDUCATION

G. S. Cargill, III, Professor and Chair,
Department of Materials Science and Engineering
Lehigh University

Undergraduate materials education in the United States is provided mostly by programs at 65 universities which offer B.S. degrees in Materials Science and Engineering (MS&E), Materials Engineering, Metallurgical Engineering, Polymer Science and Engineering, or Composite Materials Engineering. The B.S. level materials programs at 59 of these institutions are accredited by ABET, the Accreditation Board for Engineering and Technology. Procedures and criteria for ABET accreditation were changed during the period 1999-2001, to be less prescriptive and to be more outcome based. The ABET accreditation process has influenced undergraduate materials education over the years in the U.S. and it continues to do so. Has ABET had a positive, or negative, effect? Are the new ABET procedures and criteria a real improvement?

Slade Cargill is the Sherman Fairchild Professor and Chair of the Department of Materials Science and Engineering at Lehigh University. He came to Lehigh in 1997 from Columbia University, where he held a joint appointment in materials and in applied physics. Previously, he was a senior manager in the Physical Sciences Department at IBM's Thomas J. Watson Research Center, where he spent 18 years. He received his BS degree in physics from Georgia Tech and SM and PhD degrees in applied physics from Harvard. Besides university teaching, research and administration, his involvement with materials science and education includes serving as an ABET evaluator for materials programs, past chair of the MRS Accreditation Subcommittee, Chair of the TMS Accreditation Committee, and a member for the ABET Engineering Accreditation Commission

DEVELOPMENTS IN GRADUATE EDUCATION IN MATERIALS SCIENCE AND ENGINEERING

Alan W. Cramb, Professor and Head
Department of Materials Science and Engineering
Carnegie Mellon University

The field of Materials Science and Engineering continues to evolve and broaden. For example, in the past ten years, materials research in such diverse areas as energy production and transmission, nanotechnology and biomedical and health engineering has become popular at many top research universities. Thus, in addition to the traditional areas of materials science, the area has further developed by adding significant thrusts in these topics. This has, of course, led to significant issues in the development of the graduate curriculum of Materials Science and Engineering Departments. In this talk, the current status of curricular developments in North America will be discussed with reference to the definition of core courses in Materials Science, the development of choice within a given program and the relationship between formal coursework and doctoral graduation. Future directions in graduate education in Materials Science and Engineering will be subsequently discussed.

Alan W. Cramb is the Posco Professor of Iron and Steelmaking and Head of the Department of Materials Science and Engineering at Carnegie Mellon University. Dr. Cramb received his Ph.D. from the University of Pennsylvania and was employed first by the Inland Steel Co. and then by the Bethlehem Steel Co. at the Homer Research Laboratories before joining CMU in 1986. His research interests include casting processes, solidification, clean steel manufacture and the processing of titanium alloys. He is the author of over 160 publications and 2 patents and was the recipient of the AISI Medal in 1985 and 1986 and the Robert Woolston Hunt Award of the Iron and Steel Society in 1987. He received the Benjamin Richard Teare Award at CMU for excellence in education in 1995. Alan was President of the Iron and Steel Society in 2000 and was made a Fellow in 2002. In 2003 he was awarded the Benjamin Fairless Award of AIME. He has had the pleasure to advise 15 doctoral students and 14 Masters students.

KEEPING FACULTY ON THE LEADING EDGE OF MSE EDUCATION WITH NATIONAL EDUCATORS' WORKSHOPS

Jim Jacobs, Professor
School of Science and Technology
Norfolk State University

The National Educator's Workshops (NEW:Updates) were conceived in 1985 as a means to help educators in community colleges, small colleges and universities to stay current with the exploding field of materials science and engineering. NEW:Updates also focus on experiments and demonstrations that aid in teaching both traditional and emerging MSE concepts. The 18 annual NEW:Updates have been hosted in national laboratories, corporate R&D centers and universities. Over 6,700 participants, including textbook authors, have observed and taken part in hands-on experiments, demonstrations and update presentations over the full range of MSE topics in state-of-the-art labs, manufacturing facilities, and innovative classrooms. The theme for NEW:Update 2004 is *Nano/Bio Science and Technology Education for the 21st Century*, hosted by Arizona State University and Phoenix area industry on October 16-20, 2004. Information: http://MST-Online.nsu.edu

Jim Jacobs is Professor in the School of Science and Technology at Norfolk State University. He developed the concept and has been co-director of the National Educators Workshop series (NEW:Updates). He has 38 years of teaching experience in public schools, community colleges, and universities. He has developed curricula offerings at all three levels, including courses in material science, materials and processes technology, engineering materials technology, and principles of manufacture. He has industrial experience with Westinghouse, Tenneco, Ford Motor Co., and IBM. Dr. Jacobs co-authored *Engineering Materials Technology* and led the project to develop the CD ROM, *Experiments in Materials Science, Engineering and Technology*. He has been involved as a consultant and director with numerous grants, seminars, and curriculum development efforts in engineering materials, manufacturing, robotics, and CAD/CAM.

MATERIALS ENGINEERING TECHNOLOGY: THE ROLE OF COMMUNITY COLLEGES IN PREPARING THE TECHNICAL WORKFORCE OF THE 21ST CENTURY

Michael J. Kenney, ASM International
John Pridgeon, Allvac (retired, deceased)
John McKay, South Piedmont Community College
Patricia Pohar, South Piedmont Community College

U.S. companies involved in manufacturing are experiencing both a shortage of qualified workers and a need to retrain existing personnel on new technologies. Both of these situations can easily be addressed through two-year college educational programs. Advantages of the Community College include proximity to the workplace, knowledge and understanding of the needs of adult leaders, and strong community ties. This presentation will present a case study of the efforts of South Piedmont Community College in collaboration with a local employer, Allvac, and ASM International. Lessons learned, both positive and negative, of a unique degree program will be highlighted.

Michael J. Kenney is ASM International's Director, Business Initiatives — Government Labs, Academia and Contract R&D. He is responsible for generating new business revenue and building strategic alliances, as well as the technical development and training courses offered by ASM International. ASM hosts several international meetings annually as well as multiple regional offerings. Courses are delivered in a variety of formats including home study, classroom and laboratory seminars, chapter and regional courses, and distance learning via the Internet. The ASM International Education Department is housed in a recently renovated classroom and laboratory facility that is equipped with equipment and instrumentation found in advanced metallurgical and materials science laboratories throughout industry.

A native Midwesterner, Mike spent several years working in Washington, DC. He was Program Manager for National Chemistry week, the largest public outreach program sponsored by the American Chemical Society, and National Science & Technology Week, sponsored by the National Science Foundation. As Director of Science & Education for a marketing communications firm, he directed accounts for CIIT, Smithsonian Institution, US Geological Survey and The Carnegie Institution of Washington. He worked as a consultant on the Bayer/NSF Award for Community Innovation and the Discovery Youth Science Coalition. Mike has a strong interest in the application of technology to instruction at all levels. He completed a Master's Degree in Information Systems Technology at George Washington University with an emphasis in Business Technologies.

John McKay has served as President of South Piedmont Community College since July, 2003. Prior to coming to SPCC he served in four community colleges and at the state level in Colorado, Arkansas and South Carolina. He was Deputy Director for Technical Education at the Arkansas Department of Higher Education and provided statewide leadership in developing 14 new technical colleges. He has focused his efforts on student learning, economic and workforce development and serving the local community.

Pat Pohar has served as Dean, Educational Services of South Piedmont Community College since 1998. She coordinates with curriculum department chairs and continuing education directors to provide courses and programs, and works with industry/professional groups/agencies in development of new curriculum. In collaboration with ASM International and materials industries, she developed a new Metallurgical Science Technology 2-year program, the first of its kind in the North Carolina Community College System. Earlier in her career, she served at community colleges in both North and South Carolina. Pat holds an M.S. in Education, and is a member of ASM International, Society of Manufacturing Engineers, APICS, and the Board of Directors of her Local Red Cross.

INTEGRATION OF EMPLOYABILITY SKILLS
IN MATERIALS EDUCATION
THROUGH SkillsUSA

Timothy W. Lawrence, Executive Director
SkillsUSA

SkillsUSA is a national student leadership organization, serving 260,000 high school and college students in technical education. This presentation will provide information on the delivery of leadership and employability skills training through two models: (1) The local SkillsUSA chapter where students develop communication, teamwork and volunteer service skills; and (2) The award-winning *Professional Development Program* which guides students through 84 employability skills activities that help meet the competencies outlined as critical by the US Department of Labor's SCAN report. It provides the tools to strengthen school-based learning, work-based learning and connecting activities. Skills lessons include self-assessments, communications, ethics, conflict resolution, government awareness, time management, career research and much more.

Tim Lawrence firmly believes that getting involved in technical education and joining SkillsUSA in high school set his course for a successful future. He worked in both labor and management positions in the manufacturing industry for nine years while continuing his education, and received his teaching credentials from Virginia Tech and his degree in Administration and Training from James Madison University. He fulfilled one of his life dreams when he became a teacher in Virginia in 1978. He achieved another life goal when he was named the National Trade and Industrial Education Teacher of the Year in 1983. In 1987, he joined the Virginia Department of Education as a vocational student specialist and chief executive officer of the state SkillsUSA organization. In 1996, Mr. Larence joined the national SkillsUSA as Partnerships Director, and became Executive Director in 2001. He serves as a board member for several national organizations and is proud to have been a member of the Manufacturing Skills Standards Council.

INCREASING PUBLIC AWARENESS AND LITERACY IN SCIENCE AND MATERIALS

David W. Richerson, Professor
University of Utah

We live in a technology-dominated society. National leaders, community leaders, and the general populace need to be at least a little literate in science and technology in order to make decisions and choices based on sound judgment. The scientific community has a responsibility to find creative ways to encourage and provide this literacy. Using materials science and engineering as the medium for this endeavor has proven to be quite effective. Professor Richerson reviews several different approaches that have been successfully pursued and especially focuses on the use of university students in a "service learning" mode.

Dave Richerson was Chair of the Education and Outreach Committee for the American Ceramic Society from 1991-2003 where he guided planning and implementation of a variety of education outreach activities such as Ceramic Demonstration Kits (samples to be used in public and classroom demonstrations), school partnerships, visiting museum exhibits, major E-Week participation, a 10-case two-year traveling museum exhibit, and dissemination of materials-related outreach books (*Boing Boing the Bionic Cat* and *The Magic of Ceramics*). While at the University of Utah, Professor Richerson has established a materials class for non-science majors (Materials Molding Civilization), conducted student service learning community projects, and established outreach modules on earth science and air quality for 4th grade and 6th grade classes. Prior to joining the University, Professor Richerson worked in industry for 22 years developing advanced materials and integrating them into demanding applications such as gas turbine engines and fuel cells, especially with the goal of increasing energy efficiency and reducing pollution. He has authored five books, including *The Magic of Ceramics* and the textbook *Modern Ceramic Engineering.*

"STRANGE MATTER": DEVELOPMENT OF AN INTERACTIVE MATERIALS SCIENCE EXHIBITION AND THE COMMUNITY OUTREACH PROGRAM

Shenda Baker, Associate Professor
Harvey Mudd College
Chair, MRS Oversight Committee for "Strange Matter"

"Strange Matter" is a community outreach project proposed by the Materials Research Society (MRS) to the National Science Foundation and additionally funded by major industrial partners. From the beginning, these two traveling exhibitions (a large and small show) have been created by scientists, designed by museum professionals and intended as the central focus for mobilizing the materials science communities around the venues to which it travels. Designed for 5th to 8th graders, the physical exhibition and accompanying web page (www.strangematterexhibit.com) attempts to bring interactive activities that highlight the fact that materials science is all around us.

Shenda Baker received her B.S. in Chemistry and French from Grinnell College in 1985. After receiving her Ph.D. in Chemistry from the California Institute of Technology, she took a postdoctoral position at the Los Alamos Neutron Scattering Center examining structural properties of thin films. In 1993, Dr. Baker became the Clare Booth Luce Assistant Professor of Chemistry at Harvey Mudd College. In addition to teaching undergraduates, both in the classroom and the laboratory, and continuing research in surfaces and polymeric thin films, her interests include national science policy and developing and sustaining national facilities. Dr. Baker has been honored by NSF with the DOE Young Scientists and Engineers Award and the Presidential Early Career Award for Scientists and Engineers. She served on a DOE Basic Energy Sciences Advisory Committee subpanel to help guide the future of neutron scattering facilities in the U.S. In addition to her work with MRS, she also serves on the advisory board of the NSF Research Experience for Undergraduates (Chemistry Division) and the Advisory Committee to the NSF Directorate of Math and Physical Sciences.

MATERIALS AS TOOLS FOR DESIGN EDUCATION

Stacie E. Lemmon, Outreach Programs Coordinator
National Building Museum

The National Building Museum's Outreach Programs are recognized both locally in the greater Washington, DC area, and nationally for using design to teach young people about the world we build for ourselves. Through design education, youth learn about design and its process. This enhances their problem-solving skills useful in many areas of their lives. The Museum's Design Apprenticeship Program, *DAP Squad*, is an advanced design education program in which local youth expand their design and art experience through hands-on projects that they control from concept to completion. Materials, ranging all the way from food to copper tubes, are the experimental tools that enable participants to explore and create design possibilities.

Stacie E. Lemmon is the Outreach Programs Coordinator for the National Building Museum, located in Washington, DC. In this role, she works primarily with at-risk teenagers from the DC Metro area, facilitating three design education programs. Ms. Lemmon earned a Master of Arts in Teaching from the Museum Education Program at The Gorge Washington University and a B.A. from Indiana University.

ENCOURAGING PHYSICAL SCIENCE CAREERS THROUGH COMPETITION OPPORTUNITIES

Eric D. Packenham, Director, Building a Presence
National Science Teachers Association

This session outlines how physical science competitions motivate, nurture, and reward the scientist in K-12 students, challenging them to use creativity and imagination along with science, technology, and mechanical ability. Academic fairs and competitions offer visible forums for enhancing math and science literacy — a goal shared by educators, government and industry leaders. Educators serve as the coach to explain the requirements of competition and make an effort to learn about independent student research. Educators inspire students to read science journals or network with research being conducted on college campuses or in private laboratories. This connection to competitions and careers is the pipeline for our educated workforce.

Eric D. Packenham is the Director of the Building a Presence for Science program at the National Science Teachers Association (NSTA), the world's largest professional organization of science teachers. At NSTA he is presently working with 26 states to develop and implement a comprehensive online network of teachers in every school (both public and private). The network of teachers receives monthly communications about standards-based teaching and gains awareness about professional development opportunities. Mr. Packenham provides leadership within the Building a Presence for Science partnerships to increase the number and diversity of schools, teachers and students engaged in science teaching. He has served on NSF Proposal Review Panels, and on the Adolescence & Young Adulthood/Science Standards Committee for the National Board of Professional Teaching Standards. Before joining the NSTA staff, Mr. Packenham served as the Assistant Director, Center for Mathematics and Science Education, at the University of North Carolina at Chapel Hill.

ESTABLISHING A HIGH SCHOOL CURRICULUM IN MATERIALS SCIENCE IN THE UK

Peter Davies, Education Manager
The Institute of Materials, Minerals & Mining

Materials Science has emerged as one of the most important influences for technological change in the 21st century. It underpins advances in many critical areas of science and technology and influences nearly every aspect of daily life. Consultation undertaken by the Institute of Materials, Minerals and Mining between a wide-ranging representative group of schools, universities, professional associations, learned societies and government has established that the relevance and visibility of science and math in schools needs to be raised. A major initiative to introduce a stimulating and exciting advanced course in materials is seen as a possible solution to this concern. Such a course will enable and encourage students' scientific understanding by utilising easily accessible contexts, which will also complement existing subjects.

Peter Davies has been with the Institute of Materials, Minerals & Mining for six years and is currently the Institute's Education and Accreditation Manager. Having previously been Head of Members' Support with the former Institute of Materials, Peter has gained a wide understanding of the Institute's activities. Peter completed a Metallurgy degree in 1990 and a Materials PhD in 1993, which was followed by post-doctoral research and positions within customer services industries.

MATERIAL SCIENCE & DESIGN: SPANNING THE REALITY DIVIDE BETWEEN HIGH SCHOOL AND THE WORLD BEYOND

Kate Heroux, Teacher
Lake Forest High School

Establishing a course based upon material science and associated inquiry by design, with the small group as its supporting structure, has the potential to invigorate a high school science curriculum in a multitude of ways. Because of its inherent interdisciplinary nature, material science offers an unprecedented range of possibilities for student led investigation. The participants in the course heighten their scientific literacy and sharpen their practical skills through the process of teamwork and problem solving. The course offers the opportunity to begin their study through certain specific categories of materials such as polymers, concrete, ceramics, food packaging, piezoelectric and electronics related topics.

Kate Heroux completed her undergraduate and postgraduate education in Manchester, England, and taught science in secondary school there for seven years before returning to the U.S. She was hired to teach chemistry at Lake Forest High School eight years ago, but immediately seized the opportunity to work with Northwestern University's Material World Modules. The initial relationship led to the development and writing of a module on Food Packaging Materials. Since then she has worked as a consultant on assessment and validity testing. Earlier this year, at the invitation of Professor Bob Chang, she participated on the advisory board for the new Nanoscale Science Center for Learning and Teaching. She considers the most significant outcome of her collaboration with Northwestern to be the Material Science and Design Course that exists today at Lake Forest High School.

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MATERIALS EDUCATION OUTREACH TO MIDDLE AND HIGH SCHOOLS IN THE LEHIGH VALLEY

Clifford A. Prescott and Wojciech Misiolek
Lehigh University
Kelly P. Wardlow, Teacher
East Norristown Middle School

Aluminum industry leaders identify the lack of quality education in technological areas — specifically materials engineering and aluminum technologies — to be an important problem to overcome in the pursuit of excelling production, gaining a global market, and developing innovative techniques and products. Unfortunately, many K-12 teachers do not know about these technologies or understand how such information can tie into school curriculum or benefit students. The Lehigh University Institute for Metal Forming (IMF) along with the Lehigh College of Education have developed a K-12 outreach program that disseminates materials engineering and aluminum information into local schools through demonstrations, web sites, lesson plans, and sending engineering students to teach in local schools. This paper outlines the steps the IMF took to develop this program, and what other universities and industries can do to help bring about aluminum technological understanding. The model shows how a university of any size or any company can make a difference.

Andy Prescott received a B.S. in Materials Science and Engineering from Lehigh University in 2003. He is currently enrolled in the Industrial Engineering Department working toward an M.S. in Management Science, and works for the IMF as a research assistant. As an undergraduate, Andy participated in an educational outreach course designed to give college students a chance to experience teaching a lesson on a materials topic to a local high school class. He also participated in a number of extracurricular presentations to middle schools and high schools. This summer he will be participating in a materials camp for junior and high school students, partially funded by the ASM Materials Education Foundation.

GLOBAL WORKFORCE ISSUES
DEFINITIONS, DRIVERS AND DILEMMAS

Toni Marechaux, Director
National Materials Advisory Board

A number of trends are affecting the globalization of the research, development and production of materials. Although financial drivers (the costs of energy and labor, for example) are most often cited, some higher-level trends may ultimately be more important. An important trend is the formation of multinational networks of laboratories, development units, and production plants coordinated to serve complex global markets. Some of the drivers for this trend include New communication of not only business information, but also of real-time national regulations and policies which restrict data sharing and have been found to have both intended and unintended consequences. An additional driver, which may turn out to be the most important, is the leveling of education, training, knowledge, and skills around the world. This presentation will outline the progress of these and other trends as applied to the materials industry.

Toni Grobstein Marechaux is the Director of the National Materials Advisory Board at the National Academies. She also directs the staff and activities for the Board on Manufacturing and Engineering Design. Both boards act as advisors to the Nation on science and engineering issues. Recent NMAB activities have addressed materials research needs for 21st century defense needs, the need for accelerated technology transition, and the globalization of materials R&D. Prior to joining the National Academies, Dr. Marechaux directed a variety of projects and programs promoting the use of advanced materials and manufacturing technologies at National Steel, the NASA Glenn Research Center, and the U.S. Department of Energy. She has a BS in Metallurgical Engineering from the University of Illinois at Urbana-Champaign, and MS and PhD degrees in Materials Science from Case Western Reserve University.

GLOBALIZATION — TECHNOLOGY, EDUCATION, JOBS, TRADE

Jennie S. Hwang, President
H-Technologies Group, Inc.

The new economy comes with a unique set of characteristics. This economic transformation is fueled by globalization, digitization, and technology. Competitiveness and technological advancements rely on the skilled workforce and a solid educational system. Dr. Hwang will provide a capsule view on the characteristics of the new economy, its challenges to workforce, and the important building blocks that shape the future workforce. Education, national science/technology policy and trade policy are among the forefront factors to the makeup of the workforce and the retention and creation of jobs. The presentation will conclude with the illustration of the close linkage yet intricate relations among technology, education, jobs and trade.

Jennie Hwang holds a Ph.D. in Engineering and two M.S. degrees in chemistry and liquid crystal science from Columbia University and Kent State University, respectively. She is internationally recognized as a pioneer in electronics miniaturization, manufacturing and infrastructure development covering medical, military, consumer, computer and telecommunications industries. She has held various research and senior executive positions with Lockheed Martin Corporation, Sherwin Williams Company, SCM Corporation, and International Electronic Materials Corporation, and is currently President of H-Technologies Group, Inc. Dr. Hwang is the author of 200 publications including the sole author of several internationally-used textbooks. Among many other honors, she was named among the "R&D Stars-to-Watch" by *Industry Week* and was elected to the National Academy of Engineering in 2003. As a columnist, she regularly addresses technology issues and global market trends.

VIRTUAL FACILITIES AND GLOBALIZATION

R. Byron Pipes, University of Akron

A four-year base set of university learning currently is the biggest piece of education to prepare someone for a career. In that program, a student packs all of their learning into a short time and then sets out on a career with it. A broader scope is necessary to look at learning as a lifetime experience that may cover 40 years or more, an order of magnitude difference. This presentation will propose a new role the university could play to cover this expanded range of educational needs. The function of shared facilities and virtual laboratories is especially important to this endeavor.

R. Byron Pipes is Goodyear Tire & Rubber Professor of Polymer Engineering at the University of Akron. He served as President, Rensselaer Polytechnic Institute from 1993-1998. As Distinguished Visiting Scholar at the College of William and Mary, he pursued research at the NASA Langley Research Center in the field of carbon nanotechnology. He also served as Provost and Vice President for Academic Affairs, as Dean of the College of Engineering and Director of the Center for Composite Materials, all at the University of Delaware. Dr. Pipes was elected to the National Academy of Engineering in 1987 and the Royal Swedish Academy of Engineering Sciences in 1993. The author of over 100 archival publications including four books, Dr. Pipes holds Fellow rank in ACS, ASME and SAMPE. He served as one of the first six directors of National Engineering Research Centers of the National Science Foundation. Dr. Pipes received his doctoral degree in mechanical engineering from the University of Texas and the MSE from Princeton University. He has served on a number of National Research Council committees as both member and chair and served two terms on the National Materials Advisory Board.

LUNCHEON SPEAKER

Dr. William O. Berry
Director for Basic Research
Office of the Deputy Undersecretary of Defense
(Laboratories and Basic Sciences)

As the Director for Basic Research since January 2001, Dr. Berry is responsible for providing scientific leadership, management oversight, policy guidance and coordination of the $1.2 billion yearly basic research programs of the Military Services and Defense Agencies. In this capacity, Dr. Berry has cognizance over the complete spectrum of basic research including biology, chemistry, physics, mathematics, experimental psychology, electronics, engineering sciences, computer science and environmental sciences. In addition, he is responsible for science, technology, engineering and mathematics education and workforce issues, and policy for grants.

Dr. Berry began his association with the Department of Defense as a National Research Council Postdoctoral Fellow at the Air Force Aerospace Medical Research Laboratory in 1976. At the Air Force Office of Scientific Research (1978-1997) he was responsible for a $50M Air Force basic research program in chemistry and life sciences. From 1983-1988 he served on the Aerospace Medical Panel of the North Atlantic Treaty Organization Advisory Group for Aerospace Research and Development. Immediately prior to his current position, Dr. Berry was Associate Deputy Assistant Secretary of the Air Force for Science Technology and Engineering and Director of the Washington Office of the Air Force Research Laboratory.

Dr. Berry's research publications are in the fields of environmental toxicology and neuroscience. He is the co-editor of four scientific books and monographs. Dr. Berry earned a BS in Biology from Lock Haven University, Lock Haven, PA, a MAT in Zoology from Miami University, Oxford, OH, and a Ph.D. in Zoology/Biochemistry from the University of Vermont, Burlington, VT. He is a member of the American Association for the Advancement of Science and Sigma Xi, The Scientific Research Society.

MATERIALS MINI-CAMP
FOR HIGH SCHOOL TEACHERS
AND STUDENTS

This one-day camp, conducted at the National Building Museum, will provide a condensed demonstration of the laboratory and classroom experiences that high school teachers and students would encounter in an educational outreach program on materials science and engineering. The most appropriate experiments and demonstrations for this purpose are selected from established curricula of the ASM Materials Education Foundation and from the Princeton University Materials Academy (PUMA).

Career choices for many high school students, especially from disadvantaged households, are often based on over-exposure to media descriptions of "high profile" occupations and to personal experiences with teachers and adult relatives and friends. The function of a materials educational enrichment camp is to open the eyes of students and to acquaint influential K-12 teachers with the field of materials science and engineering (MSE). They should know that the lessons learned in materials science can enable both fundamental advances in the physical sciences and the application of unique metal, ceramic, and polymer materials in many new technological areas from more energy efficient and environmentally benign construction, to more powerful computers and electronic devices, to biomaterials for health field advances.

The teacher mini-camp is a hands-on experience designed to introduce the instructor to many demonstrations in materials science and engineering. Each of these activities can easily (and inexpensively) be incorporated into a science class.

The student mini-camp includes demonstrations and hands-on experiments, labs and games including introductions to engineering, materials science, polymers, smart sensors and other topics. Students will make a microphone, evade a motion detector, and design a smart sensor among other fun and educational activities.

MATERIALS MINI-CAMP FACULTY

ASM MATERIALS EDUCATION FOUNDATION

Chuck Hayes is Executive Director of the ASM Materials Education Foundation. He was born in Detroit and raised in Pittsburgh in an Irish working-class family. As a youth, he worked as a cobbler and in construction. He received a bachelor's degree in Social Work/Psychology from Mercyhurst College, then received his master's degree in Guidance and Counseling from Gannon University. Prior to joining ASM, he held senior fund raising and executive positions in the United Way system, and with independent schools and private family service agencies.

Len Booth has over 31 years experience teaching in high schools, primarily in material science, chemistry, physics and physical science, and four years teaching chemistry at the community college level. During 15 years teaching instructors and presenting workshops involving materials science and related concepts, he wrote a series of units on materials designed for high school students.

PRINCETON UNIVERSITY MATERIALS ACADEMY

Dan Steinberg is Director of Education and Outreach for the Princeton Center for Complex Materials. Previously, Dan worked as an Operations Astronomer for the Hubble Space Telescope at the Space Telescope Science Institute and before that as a National Research Fellow at NASA's Goddard Space Flight Center. Active in education and outreach throughout his career, in 1998 he was awarded the Space Telescope Science Institute's Star of Public Outreach Award. His Ph.D. is from Binghamton University.

Pete Gange has been the Lead Teacher for the Princeton University Materials Academy since 2002. He has been a teacher in the Middlesex Boro (NJ) public school system since 1979, teaching Biology, Chemistry, General Science, and in the Gifted & Talented Program. His B.S. in Biology is from St. John's University, and he received his teacher certification from C.W. Post College.

The Federation of Materials Societies (FMS) is an umbrella organization whose members represent the professional societies, universities and National Research Council organizations which are involved with materials science, engineering, and technology. FMS constituent societies have nearly one million members. FMS serves as a clearinghouse where materials professionals can share best practices, current activities, and the opportunities and problems cutting across specific materials concerns and materials societies. Through meetings and its Biennial Conferences on National Materials Policy — of which "Materials Education for the 21st Century" is the 18th — FMS provides a forum where policy makers and the materials community meet to discuss issues, develop policy and recommend actions.

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