Ryan B. Wicker, Ph.D., P.E.

DETAILED ACADEMIC CURRICULUM VITAE

TABLE OF CONTENTS

Ryan B. Wicker, Ph.D., P.E.

Professor of Mechanical Engineering
Mr. and Mrs. MacIntosh Murchison Chair I in Engineering
Director, W.M. Keck Center for 3D Innovation
Director, America Makes Satellite Center
Editor-in-Chief, *Additive Manufacturing*, an Elsevier Journal
The University of Texas at El Paso
El Paso, Texas 79968-0521
phone: (915) 747-7099; fax: -5019
email: rwicker@utep.edu
web: www.utep.edu/keck

BIOGRAPHY

Ryan Wicker, Ph.D., P.E., is the endowed Mr. and Mrs. MacIntosh Murchison professor of mechanical engineering at the University of Texas at El Paso (UTEP). Ryan received degrees in mechanical engineering from The University of Texas at Austin (B.S., 1987 with Highest Honors) and Stanford University (M.S., 1991, and Ph.D., 1995), worked at General Dynamics Fort Worth Division (1987-1989), and has spent his entire academic career at UTEP (1994-present). He has co-founded two university spin-out companies and is a registered Professional Engineer in the State of Texas.

Ryan has 28 U.S. patents, 9 foreign patents (Europe and Asia), and over 150 journal publications, most of which are related to additive manufacturing. He is the founding Editor-in-Chief (2014) of *Additive Manufacturing*, an Elsevier journal (Impact Factor of 11.632 in 2022). This peer-reviewed journal provides academia and industry with high quality research articles and reviews in additive manufacturing. It covers a wide scope of topics including new technologies, processes, methods, materials, systems, and applications.

Ryan serves as director and founder of the UTEP W.M. Keck Center for 3D Innovation (Keck Center). The Keck Center (utep.edu/keck) was established in 2001 as part of a grant from the W.M. Keck Foundation and is arguably the best equipped academic laboratory focusing on additive manufacturing in the world. The Keck Center houses more than 100 additive manufacturing systems and combined facilities for additive manufacturing (metal, polymer, ceramic, electronics, and large-area), machining, CAD and simulation, reverse engineering, metrology, materials characterization, mechanical testing, post-processing, synthetic and analytical chemistry, and cell culture. Research at the Keck Center focuses on the use and development of additive manufacturing technologies for fabricating 3D objects that are plastic, metal, ceramic, of bio-compatible materials, composite materials, or that contain electronics. Major research efforts are underway in the areas of additive manufacturing technology development; closed-loop process control strategies for additive manufacturing; additive manufacturing of various powder metal alloy systems; development of new polymers for use in additive manufacturing; and 3D structural electronics in which electronics, and thus intelligence, are fabricated within additive manufacturing-fabricated structures.

The Keck Center has always promoted student engagement, professional development, and success through a commitment to research excellence, providing its student participants with unparalleled educational opportunities. As its research excellence in additive manufacturing (AM) has grown to include 13,000 sq. ft. on-campus and 17,000 sq. ft. off-campus facilities, so have the educational opportunities the center provides. The Keck Center and its research have been the cornerstone of educational programs, including a Ph.D. program in mechanical engineering approved by the Texas Higher Education Coordinating Board in 2016, a Graduate Certificate program in 3D Engineering and Additive Manufacturing established in 2017, and global training in additive manufacturing to the

department of defense that began in 2015. The off-campus facility provides the university, government, and the community with a tremendous asset for STEM outreach to El Paso's (and UTEP's) historically underrepresented and economically disadvantaged community; industry, government and student programs in advanced manufacturing and workforce development and training; and, the nexus of a technology business creation ecosystem for El Paso focused on AM. In November 2019, the University of Texas System Board of Regents approved $70 million for a new facility at UTEP to house research and education efforts in advanced manufacturing and aerospace – soon to provide an even greater reach for the Keck Center's impact on UTEP's students, the El Paso region, and the nation (https://www.utep.edu/newsfeed/campus/regents-approve-70-million-center-for-advanced-manufacturing-and-aerospace-at-utep.html). This new facility is currently in the design phase.

The Keck Center represents a truly unique facility that provides unparalleled experiences for students. It is home to more than 100 students, faculty, and staff from a wide array of engineering disciplines, including mechanical, electrical, metallurgical, industrial, and biomedical. Ryan has served as thesis advisor and post-graduate scholar sponsor to more than 60 students and scholars, and supported more than 500 undergraduate students in his research. He has been recognized for student mentoring by SAE, DoE, Governors' Ethanol Coalition, and the UT System LSAMP Program. The center also draws interest with ~10,000 yearly visitors, including industry professionals, K-12 students, and government officials. The Keck Center has also strived to develop strong multi-disciplinary national and international collaborations with other universities, government agencies, and industrial partners as well as strengthen and expand collaborations within UTEP.

Within the Keck Center, Ryan established a recharge center to provide contractual engineering and manufacturing services to industry, government agencies, and universities. Through these services, unique educational opportunities are provided to students in an industrial-type setting, while allowing the technology developed in the center to be tested and available to external clients. The recharge center also provides a mechanism for commercial ventures between UTEP and industry, enabling the Keck Center to utilize its intellectual property, expertise, and infrastructure to provide contractual services that in whole or in part pay for student salaries, laboratory equipment, maintenance, and materials. To date, the Keck Center has worked with more than 100 companies and entrepreneurs and maintains an active base of more than 50 clients.

Due to its national prominence, the Keck Center was named the first satellite center for America Makes in April 2015. The goal of America Makes is to innovate and accelerate additive manufacturing technologies to increase the nation's global manufacturing competitiveness. The Keck Center helps provide a new level of national reach for America Makes, similar to the Department of Energy's Manufacturing Demonstration Facility at Oak Ridge National Laboratory. Ryan hopes these efforts will not only serve to advance research in additive manufacturing, but also help to build both local and national economies by bringing manufacturing jobs back to the U.S., and provide unique opportunities for UTEP students to drive a new economy in the El Paso region. In support of this goal, Ryan successfully recruited Aconity3D of Germany to El Paso to serve as its North American base of operations (see www.elpasotimes.com/story/news/utep/2018/08/08/german-3-d-printing-company-us-headquarters-utep-el-paso/902293002/).

Ryan's principal motivation at UTEP has been and is to provide exceptional research opportunities for students, preparing them for success in the global marketplace. These highly trained graduates are aggressively recruited by employers across the U.S. and beyond. However, there are few opportunities for these graduates to remain in El Paso. As such, Ryan has been focusing on creating opportunities for graduates to stay in El Paso and contribute to the region's economic growth and improved economic vitality (see https://www.elpasotimes.com/story/opinion/columnists/2015/09/01/ryan-wicker-building-el-pasos-economy-around-3/31308207/). By leveraging the expertise, capabilities, and global

recognition of the Keck Center and continuing to drive its positive trajectory, Ryan has been creating an ecosystem that includes graduates starting up their own high-tech businesses as well as being employed in engineering companies, large and small, that have located in El Paso as a result of this vibrant talent pool and world-leading Keck Center activities. As part of this effort, Ryan created and teaches a high technology business creation class in which students develop AM-focused business concepts - with multiple examples of producing real spin-out companies. Ryan shares the vision of expanding student impact and local economic prosperity with Ahsan Choudhuri, director and founder of UTEPs NASA MIRO Center for Space Exploration and Technology Research (cSETR), now UTEP's Aerospace Center. The Keck Center and Aerospace Center have joined forces on a strategic initiative that is catalyzing the development of a regional high-tech ecosystem and producing talent with expertise and capabilities in Advanced Manufacturing, Aerospace and Defense Systems, and Energy Systems. Our economic development initiatives (combining forces beginning in 2015) have catalyzed tremendous activity within our region beyond the university, resulting in nearly $100M in investment to date (including our recent notification of award from the US Economic Development Agency for our proposal to the Build Back Better Regional Challenge…currently negotiating ~$80M total award, $40M agency and $40M regional match). As an El Paso native, Ryan anticipates many more successes from this initiative and looks forward to providing a positive and measureable impact on the region for the benefit of future generations of El Pasoans.

Ryan B. Wicker, Ph.D., P.E.

Professor of Mechanical Engineering
Mr. and Mrs. MacIntosh Murchison Chair I in Engineering
Director, W.M. Keck Center for 3D Innovation
Director, America Makes Satellite Center
Editor-in-Chief, *Additive Manufacturing*, an Elsevier Journal
The University of Texas at El Paso
El Paso, Texas 79968-0521
phone: (915) 747-7099; fax: -5019
email: rwicker@utep.edu
web: www.utep.edu/keck

EDUCATION

Ph.D. in Mechanical Engineering - January 1995
Stanford University
Dissertation: "Structure and Control of a Particle-Laden Coaxial Jet with and without Annular Swirl"
Advisor: John K. Eaton

M.S. in Mechanical Engineering - January 1991
Stanford University

B.S. in Mechanical Engineering, with Highest Honors - May 1987
The University of Texas at Austin

PROFESSIONAL REGISTRATION

Registered Professional Engineer in the State of Texas (Registration Number 113527, approved January 28, 2013)

PROFESSIONAL EXPERIENCE

ACADEMIC APPOINTMENTS

The University of Texas at El Paso:

Professor of Mechanical Engineering, September 2005 – present
Associate Professor of Mechanical Engineering, September 2000 - August 2005
Assistant Professor, September 1996 - August 2000
Visiting Assistant Professor, November 1994 - August 1996
Associate Dean for Research, College of Engineering, January 2006 - September 2007
Vice President, UTEP Faculty Senate, September 2004 - January 2006
Member, Faculty Senate Executive Council, September 2001 - January 2006
For summary of work experience while a professor at UTEP, see following section entitled, "Academic Experience."

Texas Tech University Health Sciences Center in El Paso:

Adjunct Associate Professor, Department of Orthopaedic Surgery, June 2001 - May 2003
Worked with orthopaedic surgeons on utilizing pre-surgical models extracted from patient data and manufactured with additive manufacturing technologies for unique and complex surgical applications.

Stanford University:

Visiting Scholar, Department of Mechanical Engineering, July 2000 - August 2000
Worked with engineering and medical school faculty and developed method of manufacturing compliant cardiovascular replicas using water-soluble support material from Fused Deposition Modeling (FDM). This work provided the basis for the successful proposal to the W.M. Keck Foundation (awarded in December 2001).

ENDOWED APPOINTMENTS

The University of Texas at El Paso:

Mr. and Mrs. MacIntosh Murchison Chair I in Engineering, March 2004 - present
John T. MacGuire Professorship in Mechanical Engineering, September 2000 - February 2004

SIGNIFICANT RESEARCH LABORATORY DEVELOPMENT

The University of Texas at El Paso:

Director and Founder, W.M. Keck Center for 3D Innovation, August 2000 – present
Director and Founder, America Makes Satellite Center, April 2015 – present
Director and Founder, Rapid Design and Manufacturing Laboratory (a University Recharge Center), June 2004 – present
Director and Founder, Engines and Alternative Fuels Research Laboratory, August 1995 – August 2005
Director and Founder, NASA Flow and Thermal Imaging Laboratory, February 1998 – August 2005
For summary of these laboratories, see following section entitled, "Academic Experience."

INDUSTRY EXPERIENCE

Engineering Thermodynamic Analyst, August 1987 - May 1989
General Dynamics-Fort Worth Division
Performed structural heating analyses for aircraft components and documented the results in internal memos, developed a computer code to provide transient temperature profiles for missile launch structural heating analyses, and wrote two end-of-the-year technical research reports.

Engineer in Training, Summer 1985
General Motors Corporation, CPC
Warren, Michigan

STUDENT RESEARCH AND TEACHING EXPERIENCE

Research Assistant, **September 1989 - November 1994**
Stanford University
Developed experiment to examine the interaction of solid particles with the temporal features of a swirling, recirculating jet flow field. Open-loop active and passive control strategies were

used to control the instantaneous particle concentration field. Applications of the research are in combustion control.

Teaching Assistant, **Spring 1993**

Stanford University

Served as teaching assistant for laboratory section of graduate computers and instrumentation course. LabVIEW was used for experimental data acquisition and control.

UNIVERSITY TECHNOLOGY SPIN-OFF COMPANY ACTIVITIES

*Actively exploring commercialization of university-developed technology for additive manufacturing businesses resulting from university activities. In addition, currently leading an economic development effort whereby additive manufacturing (3D printing) will be used to create businesses through university incubation motivated by the hypothesis that game changing ideas (from anywhere in the world) combined with expert execution (available within UTEP's Keck Center) will lead to successful business creation – see www.elpasotimes.com/story/opinion/columnists/2015/09/01/ryan-wicker-building-el-pasos-economy-around-3/31308207/ for OpEd in El Paso Times on Sep 1, 2015 describing effort. Most recently developed and taught/teaching a senior level undergraduate mechanical engineering technical elective course entitled "Engineering Entrepreneurship - Building a 3D Printing Business".

Co-Founder, Additive Manufacturing Education Partners, LLC, July 2022 - present

El Paso, Texas

- Additive Manufacturing Education Partners (AMEP) was established to provide customized education, training, and advisory solutions for government and industry clients that require assistance in employing additive manufacturing, particularly in advanced end-use applications.
- With more than 22 years of experience educating and performing state-of the-art research in additive manufacturing (AM) across all seven AM process categories and many material systems (polymers, metals, ceramics, composite materials, and embedded systems), AMEP is uniquely positioned to provide customized, efficient, and realistic solutions for its clients.
- In addition to its services, AMEP is committed to improving society by serving the broader community through various outreach efforts, and is particularly committed to making a difference in the lives of children and adults with special needs through access to and providing meaningful, hands-on experiences with additive manufacturing and other advanced manufacturing technologies.
- AMEP was founded by Elisabeth and Ryan Wicker in July 2022.

Co-Founder, 3D Monolithix, September 2011 – February 2013

El Paso, Texas

- 3D Monolithix was established as a contract manufacturing company specializing in structural and printed electronic devices that enable advanced, 3D electronic packages. We are developing fast and high quality digital printing processes that will print electronic materials in 3D form factors.
- 3D Monolithix is a UTEP spin-off venture partnered with nScrypt, Inc. with both entities providing initial intellectual property (IP), establishing a portfolio of patents and trade secrets. The inventors of the IP at nScrypt and UTEP useful to 3D Monolithix are the founders of the company.
- 3D Monolithix was founded in September 2011 by Kenneth Church, Mike Newton, Eric MacDonald, and Ryan Wicker.

- The company was not able to secure external investment (primarily through the State of Texas Emerging Technology Fund), and as a result, the concept was abandoned in February 2013.

Co-Founder, Additive Partners, LLC, February 2008 – December 2008

El Paso and Austin, Texas

- Additive Partners (AP) is a privately-held start-up venture located in Texas. As a rapid manufacturing/rapid prototyping (RM/RP) parts fabrication service bureau, AP provides precision manufacturing excellence and capacity as well as access to emerging technologies to the industry's other service bureaus, effectively becoming the Service Bureau's Service Bureau. AP offers a variety of manufacturing technologies, precision and quality manufactured parts, and an excellent set of services that are specifically tailored to its service bureau customers.
- Additive Partners was founded in February 2008 by Marc Spier and Ryan Wicker. The company continues to operate, although my interests in the company were purchased by Marc Spier in December 2008.

ACADEMIC EXPERIENCE

COURSES TAUGHT

1. Undergraduate Thermodynamics I
2. Undergraduate Thermodynamics II
3. Undergraduate Fluid Mechanics
4. Undergraduate Dynamics
5. Undergraduate and Graduate Internal Combustion Engines (New course and curriculum)
6. Undergraduate Senior Design (Course redesign)
7. Undergraduate Automatic Controls Laboratory
8. Graduate Advanced Heat Transfer-Convection
9. Graduate Advanced Thermodynamics
10. Undergraduate and Graduate Rapid Manufacturing Systems (New course and curriculum)
11. Undergraduate Introduction to Additive Manufacturing (New course and curriculum)
12. Graduate Advanced Manufacturing (New course and curriculum)
13. Undergraduate Orthopedic Medical Device Design (New course and curriculum)
14. Developing new program in 3D Engineering and Additive Manufacturing (see below).
15. Undergraduate Technical Elective - Engineering Entrepreneurship, Building a 3D Printing Business (New course and curriculum)
16. Graduate Introduction to 3D Engineering and Additive Manufacturing

NEW EDUCATION PROGRAM DEVELOPMENT

1. Graduate Certificate in 3D Engineering and Additive Manufacturing – founded a 15 credit hour coursework graduate certificate program configured to serve not only local UTEP students but industry engineers around the country and world. As additive manufacturing technologies disrupt the manufacturing supply chain by direct fabrication of end-use parts, a new education paradigm is required. AM technologies have seen considerable advancements in terms of 3D modeling, simulations, processes, automatic controls, materials, and applications, and as a result, engineering education must be reinvented to leverage the design freedom enabled by AM. It is expected that this certificate program will serve to satisfy a tremendous industry need and is expected to expand to additional programs (M.S. and Ph.D.) in the future.

2. Manufacturing PhD program proposal – led the development of a PhD program proposal in Manufacturing Engineering for the College of Engineering

PROFESSIONAL TEACHING DEVELOPMENT

1. Model Institutions for Excellence - Phase II Workshop: attended three-day workshop July 25 - 27, 1999 entitled, "Course Blocks for Lower Division Courses in Science, Engineering and Mathematics - Analysis and Assessment."
2. Advanced Cooperative Learning Workshop: attended a 4-day workshop July 29- August 1, 1997 in Cloudcroft, New Mexico entitled, "Advanced Cooperative Learning," taught by Dr. Karl Smith, Associate Professor, Civil Engineering, University of Minnesota, and organized by the UTEP-Model Institutions for Excellence program.
3. Foundation Coalition Faculty Conference: attended a two-day conference in Plymouth, Massachusetts June 23-24, 1997. Members of the NSF-funded Foundation Coalition presented progress on their curriculum reform efforts.
4. MIE Effective Curriculum Integration: Strategic Planning for Student Success: attended a daylong workshop May 6, 1997 designed to improve undergraduate SEM education and research.
5. Educational Seminar: attended a seminar November 12, 1996 entitled, "Using the Principles of Cognitive Psychology as a Pedagogy for Higher Education," presented by Dr. Diane Halpern, Cognitive Psychologist, California State University, San Bernadino.
6. Interactive Video Workshop: attended a two-hour workshop October 16, 1996 entitled, "Teaching with Style-Enhancing Learning by Understanding Teaching and Learning Styles," taught by Dr. Tony Grasha, Professor of Psychology, University of Cincinnati, and organized by the UTEP Partnership for Excellence in Teacher Education program.
7. Cooperative Learning Workshop: attended a 5-day workshop August 12-16, 1996 in Cloudcroft, New Mexico entitled, "Cooperative Learning in the College Classroom," taught by Dr. Edythe Johnson Holubec, Associate, Cooperative Learning Center, University of Minnesota, and organized by the UTEP-Model Institutions for Excellence program.

STUDENT MENTORING

Ph.D. Students (Completed)

*UTEP received approval for a Mechanical Engineering PhD program in 2016, representing a tremendous accomplishment for the dedicated faculty in the ME Department, and after many years of effort, now providing exciting ME-focused educational opportunities for UTEP mechanical engineering students. Prior to approval of the ME PhD program, I utilized the interdisciplinary program in Materials Science and Engineering to serve students desiring a PhD related to materials.

1. Karina Arcaute (Ph.D. in Materials Science and Engineering, December 2008. Defense date: November 25, 2008)
   Dissertation title: "Stereolithography of Poly (Ethylene Glycol) Hydrogels with Application in Tissue Engineering as Peripheral Nerve Regeneration Scaffolds"

   Awarded Most Outstanding Dissertation in the University (Colleges of Engineering and Science) for 2009 Graduates.

2. Amit Lopes (Ph.D. in Materials Science and Engineering, December 2010. Defense date: November 9, 2010)
   Dissertation title: "Hybrid Manufacturing: Integrating Stereolithography and Direct Print Technologies"

Awarded Highly Commended in 2012 Emerald Engineering Outstanding Doctoral Research Awards in the Additive Manufacturing Category.

Article from Dissertation Recognized by Emerald Group Publishing as Outstanding Paper and received the Emerald Literati Network Awards for Excellence 2013.

3. Karina Puebla (Co-Chair with Larry Murr, Ph.D. in Materials Science and Engineering, May 2012. Defense date: December 1, 2011)
   Dissertation title: "The Influence of Build Parameters on the Microstructure during Electron Beam Melting of Ti-6Al-4V"
4. Frank Medina (Ph.D. in Materials Science and Engineering, December 2013. Defense date: August 23, 2013)
   Dissertation title: "Reducing Metal Alloy Powder Costs for use in Powder Bed Fusion Additive Manufacturing: Improving the Economics for Production"
5. Cesar Terrazas (Ph.D. in Materials Science and Engineering, August 2014. Defense date: June 27, 2014)
   Dissertation title: "Characterization of High-Purity Niobium Structures Fabricated using the Electron Beam Melting Process"
6. Jose Gonzalez (Ph.D. in Materials Science and Engineering, August 2017. Defense date: August 8, 2017)
   Dissertation title: "Characterization and Comparison of Metallic and Ceramic Parts Fabricated Using Powder Bed-Based Additive Manufacturing Technologies"
7. Mohammad Hossain (Ph.D. in Mechanical Engineering, December 2017. Defense date: November 21, 2017)
   Dissertation title: "Process Development and Characterization of Smart Parts Fabricated using Powder Bed Fusion Additive Manufacturing Technologies"
8. David Espalin (Ph.D. in Mechanical Engineering, December 2017. Defense date: November 21, 2017)
   Dissertation title: "High Feed Rate Wire Heating and Embedding for Large Area Additive Manufacturing of Parts Containing Embedded Electronic Functionality"

M.S. Students (Completed)

1. Oscar Acosta (M.S.M.E., August 1999, defense date: July 5, 1999)
   Thesis title: "Practical Considerations for an E85 Vehicle Conversion with Performance Measurements"
2. Javier Perez (M.S.M.E., August 1999, defense date: July 12, 1999)
   Thesis title: "Design of a Continuous Emission Monitoring System"
3. Jose Bustamante (M.S.M.E., December 1999, defense date: December 29, 1999, Co-Chair: Bill Diong, Assistant Professor of Electrical Engineering)
   Thesis title: "Design and Implementation of a Throttle Control System"
4. Aaron Hutchison (M.S.M.E., December 2000, defense date: December 2000)
   Thesis title: "Transient Spray Structure Investigation Using Flow Visualization and Particle Image Velocimetry"

Awarded Most Outstanding Thesis in the Mechanical and Industrial Engineering Department, Most Outstanding Thesis in the College of Engineering, and Most Outstanding Thesis in the University (Colleges of Engineering and Science) for 2000 Graduates. Awarded in 2001 and recognized during Spring 2001 Honors Convocation and Commencement Ceremonies.

5. Robert Hennessey (M.S.M.E., August 2001, defense date: July 10, 2001)
   Thesis title: "Direct Injection Spark Ignition Fuel Spray Characterization Under Simulated Injection Strategies"
6. Hugo Loya (M.S.M.E., August 2001, defense date: July 31, 2001)
   Thesis title: "Development of a Non-Intrusive Temperature Measurement Technique Using Infrared Thermography"

   Awarded Most Outstanding Thesis in the Mechanical and Industrial Engineering Department for 2001 Graduates.

7. Luis Terrazas (M.S.M.E., August 2001, defense date: August 1, 2001)
   Thesis title: "Flow and Thermal Analysis of a Computer Chassis Using Liquid Crystal Thermography and Hot-Wire Anemometry"
8. Erasmo Lopez (M.S.MFG, August 2001, defense date: August 15, 2001)
   Thesis title: "Application of Rapid Prototyping Technologies to Enhance Spinal Instrumentation Placement"
9. Miguel Cortez (M.S.M.E., May 2002, defense date: April 15, 2002)
   Thesis title: "Fabrication of Silicone Models of Cardiovascular Systems with Prescribed Compliance"

   Awarded Most Outstanding Mechanical Engineering Thesis in the Mechanical and Industrial Engineering Department, Most Outstanding Thesis in the College of Engineering, and Most Outstanding Thesis in the University (Colleges of Engineering and Science) for 2002 Graduates. Awarded in 2003 and recognized during Spring 2003 Honors Convocation and Commencement Ceremonies.

10. Sasanka Potineni (M.S. MFG, December 2003, defense date: June 10, 2003, Co-Chair: Rolando Quintana, Associate Professor of Industrial Engineering)
    Thesis title: "3-D Laser Imaging Protocol for Rapid Anthropometric Accommodation"
11. Christopher Aguilar (M.S. MFG, August 2003, defense date: June 12, 2003, Co-Chair: Rolando Quintana, Associate Professor of Industrial Engineering)
    Thesis title: "A Video-Based Study of Female Hispanic Migrant Workers in Assembly-Type Operations from a Biomechanical Perspective"
12. Juvenal Herrera (M.S.M.E., August 2003, defense date: July 2, 2003)
    Thesis title: "Wall Wetting Characterization Using An Image-Based Scattering Technique for Gasoline Direct Injection Impinging Fuel Sprays"
13. Gilbert Palafox (M.S.M.E., December 2003, defense date: October 9, 2003)
    Thesis title: "Development of a Tunable Plug and Play In-Vitro Physiologic PIV Flow Setup and Demonstration on a Bypass Graft Model"
14. Karina Arcaute (M.S.M.E., May 2004, defense date: December 23, 2003)
    Thesis title: "Complex Silicone Cardiovascular Models Manufactured Using a Dip-Spin Coating Technique and Water-Soluble Molds"
15. Bhupendra Kenjale (M.S.MFG, December 2004, defense date: December 24, 2004)
    Thesis title: "Framework for Manufacturing Rigid Optically Accessible Internal Flow Passage Models using Water-Soluble Rapid Prototyped Molds"
16. Miguel Perez (M.S.M.E., December 2004, defense date: December 24, 2004)
    Thesis title: "Design and Development of a Motored Optically Accessible Engine"
17. Ananth Iyengar (M.S.M.E., May 2005, defense date: March 25, 2005)
    Thesis title: "Experimental Investigation of the Turbulent Flow in a Ribbed Serpentine Passage Using 2-Component Particle Image Velocimetry"

18. Atul Ranade (M.S.M.E., May 2005, defense date: March 25, 2005)
    Thesis title: "Micro-Stereolithography of Embedded Micro-Channels"
19. Oswaldo Lozoya (M.S.M.E. December 2005, defense date: November 22, 2005)
    Thesis title: "Development and Demonstration of a Multiple Material Stereolithography System"
20. Francisco Medina (M.S.M.E. May 2006, defense date: December 23, 2005)
    Thesis title: "Functional Integrated Layered Manufacturing: Expanding Horizons for Stereolithography"
21. Hector Sandoval (M.S. MME May 2006, defense date: May 11, 2006)
    Thesis title: "Functionalizing Stereolithography Resins using Multi-Walled Carbon Nanotubes"
22. Karina Puebla (M.S. MME August 2009, defense date: June 1, 2009)
    Thesis title: "Effects of Build Orientation, Aging, and Pre-Conditioning on Mechanical Properties for Stereolithography-Manufactured ASTM Type I Specimens using a Design of Experiments Approach"
23. Mahesh Tonde (M.S.M.E. August 2009, defense date: August 6, 2009)
    Thesis title: "Retrofitting a Stereolithography System within a Laminar Flow Hood"
24. Nubia Zuverza (M.S. MME August 2009, defense date: August 6, 2009)
    Thesis title: "Exploring Poly(ethylene glycol) as a Suitable Material for Peripheral Nerve Regeneration Scaffolds Manufactured by Stereolithography"
25. Yinko Grajeda (M.S.M.E. May 2010, defense date: February 22, 2010)
    Thesis title: "Automated Fluid Handling and Leveling System for Multiple Material Stereolithography"
26. David Espalin (M.S.M.E. December 2012, defense date: September 14, 2012)
    Thesis title: "Development of a Multi-material, Multi-technology FDM System for Process Improvement Experimentation"
27. Emmanuel Rodriguez (M.S.M.E. May 2013, defense date: March 14, 2013)
    Thesis title: "Development of a Thermal Imaging Feedback Control System in Electron Beam Melting"
28. Mireya Perez (M.S. BME December 2013, defense date: May 13, 2013)
    Thesis title: "Manufacturing Nerve Guidance Conduits by Stereolithography for use in Peripheral Nerve Regeneration"

    First Graduate of the UTEP Biomedical Engineering Program

    Awarded Most Outstanding Thesis in the University for 2013 Graduates.

29. Jorge Ramos (M.S.M.E. December 2013, defense date: December 13, 2013)
    Thesis title: "The Development of Self-Supported Electromechanical Structures Using Fused Deposition Modeling"
30. Jorge Mireles (M.S. MME December 2013, defense date: December 13, 2013)
    Thesis title: "Process Study and Control of the Electron Beam Melting Process using Infrared Thermography"
31. Jonathan Minjares (M.S.M.E. May 2014, defense date: May 15, 2014)
    Thesis title: "Fabrication of a Nickel-Based Superalloy in Electron Beam Melting and Process Improvements Using Thermal Feedback from a Multi-Wavelength Pyrometer"
32. Mohammad Hossain (M.S.M.E. May 2014, defense date: May 16, 2014)
    Thesis title: "Fused Deposition Modeling (FDM) Fabricated Part Behavior under Tensile Stress, Thermal Cycling, and Fluid Pressure"
33. Shakerur Ridwan (M.S.M.E. August 2015, defense date: July 10, 2015)
    Thesis title: "Process Monitoring in Additive Manufacturing Aimed Toward Part Qualification"

34. Steven Ambriz (M.S.M.E. December 2015, defense date: December 8, 2015)
    Thesis title: "Design and Development of the Portable Build Platform and Heated Traveling Envelope for the Multi^{3D} Manufacturing System"
35. Jose Coronel (M.S.M.E. December 2015, defense date: December 8, 2015)
    Thesis title: "Multi^{3D} System: Advanced Manufacturing through the Implementation of Material Handling Robotics"
36. Paola Cordero (M.S. MME 2016, defense date: April 1, 2016)
    Thesis title: "Effects of Fabrication Conditions on Mechanical Properties of Ti-6Al-4V Fabricated by Powder Bed Fusion Additive Manufacturing"
37. Daniel Marquez (M.S.M.E. 2016, defense date: May 11, 2016)
    Thesis title: "Development of the Thermal Wire Embedding Technology for Electronic and Mechanical Applications on FDM-Printed Parts"
38. Betty McKenzie (M.S.M.E. 2017, defense date: April 5, 2017)
    Thesis title: "Design and Development of the Foil Application Tool for a Foil Embedding Process in the Multi3D Manufacturing System"
39. Kazi Md Masum Billah (M.S.M.E. 2017, defense date: August 3, 2017)
    Thesis title: "Characterization of Electrically Conductive Inks in Simulated Space Environment"
40. Zia Uddin (M.S.M.E. 2018, defense date: November 9, 2018)
    Thesis title: "Experimental Laser Powder Bed Fusion System for Difficult to Process Metallic Materials"
41. Alfonso Fernandez (M.S.M.E. 2019, defense date: December 14, 2018)
    Thesis title: "Development of Actuators using Material Extrusion Additive Manufacturing with Embedded Shape Memory Alloy Wire"
42. Carlos Acosta (M.S.M.E. 2019, defense date: scheduled June 2019)
    Thesis title: "Additive Manufactured Ear Pinna for Spatial Cues Preservation in Custom Hearing Devices"
43. Andres Navarro (M.S.M.E. 2019, defense date: scheduled June 2019)
    Thesis title: "In Situ Selective Nitriding using Open Architecture Laser Powder Bed Fusion System"
44. Shuvo Moinuddin (M.S.M.E. 2020, defense date: July 30, 2020)
    Thesis title: "Multi-Wavelength Pyrometry for Emissivity Mapping and Accurate Surface Temperature Measurement in Powder Bed Fusion Systems"
45. Alejandra Belmont (M.S. BME, 2020, defense date: December 17, 2020)
    Thesis title: "Accurate Replication of an Ear Pinnae Geometry for use in Acoustic Testing of Spatial Cues and Sound Localization"
46. Alejandro Romero (M.S.M.E. 2022, defense date: May 13, 2022)
    Thesis title: "Use of Multi-Wavelength Pyrometry to Measure the Spectral Emissive Behavior of Inconel Alloys during Processing in Electron Beam Melting"
47. Brenda Valadez (M.S. BME 2022, defense date: July 28, 2022)
    Thesis title: "Development of a Custom, 3D Printed Multi-Microphone, Noise-Cancelling, Hearing Protection Device with a Magnetically Attached Printed Ear Canal for Sound Localization Preservation"
48. Hugo Estrada (M.S. BME 2022, defense date: July 28, 2022)
    Thesis title: "Design of a Hemi-Anechoic Chamber for Acoustic Testing of Hearing Devices and Development of Custom-Designed 3D Printed Pinnae for Accurate Representation of the Anatomical Frequency Response"

Ph.D. Students (In Progress)
1. Michael Guinn (Chair, Ph.D. candidate in Mechanical Engineering)
2. Hunter Taylor (Chair, Ph.D. candidate in Materials Science and Engineering)
3. Steven Sun (Chair, Ph.D. candidate in Mechanical Engineering)
4. Hugo Estrada (Chair, Ph.D. candidate in Mechanical Engineering)
5. Brenda Valadez (Chair, Ph.D. candidate in Mechanical Engineering)

M.S. Students (In Progress)
1. Alex Hernandez (M.S. candidate in Mechanical Engineering)
2. Emmanuel Levario (M.S. candidate in Mechanical Engineering)
3. Ernesto Gamboa (M.S. candidate in Mechanical Engineering)

Undergraduate Students

Undergraduate Students in Research

*I have been and continue to be committed to developing meaningful research experiences for undergraduate students and believe strongly in the importance of these experiences to undergraduate students in the educational process – connecting classroom theory to real-world research and applications and serving to motivate lifelong learning and improve depth in understanding, communication skills, ability to work in teams, and numerous other benefits. As a result, I have funded and mentored over 500 undergraduate students in my research activities.

Undergraduate Senior Projects

*In addition to supporting undergraduate students in outside the classroom research experiences, I am committed to providing capstone projects for senior design students. The abbreviated list below is intended to provide a sample of senior projects conceived, defined, and/or supervised by me.

1. Manufacturing and Finishing Complex Cardiovascular System Models – Jorge Flores, Mauricio Melendez, and Mark Mercado.
2. Index Matching for Hemodynamic Stereo PIV Measurements – Nidia Cardenas, Ana Holguin, and Gonzalo Lopez.
3. In-Vitro Cardiovascular Model Pressure Measurement System – Oscar Cano, Gilbert Moreno, and Jeffrey Wilkinson.
4. Development of a Particle Seed System for PIV Measurements – Ivan Marquez, Miguel Olivas, and Alex Seade.
5. Inspection of Rapid Prototyped Microfluidic Elements using Infrared Imaging – Pedro Berges, Jaime Garcia, and Ludovico Lorandi.
6. Extraction and Manufacturing of a Patient-Specific Aortic Dissection Phantom for Experimental Investigation of Flow in the False Lumen – Ivan Acosta, and Manny Gonzales.
7. Recoating System for a Multi-Material SLA – Daniel O. Alanis, Andres Enriquez-Fernandez, Marco A. Hernandez.
8. Creation of a Sterile Build Environment in a Stereolithography Machine with Applications in Tissue Engineering – Angel Hernandez, Karina Puebla, Julieta Ventura.
9. Allowing Rapid Prototyping in a Sterile Environment by Reconfiguring a Stereolithography Apparatus Inside a Laminar Flow Hood – Hayde Rivas, Roberto Rosales, Christopher Tolman.
10. Improvement of Manufacturing Process of Dynamic Mask Projection Microstereolithography – Alicia Morales, Edgar Sac.

RESEARCH LABORATORY DEVELOPMENT

W.M. Keck Center for 3D Innovation

- Founded the W.M. Keck Center for 3D Innovation as a result of a $1 million grant awarded January 2002 from the W.M. Keck Foundation. Received additional infrastructure grants from Sandia National Laboratories ($1 million), University of Texas System faculty STARS program ($500k), and University of Texas System joint equipment requests with UT medical institutions ($1.4 million, proposals for equipment to participate in collaborative research with UT M D Anderson Cancer Center and UT Health Science Center at Houston). Received ~$9 million grant in 2010 ($3 million state, $3 million UT System, and $3 million industry match) as part of the State of Texas Emerging Technology Fund to formally expand activities in 3D electronics within the Keck Center.
- Managed the original (in 2005/2006) renovation and expansion from 1,500 square feet of floor space to over 6,100 square feet, expansion from 6,100 square feet to over 13,000 square feet (2010/2011), and new facility expansion/renovation of 17,000 sq. ft. building located in downtown El Paso (2017-present). Currently, providing oversight for design of new $70M building to house UTEP's Keck Center and Aerospace Center. In career, specified and acquired over $20 million in equipment for additive and conventional manufacturing; materials and mechanical testing; experimental fluid mechanics; reverse engineering and metrology; analytical and synthetic chemistry; and cell culture/tissue engineering.
- The W.M. Keck Center for 3D Innovation, an engineering, biomedical and advanced manufacturing laboratory focused on multi-disciplinary biomedical, materials, and manufacturing research, represents a premier university research facility – including over 100 additive manufacturing systems and combined facilities for advanced manufacturing, metrology and reverse engineering, materials characterization and testing, cell culture and synthetic and analytical chemistry. Research at the Keck Center focuses on the use and development of additive manufacturing technologies for fabricating 3D objects that are plastic, metal, ceramic, of bio-compatible materials, composite materials, or that contain electronics. Major research efforts are underway in the areas of additive manufacturing technology development; closed-loop process control strategies for additive manufacturing; additive manufacturing of various powder metal alloy systems; development of new polymers for use in additive manufacturing; and 3D structural electronics in which electronics, and thus intelligence, are fabricated within additive manufacturing-fabricated structures.
- Developing (patented and patent pending) additive manufacturing technologies for fabricating bioactive tissue engineered scaffolds, 3D structural electronic devices, and multiple material devices using AM and other integrated technologies.
- Working with medical device companies and developing unique anatomical models for medical device development.
- Working with surgeons and providing pre-surgical anatomical models manufactured using additive manufacturing technologies for improved surgical planning, patient diagnosis, and patient consultation.
- Investigating and developing commercialization opportunities for technology developed within the W.M. Keck Center for 3D Innovation.

Rapid Design and Manufacturing Laboratory (a University Recharge Center)

- The Rapid Design and Manufacturing Laboratory, part of the W.M. Keck Center for 3D Innovation, was created to provide contractual engineering and manufacturing services to industry, government agencies, and universities.
- The Rapid Design and Manufacturing Lab provides unique educational opportunities for its students in an industrial-type setting, while allowing the technology developed in the W.M. Keck Center for 3D Innovation (where the fundamental and applied research occurs) to be tested and available to the government, universities, and industry (including the manufacturing, aerospace, defense, biotechnology, medical device, and health care industries), providing a mechanism for commercial ventures between the academic institution and industry, and enabling the institution to utilize its intellectual property, expertise, and infrastructure to bill for services and outreach activities (through industrial collaborations and biomodeling applications such as pre-surgical planning anatomical models) that in whole or in part pay for student salaries, laboratory equipment, maintenance, and materials.

Engines and Alternative Fuels Research Laboratory/NASA Flow and Thermal Imaging Laboratory

- Founded the Engines and Alternative Fuels Research Laboratory (EAFRL) in 1995, managed multiple EAFRL renovations, and acquired and developed EAFRL infrastructure in excess of $1 million, including the NASA Flow and Thermal Imaging Laboratory (NASA FTIL), which was founded in 1998.
- Developed research programs in the general areas of engines and alternative fuels and flow and thermal imaging.
- Previous accomplishments include development of fuel systems for alternative fuels, fuel spray characterization studies for direct injection spark ignition engines, and thermal imaging using infrared and visible imaging technologies.
- Department of Mechanical Engineering hired a new faculty member in 2005 to lead the EAFRL so I could focus on the activities in the W.M. Keck Center for 3D Innovation.

AWARDS AND HONORS

The W.M. Keck Center for 3D Innovation named the 2021 Institution of the Year by the El Paso Chamber for its efforts towards technology development and innovation in the El Paso region

Distinguished Entrepreneurship Fellow, El Paso Chamber, 2021

Fellow, National Academy of Inventors, 2019

America Makes Ambassador, 2019

Grand Marshal, UTEP Spring 2019 Commencement, Engineering and Science, May 19, 2019.

Engineers' Council recognized NASA, UTEP, and Launchpoint Compact Additively Manufactured Innovative Electric Motor team for “Distinguished Engineering Project Achievement Award,” 63rd Annual National Engineers Week Honors & Awards Banquet, February 24, 2018.

Served as Thesis Chair for Ms. Mireya Perez (M.S.BME December 2013). Awarded Most Outstanding Thesis in the University (Health Environment, Biological Sciences and Biomedical Engineering) for 2013 Graduates.

Journal article recognized by Emerald Group Publishing as Outstanding Paper (for 2012) and received the Emerald Literati Network Awards for Excellence 2013 (A.J. Lopes, E. MacDonald, and R.B. Wicker, “Integrating Stereolithography and Direct Print Technologies for 3D Structural Electronics Fabrication,” *Rapid Prototyping Journal*, Volume 18, Issue 2, 2012, pages 129-143).

Best Creative Part, 2010 EBM User Group Meeting, Melbourne Beach, Florida, October 5-7, 2010.

Solid Freeform Fabrication and Rapid Prototyping Journal Best Presentation Award, 20th Annual Solid Freeform Fabrication Symposium, August 3-5, 2009, for presentation of article entitled "Fused Deposition Modeling of Polymethylmethacrylate for Use in Patient-Specific Reconstructive Surgery" by K. Arcaute, D. Rodriguez, D. Espalin, F. Medina, M. Posner, and R.B. Wicker, (article presented by David Espalin, mechanical engineering undergraduate student).

Served as Dissertation Chair for Ms. Karina Arcaute (Ph.D. in Materials Science and Engineering December 2008). Awarded Most Outstanding Dissertation in the University.

First Place, Stratasys Users Group Conference Part Competition, Entry entitled "Rapid Manufacturing of an Airplane Window Shade," *2007 Stratasys Users Group Meeting*, Charlotte, North Carolina, September 3-5, 2007.

First Place, 3D Systems Users Group Advanced Concepts Technical Competition, Entry entitled "Multi-Material Stereolithography," *2007 3D Systems Users Group Conference*, Daytona Beach, Florida, March 18-22, 2007.

Journal article recognized by Emerald Group Publishing as Outstanding Paper and received the Emerald Literati Network Awards for Excellence 2007 (J.A. Palmer, B. Jokiel, C.D. Nordquist, B.A. Kast, C.J. Atwood, E. Grant, F.J. Livingston, F.R. Medina, and R.B. Wicker, "Mesoscale RF Relay Enabled by Integrated Rapid Manufacturing," *Rapid Prototyping Journal*, Volume 12, Issue 3, 2006, pages 148-155).

2004 recipient of the Dick Aubin Distinguished Paper Award for the 2004 Rapid Prototyping and Manufacturing Conference (Rapid Technologies and Additive Manufacturing Division of the Society of Manufacturing Engineers), May 10-13, 2004.

Selected as 1 of 6 researchers featured in the 2002 W.M. Keck Foundation Annual Report, entitled "The Human Factor – Promising Directions," see http://www.wmkeck.org/ for the electronic article.

2001 SAE Teetor Educational Award Recipient.

Served as Thesis Chair for Mr. Aaron Hutchison (M.S.M.E. December 2000). Awarded Most Outstanding Thesis in the Mechanical and Industrial Engineering Department, Most Outstanding Thesis in the College of Engineering, and Most Outstanding Thesis in the University (Engineering and Science) for 2000 Graduates. Received $500 award from UTEP Graduate School for support of research program.

Served as Thesis Chair for Mr. Hugo Loya (M.S.M.E., August 2001). Awarded Most Outstanding Thesis in the Mechanical and Industrial Engineering Department for 2001 Graduates.

Served as Thesis Chair for Mr. Miguel Cortez (M.S.M.E., May 2002). Awarded Most Outstanding Mechanical Engineering Thesis in the Mechanical and Industrial Engineering Department, Most Outstanding Thesis in the College of Engineering, and Most Outstanding Thesis in the University (Engineering and Science) for 2002 Graduates. Received $500 award from UTEP Graduate School for support of research program.

Recognized by the State of Texas "for exceptional dedication and exemplary performance in the pursuit of ethanol vehicle technology." Received award during Texas Ethanol Workshop (September 27–29, 2000) in Austin, Texas from the Texas Agriculture Commissioner, Ms. Susan Combs for participation in the Ethanol Vehicle Challenge.

Best Application in the National Instruments Computer Application Contest – Academic Category, R. Hennessey, H. Loya, B. Diong, and R. Wicker, "LabVIEW-Based Automatic Control Systems Laboratory Using Local and Remote Experimentation Approaches," National Instruments Week, 2000.

1999 Governors' Ethanol Coalition Faculty Advisor Award ($10,000).

Served as faculty advisor for five consecutive DOE-organized alternatively fueled vehicle competitions, and won eleven trophies and cash awards totaling $25k.
1987 Academic Achievement Award in Mechanical Engineering, UT Austin.
Dow Chemical Presidential Scholarship 1985-1987.
Ernest Cockrell, Jr. Scholarship 1985.
Engineering Scholar 1984-1987.
Tau Beta Pi, Pi Tau Sigma, and Sigma Xi.

CONSULTING ACTIVITIES

Wolf, Greenfield & Sacks, P.C., Boston, Massachusetts (2018)
Worked with law firm on additive manufacturing litigation matter
Quinn Emanuel Urquhart & Sullivan, LLP, Los Angeles, California (2018)
Worked with law firm on additive manufacturing litigation matter
Watershed Idea Foundry LLC, San Antonio, Texas (2016-2017)
Worked with industry experts from around the globe associated with Watershed Idea Foundry to guide entrepreneurial ideas and develop successful businesses and product portfolios
CGS Embedded Technologies LLC, San Antonio, Texas (2014-2016)
Advised and assisted with corporate strategic direction and portfolio of offerings, including assisting with project management and interfacing with surgeons, business developers, and corporate attorneys on technical matters
NVision Biomedical Technologies LLC, San Antonio, Texas (2013-2014)
Advised and assisted new start up focused on spine implants with portfolio of offerings and a variety of technical matters
DSM Desotech, Inc., Elgin, Illinois (2009-2013)
Served as testifying expert in DSM Desotech, Inc. v. 3D Systems on behalf of DSM Desotech (Produced Opening and Rebuttal Reports on Patent Infringement and Reply Report on Patent Invalidity; Provided Opinion during Expert Deposition; Trial Scheduled for April 2013; Case Settled March 2013)
nScrypt, Inc., Orlando, Florida (2007-2011)
Investigated multiple strategies for using additive manufacturing to produce 3D geometries with embedded electronic intelligence
Alliance Spine, LLC, San Antonio, Texas (2009-Dec 2010)
Assisted with design and development of several medical products used in spine surgery and provided guidance on use of additive manufacturing for producing surgical instrumentation and implants
W.L. Gore and Associates, Flagstaff, Arizona (2005-2007)
Explored hemodynamics of different anastomotic geometries using magnetic resonance velocimetry

SIGNIFICANT EDITORSHIPS AND PROFESSIONAL BOARD SERVICE

Editor-in-Chief, *Additive Manufacturing*, Elsevier B.V. (2014-present)
Founding Editor-in-Chief of new journal in additive manufacturing. Inaugural issue published October 2014
GN Store Nord A/S, Denmark (2015-2017)
Serving on Scientific Advisory Board of GN Store Nord of Denmark and participating in meetings and providing technical input on corporate strategic direction

National Research Council (of the National Academies) Panel on Mechanical Science and Engineering at the Army Research Laboratory (Term: January 2015-April 30, 2017).
Align Technology, Inc., San Jose, California (2012-2013)
Served on corporate Scientific Advisory Board, participated in strategic meeting to provide technical input on corporate strategic direction
National Research Council (of the National Academies) Committee on Space-Based Additive Manufacturing of Space Hardware (Term: July 16, 2013-December 31, 2014)
Served on committee to assist in the evaluation of using additive manufacturing technologies in space for the manufacture of space hardware and as part of space operations.
Committee produced the following report: 3D Printing in Space, National Academies Press, 2014, ISBN: 978-0-309-31008-6 (106 pages).

PROFESSIONAL SOCIETIES

National Academy of Inventors (current)
American Society of Mechanical Engineers (current)
Society of Manufacturing Engineers (current)
Materials Research Society (current)
ASTM International (current)
American Society for Engineering Education (current)
Biomedical Engineering Society
Tissue Engineering and Regenerative Medicine International Society (TERMIS)
Society of Automotive Engineers (Faculty Advisor, UTEP Student Section, 1998 - 2002)
Tau Beta Pi, Pi Tau Sigma, and Sigma Xi (Honorary Societies)

PATENTS

*28 issued U.S. patents as of July 2022 with 9 issued foreign patents (Europe and Asia) and several patents pending.

1. "Wire Embedding System with a Curved Delivery Path," U.S. Patent 11,317,515, D. Espalin, R. Wicker, A. Fernandez, J. Ramirez, J. Motta, April 26, 2022.
2. "Method and System for Powder Bed Fusion Additive Manufacturing of Crack-Free Aluminum Alloys," U.S. Patent 11,260,475 B2, P.A. Morton, S.Z. Uddin, R.B. Wicker, D. Espalin, L.E. Murr, March 1, 2022.
3. "Methods and Apparatus for Embedding a Wire Intermittently," U.S. Patent 11,203,165 B2, C.Y. Kim, R. Wicker, D. Espalin, C. Sullivan, December 21, 2021.
4. "Metal Objects Spanning Internal Cavities in Structures Fabricated by Additive Manufacturing," U.S. Patent 10,974,499 B2, E. MacDonald, R. Wicker, D. Espalin, April 13, 2021.
5. "Structurally Integrating Metal Objects into Additive Manufactured Structures," U.S. Patent 10,913,202 B2, D. Espalin, E. MacDonald, R.B. Wicker, February 9, 2021.
6. "Extrusion-based Additive Manufacturing System for 3D Structural Electronic, Electromagnetic and Electromechanical Components/Devices," U.S. Patent 10,748,867 B2, R.B. Wicker, E. MacDonald, F. Medina, D. Espalin, D.W. Muse, Aug 18 2020.
7. "In-Situ Diagnostics and Control Method and System for Material Extrusion 3D Printing," U.S. Patent 10,691,095 B2, C.Y. Kim, D. Espalin, E. MacDonald, R. Wicker, Jun 23, 2020.
8. "Method for Connecting Inter-layer Conductors and Components in 3D Structures," U.S. Patent 10,660,214 B2, R.B. Wicker, F. Medina, E. MacDonald, D.W. Muse, D. Espalin, May 19, 2020.

9. "Method and System for Producing Functionally Graded Structures in Powder Bed Fusion Processing," *U.S. Patent 10,610,931 B2*, P.A. Morton, R. Wicker, J. Mireles, A. Hinojos, Apr 7, 2020.
10. "Apparatus for Wire Handling and Embedding on and Within 3D Printed Parts," *U.S. Patent 10,582,619 B2*, D. Espalin, D. Marquez, A. Fernandez, C. Kim, E. MacDonald, and R.B. Wicker, Mar 3, 2020.
11. "Connecting Metal Foils/Wires at Different Layers in 3D Printed Substrates with Wire Spanning," *U.S. Patent 10,569,464 B2*, E. MacDonald, D. Espalin, I. Varela, and R.B. Wicker, Feb 25, 2020.
12. "Methods and Systems for Embedding Filaments in 3D Structures, Structural Components, and Structural Electronic, Electromagnetic and Electromechanical Components/Devices," *U.S. Patent 10,518,490 B2*, R.B. Wicker, F. Medina, E. MacDonald, D.W. Muse, D. Espalin, Dec 31, 2019.
13. "Method of Fabrication for the Repair and Augmentation of Part Functionality of Metallic Components," *U.S. Patent 10,449,624 B2*, J. Mireles, M. Hossain, R.B. Wicker, Oct 22, 2019.
14. "Metal Objects Spanning Internal Cavities in Structures Fabricated by Additive Manufacturing," *U.S. Patent 10,464,306 B2*, E. MacDonald, R.B. Wicker, D. Espalin, Nov 5, 2019.
15. "Electronic Gaming Die," *U.S. Patent 10,335,673 B2*, D.W. Muse, R. Wicker, E. MacDonald, R. Salas, F. Medina, Jul 2, 2019.
16. "Connecting Metal Foils/Wires and Components in 3D Printed Substrates with Wire Bonding," *U.S. Patent 10,259,081 B2*, E. MacDonald, D. Espalin, R.B. Wicker, Apr 16, 2019.
17. "Electronic Gaming Die," *U.S. Patent 9,908,037 B2*, D. Muse, R.B. Wicker, E. MacDonald, R. Salas, and F. Medina, 2018.
18. "Multi-layered 3D Printed Laser Direct Structuring for Electrical Interconnect and Antennas," *U.S. Patent 9,777,380 B2*, E. MacDonald, D. Espalin, and R.B. Wicker, 2017.
19. "Method for Connecting Inter-Layer Conductors and Components in 3D Structures," *U.S. Patent 9,414,501 B2* (Notice of Allowance, March 22, 2016), R.B. Wicker, F. Medina, E. MacDonald, D. Muse, and D. Espalin, 2016.
20. "Reticulated Mesh Arrays and Dissimilar Array Monoliths by Additive Layered Manufacturing using Electron and Laser Beam Melting," *U.S. Patent 8,828,311 B2*, F. Medina, L.E. Murr, R.B. Wicker, and S.A. Gaytan, 2014 (Provisional patent application filed May 15, 2009 and full application filed May 14, 2010 with U.S. Patent and Trademark Office).
21. "Methods and Systems for Integrating Fluid Dispensing Technology with Stereolithography," *U.S. Patent 8,252,223*, F. Medina, R.B. Wicker, J. Palmer, D. Davis, B. Chavez, and P. Gallegos, 2012 (joint UTEP/Sandia National Laboratories patent, continuation of *U.S. Patent 7,658,603*).
22. "Hydrogel Constructs using Stereolithography," *U.S. Patent 8,197,743*, R.B. Wicker, F. Medina, K. Arcaute, L. Ochoa, C.J. Elkins, and B.K. Mann, 2012 (continuation of U.S. Patent *7,780,897*).
23. "Methods for Multi-Material Stereolithography," *U.S. Patent 7,959,847*, R.B. Wicker, F. Medina, and C. Elkins, 2011 (Notice of Allowance Issued February 8, 2011, Divisional Application for withdrawn methods claims from Multi-Material Stereolithography patent, *U.S. Patent 7,556,490*).
24. "Hydrogel Constructs using Stereolithography," *U.S. Patents 7,780,897*, R.B. Wicker, F. Medina, K. Arcaute, L. Ochoa, C.J. Elkins, and B.K. Mann, 2010 (Patent Application 20060237880; disclosed April 2005; filed April 2005 with U.S. Patent and Trademark Office; received first office action dated September 3, 2008; Notice of Allowance dated April 20, 2010).
25. "Methods and Systems for Integrating Fluid Dispensing Technology with Stereolithography," *U.S. Patent 7,658,603*, F. Medina, R.B. Wicker, J. Palmer, D. Davis, B. Chavez, and P. Gallegos, 2010 (joint UTEP/Sandia National Laboratories patent application, Patent Application 20060225834; disclosed July 2004; filed March 31, 2005 with U.S. Patent and Trademark Office; received first office action dated November 5, 2008; Notice of Allowance dated September 22, 2009).

26. "Multi-Material Stereolithography," *U.S. Patent 7,556,490*, R.B. Wicker, F. Medina, and C. Elkins, 2009 (disclosed December 2003, filed July 30, 2004 with U.S. Patent and Trademark Office, Notice of Allowance Issued March 9, 2009).
27. "Methods and Systems for Rapid Prototyping of High Density Circuits," *U.S. Patent 7,419,630*, J. Palmer, D. Davis, B. Chavez, P. Gallegos, R.B. Wicker, and F. Medina, 2008. (joint Sandia National Laboratories/UTEP patent application; Patent Application 20060237879; disclosed July 2004; filed April 2005 with U.S. Patent and Trademark Office).
28. "Methods and Systems for Image-Guided Placement of Implants," *U.S. Patent 7,194,120*, R.B. Wicker and B. Tedla, 2007 (disclosed December 2002; filed May 2003 with U.S. Patent and Trademark Office; Notice of Allowance Issued June 20, 2006).

SCHOLARLY ACTIVITY

JOURNAL ARTICLES

1. H.C. Taylor, R.B. Wicker, "Impacts of Microsecond Control in Laser Powder Bed Fusion Processing," Additive Manufacturing, in review, 2022.
2. C.A. Terrazas, A. Romero, R. Felice, R.B. Wicker, "Multi-Wavelength Pyrometry as an In Situ Diagnostic Tool in Metal Additive Manufacturing: Detecting Sintering and Liquid Phase Transitions in Electron Beam Powder Bed Fusion," Additive Manufacturing, in review, 2022.
3. A. Lopes, J. Rivas, H.C. Taylor, C. Orquiz, R.B. Wicker, "Measurement Systems Analysis for Beam Compensation, Scaling Factors and Geometric Dimensioning for a Metallic Additively Manufactured Test Artifact," CIRP Journal of Manufacturing Science and Technology, in review, 2022.
4. N. Derimow, A. Romero, A. Rubio, C. Terrazas, N. Moser, O.L. Kafka, J. T. Benzing, F. Medina, R. Wicker, N. Hrabe, "Assessment of Intra-Build Variations in Tensile Strength in Electron Beam Powder-Bed Fusion Ti-6Al-4V Part 1: Effects of Build Height," Materials Science and Engineering: A, Volume 849, 2022, 143354.
5. N. Derimow, A. Romero, A. Rubio, C. Terrazas, F. Medina, R. Wicker, N. Hrabe "Sintered Powder Oxidation Variation as a Function of Build Height for Titanium Alloy Produced by Electron Beam Powder-Bed Fusion," Additive Manufacturing Letters, Volume 1, 100023.
6. A. Fernandez, R. Felice, C.A. Terrazas, R.B. Wicker, "Implications for Accurate Surface Temperature Monitoring in Powder Bed Fusion: Using Multi-Wavelength Pyrometry to Characterize Spectral Emissivity During Processing," Additive Manufacturing, Volume 46, October 2021, 102138.
7. C.A. Terrazas, F.L.Mayoral, O.F. Garcia, M.S. Hossain, D. Espalin, A. Fernandez, L.E. Murr, R.B. Wicker, "Effects of Process Interruptions on Microsctructure and Mechanical Properties of Three Face Centered Cubic Alloys Process by Laser Powder Bed Fusion," Journal of Manufacturing Process, Volume 66, June 2021, Pages 397-406.
8. H.C. Taylor, E.A. Garibay, R.B. Wicker, "Toward a Common Laser Powder Bed Fusion Qualification Test Artifact," Additive Manufacturing, Volume 39, 2021, 101803.
9. F. Dugast, P. Apostolou, A. Fernandez, W. Dong, Q. Chen, S. Strayer, R. Wicker, A.C. To, "Part-scale thermal process modeling for laser powder bed fusion with matrix-free method and GPU computing," Additive Manufacturing, Volume 37, 2021, 101732.
10. A. Gamon, E. Arrieta, P.R.Gradl, C.Katsarelis, L.E. Murr, R.B. Wicker, F. Medina, "Microstructure and Hardness Comparison of As-Built Inconel 625 Alloy Following Various Additive Manufacturing Processes," Results in Materials, Volume 12, December 2021, 100239.

11. C. Kim, C. Sullivan, A. Hillstrom, R. Wicker, "Intermittent Embedding of Wire into 3D Prints for Wireless Power Transfer," International Journal of Precision Engineering and Manufacturing, Volume 22, 919-931.
12. J. Urbina, S.M. Monks, L. Ochoa, R.F. Stump, R.B. Wicker, C. Danek, V.I. Torres, S.B. Crawford, "Development and Evaluation of an Automated Manual Resuscitator-Based Emergency Ventilator-Alternative," Cureus, Volume 13 (3), 2021, e13642; DOI: 10.7759/cureus.13642.
13. J. Varela, E. Arrieta, M. Paliwal, M. Marucci, J.H. Sandoval, J.A. Gonzalez, B. McWilliams, L.E. Murr, R.B. Wicker, F. Medina, "Investigation of Microstructure and Mechanical Properties for Ti-6Al-4V Alloy Parts Produced Using Non-Spherical Precursor Powder by Laser Powder Bed Fusion," Materials 2021, Volume 14, Number 11, 3028; https://doi.org/10.3390/ma14113028.
14. J. Merino, B. Ruvalcaba, J.Varela, E. Arrieta, L.E. Murr, R.B. Wicker, M. Benedict, F. Medina, "Multiple, Comparative Heat Treatment and Aging Schedules for Controlling the Microstructures and Mechanical Properties of Laser Powder Bed Fusion Fabricated AlSi10Mg Alloy," Journal of Materials Research and Technology, Volume 13, July-August 2021, Pages 669-685.
15. S.E. Hall, J.E. Regis, A. Renteria, L.A. Chavez, L. Delfin, S. Vargas, M.R. Haberman, D. Espalin, R. Wicker, Y. Lin, "Paste Extrusion 3D Printing and Characterization of Lead Zirconate Titanate Piezoelectric Ceramics," Ceramics International, Volume 47, Issue 15, 2021, Pages 22042-22048.
16. J. Varela, J. Merino, C. Pickett, A. Abu-Issa, E. Arrieta, L.E. Murr, R.B. Wicker, M. Ahlfors, D. Godfrey, F. Medina, "Performance Characterization of Laser Powder Bed Fusion Fabricated Inconel 718 Treated with Experimental Hot Isostatic Processing Cycles," Journal of Manufacturing and Materials Processing, Volume 4, Issue 3, 2020 page 73 (15 pages).
17. A. Abu-Issa, M. Lopez, C. Pickett, A. Escarcega, E. Arrieta, L.E. Murr, R.B. Wicker, M. Ahlfors, D. Godfrey, F. Medina, "Effects of altered hot isostatic pressing treatments on the microstructures and mechanical performance of electron beam melted Ti-6Al-4V," Journal of Materials Research and Technology, Volume 9, Issue 4, 2020, pages 8735-8743.
18. K.M.M. Billah, F.A.R. Lorenzana, N.L. Martinez, R.B. Wicker, D. Espalin, "Thermomechanical characterization of short carbon fiber and short glass fiber-reinforced ABS used in large format additive manufacturing," Additive Manufacturing, 2020, 101299.
19. M. Lopez, C. Pickett, E. Arrieta, L.E. Murr, R.B. Wicker, M. Ahlfors, D. Godfrey, F. Medina, "Effects of Postprocess Hot Isostatic Pressing Treatments on the Mechanical Performance of EBM Fabricated TI-6Al-2Sn-4Zr-2Mo," Materials, Volume 13, Issue 11, 2020, page 2604 (19 pages).
20. P.A. Morton, H.C. Taylor, L.E. Murr, O.G. Delgado, C.A. Terrazas, R.B. Wicker, "In Situ Selective Laser Gas Nitriding for Composite TiN/Ti-6Al-4V Fabrication via Laser Powder Bed Fusion," *Journal of Materials Science & Technology*, Volume 45, 2020, pages 98-107.
21. A.J. Lopes, M.A. Perez, D. Espalin, R.B. Wicker "Comparison of Ranking Models to Evaluate Desktop 3D Printers in a Growing Market," *Additive Manufacturing*, 2020, 101291.
22. L.A. Chavez, P. Ibave, B. Wilburn, D. Alexander IV, C. Stewart, R. Wicker, Y. Lin, "The Influence of Printing Parameters, Post-Processing, and Testing Conditions on the Properties of Binder Jetting Additive Manufactured Functional Ceramics," Ceramics, Volume 3, Issue 1, Feb 2020, pages 65-77.
23. E. Meraz Trejo, X. Jimenez, K. Billah, J. Seppala, R. Wicker, D. Espalin, "Compressive Deformation Analysis of Large Area Pellet-Fed Material Extrusion 3D Printed Parts in Relation to In Situ Thermal Imaging," *Additive Manufacturing*, Volume 33, May 2020, 101099.

24. L.A. Chavez, B.R. Wilburn, P. Ibave, L.C. Delfin, S. Vargas, H. Diaz, C. Fulgentes, A. Renteria, J. Regis, Y. Liu, R.B. Wicker, and Y. Lin, "Fabrication and Characterization of 3D Printing Induced Orthotropic Functional Ceramics." Smart Materials and Structures, Volume 28, 2019, 125007 (7pp).
25. A. Aguilar, C.A. Diaz-Moreno, A.D. Price, R.K. Goutam, C.E. Botez, Y. Lin, R.B. Wicker, C. Li, "Non-destructive Optical Second Harmonic Generation Imaging of 3D Printed Aluminum Nitride Ceramics," Ceramics International, Volume 45, Issue 15, Oct 2019, pages 18871-18875.
26. I.A. Segura, L.E. Murr, C.A. Terrazas, D. Bermudez, J. Mireles, V.S.Y. Injeti, K. Li, B. Yu, R.D.K. Misra, R.B. Wicker, "Grain Boundary and Microstructure Engineering of Inconel 690 Cladding on Stainless-Steel 316L using Electron-Beam Powder Bed Fusion Additive Manufacturing," Journal of Materials Science & Technology, Volume 35, Issue 2, 2019, pages 351-367.
27. C.A. Terrazas, L.E. Murr, D. Bermudez, E. Arrieta, D.A. Roberson, R.B. Wicker, "Microstructure and Mechanical Properties of Ti-6Al-4V-5% Hydroxyapatite Composite Fabricated using Electron Beam Powder Bed Fusion," *Journal of Materials Science & Technology*, Volume 35, Issue 2, 2019, pages 309-321.
28. K. Schnittker, E. Arrieta, X. Jimenez, D. Espalin, R.B. Wicker, D.A. Roberson, "Integrating Digital Image Correlation in Mechanical Testing for the Materials Characterization of Big Area Additive Manufacturing Feedstock," *Additive Manufacturing*, Volume 26, 2019, pages 129-137.
29. M.N. Jahangir, K.M.M. Billah, Y. Lin, D.A. Roberson, R.B. Wicker, D. Espalin, "Reinforcement of Material Extrusion 3D Printed Polycarbonate using Continuous Carbon Fiber," *Additive Manufacturing*, Volume 28, August 2019, pages 354-364.
30. K. Billah, J.L. Coronel, M.C. Halbig, R.B. Wicker, D. Espalin, "Electrical and Thermal Characterization of 3D Printed Thermoplastic Parts with Embedded Wires for High Current-Carrying Applications," *IEEE Access*, Volume 7, 2019, pages 18799-18810.
31. C.A. Díaz-Moreno, Y. Lin, A. Hurtado-Macías, D. Espalin, C.A. Terrazas, L.E. Murr, R.B. Wicker, "Binder Jetting Additive Manufacturing of Aluminum Nitride Components," *Ceramics International*, 2019.
32. J.A. Gonzalez, J. Mireles, S.W. Stafford, M.A. Perez, C.A. Terrazas, R.B. Wicker, "Characterization of Inconel 625 Fabricated Using Powder-Bed-Based Additive Manufacturing Technologies," *Journal of Materials Processing Technology*, Volume 264, 2019, pages 200-210.
33. E. Arrieta, M. Haque, J. Mireles, C. Stewart, C. Carrasco, R.B. Wicker, "Mechanical Behavior of Differently Oriented Electron Beam Melting Ti-6Al-4V Components Using Digital Image Correlation," *Journal of Engineering Materials and Technology*, Volume 141, Issue 1, 2019.
34. Z. Uddin, L.E. Murr, C.A. Terrazas, P. Morton, D.A. Roberson, R.B. Wicker, "Processing and Characterization of Crack-Free Aluminum 6061 using High-Temperature Heating in Laser Powder Bed Fusion Additive Manufacturing," *Additive Manufacturing*, Volume 22, 2018, pages 405-415.
35. X. Yu, M. Liang, C. Shemelya, D.A. Roberson, R.B. Wicker, E. MacDonald, H. Xin, "3-D Printed Parts for a Multilayer Phased Array Antenna System," *IEEE Antennas and Wireless Propagation Letters*, Volume 17, Issue 11, 2018, pages 2150-2154.
36. C.A. Díaz -Moreno, J.A. Lopez, Y. Ding, A.H. Macias, C. Li, R.B. Wicker, "Multiferroic and Optical Properties of $La_{0.05}Li_{0.85}NbO_3$ and $LiNbO_3$ Nanocrystals," Journal of Nanotechnology, 2018.
37. I.A. Segura, J. Mireles, D. Bermudez, C.A. Terrazas, L.E. Murr, K. Li, V.S.Y. Injeti, R.D.K. Misra, R.B. Wicker, "Characterization and Mechanical Properties of Cladded Stainless Steel

316L with Nuclear Applications Fabricated using Electron Beam Melting," *Journal of Nuclear Materials*, Volume 507, 2018, pages 164-176.

38. E. MacDonald, D. Espalin, D. Doyle, J. Muñoz, S. Ambriz, J. Coronel, A. Williams, R.B. Wicker, "Fabricating Patch Antennas within Complex Dielectric Structures through Multi-Process 3D Printing," *Journal of Manufacturing Processes*, Volume 34, Part A, 2018, pages197-203.
39. C. Kim, D. Espalin, A. Cuaron, M.A. Perez, E. MacDonald, R.B. Wicker, "Unobtrusive In Situ Diagnostics of Filament-Fed Material Extrusion Additive Manufacturing," *IEEE Transactions on Components, Packaging and Manufacturing Technology*, Volume 8, Issue 8, 2018, pages 1469-1476.
40. M.S. Hossain, J. Mireles, P. Morton, Y. Lin, C.A. Terrazas, R.B. Wicker, "Part Re-Registration During Process Interruption of Electron Beam Melting Additive Manufacturing," *International Journal of Advanced Manufacturing Technology*, Volume 96, Issue 1-4, 2018, pages 337-344.
41. C. Bailey, E. Aguilera, D. Espalin, J. Motta, A. Fernandez, M.A. Perez, C. DiBiasio, D. Pryputniewicz, E. MacDonald, R.B. Wicker, "Augmenting Computer-Aided Design Software with Multi-Functional Capabilities to Automate Multi-Process Additive Manufacturing," *IEEE Access*, Volume 6, 2018, pages 1985-1994 (doi: 10.1109/ACCESS.2017.2781249).
42. C.O. Balderrama-Armendariz, E. MacDonald, D. Espalin, D. Cortes-Saenz, R. Wicker, and A. Maldonado-Macias, "Torsion Analysis of the Anisotropic Behavior of FDM Technology," *International Journal of Advanced Manufacturing Technology*, Volume 96, Issue 1-4, 2018, pages 307-317.
43. C.A. Diaz-Moreno, Y. Ding, J. Portelles, J. Heiras, A. Hurtado Macias, A. Syeed, A. Paez, C. Li, J. López, R. Wicker, "Optical Properties of Ferroelectric Lanthanum Lithium Niobate," *Ceramics International*, Volume 44, Issue 5, 2018, pages 4727-4733.
44. M. Meyer, M.A. Perez, M.S. Hossain, E.B. Silverman, R.B. Fitch, and R.B. Wicker, "Effect of Headless Compression Screw on Construct Stability for Centre of Rotation and Angulation-Based Levelling Osteotomy," *Veterinary and Comparative Orthopaedics and Traumatology (VCOT)*, Issue 4 2017, pages 243-247.
45. C. Shemelya, A. De La Rosa, A.R. Torradoa, K.Yu, J. Domanowski, P.J. Bonacuse. R.E. Martin, M. Juhasz, F. Hurwitz, R.B. Wicker, B. Conner, E. MacDonald, D.A. Roberson, "Anisotropy of Thermal Conductivity in 3D Printed Polymer Matrix Composites for Space Based Cube Satellites," *Additive Manufacturing*, Volume 16, August 2017, pages 186-196.
46. B.A. Fisher, J. Mireles, S. Ridwan, R.B. Wicker, J. Beuth, "Consequences of Part Temperature Variability in Electron Beam Melting of Ti-6Al-4V," *JOM*, Volume 69, Issue 12, December 2017, pages 2745-2750.
47. S. Ambriz, J. Coronel, B. Zinniel, R. Schloesser, C. Kim, M. Perez, D. Espalin, R.B. Wicker, "Material Handling and Registration for an Additive Manufacturing-Based Hybrid System," *Journal of Manufacturing Systems*, Volume 45, October 2017, pages 17-27.
48. P.M. Cordero, J. Mireles, S. Ridwan, R.B. Wicker, "Evaluation of Monitoring Methods for Electron Beam Melting Powder Bed Fusion Additive Manufacturing Technology," *Progress in Additive Manufacturing*, Volume 2, Issue 1-2, June 2017, pages 1-10.
49. C. Kim, D. Espalin, M. Liang, H. Xin, A. Cuaron, I. Varela, E. MacDonald, R.B. Wicker, "3D Printed Electronics with High Performance, Multi-Layered Electrical Interconnect," *IEEE Access*, Volume 5, 2017, pages 25286-25294 (doi: 10.1109/ACCESS.2017.2773571).
50. E.W. MacDonald and R.B. Wicker, "Multi-process 3D Printing for Increasing Component Functionality," *Science*, Volume 353, Issue 6307, aaf2093, 2016.

51. J. Gonzalez, J Mireles, Y. Lin, R. Wicker, "Characterization of Ceramic Components Fabricated Using Binder Jetting Additive Manufacturing Technology," *Ceramics International*, Volume 42, Issue 9, 2016, pages 10559-10564. doi:10.1016/j.ceramint.2016.03.079.
52. C. Shemelya, M. Zemba, M. Liang, X. Yu, D. Espalin, R. Wicker, H. Xin, E. MacDonald, "Multi-layer Archimedean Spiral Antenna Fabricated using Polymer Extrusion 3D Printing," *Microwave and Optical Technology Letters*, Volume 58, Issue 7, 2016, pages 1662-1666.
53. M. Hossain, J. Gonzalez, R. Martinez, M. Arif, I. Shuvo, J. Mireles, A. Choudhuri, Y. Lin, R. Wicker, "Fabrication of Smart Parts Using Powder Bed Fusion Additive Manufacturing Technology," *Additive Manufacturing*, Volume 10, 2016, pages 58-66. doi: 10.1016/j.addma.2016.01.001.
54. C.A. Terrazas, J. Mireles, S.M. Gaytan, P.A. Morton, A. Hinojos, P. Frigola, R.B. Wicker, "Fabrication and Characterization of High Purity Niobium Using Electron Beam Melting Additive Manufacturing Technology," *International Journal of Advanced Manufacturing Technology*, Volume 84, Issue 5, 2016, pages 1115-1126.
55. A. Hinojos, J. Mireles, A. Reichardt, P. Frigola, P. Hosemann, L. Murr, R. Wicker, "Joining of Inconel 718 and 316 Stainless Steel using Electron Beam Melting Additive Manufacturing Technology," *Materials & Design*, Volume 94, 2016, pages 17-27. doi: 10.1016/j.matdes.2016.01.041
56. D.A. Roberson, A.R. Torrado, C.M. Shemelya, A. Rivera, E.W. MacDonald, R.B. Wicker, "Comparison of Stress Concentrator Fabrication for 3D Printed Polymeric Izod Impact Test Specimens," *Additive Manufacturing*, Volume 7, 2015, pages 1-11.
57. C. Kim, D. Espalin, E. MacDonald, R. Wicker, D. Kim, J. Sung, J. Lee, "A Study on Manufacturing System Integration with a 3D Printer Based on the Cloud Network," Journal of the Korean Society of Manufacturing Process Engineers, Volume 14, Number 3, 2015, P. 15-20 (In Korean).
58. C. Shemelya, A. Rivera, A. Torrado Perez, C. Rocha, M. Liang, X. Yu, C Kief, D. Alexander, J. Stegeman, H. Xin, R. Wicker, E. MacDonald, D. Roberson, "Mechanical, Electromagnetic, and X-ray Shielding Characterization of a 3D Printable Tungsten–Polycarbonate Polymer Matrix Composite for Space-Based Applications," *Journal of Electronic Materials*, Volume 44, Issue 8, 2015, pages 2598-2607. doi: 10.1007/s11664-015-3687-7.
59. M. Liang, C. Shemelya, E. MacDonald, R. Wicker, H. Xin, "3-D Printed Microwave Patch Antenna via Fused Deposition Method and Ultrasonic Wire Mesh Embedding Technique," *IEEE Antennas and Wireless Propagation Letters*, Volume 14, 2015, pages 1346-1349. doi: 10.1109/LAWP.2015.2405054.
60. Y. Lu, S.N. Mantha, D.C. Crowder, S. Chinchilla, Y.H. Yun, R.B. Wicker, J.W. Choi, "Microstereolithography and Characterization of Poly(propylene fumarate)-based Drug-loaded Microneedle Arrays," *Biofabrication*, Volume 7, Number 4, 2015, pages 0045001.
61. P.A. Morton, J. Mireles, H. Mendoza, P. Cordero, M. Benedict, R.B. Wicker, "Enhancement of Low-Cycle Fatigue Performance From Tailored Microstructures Enabled by Electron Beam Melting Additive Manufacturing Technology," *Journal of Mechanical Design*, Volume 137, Issue 11, 111412 (4 pages) 2015. doi:10.1115/1.4031057.
62. J. Mireles, S. Ridwan, P.A. Morton, A. Hinojos, R.B. Wicker, "Analysis and Correction of Defects Within Parts Fabricated Using Powder Bed Fusion Technology," *Surface Topography: Metrology and Properties*, Volume 3, Number 3, 034002, 2015, doi:10.1088/2051-672X/3/3/034002.

63. J. Mireles, C. Terrazas, S.M. Gaytan, D.A. Roberson, R.B. Wicker, "Closed-Loop Automatic Feedback Control in Electron Beam Melting," *International Journal of Advanced Manufacturing Technology*, Volume 78, Issue 5, 2015, pages 1193-1199. doi: 10.1007/s00170-014-6708-4.
64. C. Kim, D. Espalin, A. Cuaron, M. Perez, M. Lee, E. MacDonald, R. Wicker, "Cooperative Tool Path Planning for Wire Embedding on Additively Manufactured Curved Surfaces Using Robot Kinematics," *Journal of Mechanisms and Robotics*, Volume 7, Issue 2, 021003 (10 pages, Paper No: JMR-14-1218), 2015. doi: 10.1115/1.4029473.
65. A.R. Torrado, C.M. Shemelya, J.D. English, Y. Lin, R.B. Wicker, D.A. Roberson, "Characterizing the Effect of Additives to ABS on the Mechanical Property Anisotropy of Specimens Fabricated by Material Extrusion 3D Printing," *Additive Manufacturing*, Volume 6, 2015, pages 16-29.
66. S.M. Gaytan, M.A. Cadena, H. Karim, D. Delfin, Y. Lin, D. Espalin, E. MacDonald, R.B. Wicker, "Fabrication of Barium Titanate by Binder Jetting Additive Manufacturing Technology," *Ceramics International*, Volume 41, Issue 5, Part A, 2015, pages 6610-6619.
67. M. Evangelista, M. Perez, J. Hassan, A. Salibian, S. Darcy, G. Wirth, K. Paydar, R. Wicker, K. Arcaute, B. Mann, G. Evans, "Single-Lumen and Multi-Lumen Poly(ethylene glycol) Nerve Conduits Fabricated by Stereolithography for Peripheral Nerve Regeneration In Vivo," *Journal of Reconstructive Microsurgery*, Volume 31, Issue 5, 2015, pages 327-335.
68. H. Karim, D. Delfin, M.A.I. Shuvo, L.A. Chavez, C.R. Garcia, J.H. Barton, S.M. Gaytan, M.A. Cadena, R.C. Rumpf, R.B. Wicker, Y. Lin, A. Choudhuri, "Concept and Model of a Metamaterial-Based Passive Wireless Temperature Sensor for Harsh Environment Applications," IEEE Sensors, Volume 15, Issue 3, 2015, pages 1445-1452.
69. E. Rodriguez, J. Mireles, , C.A. Terrazas, D. Espalin, M.A. Perez, R.B. Wicker, "Approximation of Absolute Surface Temperature Measurements of Powder Bed Fusion Additive Manufacturing Technology using In Situ Infrared Thermography," *Additive Manufacturing*, Volume 5, 2015, pages 31-39.
70. D.A. Roberson, C.M. Shemelya, E. MacDonald, R.B. Wicker, "Expanding the Applicability of FDM-Type Technologies through Materials Development," *Rapid Prototyping Journal*, Volume 21 Issue 2, 2015, pages 137 - 143.
71. D.A. Roberson, R.B. Wicker, E. MacDonald, "Ohmic Curing of Three-Dimensional Printed Silver Interconnects for Structural Electronics," *Journal of Electronic Packaging*, Volume 137, Issue 3: 031004, 2015, 8 pages.
72. C. Shemelya, E. MacDonald, R.B. Wicker, "Encapsulated Copper Wire and Copper Mesh Capacitive Sensing for 3D Printing Applications," *IEEE Sensors*, Volume 15, Issue 2, 2014, pages 1280-1286.
73. C. Rocha, A. T. Perez, D. A. Roberson, C. Shemelya, E. MacDonald, R. B. Wicker, "Novel ABS-Based Binary and Ternary Polymer Blends for Material Extrusion 3D Printing," *Journal of Materials Research*, Volume 29, Issue 17, 2014, pages 1859-1866.
74. M. Hossain, D. Espalin, J. Ramos, M. Perez, R. B. Wicker, "Improved Mechanical Properties of FDM-Manufactured Parts through Build Parameter Modification," *Journal of Manufacturing Science and Engineering*, Volume 136, Issue 6, 061002 (12 pages); 2014, doi: 10.1115/1.4028538.
75. A.R. Torrado Perez, D.A. Roberson, R.B. Wicker, "Fracture Surface Analysis of 3D-Printed Tensile Specimes of Novel ABS-Based Materials," *Journal of Failure Analysis and Prevention*, Volume 14, Issue 3, 2014, pages 343-353 (DOI: 10.1007/s11668-014-9803-9).
76. A.J. Lopes, I.H. Lee, E. MacDonald, R. Quintana, R.B. Wicker, "Laser Curing of Silver-Based Conductive Inks for In Situ 3D Structural Electronics Fabrication in Stereolithography," *Journal*

of Materials Processing Technology, Volume 214, Issue 9, 2014, pages 1935-1945 (DOI: 10.1016/j.jmatprotec.2014.04.009).

77. E. MacDonald, R. Salas, D. Espalin, M. Perez, E. Aguilera, D. Muse, R.B. Wicker, "3D Printing for the Rapid Prototyping of Structural Electronics," *IEEE Access*, Volume 2, 2014, pages 234-242 (DOI: 10.1109/ACCESS.2014.2311810).
78. D. Espalin, D W. Muse, F. Medina, E. MacDonald, R.B. Wicker, "3D Printing Multi-Functionality: Structures with Electronics," *International Journal of Advanced Manufacturing Technology*, Volume 72, 2014, pages 963-978 (DOI: 10.1007/s00170-014-5717-7).
79. D. Espalin, J. Ramirez, F. Medina, R. Wicker, "Multi-Material, Multi-Technology FDM: Exploring Build Process Variations," *Rapid Prototyping Journal*, Volume 20, Issue 3, 2014.
80. C.A. Terrazas, S.M. Gaytan, E. Rodriguez, D. Espalin, L.E. Murr, F. Medina, and R.B. Wicker, "Multi-material Metallic Structure Fabrication using Electron Beam Melting," *International Journal of Advanced Manufacturing Technology*, Volume 71, Issue 1-4, 2014, pages 33-45 (DOI: 10.1007/s00170-013-5449-0).
81. L.E. Murr, E. Martinez, X. Pan, C. Meng, J. Yang, S. Li, F. Yang, Q. Xu, J. Hernandez, W. Zhu, S.M. Gaytan, F. Medina, R.B. Wicker, "Microstructures and Properties of Solid and Reticulated Mesh Components of Pure Iron Fabricated by Electron Beam Melting," *Journal of Materials Research and Technology*, Volume 2, Issue 4, 2013, pages 376-385 (DOI: 10.1016/j.jmrt.2013.10.002).
82. J. Hernandez, S.J. Li, E. Martinez, L.E. Murr, X.M. Pan, K.N. Amato, X.Y. Cheng, F. Yang, C.A. Terrazas, S.M. Gaytan, Y.L. Hao, R. Yang, F. Medina, and R.B. Wicker, "Microstructures and Hardness Properties for β-Phase Ti-24Nb-4Zr-7.9Sn Alloy Fabricated by Electron Beam Melting," Journal of Materials Sicence Technology, Volume 29, Issue 11, 2013, pages 1011-1017.
83. D. Roberson, D. Espalin, R.B. Wicker, "3D Printer Selection: A Decision-making Evaluation and Ranking Model," *Virtual and Physical Prototyping*, Volume 8, Issue 3, 2013, pages 201-212.
84. R.C. Rumpf, J. Pazos, C.R. Garcia, L. Ochoa, R.B. Wicker, "3D Printed Lattices with Spatially Variant Self-Collimation," *Progress in Electromagnetics Research*, Volume 139, 2013, pages 1-14.
85. E. Martinez, L.E. Murr, J. Hernandez, X. Pan, K. Amato, P. Frigola, C. Terrazas, S. Gaytan, E. Rodriguez, F. Medina, R.B. Wicker, "Microstructures of Niobium Components Fabricated by Electron Beam Melting,", *Metallography, Microstructure, and Analysis*, Volume 2, 2013, pages 183-189 (DOI: 10.1007/s13632-013-0073-9).
86. L.E. Murr, E. Martinez, X.M. Pan, S.M. Gaytan, J.A. Castro, C.A. Terrazas, F. Medina, R.B. Wicker, D.H. Abbott, "Microstructures of Rene 142 Nickel-based Superalloy Fabricated by Electron Beam Melting," *Acta Materialia*, Volume 61, Issue 11, 2013, pages 4289-4296.
87. J. Mireles, H.C. Kim, I.H. Lee, D. Espalin, F. Medina, E. MacDonald, and R.B. Wicker, "Development of a Fused Deposition Modeling System for Low Melting Temperature Metal Alloys," *Journal of Electronic Packaging*, Volume 135, Issue 1, (011008), 2013, 6 pages, (doi:10.1115/1.4007160).
88. L.E. Murr, S. Gaytan, E. Martinez, F. Medina, and R.B. Wicker, "Next Generation Orthopaedic Implants by Additive Manufacturing Using Electron Beam Melting," *International Journal of Biomaterials*, Volume 2012, Article ID 245727, 14 pages (doi:10.1155/2012/245727), 2012.
89. X.Y. Cheng, S.J. Li, L.E. Murr, Z.B. Zhang, Y.L. Hao, R. Yang, F. Medina, and R.B. Wicker, "Compression Deformation Behavior of Ti-6Al-4V Alloy with Cellular Structures Fabricated by Electron Beam Melting", *Journal of the Mechanical Behavior of Biomedical Materials*, Volume 16, 2012, pages 153-162.

90. D.A. Roberson, R.B. Wicker, and E. MacDonald, "Ohmic Curing of Printed Silver Conductive Traces," *Journal of Electronic Materials*, 2012. (doi: 10.1007/s11664-012-2140-4).
91. L.E. Murr, S.M. Gaytan, D.A. Ramirez, E. Martinez, J. Hernandez, K.N. Amato, P.W. Shindo, F. Medina and R.B. Wicker, "Metal Fabrication by Additive Manufacturing Using Laser and Electron Beam Melting Technologies," *Journal of Materials Science and Technology,* Volume 28, Issue 1, 2012, pages 1-14.
92. R.B. Wicker and E.W. MacDonald, "Multi-Material, Multi-Technology Stereolithography," *Virtual and Physical Prototyping*, Volume 7, Number 3, 2012, pages 181-194.
93. K. Puebla, K. Arcaute, R. Quintana, and R.B. Wicker, "Effects of Environmental Conditions, Aging, and Build Orientations on the Mechanical Properties of ASTM Type I Specimens Manufactured via Stereolithography," *Rapid Prototyping Journal*, Volume 18, Issue 5, 2012, pages 374-388.
94. J. Hernandez, L.E. Murr, K.N. Amato, E. Martinez, P.W. Shindo, F. Medina, R.B. Wicker, S.J. Li, and X-Y. Cheng, "Microstructures and Properties for a Superalloy Powder Mixture Processed by Electron Beam Melting," *Journal of Materials Science Research*, Volume 1, Number 3, 2012, pages 124-144.
95. K. Puebla, L.E. Murr, S.M. Gaytan, E. Martinez, F. Medina, and R.B. Wicker, "Effect of Melt Scan Rate on Microstructure and Macrostructure for Electron Beam Melting of Ti-6Al-4V," *Materials Sciences and Applications*, Volume 3, 2012, pages 259-264.
96. L.E. Murr, S.M. Gaytan, E. Martinez, F. Medina, and R.B. Wicker, "Fabricating Functional Ti-Alloy Biomedical Implants by Additive Manufacturing using Electron Beam Melting," *Journal of Biotechnology and Biomaterials*, Volume 2, Issue 3, 1000131, 2012, 11 pages.
97. D.A. Roberson, R.B. Wicker, and E. MacDonald, "Microstructural Characterization of Electrically Failed Conductive Traces Printed from Ag Nanoparticle Inks," *Materials Letters*, Volume 76, 2012, pages 51-54.
98. A. Lopes, E. MacDonald, and R.B. Wicker, "Integrating Stereolithography and Direct Print Technologies for 3D Structural Electronics Fabrication," *Rapid Prototyping Journal*, Volume 18, Issue 2, 2012, pages 129-143.

    Recognized by Emerald Group Publishing as Outstanding Paper and received the Emerald Literati Network Awards for Excellence 2013

99. S.J. Li, L.E. Murr, X.Y. Cheng, Z.B. Zhang, Y.L. Hao, R. Yang, F. Medina, R.B. Wicker, "Compression Fatigue Behavior of Ti-6Al-4V Mesh Arrays Fabricated by Electron Beam Melting," *Acta Materialia*, Volume 60, Issue 3, 2012, pages 793-802.
100. M.D. Irwin, D.A. Roberson, R.I. Olivas, R.B. Wicker and E. MacDonald, "Conductive Polymer-Coated Threads as Electrical Interconnects in e-Textiles," *Fibers and Polymers,* Volume 12, Number 7, 2011, pages 904-910 (doi: 10.1007/s12221-011-0904-8).
101. D.A. Roberson, R.B. Wicker, L.E. Murr, K. Church, and E. MacDonald, "Microstructural and Process Characterization of Conductive Traces Printed from Ag Particulate Inks," *Materials*, Volume 4, Issue 6, 2011, pages 963-979 (doi:10.3390/ma4060963).
102. L.E. Murr, E. Martinez, S.M. Gaytan, D.A. Ramirez, B.I. Machado, P.W. Shindo, J.L. Martinez, F. Medina, J. Wooten, D. Ciscel, U. Ackelid, and R.B. Wicker, "Microstructural Architecture, Microstructures, and Mechanical Properties for a Nickel-Base Superalloy Fabricated by Electron Beam Melting," *Metallurgical and Materials Transactions A*, Volume 42, Issue 11, 2011, pages 3491-3508 (doi: 10.1007/s11661-011-0748-22011) (chosen by the Editors of Metallurgical and Materials Transactions to appear on Springer's website, SpringerLink, as a "Free Access" article).

103. L.E. Murr, K.N. Amato, S.J. Li, Y.X. Tian, X.Y. Cheng, S.M. Gaytan, E. Martinez, P.W. Shindo, F. Medina, and R.B. Wicker, "Microstructure and Mechanical Properties of Open-Cellular Biomaterials Prototypes for Total Knee Replacement Implants Fabricated by Electron Beam Melting," *Journal of the Mechanical Behavior of Biomedical Materials,* Volume 4, Issue 7, 2011, pages 1396-1411.
104. J.W. Choi, R. Quintana, R.B. Wicker, "Fabrication and Characterization of Embedded Horizontal Micro-channels using Line-scan Stereolithography," *Rapid Prototyping Journal*, Volume 17, Issue 5, 2011, pages 351-361.
105. M.S. Nuzzo, M. Posner, W.J. Warme, F. Medina, R.B. Wicker, and B.D. Owens, "Compression Force and Pullout Strength Comparison of Bioabsorbable Implants for Osteochondral Lesion Fixation," *The American Journal of Orthopedics*, Volume 40, Number 4, 2011, E61-63.
106. D.A. Ramirez, L.E. Murr, S.J. Li, Y.X. Tian, E. Martinez, J.L. Martinez, B.I. Machado, S.M. Gaytan, F. Medina, and R. B. Wicker, "Open-Cellular Copper Structures Fabricated by Additive Manufacturing using Electron Beam Melting," *Materials Science and Engineering A*, Volume 528, 2011, pages 5379-5386 (doi: 10.1016/j.msea.2011.03.053).
107. S.M. Gaytan, L.E. Murr, D.A. Ramirez, B.I. Machado, E. Martinez, D.H. Hernandez, J.L. Martinez, F. Medina, and R.B. Wicker, "A TEM Study of Cobalt-Base Alloy Prototypes Fabricated by EBM," *Materials Sciences and Applications*, Volume 2, 2011, pages 355-363 (doi: 10.4236/msa.2011.25046).
108. D.A. Ramirez, L.E. Murr, E. Martinez, D.H. Hernandez, J.L. Martinez, B.I. Machado, F. Medina, P. Frigola, and R.B. Wicker, "Novel Precipitate-Microstructural Architecture Developed in the Fabrication of Solid Copper Components by Additive Manufacturing Using Electron Beam Melting," *Acta Materiala*, Volume 59, Issue 10, June 2011, pages 4088-4099.
109. E.O. Kung, A.S. Les, F. Medina, R.B. Wicker, M.V. McConnell, C.A. Taylor, "In Vitro Validation of Finite-Element Model of AAA Hemodynamics Incorporating Realistic Outflow Boundary Conditions," *Journal of Biomechanical Engineering,* Volume 133, Issue 4, 041003 (11 pages), 2011 doi:10.1115/1.4003526.
110. E.O. Kung, A.S. Les, C.A. Figueroa, F. Medina, K. Arcaute, R.B. Wicker, M.V. McConnell, C.A. Taylor, "In Vitro Validation of Finite Element Analysis of Blood Flow in Deformable Models," *Annals of Biomedical Engineering,* Volume 39, Number 7, 2011, pages 1947-1960 (doi: 10.1007/s10439-011-0284-7).
111. A.J. Onstad, C.J. Elkins, F. Medina, R.B. Wicker, J.K. Eaton, "Full-field Measurements of Flow through a Scaled Metal Foam Replica," *Experiments in Fluids,* Volume 50, 2011, pages 1571-1585 (doi: 10.1007/s00348-010-1008-8).
112. R.F. Neville, C.J. Elkins, M.T. Alley, and R.B. Wicker, "Hemodynamic Comparison of Differing Anastomotic Geometries Using Magnetic Resonance Velocimetry," *Journal of Surgical Research,* Volume 169, Issue 2, August 2011, pages 311-318 (doi: 10.1016/j.jss.2009.12.008).
113. K. Arcaute, B.K. Mann, and R.B. Wicker, "Fabrication of Off-the-Shelf Multi-Lumen Poly(ethylene glycol) Nerve Guidance Conduits using Stereolithography," *Tissue Engineering Part C: Methods,* Volume 17, Number 1, 2011, pages 27-38 (doi:10.1089/ten.TEC.2010.0011).
114. J.W. Choi, F. Medina, C. Kim, D. Espalin, D. Rodriguez, B. Stucker, and R.B. Wicker, "Development of a Mobile Fused Deposition Modeling System with Enhanced Manufacturing Flexibility," *Journal of Materials Processing Technology*, Volume 211, 2011, pages 424-432. (2010; doi: 10.1016/j.jmatprotec.2010.10.019).
115. J.W. Choi, H.C. Kim, and R.B. Wicker, "Multi-Material Stereolithography," *Journal of Materials Processing Technology*, Volume 211, 2011, pages 318-328. (2010; doi: 10.1016/j.jmatprotec.2010.10.003).

116. S.M. Gaytan, L.E. Murr, E. Martinez, J.L. Martinez, B.I. Machado, D.A. Ramirez, F. Medina, S. Collins, and R.B. Wicker, "Comparison of Microstructures and Mechanical Properties for Solid and Mesh Cobalt-Base Alloy Prototypes Fabricated by Electron Beam Melting," *Metallurgical and Materials Transactions A*, Volume 41, Number 12, pages 3216-3227, 2010, doi: 10.1007/s11661-010-0388-y.
117. D.A. Roberson, E. MacDonald, K. Church, and R.B. Wicker, "Failure Investigation of Direct Write Pen Tips," *Journal of Failure Analysis and Prevention*, Volume 10, Number 6, 2010, pages 504-507 (doi: 10.1007/s11668-010-9387-y).
118. J.W. Choi, M. Yamashita, J. Sakakibara, Y. Kaji, T. Oshika, and R.B. Wicker, "Combined Micro and Macro Additive Manufacturing of a Swirling Flow Coaxial Phacoemulsifier Sleeve with Internal Micro-Vanes," *Biomedical Microdevices*, Volume 12, Number 5, 2010, pages 875-886 (doi: 10.1007/s10544-010-9442-1).
119. H.C. Kim, J.W. Choi, R.B. Wicker, "Development of a Multi-material Stereolithography System," *Journal of the Korean Society for Precision Engineering*, Volume 27, Number 3, 2010, pages 135-141 (In Korean).
120. D. Espalin, K. Arcaute, D. Rodriguez, F. Medina, M. Posner, and R.B. Wicker, "Fused Deposition Modeling of Patient-Specific Polymethylmethacrylate Implants," *Rapid Prototyping Journal*, Volume 16, Issue 3, 2010, pages 164-173.
121. L.E. Murr, S.M. Gaytan, F. Medina, H. Lopez, E. Martinez, B.I. Machado, D.H. Hernandez, L. Martinez, M.I. Lopez, R.B. Wicker, J. Bracke, "Next Generation Biomedical Implants Using Additive Layered Manufacturing of Complex, Cellular and Functional Mesh Arrays," *Philosophical Transactions of the Royal Society A*, Royal Society of London, Volume 368, Number 1917, 2010, pages 1999-2032 (doi:10.1098/rsta.2010.0010).
122. H. Kim, J.W. Choi, and R.B. Wicker, "Scheduling and Process Planning for Multi-Material Stereolithography," *Rapid Prototyping Journal*, Volume 16, Issue 4, 2010, pages 232-240.
123. H. Kim, J.W. Choi, E. MacDonald, and R.B. Wicker, "Slice Overlap Detection Algorithm for Process Planning in Multiple Material Stereolithography," *International Journal of Advanced Manufacturing Technology*, Volume 46, Issue 9, 2010, pages 1161-1170 (DOI: 10.1007/s00170-009-2181-x).
124. L.E. Murr, S.M. Gaytan, A. Ceylan, E. Martinez, J.L. Martinez, D.H. Hernandez, B.I. Machado, D.A. Ramirez, F. Medina, S. Collins, and R.B. Wicker, "Characterization of Titanium Aluminide Alloy Components Fabricated by Additive Manufacturing Using Electron Beam Melting," *Acta Materialia*, Volume 58, 2010, pages 1887-1894.
125. L.E. Murr, S.M. Gaytan, F. Medina, E. Martinez, J.L. Martinez, D.H. Hernandez, B.I. Machado, D.A. Ramirez, R.B. Wicker, "Characterization of Ti-6Al-4V Open Cellular Foams Fabricated by Additive Manufacturing Using Electron Beam Melting," *Materials Science and Engineering A*, Volume 527, 2010, pages 1861-1868.
126. K. Arcaute, B.K. Mann, and R.B. Wicker, "Stereolithography of Spatially-Controlled Multi-Material Bioactive Poly(ethylene glycol) Scaffolds," *Acta Biomaterialia*, Volume 6, 2010, pages 1047-1054. (DOI: 10.1016/j.actbio.2009.08.017).
127. R. Quintana, J.W. Choi, K. Puebla, and R.B. Wicker, "Effects of Build Orientation on Tensile Strength for Stereolithography Manufactured ASTM D-638 Type I Specimens," *International Journal of Advanced Manufacturing Technology*, Volume 46, Numbers 1-4, 2010, pages 201-215 (DOI: 10.1007/s00170-009-2066-z).
128. J.W. Choi, E. MacDonald, R.B. Wicker, "Multi-Material Microstereolithography," *International Journal of Advanced Manufacturing Technology*, Volume 49, Issue 5, 2010, pages 543-551 (DOI: 10.1007/s00170-009-2434-8).

129. S.M. Gaytan, L.E. Murr, F. Medina, E. Martinez, M.I. Lopez and R.B. Wicker, "Advanced Metal Powder Based Manufacturing of Complex Components by Electron Beam Melting," *Materials Technology*, Volume 24, Number 3, 2009, pages 180-190 (DOI: 10.1179/106678509x12475882446133).
130. J.W. Choi, R.B. Wicker, S.H. Lee, K.H. Choi, I.D. Jung, C.S. Ha, and I. Chung, "Fabrication of 3D Biocompatible/Biodegradable Micro-Scaffolds using Dynamic Mask Projection Microstereolithography," *Journal of Materials Processing Technology*, Volume 209, 2009, pages 5494-5503 (DOI: 10.1016/j.jmatprotec.2009.05.004).
131. L.E. Murr, S.M. Gaytan, M.I. Lopez, E. Martinez, F. Medina, R.B. Wicker, "Metallographic Characterization of Additive-Layer Manufactured Products by Electron Beam Melting of Ti-6Al-4V Powder," *Practical Metallography (invited paper for issue dedicated to George Vander Voort for his 65th birthday)*, Volume 46, September 2009, pages 442-453. (in English and German).
132. J.W. Choi, R.B. Wicker, C.S. Ha, and S.H. Lee, "Cure Depth Control for Complex 3D Microstructure Fabrication in Dynamic Mask Projection Microstereolithography," *Rapid Prototyping Journal*, Volume 15, Issue 1, 2009, pages 59-70.
133. L.E. Murr, S.A. Quinones, S.M. Gaytan, M.I. Lopez, A. Rodela, E.Y. Martinez, D.H. Hernandez, E. Martinez, F. Medina, and R.B. Wicker, "Microstructure and Mechanical Behavior of Ti-6Al-4V Produced by Rapid-Layer Manufacturing, for Biomedical Applications" *Journal of the Mechanical Behavior of Biomedical Materials*, Volume 2, Issue 1, 2009, pages 20-32 (DOI: 10.1016/j.jmbbm.2008.05.004).
134. L.E. Murr, E.V. Esquivel, S.A. Quinones, S.M. Gaytan, M.I. Lopez, E.Y. Martinez, F. Medina, D.H. Hernandez, E. Martinez, J.L. Martinez, S.W. Stafford, D.K. Brown, T. Hoppe, W. Meyers, U. Lindhe, and R.B. Wicker, "Microstructures and Mechanical Properties of Electron Beam-Rapid Manufactured Ti-6Al-4V Biomedical Prototypes Compared to Wrought Ti-6Al-4V," *Materials Characterization*, Volume 60, 2009, pages 96-105 (DOI: 10.1016/j.matchar.2008.07.006).
135. K. Arcaute and R.B. Wicker, "Patient-Specific Compliant Vessel Manufacturing Using Dip-Spin Coating of Rapid Prototyped Molds," *ASME Journal of Manufacturing Science and Engineering*, 2008, Volume 130, Issue 5, 051008, 13 pages (DOI: 10.1115/1.2898839).
136. J.H. Sandoval, L.E. Murr, K.F. Soto, and R.B. Wicker, "Nanotailoring Photocrosslinkable Epoxy Resins with Multi-Walled Carbon Nanotubes for Stereolithography Layered Manufacturing," *Journal of Materials Science*, 2007, Volume 42, Number 1, pages 156-165 (DOI: 10.1007/s10853-006-1035-2).
137. M.A. Cortez, R. Quintana, and R.B. Wicker, "Multi-Step Dip Spin Coating Manufacturing System for Silicone Cardiovascular Membrane Fabrication with Prescribed Compliance," *International Journal of Advanced Manufacturing Technology*, 2007, Volume 34, pages 667-679 (DOI: 10.1007/s00170-006-0649-5).
138. K. Arcaute, B.K. Mann, and R.B. Wicker, "Stereolithography of Three-Dimensional Bioactive Poly(Ethylene Glycol) Constructs with Encapsulated Cells," *Annals of Biomedical Engineering*, Volume 34, Number 9, 2006, pages 1429-1441 (DOI: 10.1007/s10439-006-9156-y).
139. J.H. Sandoval and R.B. Wicker, "Functionalizing Stereolithography Resins: Effects of Dispersed Multi-Walled Carbon Nanotubes on Physical Properties," *Rapid Prototyping Journal*, Volume 12, Issue 5, 2006, pages 292-303.

140. J.A. Palmer, B. Jokiel, C.D. Nordquist, B.A. Kast, C.J. Atwood, E. Grant, F.J. Livingston, F. Medina, and R.B. Wicker, "Mesoscale RF Relay Enabled by Integrated Rapid Manufacturing," *Rapid Prototyping Journal*, Volume 12, Issue 3, 2006, pages 148-155.

    Recognized by Emerald Group Publishing as Outstanding Paper and received the Emerald Literati Network Awards for Excellence 2007

141. R.B. Wicker, A. Ranade, F. Medina, and J.A. Palmer, "Embedded Micro-Channel Fabrication using Line-Scan Stereolithography," *Assembly Automation*, Volume 25, Issue 4, 2005, pages 316-329.
142. C.J. Elkins, M. Markl, A. Iyengar, R.B. Wicker, and J.K. Eaton, "Full Field Velocity and Temperature Measurements Using Magnetic Resonance Imaging in Turbulent Complex Internal Flows," *International Journal of Heat and Fluid Flow*, Volume 25, 2004, pages 702-710.
143. B. Diong, R.B. Wicker, C. Kubo Della-Piana, and R. Quintana "A Laboratory Designed to Enhance Students' Interest in and Learning of Controls," *International Journal for Engineering Education*, Volume 20, Number 4, June 2004, pages 628-637.
144. B. Diong, M. Perez, C. Kubo Della-Piana and R.B. Wicker, "Remote Experimentation with a Wind Tunnel System for Controls Education," *International Journal for Engineering Education*, Volume 19, Number 3, June 2003, pages 460-467 (invited paper for special issue entitled Distance Controlled Laboratories and Learning Systems).
145. M. Markl, F.P. Chan, M.T. Alley, K.L. Wedding, M.T. Draney, C.J. Elkins, D.W. Parker, R.B. Wicker, C.A. Taylor, R.J. Herfkens, and N.J. Pelc, "Time Resolved Three Dimensional Phase Contrast MRI (4D-Flow): Assessment of Three Directional Velocity Vector Fields," *Journal of Magnetic Resonance Imaging*, Volume 17, March 2003, pages 499-506.
146. R.B. Wicker and J.K. Eaton "Structure of a Swirling Recirculating Coaxial Free Jet and Its Effect on Particle Motion," *International Journal of Multiphase Flow*, Volume 27, Number 6, 2001, pages 949-970.
147. R.B. Wicker, H.I. Loya, P.A. Hutchison, J. Sakakibara, "SIDI Fuel Spray Structure Investigation Using Flow Visualization and Digital Particle Image Velocimetry," *1999 SAE Transactions – Journal of Fuels and Lubricants*, Section 4, October 2000, pages 1620 - 1630 (also *SAE Paper 1999-01-3535* and SAE SP-1481; original refereed paper presented at *1999 SAE International Fall Fuels & Lubricants Meeting & Exposition*, October 25-28, Toronto, Ontario, Canada, 1999).
148. R.B. Wicker and R. Quintana "An Innovation-Based Fluid Mechanics Design and Fabrication Laboratory," *Journal of Engineering Education*, Volume 89, Number 3, July 2000, pages 361-368.
149. R.B. Wicker and H.I. Loya "A Vision-Based Experiment for Mechanical Engineering Laboratory Courses," *International Journal of Engineering Education*, Volume 16, Number 3, 2000, pages 193-201.
150. R.B. Wicker and J.K. Eaton "Effect of Injected Longitudinal Vorticity on Particle Dispersion in a Swirling, Coaxial Jet," *Journal of Fluids Engineering*, Volume 121, Number 4, December 1999, pages 766-772.
151. B.R. Lutz, R.H. Stanglmaier, R.D. Matthews, J. Cohen, and R.B. Wicker "The Effects of Fuel Composition, System Design, and Operating Conditions on In-System Vaporization and Hot Start of a Liquid-Phase LPG Injection System," *1998 SAE Transactions - Journal of Fuels and Lubricants*, Volume 107, 1999 (also *SAE Paper 981388* and *SAE SP-1371*, original refereed paper presented at the *1998 SAE International Spring Fuels & Lubricants Meeting & Exposition*, May 4-6, 1998).

152. R.B. Wicker, R. Quintana, and A. Tarquin "An Evaluation Model Using the Fundamentals of Engineering Examination," *Journal of Professional Issues in Engineering Education and Practice*, Volume 125, Number 2, April 1999, pages 47-55.
153. R.D. Matthews, J. Chiu, J. Zheng, D.-Y. Wu, D. Dardalis, K. Shen, C. Roberts, M.J. Hall, J.L. Ellzey, C. Mock, R.B. Wicker, and S. Jaeger "The Texas Project: Part1 -- Emissions and Fuel Economy of Aftermarket CNG and LPG Conversions of Light Duty Vehicles," *1996 SAE Transactions - Journal of Fuels and Lubricants*, Volume 105, 1997, pages 2186-2205. (also *SAE Paper 962098 and SAE SP-1208*, original refereed paper presented at *1996 SAE International Fall Fuels & Lubricants Meeting & Exposition*, October 14-17, 1996).
154. J. Sakakibara, R.B. Wicker, and J.K. Eaton "Measurements of the Particle-Fluid Velocity Correlation and the Extra Dissipation in a Round Jet," *International Journal of Multiphase Flow*, Volume 22, Number 5, September 1996, pages 863-881.
155. R.B. Wicker and J.K. Eaton "Near Field of a Coaxial Jet With and Without Axial Excitation," *AIAA Journal*, Volume 32, Number 3, March 1994, pages 542-546.

BOOK CHAPTERS

1. C.A. Terrazas, M.S. Hossain, Y. Lin, R.B. Wicker, "Multicomponent and Multimaterials Printing: A Case Study of Embedded Ceramic Sensors in Metallic Pipes," https://doi.org/10.1002/9781119560807.ch5, Chapter 5 in: 3D Printing for Energy Applications, Editor(s): Albert Tarancón, Vincenzo Esposito, 2021, Print ISBN:9781119560753, Online ISBN:9781119560807, DOI:10.1002/9781119560807, The American Ceramic Society.
2. 3D Printing in Space, National Academies Press, 2014, ISBN: 978-0-309-31008-6 (106 pages) – Member (R.B. Wicker) of Committee on Space-Based Additive Manufacturing.
3. K. Arcaute, B.K. Mann and R.B. Wicker, "Practical Use of Hydrogels in Stereolithography for Tissue Engineering Applications," Chapter in: Stereolithography: Materials, Processes and Applications, a book edited by Professor Paulo Bártolo, 2011 (ISBN: 978-0-387-92903-3).

PROFESSIONAL TRADE MAGAZINE ARTICLES

1. D. Roberson, D. Espalin, R. Wicker, "Expanding the Impact of Polymeric-based 3D Printing Technologies," PlasticsTrends, 2015.
2. A. Choudhuri and R. Wicker, "Energy Engineering with Frontier Additive Manufacturing," Aerospace America, December 2015, pp. 59.
3. R. Hennessey, H. Loya, B. Diong, and R. Wicker "Using LabVIEW to Develop an Automatic Control System," Instrumentation Newsletter, Special Academic Edition, First Quarter 2001, National Instruments, 2001, pages A1-A2.

CONFERENCE AND OTHER PUBLICATIONS

*My center is active in presenting at national and international conferences, and we have produced hundreds of refereed and non-refereed conference publications. These publications are most importantly to provide students with opportunities to engage with the community and present their

research results as well as for those in the center to network nationally and internationally. A list of these publications can be provided upon request.

SELECT PRESENTATIONS

*I have presented many talks at technical conferences, other institutions, corporations, university events and various organizations. The abbreviated list below includes invited presentations on additive manufacturing.

1. R.B. Wicker, invited speaker (virtual), "Building an Academic Additive Manufacturing Enterprise," Pacific Northwest National Laboratory, March 17, 2021.
2. R.B. Wicker, invited speaker (virtual), National Academies of Sciences, Engineering, and Medicine, Board on Higher Education and Workforce, Defense Research at Historically Black Colleges and Universities and other Minority Institutions, Third Public Information-Gathering Meeting Session, Tuesday, February 16, 2021.
3. R.B. Wicker, invited speaker, "A Fireside Chat with Todd Grimm – Defining the Future of Additive: Why Dyndrite? Why now?," Dyndrite Corporation, October 7, 2020.
4. R.B. Wicker, invited speaker, "Building an Academic Additive Manufacturing Enterprise," Aerospace Corporation, August 25, 2020.
5. R.B. Wicker, Welcoming Address, ASTM CoE 3rd Snapshot Workshop, February 2020.
6. R.B. Wicker, invited panel speaker, Panel on Regional Economic Development – Technology Across Borders, Mexico-U.S. Sister Cities Mayors' Summit, February 28, 2020.
7. R.B. Wicker, invited speaker, "Optimize for Additive - Process Optimization," Colorado School of Mines, ADAPT Optimize for Additive Workshop, 2019.
8. R.B. Wicker, invited speaker, "Manufacturing of Functional Ceramics – Ongoing Research Progress and Directions," NIST, November 2019.
9. R.B. Wicker, invited speaker, "Potential Partnerships in Additive Manufacturing," U.S. Army ARDEC, Picatinny Arsenal, New Jersey, August 2018.
10. R.B. Wicker, invited speaker, "Expanding Additive Manufacturing NASA/UTEP Partnership," NASA Marshall Space Flight Center, Huntsville, Alabama, May 2018.
11. R.B. Wicker, invited speaker, "Frontiers in Additive Manufacturing: Components to Complex Multi-functional, Multi-material Systems," Gordon Research Conference, Ventura, CA, January 16, 2018.
12. R.B. Wicker, invited speaker, "Increasing Component Functionality via Multi-Process Additive Manufacturing," SPIE, 2017.
13. R.B. Wicker, invited speaker, "Frontiers in Additive Manufacturing: Technologies and Applications," U.S. Patent and Trademark Office, June 28, 2017.
14. R.B. Wicker, invited speaker, "Frontiers in Additive Manufacturing: Technologies and Applications," GN Resound, Ballerup, Denmark, October 25, 2017.
15. R.B. Wicker, invited speaker, "Printing Multi-Functionality using Additive Manufacturing," The Lithography Workshop, Hapuna Resort, Kamuela HI, November 6-10, 2016.
16. R.B. Wicker, invited speaker, "Increasing Component Functionality via Multi-Process Additive Manufacturing," The Sixth Annual Karles Invitational Conference on Additive Manufacturing, Naval Research Laboratory, August 10-11, 2016.
17. R.B. Wicker, invited speaker, "You can print that?" 49th Chancellor's Council Annual Meeting and Symposium, University of Texas, May 6, 2016, Austin, Texas.

18. R.B. Wicker, invited speaker, "Exploring New Frontiers in Metals Additive Manufacturing: From Electron Beams to Lasers" AKL '16 International Laser Technology Congress, April 25-27, 2016, Aachen, Germany.
19. R.B. Wicker, invited speaker, "Welcome to UTEP," America Makes Technical Review and Exchange (TRX) meeting, University of Texas El Paso, March 8-9, 2016, El Paso, Texas.
20. R.B. Wicker, invited speaker, "Improved Part Production using Layerwise Monitoring and Control in Metallic Powder Bed Fusion Additive Manufacturing Processes," TMS 2016 145th Annual Meeting & Exhibition, February 14-18, 2016, Nashville, Tennessee.
21. R.B. Wicker, invited speaker, "Printing Multi-Functionality using Additive Manufacturing," AVS 62nd International Symposium & Exhibition, San Jose Convention Center, October 18-23, 2015, San Jose, California.
22. R.B. Wicker, invited speaker, "Additive Manufacturing / 3D Printing: A Nexus of Opportunity," Presentation to the University of Texas System Board of Regents, August 19, 2015, Austin, Texas.
23. R.B. Wicker, invited speaker, "R&D Horizons in Additive Manufacturing," 2nd Additive Disruption Summit, March 31-April 2, 2015, Santa Clara Convention Center, Santa Clara, California.
24. R.B. Wicker, invited speaker and panelist on advanced manufacturing, University of Virginia Conference on National Defense and Intelligence, June 15-16, 2014.
25. R.B. Wicker, "Multi-Functional Printing through Additive Manufacturing," invited speaker and panelist, Additive Manufacturing Summit, Oak Ridge National Laboratory, Oak Ridge, Tennessee, May 13-15, 2014.
26. R.B. Wicker, "Additive Manufacturing of Multi-Functional Products", invited speaker, Society of Plastics Engineers (SPE ANTEC 2014) forum on New Frontiers in Additive (3D) Manufacturing, April 28-30, 2014 Las Vegas, Nevada.
27. R.B. Wicker, "3D Printing (aka Additive Manufacturing): From Prototypes to Uniquely Designed Production Parts", invited speaker, International Conference on Metallurgical Coatings and Thin Films (ICMCTF) 2014, April 28-May 2, 2014, San Diego, California.
28. R.B. Wicker, "Frontiers in Additive Manufacturing (aka 3D Printing): Expanding Multi-Disciplinary Horizons", invited talk, University of Minnesota IPrime Mid-Year Workshop on 3D Printing and Additive Manufacturing, January 14, 2014, Minneapolis, Minnesota.
29. R.B. Wicker, "The Next Big Step Changes in Innovation", invited panel speaker, FBR 3D Printing Conference: Additive Manufacturing's Next Inflection Point (FBR Capital Markets and Co.), December 9, 2013, The New York Palace Hotel, New York.
30. R.B. Wicker, "Frontiers in Additive Manufacturing: Printing Multi-Functionality", plenary speaker, The International Conference on Advanced Research in Virtual and Rapid Prototyping (VRAP 2013), October 1-5, 2013, Leiria, Portugal.
31. R.B. Wicker, "Printing Multi-Functionality with Multi-Technology Additive Manufacturing", plenary speaker, NSF Workshop on Frontiers of Additive Manufacturing Research and Education, July 11-12, 2013, Hilton Hotel, Arlington, Virginia.
32. R.B. Wicker, "Additive Manufacturing University-Industry Collaborations in the United States", invited talk, *University of Nottingham,* Ningbo, China, June 8, 2013.
33. R.B. Wicker, "3D Structural Electronics", invited talk, *Additive Manufacturing Consortium Spring Meeting,* (a consortium led by EWI of Columbus, Ohio), meeting held at the University of Texas at El Paso, May 1-2, 2013.

34. R.B. Wicker, "Multi-Material, Multi-Technology Additive Manufacturing," *Honeywell Additive Manufacturing Technical Excellence Global Training Presentation* (monthly meeting), April 1, on-line, 2013.
35. R.B. Wicker, "Multi-Material, Multi-Technology Additive Manufacturing", invited talk, *Technology Exchange on Additive Manufacturing* (Sponsored by the DARPA Open Manufacturing and the Penn State Center for Innovative Materials Processing through Direct Digital Deposition (CIMP-3D), January 9, 2013, Penn Stater Conference Center and Hotel, State College PA.
36. R.B. Wicker, "State-of-the-Art in Additive Manufacturing (aka 3D Printing)", invited talk, *NeXTech Project - The Adversary*, Monterey, California, November 15-16, 2012.
37. R.B. Wicker, "Additive Manufacturing (3D Printing): Reenergizing America", *Reenergize the Americas 2012*, Session on Regional Capacities in Advanced Energy Engineering Research and Development, Las Cruces, New Mexico, October 16-18, 2012.
38. R.B. Wicker, "Keck Center Research Overview", invited talk, *Raytheon Additive Manufacturing Workshop*, Tucson, Arizona, October 11, 2012.
39. R.B. Wicker, "Additive Manufacturing Processes and Possibilities: A National Interest Worthy of Investment?", invited talk, NeXTech Project - The US Warfighter, US Army War College, Carlisle, PA, August 14-15, 2012.
40. R.B. Wicker, "Additive Manufacturing: A Nexus for Transformation," invited talk, 2012 Solid Freeform Fabrication Symposium, Austin, Texas, August 6-8, 2012.
41. R.B. Wicker, "Multi-Material, Multi-Function, Multi-Technology Additive Manufacturing: Is this Real?", invited talk, International Conference on Additive Manufacturing, Nottingham, England, July 10-11, 2012.
42. R.B. Wicker, "Frontiers in Additive Manufacturing: Can We Print Anything?" invited talk, 2011 Whitney Symposium: Manufacturing in the 21st Century, GE Global Research, Niskayuna, New York, October 24-26, 2011.
43. R.B. Wicker, "Frontiers in Additive Manufacturing," invited talk, Korean Society for Precision Engineering 2011 Spring Conference, Jeju Island, South Korea, June 1-3, 2011 (talk on June 3, 2011).
44. R.B. Wicker, "Multi-Material Manufacturing using Additive Manufacturing," invited talk, DARPA sponsored Information Science and Technology (ISAT) workshop on "Future Manufacturing", Disneyland Hotel, Anaheim, CA, May 20-21, 2010.
45. R.B. Wicker, "Medical Frontiers in Additive Manufacturing," invited talk, Building Partnerships and Pathways to Address Engineering Grand Challenges Conference (sponsored by the National Science Foundation), University of Texas at El Paso, February 8-10, 2010.
46. R.B. Wicker, "Additive Manufacturing Research and Technology Development within the Keck Center for 3D Innovation," invited talk, Mechanical Engineering Department, Pusan National University, September 4, 2009, Busan, South Korea.
47. R.B. Wicker, "Additive Layer-based Fabrication Methods for Complex, Multi-Material 3D Scaffold Fabrication," Tissue Engineering and Regenerative Medicine International Society (TERMIS) World Congress 2009, August 31 - September 3, 2009, Seoul, S. Korea. (Keynote presentation on September 2).
48. R.B. Wicker, "Additive Layered Manufacturing of Complex Integrated Defense and Space Systems," invited talk, Raytheon Integrated Defense Systems, December 2, 2008, Boston, MA.
49. R.B. Wicker, "Additive Layered Manufacturing Methods for Complex 3D Scaffold Fabrication," invited talk, *2008 Materials Research Society Fall Meeting*, December 2, 2008, Boston, MA.

50. R.B. Wicker, "Additive Layered Manufacturing of Complex Integrated Defense and Space Systems," invited talk, *Raytheon Mechanical and Materials Symposium*, Westin Park Central Hotel, September 17, 2008, Dallas, TX.
51. R.B. Wicker, "Layered Manufacturing of Complex Integrated Defense and Space Systems," Lockheed Martin Aeronautics, August 27, 2008, Palmdale, CA.
52. R.B. Wicker, "Direct Digital Manufacturing," Stratasys North American Sales Meeting, Hilton Garden Inn, June 17, 2008, El Paso, Texas.
53. R.B. Wicker, "Biomedical Frontiers in Additive Layered Manufacturing," Keynote Address at the 2008 Southern Biomedical Engineering Society, April 18-20, 2008, El Paso, Texas.
54. R.B. Wicker, "Layered Manufacturing of Complex Integrated Defense and Space Systems," Sandia National Laboratories, February 13, 2008.
55. R.B. Wicker, "Improving Patient Outcomes through Layered Manufacturing," Bioengineering Seminar, Columbia University, New York City, New York, December 13, 2007.
56. R.B. Wicker, "Improving Patient Outcomes through Layered Manufacturing," Advances in Oncology Institutional Grand Rounds, University of Texas M D Anderson Cancer Center, Hickey Auditorium, August 17, 2007.
57. R.B. Wicker, "Important Fluid Mechanic Considerations in Cardiovascular Hemodynamics," Society for Clinical Vascular Surgery, Gore Lunch Symposium on "Controversies in Below-Knee Bypass Solutions," Walt Disney World Resort, Orlando, FL, March 22, 2007.
58. R.B. Wicker, "Improving Medical Outcomes through Rapid Prototyping," invited presentation, Cancer Survivors Support Group, Sierra Medical Center, El Paso, Texas, February 13, 2007.
59. R.B. Wicker, "Unique Biomedical Engineering Research and Outreach at UTEP," invited presentation, Las Amigas Study Club, El Paso, Texas, April 5, 2006.
60. R.B. Wicker, "Medical Frontiers in Rapid Prototyping," invited presentation, Mayo Clinic, Biomedical Engineering Seminar, Rochester, Minnesota, February 17, 2006.
61. R.B. Wicker, "Unique Advantages of Stratasys: A Customer's Perspective" 2006 Global FDM Sales Conference, Stratasys, Inc., San Francisco, CA, January 22-26, 2006.
62. R.B. Wicker, "Medical Frontiers in Rapid Prototyping: Applications in Cardiovascular Research," invited presentation, W.L. Gore & Associates, Flagstaff, Arizona, October 14, 2005.
63. R.B. Wicker, F. Medina, and R.E. Hennessey, "Functional Integrated Layered Manufacturing," invited presentation, Sandia National Laboratories IMOG Solid Freeform Fabrication Conference (internal DOE meeting) July 28, 2005, Sandia National Laboratories Building 878/A218S3D, Albuquerque, NM.
64. R.B. Wicker, "Multiple Material Stereolithography," 3D Systems North American Stereolithography and Selective Laser Sintering Users Group Conference, Tucson, Arizona, April 3-8, 2005.
65. R.B. Wicker, "Medical and Micro-Fabrication Rapid Prototyping Applications," invited presentation, TerraHealth and The DiLuzzio Group, San Antonio, Texas, March 21, 2005.
66. R.B. Wicker, "Medical Frontiers in Rapid Prototyping," invited presentation, University of Texas Health Science Center at Houston, Houston, Texas, March 17-18, 2005.
67. R.B. Wicker, "Expanding Horizons for Rapid Prototyping into Tissue Engineering, Rapid Iterative Design, Micro-Device Fabrication and Other Novel Applications," University of Texas at Austin, Mechanical Engineering Department Seminar, November 5, 2004.
68. R.B. Wicker, "The UTEP W.M. Keck Laboratory's Commitment to El Paso through Outreach and Economic Development," invited presentation to the Greater El Paso Association of Realtors, Commercial Investors Division, El Paso, TX, August 19, 2004.

69. R.B. Wicker, "Veins, Planes and Automobiles," 2004 Joint SLA/SLS Users Group Conference, Anaheim Hilton, Anaheim, CA, April 25-29, 2004.
70. R.B. Wicker, "Scientific and Medical Frontiers in Rapid Prototyping," invited presentation to Mechanical and Materials Engineering Faculty, Washington State University, Pullman, Washington, March 25, 2004.
71. R.B. Wicker, "Medical Frontiers in Rapid Prototyping," invited presentation to Delta Kappa Gamma--Honorary Society of Outstanding Teachers (Joint meeting of Delta Nu and Eta Kappa Chapters), El Paso Country Club, March 6, 2004.
72. R.B. Wicker, "Building a Successful University Engineering Laboratory Focused on Health Care," invited presentation to Downtown Rotary Club of El Paso, October 23, 2003.
73. R.B. Wicker, "Micro-Stereolithography using the Commercially Available 3D Systems Viper si2 Rapid Prototyping Machine," Sandia National Laboratories, October 22, 2003.
74. R.B. Wicker, "Building a Diverse Biomedical Program Using Rapid Prototyping," invited presentation to UTSA Bioengineering Faculty, Students, and Affiliates, October 14, 2003.
75. R.B. Wicker, "Building a Diverse Biomedical Research, Teaching, Outreach, and Entrepreneurship Program Using Rapid Prototyping," invited presentation to faculty in Mechanical, Industrial, and Bioengineering at Arizona State University, May 9, 2003.
76. R.B. Wicker, "Pre-Surgical Biomedical Modeling Applications Using Rapid Prototyping," presentation to Camino Real Angels, April 17, 2003.
77. R.B. Wicker, "Improved Pre-Surgical Visualization Using Rapid Prototyping," invited presentation to the El Paso P.E.O. Chapter DR, March 10, 2003.
78. R.B. Wicker, "Rapid Prototyping in Surgery: One Role for Engineers to Improve Health Care," Keynote Address at the 4th Annual University of Texas System Louis Stokes Alliance for Minority Participation Conference, El Paso, Texas, October 3, 2002.
79. R.B. Wicker, "Can Engineers Improve Health Care?" invited presentation to Sunrise Rotary Club of El Paso, May 29, 2002.
80. R.B. Wicker, "Biomedical Modeling within the W.M. Keck Border Biomedical Manufacturing and Engineering Laboratory," UTEP Graduate Seminar, September 26, 2002.
81. R.B. Wicker, "Establishment of the W.M. Keck Border Biomedical Manufacturing and Engineering Laboratory," presentation to Ms. Mercedes Talley of the W.M. Keck Foundation of Los Angeles during Keck site visit October 11, 2001.

RESEARCH ACTIVITY

SPONSORED POST-DOCTORAL SCHOLARS

1. Carlos Orquiz, Ph.D. (2021-present)
2. Edel Arrieta, Ph.D. (2018-2019)
3. Carlos Diaz, Ph.D. (2017-2019)
4. Chiyen Kim, Ph.D. (2013-2018)
5. Sara Gaytan, Ph.D. (2012-2014)
6. Karina Arcaute, Ph.D. (2009-2011)
7. Michael Irwin, Ph.D. (2009-2011)
8. Jae-Won Choi, Ph.D. (2007-2011)
9. Shine Joseph, Ph.D. (2006-2007)
10. John Bang, M.D., Ph.D. (2004-2005)

VISITING FACULTY RESEARCHERS

1. Professor Hochan Kim, Ph.D. (2009-2010)

2. Professor In-Hwan Lee, Ph.D. (2010-2011)
3. Professor Jun Sakakibara, Ph.D.
4. Professor Brenda Mann, Ph.D.

KECK RECHARGE CENTER OVERVIEW

In 2004, a recharge center (cost center) was established within the Keck Center to provide contractual engineering and manufacturing services to industry, government agencies, and universities. Through these services, unique educational opportunities are provided to students in an industrial-type setting, while allowing the technology developed in the center to be tested and available to external clients. The recharge center also provides a mechanism for commercial ventures between UTEP and industry, enabling the Keck Center to utilize its intellectual property, expertise, and infrastructure to provide contractual services that in whole or in part pay for student salaries, laboratory equipment, maintenance, and materials. To date, the Keck Center has worked with more than 100 companies and entrepreneurs and maintains an active base of more than 50 clients.

Summary of *Keck Recharge Center* Contractual Services

04/05	$66,072
05/06	$177,004
06/07	$234,946
07/08	$298,243
08/09	$231,653
09/10	$221,918
10/11	$379,811
11/12	$429,733
12/13	$615,605
13/14	$855,332
14/15	$498,463
15/16	$566,933
16/17	$536,907
17/18	$618,762
18/19	$797,210
19/20	$556,406
20/21	$402,550
Total (through Aug 2021)	**$7,421,476**

SPONSORED PROJECTS

Chronological List of Sponsored Projects

*Managed in excess of $40M as PI in sponsored projects (of more than $150M in total combined impact as PI and Co-PI)

1. Final DRIVE AM (PI: Ryan Wicker, Co-PIs: David Espalin, Francisco Medina, Ahsan Choudhuri)
   Agency: Air Force Research Laboratory (through National Center for Defense Manufacturing and Machining)
   Period: 9-1-2022 through 8-31-2024
   Amount Awarded: $1.2M, pending award

2. Aerospace and Defense Innovation Network for Manufacturing (PI: Ahsan Choudhuri, Co-PI: Ryan Wicker)
   Agency: US Economic Development Administration
   Period: 5 year award (notified by EDA intent to award)
   Amount Awarded: $40M ($81.75M total, $40M EDA, $26.5M cash, $13 million in-kind City of El Paso, $1.875M cash from County of El Paso, pending award)
3. Reclaiming Aerospace and Defense Manufacturing Dominance through Frontier Technologies (PI: Ahsan Choudhuri, Co-PI: Ryan Wicker)
   Agency: US Economic Development Administration
   Period: 12-15-21 through 12-14-23
   Amount Awarded: $500,000
4. El Paso Makes: Aerospace and Defense Supply Chain Innovation Network for Manufacturers (PI: Ahsan Choudhuri, Co-PI: Ryan Wicker)
   Agency: US Economic Development Administration
   Period: 10-1-21 through 9-30-24
   Amount Awarded: $1.5M (plus $1.5M match from City of El Paso)
5. MRI: Acquisition of Open-Source Electron Beam Powder Bed Fusion Platform to Expand Advanced Manufacturing Research and Education (PI: Francisco Medina, Co-PIs: Ryan Wicker, Yirong Lin, Eric MacDonald)
   Agency: National Science Foundation
   Period: 8-15-21 through 7-31-23
   Amount Awarded: $400,728
6. Hypersonics Enabling Additive Manufacturing (PI: Ahsan Choudhuri, CoPI: Ryan Wicker)
   Agency: Air Force Research Laboratory (through National Center for Defense Manufacturing and Machining)
   Period: 8-11-21 through 8-10-23
   Amount Awarded: $3M
7. Advancing DRIVE AM: Driving Research, Innovation, and Value through Education in Additive Manufacturing (PI: Ryan Wicker, Co-PIs: Ahsan Choudhuri, Francisco Medina, David Espalin)
   Agency: Air Force Research Laboratory (through National Center for Defense Manufacturing and Machining)
   Period: 8-1-21 through 9-30-23
   Amount Awarded: $8.9M ($1M cost share)
8. DRIVE AM Task 7: Digital Engineering Aerospace and Defense Design Center @El Paso and @Youngstown (PI: Ahsan Choudhuri, CoPI: Ryan Wicker)
   Agency: Air Force Research Laboratory (through National Center for Defense Manufacturing and Machining)
   Period: 8-1-21 through 8-31-23
   Amount: $3.9M
9. Powder Bed Fusion Build Layout, Test Array and Demonstration Build for EB-PBF Technical Publication (PI: Francisco Medina, Co-PI: Ryan Wicker)
   Agency: Air Force Office of Scientific Research (through Edison Welding Institute)
   Period: 2-5-21 through 9-30-21
   Amount Awarded: $206,337

10. Global Test Artifact Data Exchange Program (GTADExP, PI: Ryan Wicker)
    Agency: National Institute of Standards and Technology
    Period: 1-1-2021 through 12-31-2022
    Amount Awarded: $1,000,000

11. Selective Laser Sintering of High Performance Thermoplastics and Thermosets (PI, Yirong Lin, Co-PIs, Ryan Wicker, David Espalin)
    Agency: U.S. Department of Energy, Kansas City National Security Campus
    Period: 11-17-20 through 8-31-21
    Amount Awarded: $82,400

12. Thermal Aging Study for Additively Manufactured F357 Aluminum (PI, Francisco Medina, Co-PIs, David Espalin, Cesar Terrazas, Ryan Wicker)
    Agency: Air Force Research Laboratory (through National Center for Defense Manufacturing and Machining)
    Period: 11-1-20 through 10-31-22
    Amount Awarded: $136,700

13. Additive Manufacturing of Self-Sensing Polymer Composites (PI, Yirong Lin, Co-PIs, David Espalin, Ryan Wicker)
    Agency: U.S. Department of Energy, Kansas City National Security Campus
    Period: 10-28-20 through 8-31-21
    Amount Awarded: $50,000

14. DRIVE AM: Driving Research, Innovation, and Value through Education in Additive Manufacturing (PI, Ryan Wicker, Co-PIs, Ahsan Choudhuri, David Espalin, Francisco Medina)
    Agency: Air Force Research Laboratory (through National Center for Defense Manufacturing and Machining)
    Period: 9-1-20 through 8-31-22
    Amount Awarded: $4,834,612 (plus $500,000 cost share)

15. STTR I: Holistic Alloy Development for Additive Manufacturing, Initially Focused on High Performance Cu-Alloy for Injection Mold Making (PI, Ryan Wicker)
    Agency: National Science Foundation (through Tailored Alloys LLC)
    Period: 5-15-20 through 4-30-21
    Amount Awarded: $116,549

16. Advance Expeditionary 3D Printing to Support Warfighters at the Point of Need (PI: Ryan Wicker)
    Agency: U.S. SOCOM (through the National Center for Defense Manufacturing and Machining)
    Period: 5-1-20 through 12-31-20
    Amount Awarded: $39,524

17. Thermal Aging of AlSi10Mg (PI, Francisco Medina, Co-PIs, Ryan Wicker, David Espalin)
    Agency: Air Force Research Laboratory (through the National Center for Defense Manufacturing and Machining)
    Period: 10-1-19 through 9-30-20
    Amount Awarded: $72,000

18. Development of an Ecosystem for Qualification of Additive Manufacturing Processes and Materials in Aviation (PI, Ryan Wicker)
    Agency: NASA (through Carnegie Mellon University)

Period: 9-1-2019 through 8-31-22
Amount Awarded: $606,000

19. SBIR I: Fabrication of Complex Gamma-TiAl Components for Hypersonic Application (PI, Francisco Medina, Co-PIs, Ryan Wicker, Cesar Terrazas)
Agency: NASA (through Advanced Manufacturing LLC)
Period: 8-22-19 through 8-31-20
Amount Awarded: $37,000

20. Additive Manufacturing of Piezoelectric Ceramic Transducers (PI, Ryan Wicker, Co-PIs, David Espalin, Yirong Lin)
Agency: UT Austin Applied Research Laboratories
Period: 2-15-19 through 5-31-21
Amount Awarded: $82,530

21. Structural Battery Module and Components (PI, Ryan Wicker)
Agency: UT Austin Applied Research Laboratories
Period: 2-15-19 through 3-31-20
Amount Awarded: $24,000

22. Multi-Material Additive Manufacturing for Advanced Space Systems (PI, David Espalin, Co-PI, Ryan Wicker)
Agency: AURA Technologies
Period: 10-18-18 through 5-31-20
Amount Awarded: $241,153

23. Advancement of Additive Manufacturing Process Monitoring and Metal Matrix Composite Fabrication (PI, Ryan Wicker, Co-PIs, Philip Morton, Cesar Terrazas)
Agency: ARDEC through MSRDC
Period: 12-21-17 through 9-30-20
Amount Awarded: $437,470

24. Additive Manufacturing Build Interruption Effects (PI, David Espalin, Co-PIs, Cesar Terrazas, Ryan Wicker)
Agency: AFRL through America Makes
Period: 12-1-17 through 12-31-18
Amount Awarded: $180,000

25. EDA 2017 Regional Innovation Strategies Program (PI, Ahsan Choudhuri, Co-PI, Ryan Wicker)
Agency: U.S. Economic Development Administration
Period: 11-1-17 through 10-31-20
Amount Awarded: $500,000

26. Interface and Process Analysis for Metals Additive Manufacturing (PI, Ryan Wicker, Co-PI, David Espalin)
Agency: Army Research Laboratory
Period: 4-3-17 through 4-2-18
Amount Awarded: $120,000

27. Innovative Compact Additively Manufactured Electric Motor (PI, Ryan Wicker, Co-PI, David Espalin)
    Agency: NASA
    Period: 2-1-17 through 3-31-19
    Amount Awarded: $860,000

28. Fabrication of Niobium Components using Selective Laser Melting Additive Manufacturing Technology (PI, Ryan Wicker, Co-PI, Jorge Mireles)
    Agency: Lawrence Livermore National Lab
    Period: 1-15-17 through 4-30-17
    Amount Awarded: $15,296

29. Multi-Functional BAAM: Big Area Additive Manufacturing With Multi-Purpose Wire Embedding (Partners: Autodesk, Cincinnati) (PI, Ryan Wicker, Co-PIs, David Roberson, David Espalin)
    Agency: America Makes
    Period: 9-1-16 through 4-30-19
    Amount Awarded: $1,000,000 ($2.1M total including cost share)

30. Additive Manufacturing of Energy Harvesting Material System for Active Wireless MEMS Sensors (PI, Yirong Lin, Co-PIs, Ryan Wicker, Norman Love)
    Agency: U.S. Department of Energy
    Period: 9-1-16 through 8-31-19
    Amount Awarded: $250,000

31. AFRL Collaboration Program - Materials and Manufacturing (PI, Ryan Wicker, Co-PIs, David Espalin, Eric MacDonald)
    Agency: Clarkson Aerospace
    Period: 6-1-16 through 5-15-18
    Amount Awarded: $105,000

32. Development of Copper Wire Embedding Tool for LulzBot TAZ 5 (PI, Ryan Wicker, Co-PI, David Espalin)
    Agency: Draper Laboratory
    Period: 2-1-16 through 12-30-16
    Amount Awarded: $50,000

33. Geometrically Sensitive Process Strategies for Electron Beam Powder Bed Additive Manufacturing Support (PI, Ryan Wicker)
    Agency: AFRL-HBCU (through General Dynamics)
    Period: 11-1-15 through 2-11-18
    Amount Awarded: $186,000

34. Metal 3D Printing of Low-NOX Fuel Injectors with Integrated Temperature Sensors (PI, Ahsan Choudhuri, Co-PI, Ryan Wicker)
    Agency: Department of Energy
    Period: 10-1-15 through 9-30-18
    Amount Awarded: $250,000

35. STTR II: Development of Nuclear Quality Components using Metal Additive Manufacturing (PI, Ryan Wicker, Co-PI, Jorge Mireles)
    Agency: U.S. Department of Energy (through Radiabeam Technologies)

Period: 9-1-15 through 7-27-17
Amount Awarded: $350,000

36. SOCOM 3D Printing Workforce Development (PI, Ryan Wicker, Co-PI, Eric MacDonald)
Agency: National Additive Manufacturing Innovation Institute (National Center for Defense Manufacturing and Machining)
Period: 9-1-15 through 5-31-16
Amount Awarded: $143,119

37. A Low Cost Industrial Multi^{3D} System for 3D Electronics Manufacturing (PI, Ryan Wicker, Co-PI, Eric MacDonald)
Agency: America Makes
Period: 8-1-15 through 1-31-17
Amount Awarded: $1,000,000 ($2.2M total including cost share)

38. MIRO Center for Space Exploration and Technology Research (Pi Ahsan Choudhuri, Co-PIs, Ryan Wicker, John Chessa, Norman Love, Evgeny Shafirovich)
Agency: NASA
Period: 8-1-15 through 7-31-20
Amount Awarded: $4,686,024

39. Development of Direct Wire Embedding for the Multi-Robotic Additive Cluster System (PI, Ryan Wicker, Co-PI, David Espalin)
Agency: Lockheed Martin
Period: 6-25-15 through 10-30-15
Amount Awarded: $50,000

40. Enabling Higher Levels of Hardware Integration through the Combination of FDM Additive Manufacturing and Automated Pick and Place Processes (PI, Ryan Wicker, Co-PI, David Espalin)
Agency: Raytheon
Period: 5-15-15 through 11-15-15
Amount Awarded: $100,000

41. Investigation of Additive Manufacturing Toward Arbitrary Electromagnetic Structures (PI, Hao Xin, U of Arizona, UTEP PI, David Roberson, Co-PIs, Ryan Wicker, Eric MacDonald)
Agency: National Science Foundation (through University of Arizona)
Period: 9-1-14 through 8-31-17
Amount Awarded: $180,000 (to UTEP)

42. Cooling Rate Correlation Between Microstructural Phases and Geometry for EBM-Fabricated Parts (PI, Ryan Wicker)
Agency: National Science Foundation
Period: 9-1-14 through 12-31-16
Amount Awarded: $198,142

43. Monolithic Fabrication of Multi-Function Heterogeneous Systems (PI, Ryan Wicker, Co-PI, Eric MacDonald)
Agency: Draper Laboratory
Period: 7-1-14 through 6-30-15
Amount Awarded: $110,000

44. STTR I: Development Of Nuclear Quality Components Using Metal Additive Manufacturing (PI, Ryan Wicker, Co-PI, Sara Gaytan)
    Agency: U.S. Department of Energy (through RadiaBeam Technologies)
    Period: 6-1-14 through 3-1-15
    Amount Awarded: $73,070

45. A Cyber-Enabled Platform for Process Variable vs. Part Quality Relationships in Direct Metal Additive Manufacturing (PI, Ryan Wicker, Co-PI, Jorge Mireles)
    Agency: Office of Naval Research (through Carnegie Mellon University)
    Period: 5-20-14 through 8-30-17
    Amount Awarded: $152,101

46. Investigation and Testing of Direct Manufacturing Technology for Aerospace Tooling (PI, Ryan Wicker, Co-PI, Eric MacDonald)
    Agency: Lockheed Martin
    Period: 4-14-14 through 2-28-17
    Amount Awarded: $338,992

47. 3D Printing Multifunctionality: Additive Manufacturing for Aerospace Applications (PI, Ryan Wicker, Co-PIs, Eric MacDonald, David Roberson)
    Agency: America Makes
    Period: 3-1-14 through 5-31-16
    Amount Awarded: $1M ($2.2M total including cost share)

48. Using IR Imaging for Defect Detection E-Beam Powder Bed Technology (PI, Ryan Wicker, Co-PI, Francisco Medina)
    Agency: Lockheed Martin Corporation
    Period: 3-1-14 through 2-28-15
    Amount Awarded: $80,001

49. Additive Manufacturing Topology Optimization For Aerospace Components (PI, Ryan Wicker, Co-PI, Francisco Medina)
    Agency: Air Force Research Laboratory (through General Dynamics Information Technology)
    Period: 10-14-13 through 7-21-15
    Amount Awarded: 92,115

50. Layerwise Quality Certification for Additive Manufacturing (PI, Ryan Wicker, Co-PI, Francisco Medina)
    Agency: National Institutes of Standards and Technology (through University of Louisville)
    Period: 10-1-13 through 9-30-15
    Amount Awarded: $250,000

51. Investigation on Smart Parts with Embedded Piezoelectric Sensors via Additive Manufacturing (PI, Yirong Lin, Co-PIs, Ahsan Choudhuri, Ryan Wicker)
    Agency: DoE
    Period: 10-1-13 through 9-30-16
    Amount Awarded: $913,362

52. NUE: Printing Innovative Nano Technology Research and Elite Education (PINE TREE) Program (PI, Namsoo Kim, Co-PIs, Ryan Wicker, David Roberson, Larry Murr)
    Agency: NSF
    Period: 10-1-13 through 9-30-15
    Amount Awarded: $191,240

53. Fusing Rapid Manufacturing with 3D Virtual Facility and Cyber Tutor System into Engineering Education (PI, Bill Tseng, Co-PI, Ryan Wicker)
    Agency: NSF
    Period: 7-1-13 through 6-30-15
    Amount Awarded: $200,000

54. Specialized Non-Standard Engineering Services (PI, Ryan Wicker)
    Agency: U.S. Military Academy, West Point
    Period: 9-12-13 through 9-11-14
    Amount Awarded: $8,500

55. Printing the Complete CubeSat (PI, Eric MacDonald, Co-PIs, Ryan Wicker, David Roberson)
    Agency: National Aeronautics and Space Administration (NASA)
    Period: 9-9-13 through 9-9-15
    Amount Awarded: $168,893

56. STTR II: Advance Additive Manufacturing Method for SRF Cavities Of Various Geometries (PI, Ryan Wicker)
    Agency: Radiabeam Technologies (from DOE STTR Phase II)
    Period: 5-1-13 through 5-1-15
    Amount Awarded: $350,000

57. Development of Lick and Stick Wireless Temperature Sensors (PI, Ahsan Choudhuri, Co-PIs, Ryan Wicker, Yirong Lin)
    Agency: U.S. Department of Energy
    Period: 2-5-13 through 6-30-14
    Amount Awarded: $200,000

58. Direct Digital Manufacturing for T700-701D Intermediate Maintenance Proposal (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: GE Global Research (from ARDEC)
    Period: 10-1-12 through 12-31-13
    Amount Awarded: $296,342 (originally $899,999 for 3 years, program canceled after year 1)

59. Enabling Higher Levels of Hardware Integration with the FDM (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: Raytheon
    Period: 9-1-12 through 1-15-13 (extended to 8-31-13)
    Amount Awarded: $67,761

60. Large-scale Manufacturing of Polymer Matrix Composites using Fused Deposition Modeling a 3-D Printing Technology (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: Materials Modification, Inc. (from NASA)
    Period: 2-13-12 through 2-12-13
    Amount Awarded: $45,191

61. Advance Additive Manufacturing Method for SRF Cavities of Various Geometries (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: RadiaBeam Technologies (from DOE)
    Period: 3-1-12 through 11-1-12
    Amount Awarded: $45,050 (awarded Phase II, $350k to UTEP)

62. Development of IR Imaging Feedback in E-Beam Powder Bed Technology (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: Lockheed Martin Corporation
    Period: 7-11-12 through 8-31-13
    Amount Awarded: $80,000

63. Implementation of Infrared Imaging Feedback in Electron Beam Melting (PI, Ryan Wicker, Co-PIs, Frank Medina, Eric MacDonald, Larry Murr)
    Agency: Lockheed Martin Corporation
    Period: 4-1-11 through 5-31-12
    Amount Awarded: $139,865

64. Integrated 3D Systems Technologies (PI, Richard Schoephoerster, Co-PIs, Ryan Wicker, Ken Church)
    Agency: State of Texas Governor's Office, Emerging Technology Fund
    Period: 1-1-10 through 12-31-14
    Amount Awarded: $3M (including $3M UT System and $3M industry match)

65. Development and Evaluation of e-Based Bio-Manufacturing Laboratory for Engineering Education (PI, Bill Tseng, Co-PIs, Ryan Wicker, Rong Pan (Arizona State University))
    Agency: Department of Education, FIPSE
    Period: 10-1-08 through 9-30-12
    Amount Awarded: $599,090

66. For the Direct Print of Electromagnetically Responsive Structures (PI, Eric MacDonald, Co-PIs, Ryan Wicker, Ken Church)
    Agency: Lockheed Martin Corporation
    Period: 11-4-10 through 8-31-12
    Amount Awarded: $242,566 (2 installments, $117,566 and $125,000)

67. Low Risk, Rapid Product Development using Additive Manufacturing for an Electronic Gaming Die (PI, Ryan Wicker, Co-PI, Eric MacDonald)
    Agency: Loya Innovation Fund
    Period: 9-1-11 through 8-31-12
    Amount Awarded: $50,000

68. EBM Build Parameter Development for Inconel 625, 718 and Ti-Al (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: GE Aviation
    Period: 9-1-10 through 8-31-12
    Amount Awarded: $120,000

69. Flow Model Development for Magnetic Resonance Velocimetry (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: GE Global Research
    Period: 12-1-11 through 8-31-12
    Amount Awarded: $14,575

70. Manufacturing of Copper Components using EBM (PI, Ryan Wicker, Co-PI, Frank Medina)
    Agency: RadiaBeam, Inc.
    Period: 9-1-10 through 8-31-12
    Amount Awarded: $115,000

71. Circuit Printing on Doubly Curved 3D Surfaces II (PI, Eric MacDonald, Co-PIs, Ken Church and Ryan Wicker)
    Agency: Lockheed Martin Corporation
    Period: 10-19-10 through 11-30-10
    Amount Awarded: $121,250

72. Circuit Printing on Doubly Curved 3D Surfaces (PI, Eric MacDonald, Co-PIs, Ken Church and Ryan Wicker)
    Agency: Lockheed Martin Corporation
    Period: 3-5-10 through 5-17-10
    Amount Awarded: $124,800

73. 3D Electrically Responsive Structures and Materials (PI, Eric MacDonald, Co-PIs, Ken Church and Ryan Wicker)
    Agency: Lockheed Martin Corporation
    Period: 3-16-10 through 6-15-10
    Amount Awarded: $121,269

74. Net Shape Feasibility (PI, Larry Murr, Co-PI, Ryan Wicker)
    Agency: Lockheed Martin Corporation
    Period: 8-1-10 through 12-10-10
    Amount Awarded: $74,937

75. Wearable Electronics with Conformal and Flexible Interconnect and Antennas (PI, Eric MacDonald, Co-PI, Ryan Wicker)
    Agency: Department of Defense (Central Intelligence Agency through the National Geospatial Intelligence Agency)
    Period: 7-1-09 through 9-6-11
    Amount Requested: $240,000

76. Development and Implementation of W.M. Keck Center for 3D Innovation as a Recharge Center (PI, Ryan Wicker)
    Agency: University of Texas System, Texas Ignition Fund
    Period: 4-13-09 through 9-30-09
    Amount Awarded: $10,000

77. For the Development of Resistive Inkjet Inks (PI, Eric MacDonald, Co-PI, Ryan Wicker)
    Agency: Lockheed Martin Corporation
    Period: 5-1-09 through 12-10-09
    Amount Awarded: $130,000

78. For the Development of Mechanical Resistive Inkjet Inks (PI, Eric MacDonald, Co-PI, Ryan Wicker)
    Agency: Lockheed Martin Corporation
    Period: 11-1-08 through 12-10-09
    Amount Awarded: $344,217

79. Development of Emerging Technology Utilization Plan (PI, Ricardo Pineda, Co-PIs, Ryan Wicker, Larry Murr, Eric MacDonald, Ramana Chintalapalle, David Zubia, Oscar Salcedo)
    Agency: Lockheed Martin Corporation
    Period: 11-15-08 through 12-20-08
    Amount Awarded: $200,000

80. Integrating Field Programmable Gate Arrays on Flexible, Thin and Layered Substrates (PI, Ken Church, nScrypt Inc., UTEP PI, Eric MacDonald, Co-PI, Ryan Wicker)
    Agency: Department of Defense, Air Force SBIR Phase II
    Period: 4-3-09 through 12-31-10
    Amount Awarded: $750,000 ($276,800 to UTEP)

81. Miniaturized 3D Embedded Electronics Integration (PI, Eric MacDonald, Co-PI, Ryan Wicker)
    Agency: Department of Defense (Space & Missile Defense Command through the Homeland Protection Institute)
    Period: 10-23-09 through 3-22-10
    Amount Awarded: $533,756

82. Miniaturized 3D Embedded Electronic Sensors for Integrated Defense Systems (PI, Eric MacDonald, Co-PI, Ryan Wicker)
    Agency: Department of Defense (Space & Missile Defense Command through the Homeland Protection Institute)
    Period: 10-1-07 through 1-15-09
    Amount Awarded: $314,037

83. Stereolithography of Multi-Lumen, Multi-Material Bioactive Nerve Guidance Conduits (PI, Ryan Wicker; Co-PI, Brenda Mann, University of Utah)
    Agency: National Science Foundation
    Period: 9-1-07 through 8-31-11
    Amount Awarded: $270,000

84. Direct Digital Manufacturing of Integrated Naval Systems using Ultrasonic Consolidation, Support Material Deposition and Direct Write Technologies (UTEP PI, Ryan Wicker; subcontract to Utah State University, USU PI, Brent Stucker)
    Agency: Office of Naval Research, Disruptive Technologies for Direct Digital Manufacturing
    Period: 3-1-07 through 2-28-10
    Amount Awarded: $501,884, (UTEP portion $243,046)

85. Integrating Field Gate Programmable Arrays on Flexible, Thin, and Layered Substrates (PI, Ken Church, Sciperio, Inc., Subcontracts to Eric MacDonald and Ryan Wicker)
    Agency: Air Force SBIR
    Period: 1-1-08 through 8-31-08
    Amount Awarded (to Sciperio, Inc.): $100,000

86. Acquisition of a Metals-Based Direct Digital Manufacturing System – Digital Manufacturing of Medical Implants (PI, Ryan Wicker; Co-PIs, Stella Quiñones, Larry Murr, Steve Stafford)
    Agency: University of Texas System (joint request with M D Anderson Cancer Center)
    Period: 9-1-07 through 8-31-08
    Amount Awarded: $991,700

87. Rapid Manufacturing of Flight-Like Satellite Electronics (PI, Ryan Wicker)
    Agency: Sandia National Laboratories, Lab Directed Research and Development Program
    Period: 1-24-08 through 8-31-08
    Amount Awarded: $50,000

88. Investigation of Alternative Rapid Prototyping Technologies (PI, Ryan Wicker)
    Agency: Sandia National Laboratories, Lab Directed Research and Development Program
    Period: 10-25-06 through 9-30-07
    Amount Awarded: $37,000

89. Develop Interconnect for MEMS-Based Antenna using Direct Write on Layer Manufactured Structures (PI, Ryan Wicker, Co-PI, Eric MacDonald)
    Agency: Sandia National Laboratories
    Period: 10-1-05 through 9-30-06
    Amount Awarded: $14,000

90. Investigation of Alternative Rapid Prototyping Technologies (PI, Ryan Wicker, Co-PI, Eric MacDonald)
    Agency: Sandia National Laboratories, Lab Directed Research and Development Program
    Period: 10-1-05 through 9-30-06
    Amount Awarded: $69,000

91. Rapid Prototyping Infrastructure Improvement (PI, Ryan Wicker)
    Agency: Sandia National Laboratories (through NSF, transfer documentation signed 2-5-05)
    Amount Awarded: $518,155 (transfer of 1 SLS and 2 SLA rapid prototyping machines)

92. Rapid Response Layered Manufacturing (PI, Ryan Wicker)
    Agency: Sandia National Laboratories (through NSF, transfer documentation signed 3-22-06)
    Amount Awarded: $508,507 (transfer of 1 SLA 500 rapid prototyping machine)

93. Layered Manufacturing Infrastructure Development for Tissue Engineering Applications (PI, Ryan Wicker)
    Agency: University of Texas System STARS Award
    Period: 1-4-05 through 11-30-06
    Amount Awarded: $500,000

94. Improved Maxillofacial and Craniofacial Modeling using Layered Manufacturing (PI, Ryan Wicker)
    Agency: University of Texas System PUF/LERR (special opportunity for proposed medical/academic university collaboration)
    Period: 9-1-05 through 12-31-06
    Amount Awarded: $380,000

95. Small-Scale Flow Variability Inside Branched Coral Colonies: Computations and Experimental Verification (PI, Ryan Wicker on subcontract to Stanford University, Stanford PIs, Stephen Monismith, Jeff Koseff, and John Eaton)
    Agency: Stanford University (subcontract to Stanford University for proposal to National Science Foundation, Physical Oceanography, Division of Ocean Sciences)
    Period: 9-1-04 through 8-31-06 (NSF proposal period 9-1-04 through 8-31-07)
    Amount Awarded: $28,000 (total proposal funded at $500k)

96. Manufacturing System for Three-Dimensional Implantable Hydrogel Constructs Using Stereolithography (PI, Ryan Wicker)
    Agency: Texas Higher Education Coordinating Board – Advanced Technology Program
    Period: 1-1-04 through 12-31-05
    Amount Awarded: $149,604

97. Establishment of the W.M. Keck Border Biomedical Manufacturing and Engineering Laboratory (PI, Ryan Wicker)
    Agency: W.M. Keck Foundation
    Period: 12-31-01 through 12-31-05
    Amount Awarded: $1 million ($700k university match)

98. Micro-Stereolithography Technology Demonstration and Development (PI, Ryan Wicker)
    Agency: Sandia National Laboratories (Lab Directed Research and Development Program)
    Period: 10-1-03 through 9-30-05 (Years 3 and 4)
    Amount Awarded: $130,000

99. Tissue Engineering Constructs Aimed at Understanding Guided Angiogenesis and Anti-Angiogenesis (PI, Ryan Wicker, Stanford PIs/Collaborators, Chris Elkins, Jacob Waugh, and Michael Dake)
    Agency: UTEP Tobacco Settlement Funds
    Period: 2-1-04 through 8-31-04
    Amount Awarded: $24,600

100. Advanced Rapid Prototyping Technology Development (PI, Ryan Wicker)
    Agency: Sandia National Laboratories
    Period: 10-1-02 through 9-30-03
    Amount Awarded: $60,000

101. An Interdisciplinary Approach Toward a Strategic Framework for the Quantification of Baseline Anthropometric and Physiological Data, Occupational Disorder Risk and Severity, and Work Design Parameters of Female Hispanic Migrant Workers (PI, Mary Carlson and Co-PIs Jan Ryberg, Rolando Quintana, and Ryan Wicker)
    Agency: Department of Health and Human Services-Federal Migrant Border Health Initiative (UTEP PI, Jack Conway, Dean, College of Health Sciences)
    Period: 9-1-02 through 8-31-03
    Amount Awarded: $109,217

102. Accuracy Study of Bony Anatomy Physical Modeling using Medical Imaging Data and Cadaveric Specimens (PI, Ryan Wicker)
    Agency: Sierra Providence Health Network (Tenet Healthcare System)
    Period: 9-1-02 through 8-31-03
    Amount Awarded: $180,923 (In-kind support for use of CT scanning facility)

103. Passive Control of Particle Dispersion in a Particle-laden Circular Jet using Elliptic Co-annular Flow: A means for Improving Utilization and Emission Reductions in Pulvarized Coal Burner (Co-PI with PI, Ahsan Choudhuri)
Agency: Department of Energy
Period: 10-1-01 through 12-31-02 (Date Submitted: 3-19-01)
Amount Awarded: $20,000

104. Developing Rigid and Compliant Cardiovascular System Models Using Rapid Prototyping (PI, Ryan Wicker)
Agency: Sandia National Laboratories
Period: 3-5-02 through 9-30-02
Amount Awarded: $25,000

105. Border Biomedical Manufacturing and Engineering Program Business Plan (PI, Ryan Wicker)
Agency: UTEP document solicited by UTEP administration
Date Submitted: 1-15-01
Amount Awarded: $400,000

106. Manufacturing human cardiovascular system models for hemodynamic investigations of the border Hispanic population (PI, Ryan Wicker)
Agency: UTEP Border Health Research Initiative
Period: 1-1-01 through 8-31-01 (Date Submitted: 12-00)
Amount Awarded: $18,000

107. Developing a Design Validation Tool for Computer Chassis (PI, Ryan Wicker)
Agency: Axxion Corporation
Period: 1-1-00 through 8-31-01 (Date Submitted: 12-99)
Amount Awarded: $18,500

108. Development and Demonstration of an E85-Fueled Vehicle (PI, Ryan Wicker)
Agency: State of Texas Energy Conservation Office
Date Submitted: 6-00
Amount Awarded: $8,800

109. A Multi-Disciplinary Dynamic Systems and Controls Laboratory (PI, Bill Diong and Co-PIs Rick Zadoks and Ryan Wicker)
Agency: Hewlett Packard University Grants Program
Date Submitted: 12-99
Amount Awarded: $27,430 (awarded computer equipment)

110. Remote Experimentation in Dynamic Systems and Control for Distance Education and Research (PI, Bill Diong; Co-PI, Ryan Wicker)
Agency: UTEP-NASA-NRTS
Period: 9-99 through 8-31-00 (Date Submitted: 9-99)
Amount Awarded: $10,000

111. UTEP/University of Alberta Collaboration for 2000 Ethanol Vehicle Challenge (PI, Ryan Wicker)
Agency: Natural Resources Canada (through University of Alberta)
Period: 9-1-99 through 8-31-00
Amount Awarded: $18,800

112. Development of a Dedicated E85-Fueled Vehicle (PI, Ryan Wicker)
Agency: Western Regional Biomass Program
Period: 9-99 through 12-31-99 (Date Submitted: 8-99)
Amount Awarded: $4,950

113. Multi-Source Power Generation (PI, Rick Zadoks; Co-PI, Ryan Wicker)
Agency: El Paso Electric Company
Period: 5-99 through 12-99 (Date Submitted: 1-99)
Amount Awarded: $25,000

114. Dynamic Systems and Controls Laboratory (PI, B. Diong and Co-PIs, R. Zadoks and Ryan Wicker)
Agency: National Science Foundation-CCLI (Grant Number DUE-9950723)
Period: 7-1-99 through 6-30-01 (Date Submitted: 11-16-98)
Amount Awarded: $50,210 agency; $58,275 (UTEP match); total $108,485

115. Development of Current Hybrid Electric Vehicle Component Technology (PI, Ryan Wicker)
Agency: Argonne National Laboratory – University of Chicago
Period: 6-16-98 through 8-31-98 (Date Submitted: 5-98)
Amount Awarded: $13,874

116. Development and Demonstration of a Dedicated E85 Vehicle (PI, Ryan Wicker)
Agency: Texas General Services Commission - State Energy Conservation Office
Period: 5-20-98 through 8-31-98 (Date Submitted: 5-98)
Amount Awarded: $20,000

117. Development of a Hybrid Electrical Power System Using a Wind Turbine and a Spark Ignited Engine for Air Pollution Mitigation and Water Conservation in the El Paso/Juarez Region (PI, Ryan Wicker; Co-PI Rick Zadoks)
Agency: Southwest Center for Environmental Research and Policy
Period: 6-1-98 through 3-31-00 (Date Submitted: 3-3-98)
Amount Awarded: $29,802

118. An Imaging Framework for Aerodynamic, Fluid Mechanic, and Heat Transfer Scientific-Grade Measurements (PI, Ryan Wicker)
Agency: NASA
Period: 2-27-98 through 12-31-01 (Date Submitted: 10-21-97)
Amount Awarded: $294,177

119. Performance Measurements of an LPG Liquid Phase Port Fuel Injection Engine (PI, Ryan Wicker)
Agency: UTEP-University Research Initiative
Period: 1-1-98 - 8-31-98 (Date Submitted: 10-1-97)
Amount Awarded: $7,585

120. A “Green” Distributed Electrical Power System Including a Wind Turbine and Propane-Fueled Engine (PI, Rick Zadoks; Co-PI, Ryan Wicker)
Agency: Texas Higher Education Coordinating Board-Advanced Technology Program
Period: 1-1-98 through 12-31-99 (Date Submitted: 7-10-97)
Amount Awarded: $157,750 (requested $265,571); $28,000 (matching contribution from Caterpillar Inc. for a 3306 gas engine); total $185,750

121. UTEP Entry in the 1999 Ethanol Vehicle Challenge (PI, Ryan Wicker)
Agency: DOE, General Motors
Period: 8-1-98 through 5-31-00 (Date Submitted: 5-27-97)
Amount Awarded: $36k (awarded vehicle and engine)

122. UTEP Entry in the 1998 Ethanol Vehicle Challenge (PI, Ryan Wicker)
Agency: DOE, General Motors
Period: 6-18-97 through 5-31-98 (Date Submitted: 5-27-97)
Amount Awarded: $20k (awarded vehicle and engine)

123. A Structured, Cross-Institutional Approach to Undergraduate Engineering Curriculum Improvement (PI, Ryan Wicker; Co-PI, Rolando Quintana)
Notes: support to pursue using the FE Exam for engineering program assessment. Provided summer support for Jay Guerra {B.S. student}, Mike Camet {B.S. student}, R. Wicker and R. Quintana)
Agency: UTEP-MIE
Period: Summer 1997 (Date Submitted: Spring 1997)
Amount Awarded: $18.5k

124. Development of the Engines and Alternative Fuels Research Laboratory (PI, Ryan Wicker)
Note: Support for EAFRL research equipment, and materials and supplies to design and build the EAFRL engine dynamometer test cell.
Agency: UTEP-MIE
Period: 1-1-97 through 8-31-97
Amount Awarded: $28k

125. Developing Vision-Based Experiments (PI, Ryan Wicker)
Agency: National Instruments
Date Submitted: 1-98
Amount Awarded: $10k (In-kind, Educational Software grant for LabVIEW and IMAQ Vision, 2 copies)

126. Development of a Liquid Phase Port Fuel Injection System for LPG (PI, Ryan Wicker)
Agency: Chrysler Canada
Date Submitted: 5-97
Amount Awarded: $3.5k, (awarded 3.3L, V6 engine with wiring harness and controller)

127. Using Experimentation to Develop a Group Discovery Process (PI, Ryan Wicker)
Note: Student support for Scott Olson and Jorge Villalobos (Fall 1996, Spring 1997).
Agency: UTEP-MIE
Period: 9-1-96 through 5-31-96 (Date Submitted: 7-96)
Amount Awarded: $17.5k

128. Virtual Engineering Laboratories-MIE Equipment Proposal (PI, Lionel Craver; Co-PIs, Darrell Schroder, Tony Tarquin, and Ryan Wicker)
Agency: UTEP-MIE
Period: Fall 1996 (Date Submitted: Summer 1996)
Amount Awarded: $185k

129. Design and Development of the 1997 UTEP LPG Challenge Vehicle (PI, Ryan Wicker)
Note: student support for Javier Perez.
Agency: UTEP-MIE
Period: 6-1-96 through 8-15-96 (Date Submitted: 5-21-96)
Amount Awarded: $3k

130. Establishment of the UTEP Engines Program (PI, Ryan Wicker)
Note: Support for SuperFlow 901 engine dynamometer system.
Agency: UTEP
Period: Spring 1996
Amount Awarded: $36k

131. Design and Development of the 1996 UTEP LPG Challenge Vehicle (PI, Ryan Wicker)
Note: student support for Paul Valdespino and James Schalla (Spring 1996).
Agency: UTEP-MIE
Period: Spring 1996 (Date Submitted: 1-96)
Amount Awarded: $5k

132. Teaching Freshman Engineering Design Using LabVIEW (PI, Lionel Craver; Co-PIs, Darrell Schroder, Tony Tarquin, and Ryan Wicker)
Notes: Developed engineering applications programs using LabVIEW to introduce engineering students to engineering design early in their academic careers.
Agency: UTEP-MIE
Period: 3-1-96 through 8-31-96 (Date Submitted: 12-95)
Amount Awarded: $62k

133. Propane Vehicle Technology (PI, Ryan Wicker)
Agency: Railroad Commission of Texas
Period: 5-14-96 through 12-31-96 (Date Submitted: 5-1-96)
Amount Awarded: $10k

134. Levi Strauss Foundation CIT Grant (PI, Ryan Wicker)
Agency: Levi Strauss Foundation CIT Grant
Period: 12-31-96 (Date Submitted: 3-12-96)
Amount Awarded: $1,500

135. Design and Development of a Liquid Phase Port Fuel Injection System for LPG (PI, Ryan Wicker)
Note: Research in support of 1997 Propane Vehicle Challenge
Agency: Docklands Science Park Pty. Ltd (An Australian Research Company)
Period: 6-1-96 through 8-15-96 (Date Submitted: 5-21-96)
Amount Awarded: $34,415 (Australian) ~$22.5k U.S. (In-kind support)

136. UTEP Entry in the 1996 LPG Vehicle Challenge (PI, Ryan Wicker)
Agency: DOE, Chrysler-Canada, Natural Resources-Canada
Period: 11-1-95 - 6-30-96 (Date Submitted: 9-95)
Amount Awarded: $25k (awarded 1996 Dodge minivan)

137. Study of Brick Kiln Designs and Development of Technical Courses for the Brickmakers Training Center in Cd. Juarez (PI, Nancy Lowery; Co-PI, Ryan Wicker)
Agency: Environmental Protection Agency (Southwest Consortium for Environmental Research and Policy)
Period: 6-1-95 to 5-31-96 (Date Submitted: 2-95)
Amount Awarded: $71k (95-96)

138. Development of an Internal Combustion Engines Course (PI, Ryan Wicker)
Agency: UTEP-Center for Environmental Resource Management
Period: Summer 1995 (Date Submitted: Spring 1995)
Amount Awarded: $5k

139. Engines and Alternative Fuels Research Laboratory In-Kind Support (PI, Ryan Wicker)
Various Research Engines
1, Caterpillar 3306 gas engine ($28,000; previously counted and not counted here)
1, GM 5.3 L V8 Generation III with wiring harness and computer ($6k)
2, GM 3.1 L V6 with wiring harness and computer ($8k)
2, GM 350 cubic inch V8 ($4k)
1, Chrysler 3.3 L V6 with wiring harness and computer ($6k)
1, 20 hp Briggs & Stratton Vanguard V-twin engine ($2k)
1, 22 hp Kohler Command V-twin engine ($2k)
A&B Chassis Dynamometer ($27,630-equipment transferred to UTEP from Railroad Commission of Texas)
GM Scan Tool ($2k)
Holley Pro-Jection System ($1k)
Barber Coleman Throttle Control System ($1k)
Micro-Motion Flow Sensor ($1.5k-Fisher Rosemount)
Autodesk donations of Mechanical Desktop and 3D Studio Max software packages ($4.5k)
Total In-Kind Support for EAFRL: $65,630 (not including $28,000 for Caterpillar engine)

140. Study of Brick Kiln Designs and Development of Technical Courses for the Brickmakers Training Center in Cd. Juarez (PI, Nancy Lowery; Co-PI, Ryan Wicker)
Agency: Environmental Protection Agency (Southwest Consortium for Environmental Research and Policy)
Period: 9-1-94 to 8-30-95 (Date Submitted: 11-94)
Amount Awarded: $62k (94-95)

141. Characterization of Emissions and Maintenance Profiles for Border Vehicles, Cost Effective Repair and Air Quality Impact (PI, Ryan Wicker)
Agency: Environmental Protection Agency (Southwest Consortium for Environmental Research and Policy)
Period: 7-1-94 - 9-30-95 (Date Submitted: Spring 1994)
Amount Awarded: $22k