



# EXPERT Welding ENGINEERING & Inspection

Engineering Excellence

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## PROFESSIONAL SUMMARY

Dr. Foster focuses on the design, manufacture, testing, and safety associated with welded structures. In addition to Dr. Foster’s significant experience in the field of welding engineering in academia and in industry, Dr. Foster possesses a PhD in Welding Engineering and numerous certifications in welding, inspection, and engineering, all of which have exceptionally prepared Dr. Foster to properly analyze failures and other welding problems that are the subject of litigation.

**General Specialties:** Welding Engineering, Welding Failure Analysis, Welding Safety, Additive Manufacturing, and Engineering Education

**Specialty Focus:** Welding Engineering, Welding Failures, Welding Safety, Welding Design, Engineering Education, Additive Manufacturing, 3-D Printing of Metals, Welding Processes, Welding Inspection and Testing, Welding Metallurgy, Welding Defects, Structural Welding Fabrication, Polymer Welding, Welding Process Efficiency and Streamlining, Welding Codes Compliance, Welding Consulting, Quality Assurance, Non-Destructive Testing, Manufacturing, Welding and NDT Auditing and In-situ Process Monitoring



## EDUCATION

<b>The Ohio State University</b> Doctor of Philosophy in Welding Engineering	GPA: 3.84	Columbus, OH August 2014
<b>The Ohio State University</b> Masters of Science in Welding Engineering	GPA: 3.86	Columbus, OH August 2008
<b>The Ohio State University</b> Bachelor of Science in Welding Engineering		Columbus, OH June 2007

## LICENSES & CERTIFICATIONS

- Certified Welding Educator (CWE) -- American Welding Society
- Certified Welding Supervisor (CWS) -- American Welding Society
- Certified Welding Inspector (CWI) -- American Welding Society
- Certified Welding Engineer (CWEng) -- American Welding Society
- Licensed Professional Engineer (PE) -- Mechanical Design and Materials
  - Licensed in MI and VA

## EXPERIENCE

### Expert Engineering and Education

Principal Engineer

VA and NJ  
July 2016-Present

*Duties: Engineering Services, Inspection & Testing Services, Research & Development, Project Management, Operations Management, Personnel Training, Curriculum Development, Course Development, Course Instruction, Business Development, Proposal Writing, Report Writing, Conference Speaking, and Marketing*

### Old Dominion University

Assistant Professor

Mechanical and Aerospace Engineering Department & Engineering Technology Department

Norfolk, VA  
July 2014-August 2017

*Duties: Engineering Services, Inspection & Testing Services, Research & Development, Project Management, Operations Management, Personnel Training, Curriculum Development, Course Development, Course Instruction, Business Development, Proposal Writing, Report Writing, Conference Speaking, and Marketing*

### NASA Glenn Research Center

NASA Glenn Faculty Fellow

Cleveland, OH  
June 2015-August 2015

*Duties: Engineering Services, Research & Development and Report Writing*

### The Ohio State University

Graduate Teaching Assistant WE 7102 and 7201

Engineering Analysis for Design and Simulation of Welded Structures; & Welding Metallurgy II

Columbus, OH  
August 2013-December 2013

*Duties: Grading, Course Support and Course Instruction*

NASA Ohio Space Grant Consortium Fellow

September 2009-August 2013

*Duties: Engineering Services, Inspection & Testing Services, Research & Development, Personnel Training, Proposal Writing, Report Writing, and Conference Speaking*

### Nano-Scale Science and Engineering Center (NSEC)

Research Associate

Columbus, OH  
June 2005-August 2006

*Duties: Engineering Services, Inspection & Testing Services, Research & Development, Personnel Training, Report Writing, and Conference Speaking*

## PROFESSIONAL ACTIVITIES

- Session Chair of FABTECH's Welding Research Panel: *Progresses in Filler Metals* (Nov 2015)
- Judge, American Welding Society (AWS) Graduate Poster Competition (2015)
- Journal Publication Reviewer, *Welding Journal*
- Journal Publication Reviewer, *Rapid Prototyping Journal*
- Journal Publication Reviewer, *Materials and Design*
- Journal Publication Reviewer, *Science and Technology of Welding and Joining*
- Journal Publication Reviewer, *Materials Processing*
- Journal Publication Reviewer, *Materials Characterization*

## INVITED TALKS

- **D.R. Foster**, Fundamentals of Welding Engineering: Reducing Shipbuilding Costs Through the Proper Use of Welding Engineering, Invited Talk and Short Course, American Society of Naval Engineers, Fleet Maintenance and Modernization Symposium 2018, Virginia Beach Convention Center, Sept. 2018, Virginia Beach, VA
- **D.R. Foster**, Welding Engineering for Marine Applications: University Status Report, Invited Talk to American Welding Society: Tidewater Chapter, Jan. 2017, Newport News, Virginia
- **D.R. Foster**, Utilization of Linear Friction Welding to Develop Hybrid Turbine Disks, Invited Talk at National Aeronautics and Space Administration Glenn Research Center, Jul. 2015, Cleveland, Ohio
- **D.R. Foster**, Welding Engineering for Marine Applications, Invited Talk to American Welding Society: Tidewater Chapter, Mar. 2015, Newport News, Virginia
- **D.R. Foster**, Process Monitoring of Ultrasonic Additive Manufacturing, Invited Talk at the Air Force Research Laboratory, Wright-Patterson Air Force Base Nov. 2013, Dayton, Ohio

## TECHNICAL REPORTS

- **D.R. Foster**; National Shipbuilding Research Program – Workforce Development Panel, “Improving Technical Arc Welding Education Using Real-Time Sensory Feedback,” January 2018
- Visible Welding LLC, **D.R. Foster**; National Shipbuilding Research Program – Workforce Development Panel, “3-D Vision for Welder Training and Production Arc Welding,” October 2017
- **D.R. Foster**; Virginia Space Grant Consortium – New Investigator Program, “Process Monitoring of Ultrasonic Welding,” September 2016
- **D.R. Foster**, National Aeronautics and Space Administration Glenn Research Center, “Utilization of Linear Friction Welding to Develop Hybrid Turbine Disks” August. 2015, Cleveland, Ohio
- **D.R. Foster**; Doctoral Dissertation; Welding Engineering Program; Dept. of Materials Science and Engineering, The Ohio State University, “Thermal and Mechanical Characterization of Ultrasonic Manufacturing” August 2014
- **D.R. Foster**; Masters Thesis; Welding Engineering Program; Dept. of Industrial, Welding & Systems Engineering, The Ohio State University, “Resistance Welding of Dissimilar Metals” August 2008
- **D.R. Foster**; Nano-scale Science and Engineering Center, The Ohio State University, “Microlaser Welding of Polypropylene Nanocomposites” August 2006
- **D.R. Foster**; Summer Research Opportunities Program, Committee for Institutional Cooperation, “Hybrid Laser Welding of Polymers” August 2005

## CURRENT PROFESSIONAL AFFILIATIONS

- ASNE, American Society of Naval Engineers–(2014- Present)
  - Professional Development Committee Member
- VSRA, Virginia Ship Repair Association–(2015- Present)
  - Quality Assurance Committee Member
- AWS, American Welding Society–(2004- Present)
  - Safety and Health Committee Member –(2018- Present)
- ASNT, American Society of Non-Destructive Testing–(2017- Present)
- ASEE, American Society of Engineering Education–(2015- Present)

## TEACHING

### The Ohio State University

Graduate Teaching Assistant

Columbus, OH  
August 2012- August 2014

- WE 4201 Engineering Analysis for Design and Simulation of Welded Structures
- WE 7201 Engineering Analysis for Design and Simulation of Welded Structures
- WE 4202 Welding Metallurgy II (SS, Al, Ni, Cu, Mg, & Ti alloys)
- WE 7102 Welding Metallurgy II (SS, Al, Ni, Cu, Mg, & Ti alloys)

### Old Dominion University

Assistant Professor

Norfolk, VA  
August 2014- May 2017

- MET 200 Manufacturing Processes and Materials
- MET 495 Introduction to Welding Technologies
- MAE 495 Fundamentals of Welding Engineering
- MAE 595 Fundamentals of Welding Engineering

### Expert Engineering and Education

Staff Instructor

Norfolk, VA  
July 2017- Present

- Certified Welding Instructor Preparation Course (Local Course)
- Fundamentals of Welding Engineering: Reducing Shipbuilding Costs Through the Proper Use of Welding Engineering
  - Short Course: Fleet Maintenance and Modernization Symposium
  - Short Course: Mega Rust Engineering Conference

### Lincoln Park Elementary School

Elementary School Science and Math Teacher

Columbus, OH  
September 2008-June 2009

- 3<sup>rd</sup> grade science and math teacher at Lincoln Park Elementary School as part of GK-12 Program
- Developed innovative science lesson plans and hands-on experiments to advance science education in Columbus City Schools
- Trained other graduate students in developing lesson plans, classroom management, and creating hands-on science experiments
- Led professional development meetings with a focus on producing interactive science lessons and hands-on activities for 3<sup>rd</sup> grade teachers

## GRANTS AWARDED

- **D.R. Foster;** National Shipbuilding Research Program – Workforce Development Panel, “Improving Technical Arc Welding Education Using Real-Time Sensory Feedback,” December 2015, **\$140,000- Primary Investigator**
- **D.R. Foster;** Virginia Space Grant Consortium – New Investigator Program, “Process Monitoring of Ultrasonic Additive Manufacturing,” April 2015, **\$20,000- Primary Investigator**
- **D.R. Foster;** National Science Foundation – National Society of Black Engineers, “Early Career Travel Grant,” April 2015, **\$1,800- Primary Investigator**
- Visible Welding LLC, **D.R. Foster;** National Shipbuilding Research Program – Workforce Development Panel, “3-D Vision for Welder Training and Production Arc Welding,” October 2016, **\$150,000- Subcontractor**

## SELECTED EXPERIENCE

### 3-D Vision for Welder Training and Production Arc Welding

- Research testing the viability of a newly developed 3-D Vision for Welder Training and Production Arc Welding. Determine effectiveness, optimal implementation and ROI due to implementation.

### Hybrid Turbine Blades

- Research in the High Temperature and Smart Materials Department of NASA Glenn.
- Research development of a hybrid turbine blade by using linear friction welding to bond a single crystal nickel turbine blade with a polycrystalline central hub to increase turbine efficiency

### Improving Technical Arc Welding Education Using Real-Time Sensory Feedback

- Research project testing the viability of a newly developed process monitoring welding system (Miller Electric's LiveArc) to improve welder education and reduce arc welding training costs.
- Cost reductions due reduction in training time, instructor load, and material reduction were evaluated.
- The output of this project was a report which detailed analysis of cost savings, educational benefits, and the optimal implementation and utilization of LIVEARC equipment

### Thermal and Mechanical Characterization of Ultrasonic Additive Manufacturing

- Investigation of *in-situ*, along with post-consolidation, **mechanical and thermal property** changes due to the creation of layered metal matrix composites using ultrasonic energy
- Developed a non-destructive process monitoring technique that can be used to determine bond quality of **aluminum alloys *in-situ***
- Investigated mechanical and thermal anisotropy due to interfacial bonding defects
- Participated in design reviews to develop the next version of the manufacturing system
- Trained colleagues to use the Ultrasonic Additive Manufacturing and Ultrasonic Welding systems

### Resistance Spot Welding of Dissimilar Metals

- Investigation of material and mechanical properties of resistance spot welds between **super austenitic stainless steel (Al-6XN)** and **nickel alloys (Hastelloy C-22 and Inconel 625)**
- Developed optimum process parameters as well as performed mechanical and metallurgical characterization of dissimilar welds

### Through Transmission Laser Welding of Polypropylene Nanocomposites

- Research project sponsored by Edison Welding Institute investigating laser welding (using scanning **Nd:YAG laser**) of polypropylene nanocomposites for packaging applications.
- **Won 3<sup>rd</sup> Place in the AWS National Undergraduate Research Poster Competition**

### Microlaser Welding of Polypropylene Nanocomposites

- Research for Nano-scale Science and Engineering Center (NSEC) exploring the possibilities of using low-power laser welding (**diode laser**) in producing micro-sized hermetical seals between a polypropylene nanocomposite film substrate for packaging applications

### Hybrid Laser Welding of Polymers

- SROP (Summer Research Opportunities Program) sponsored research exploring the applications and feasibility of hybrid laser welding using a **Ti:Sap femtosecond laser** and a **ytterbium fiber laser** to weld clear plastics

## PUBLICATIONS

- Y. Lu, H.Y. Song, **D.R. Foster**, G.A. Taber, G.S. Daehn, W. Zhang, In-Situ Measurement of Relative Motion during Ultrasonic Spot Welding of Aluminum Alloy using Photonic Doppler Velocimetry, *Journal of Materials Processing Technology*, (2016), 431-440
- **D.R. Foster**, G.A. Taber, S.S. Babu, G.S. Daehn, In-situ Velocity Measurements of Ultrasonic Additive Manufacturing Using a Photonic Doppler Velocimeter, *Science and Technology of Welding and Joining*, 19 (2014) 157-163
- **D.R. Foster**, S.S. Babu, M.J. Dapino, Elastic Constants of Ultrasonic Additive Manufactured Al 3003-H18, *Ultrasonics*, 53 (2013) 211-218
- M.R. Sriraman, M. Gonser, **D.R. Foster**, H T. Fujii, S.S. Babu, Matt Bloss, Thermal Transients During Processing of 3003 Al-H18 Multilayer Build by Very High Power Ultrasonic Additive Manufacturing, *Metallurgical and Materials Transactions B*, 43 (2012) 133-144
- D.E. Schick, S.S. Babu, **D.R. Foster**, M.J. Dapino, M. Short, J.C. Lippold, Transient Thermal Response in Ultrasonic Additive Manufacturing of Aluminum 3003, *Rapid Prototyping Journal*, 17 (2011) 369 – 379
- **D.R. Foster**, D.W. Dickinson, Characterization of Resistance Spot Welding of Al-6XN to Hastelloy C-22 and Inconel 625, *Journal of Material Processing Technology*, to be submitted

## CONFERENCE PUBLICATIONS

- J. Cheng, A. Chaudhary, S.S. Babu, M. Norfolk, **D.R. Foster**, D. Boone, Process Simulation of Ultrasonic Additive Manufacturing and The Prediction of Interface Bonding, *Materials Science and Technology 2013 Conference and Exhibition*, Oct. 2013, Montreal, Quebec, Canada
- S.S. Babu, A.G. Troug, S. A. Channagiri, **D.R. Foster**, X-Ray Tomography of Very High Power Ultrasonic Additive Manufactured builds, *Solid Freeform Fabrication Symposium 2012*, Jul. 2012, Austin, Texas
- C. D. Hopkins, **D.R. Foster**, M.J. Dapino, L., Zhang. In *Proceedings Metal Matrix Composite Metamaterials with Smart Switches Embedded by Ultrasonic Consolidation*. ASME 2010 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Oct. 2010, Philadelphia, Pa
- M. Dapino, R. Hahnen, **D.R. Foster**, C. Hopkins, UAM of Adaptive Metal-Matrix Composites. In *Proceedings of the 2009 Ultrasonic Additive Manufacturing Symposium*, Oct. 2009, Columbus, Ohio

## CONFERENCE PRESENTATIONS

- Steve Edelman (Visible Welding LLC), **D.R. Foster**; National Shipbuilding Research Program – Workforce Development Panel, “3-D Vision for Welder Training and Production Arc Welding,” September 2017
- **D.R. Foster**; National Shipbuilding Research Program – All Panel Meeting –Workforce Development Panel, “Practical Welder Training Using Augmented Reality,” March 2017
- **D.R. Foster**; National Shipbuilding Research Program – Joint Panel Meeting–Workforce Development Panel, “Fundamental Welding Engineering Training for Naval Engineers,” May 2016
- **D.R. Foster**; National Shipbuilding Research Program – Joint Panel Meeting–Workforce Development Panel, “Improving Technical Arc Welding Education Using Real-Time Sensory Feedback: Update Status Report,” May 2016
- **D.R. Foster**; National Shipbuilding Research Program – All Panel Meeting–Workforce Development Panel, “Improving Technical Arc Welding Education Using Real-Time Sensory Feedback,” March 2015
- Y. Lu, **D.R. Foster**, G.A. Taber, G.S. Daehn, W. Zhang, In-Situ Velocity Measurement During Ultrasonic Spot Welding of AA 6061-T6 Using Photonic Doppler Velocimetry, Materials Science & Technology 2015 Conference and Exhibition: Joining of Advanced and Specialty Materials (JASM XVII), Columbus, Ohio
- **D.R. Foster**, Materials Joining and Additive Manufacturing, ARL Research Symposium 2015, Mar. 2015 Anaheim, California
- **D.R. Foster**, S.S. Babu, G.S. Daehn, In-situ Velocity Measurements of Ultrasonic Additive Manufacturing Using a Photonic Doppler Velocimeter, Materials Science and Technology 2012 Conference and Exhibition, Oct. 2012, Pittsburgh, Pennsylvania
- S.S. Babu, A.G. Troug, S. A. Channagiri, **D.R. Foster**, X-Ray Tomography of Very High Power Ultrasonic Additive Manufactured builds, Solid Freeform Fabrication Symposium 2012, Jul. 2012, Austin, Texas
- **D.R. Foster**, S.S. Babu, G.S. Daehn, In-situ Velocity Measurements of Ultrasonic Additive Manufacturing, Solid Freeform Fabrication Symposium 2012, Jul. 2012, Austin, Texas
- **D.R. Foster**, S.S. Babu, Resonance Testing of Ultrasonic Additive Manufactured Components, Ohio Space Grant Consortium Student Research Symposium, NASA Glenn/Ohio Aerospace Institute, Apr. 2012, Cleveland, Ohio
- **D.R. Foster**, S.S. Babu, M.J. Dapino, Elastic Constants of Ultrasonic Additive Manufactured Al 3003-H18, NASA Future Forums, Feb. 2012, Columbus, Ohio
- **D.R. Foster**, S.S. Babu, M.J. Dapino, Elastic Constants of Ultrasonic Additive Manufactured Al 3003-H18, Materials Science and Technology 2011 Conference and Exhibition, Oct. 2011, Columbus, Ohio
- **D.R. Foster**, S.S. Babu, G.A. Taber, G.S. Daehn, Low Velocity Photonic Doppler Velocimeter Measurements, 6<sup>th</sup> Annual Photonic Doppler Velocimeter Conference, Sept. 2011, Livermore, California
- **D.R. Foster**, S.S. Babu, M.J. Dapino, Elastic Constants of Ultrasonic Additive Manufactured Al 3003-H18, Ohio Space Grant Consortium Student Research Symposium, NASA Glenn/Ohio Aerospace Institute, Apr. 2011, Cleveland, Ohio
- **D.R. Foster**, M.J. Dapino, Fundamental Understanding of Ultrasonic Additive Manufacturing, NASA Glenn/Ohio Aerospace Institute, Apr. 2010, Cleveland, Ohio