Joseph Lawrence

PhD

Senior Staff Consultant

Dr. Joseph Lawrence is a Senior Staff Consultant at ESi, where he specializes in the engineering analysis of combustion, thermal, and fluid processes, specifically regarding the origin, cause, and propagation of fires and explosions.

Dr. Lawrence has investigated fires in a wide range of applications including residential structures, internal combustion, hybrid, and electric motor vehicles, outdoor maintenance vehicles, watercraft, battery packs, and rail transport applications. These investigations included fire cause and origin determination, burn pattern interpretation, and evaluation of ignition mechanisms.

Dr. Lawrence has published scientific articles in the areas of detonation wave shaping, shock physics, hot spot initiation and sensitization, co-crystallization, explosive characterization, vibration-assisted printing, and additive manufacturing.

Applications of his research include developing safer energetic materials, tailoring detonation wave shapes, the development and evaluation of novel energetic materials, optimization of additive manufacturing techniques, and additive manufacturing of rocket propellants. Dr. Lawrence also serves as a peer reviewer for the Propellants, Explosives, and Pyrotechnics (PEP) journal.

Dr. Lawrence has held a graduate research assistant position at Zucrow Laboratories at Purdue University. Dr. Lawrence has also held positions at DEVCOM Army Research Laboratory (Aberdeen Proving Ground), Kyocera SGS Precision Tools, and Swagelok.

Education

PhD, Mechanical Engineering. Purdue University. 2024

MS, Mechanical Engineering. Purdue University. 2023

BS, Mechanical Engineering. Ohio Northern University. 2020

Positions Held

Engineering Systems Inc., Scottsdale, Arizona

- Senior Staff Consultant, 2025 – Present

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ESi Scottsdale

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Areas of Specialization

- Combustion
- Thermal Sciences
- Fluid Processes
- Fire Cause and Origin Investigation
- Residential Fire Investigation
- Vehicle Fire Investigation

Colwell Consulting LLC, Scottsdale, Arizona

- Engineer, 2024 – 2025

Continuing Education

- **Fire Investigation 1A: Fire Origin and Cause Determination** – California State Fire Marshal, 2024
- **High Voltage Vehicle Safety Systems** – Society of Automotive Engineers, 2024
- **Fundamentals of High Voltage XEV, Safety, and PPE** – Society of Automotive, 2025

Professional Affiliations/Honors

Society of Automotive Engineers International

- Member, 2024 – Present

National Fire Protection Association

- Member, NFPA 921 Task Group on Vehicle Fire Investigation, 2024

Advancing Army Modernization Priorities

- Honoree, Undergraduate Program Outstanding Mentor, 2022 & 2023

Purdue University

- Recipient, Ross Fellowship, 2020

Ohio Northern University

- Recipient, Mechanical Engineering Department Honors, 2020
- Recipient, Engineering Innovation Award, 2016

Tau Beta Pi, Engineering Honor Society

- Member, 2019

Publications

"Detonation Performance and Material Characterization of CL-20 and MDNT Cocrystals Versus Physical Mixtures," **J.R. Lawrence**, S.G. Hamlin, D.N. Patel, M. Örnek, R.E. Ferguson, and S.F. Son, Propellants, Explosives, and Pyrotechnics, Vol. 50, No. 5, 2025.

"The Effects of Material-Filled Voids on Detonation Waveshape in Rubberized RDX Explosives," **J.R. Lawrence**, A.D. Koeblitz, G.A. Montoya, P. Srinidhi, and S.F. Son, Propellants, Explosives, and Pyrotechnics, Vol. 49, No. 12, 2024.

“Switchable RDX-Based Rubberized Explosive with Thermally Expandable Microspheres,” **J.R. Lawrence**, M. Örnek, R.E. Ferguson, D.N. Collard, and S.F. Son, Propellants, Explosives, and Pyrotechnics, Vol. 49, No. 10–11, 2024.

“The Effect of Volume Loading on the Extrusion of Bimodal Glass Bead Mixtures,” **J.R. Lawrence**, H.R. Lipic, T.D. Manship, and S.F. Son, npj Advanced Manufacturing, Vol. 1, No. 5, 2024.

“Influence and Comparison of Cylindrical Engineered Defects on Detonation Waveshape in a Rubberized RDX Explosive,” **J.R. Lawrence**, G.A. Montoya, A.D. Koeblitz, and S.F. Son, Propellants, Explosives, and Pyrotechnics. Vol. 49, No. 6, 2024.

“Effects of Sub-mm Cylindrical Voids on Detonation Performance in PBX 9501,” G.A. Montoya, W.W. Chapman, **J.R. Lawrence**, T.R. Salyer, and S.F. Son, Propellants, Explosives, and Pyrotechnics, Vol. 48, No. 5, 2023.

“Additive Manufacturing and Combustion of RDX-Based Composite Solid Gun Propellants,” A. Afriat., C.W. Wernex, **J.R. Lawrence**, A.C. Hoganson, S.R. Andress, M. Örnek, J.F. Rhoads, and S.F. Son, JANNAF Journal of Propulsion and Energetics, Under Review, 2023.

“The Coupling of Vibrations and Pressure Strongly Affects the Flow Rate and Flow Obstruction Behavior of Additively Manufacturable Composite Gun Propellant Pastes: An Instrumented RAM Extrusion Study,” A. Afriat, **J.R. Lawrence**, J.F. Rhoads, and S.F. Son, JANNAF Journal of Propulsion and Energetics, Under Review, 2023.

“Evolution of Explosively Driven Flash Coatings,” G.A. Montoya, J. Dean, **J.R. Lawrence**, T.R. Salyer, and S.F. Son, AIP Conference Proceedings, Vol. 2844, No. 1, 2023.

“The Effect of Volume Loading and Monomodal Particle Size on the Extrusion of a Colloidal Suspension,” B.J. Montaño, **J.R. Lawrence**, T.D. Manship, S. Isert, and S.F. Son, JANNAF Journal of Propulsion and Energetics, Under Review, Fall 2022.

“The Influence of Microstructure and Polymorphic Conformer on the Shock Sensitivity of 1,3,5,7-Tetranitro-1,3,5,7-Tetrazoctane (HMX),” N.R. Cummock, **J.R. Lawrence**, C.J. Blum-Sorensen, V.S. Vuppuluri, and S.F. Son, Journal of Energetic Materials, Vol. 41, No. 4, pp. 483–509, 2021.

“The Influence of Microstructure and Conformational Polymorph on the Drop-Weight Impact Sensitivity of δ-Phase HMX,” N.R. Cummock, **J.R. Lawrence**, M. Örnek, and S.F. Son, Journal of Energetic Materials, Vol. 41, No. 4, pp. 483–509, 2021.

Presentations

“The Effect of Volume Loading on the Extrusion of a Bimodal Glass Bead Mixture,” **J.R. Lawrence**, H.R. Lipic, T.D. Manship, and S.F. Son, JANNAF Meeting, Pittsburgh, PA, May 22–26, 2023.

“Detonation Performance of CL-20 and MDNT Co-crystal Versus Physical Mixture,” **J.R. Lawrence**, C.J. Blum-Sorensen, S.G. Hamlin, and S.F. Son, 22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter, Anaheim, CA, July 11–15, 2022.

“Effects of Sub-mm Cylindrical Voids on Detonation Performance in PBX 9501,” G.A. Montoya, W.W. Chapman, **J.R. Lawrence**, T.R. Salyer, and S.F. Son, 22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter, Anaheim, CA, July 11–15, 2022.