KRZYSZTOF S. STOPKA

Curriculum Vitae
Homepage, LinkedIn
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RESEARCH INTERESTS

- Advanced manufacturing, specifically focused on additive manufacturing of metals and alloys
- Model-based simulations of materials using frameworks such as crystal plasticity and phase field simulations
- Microstructure characterization through conventional and advanced (e.g., synchrotron radiation) techniques
- Advanced data science and machine learning approaches to explore process-structure-property relationships

EDUCATION

Doctor of Philosophy, Mechanical Engineering May 2021
Georgia Institute of Technology, *Atlanta, GA*

Master of Science, Mechanical Engineering May 2018
Georgia Institute of Technology, *Atlanta, GA*

Bachelor of Science, Mechanical Engineering Nov 2015
Minor in Computational Science
Rose-Hulman Institute of Technology, *Terre Haute, IN*

RESEARCH EXPERIENCE

School of Aeronautics and Astronautics, Purdue University, *West Lafayette, IN*
Dr. Michael D. Sangid Research Group
Postdoctoral Research Associate Jul 2021 – Present
Research Engineer Mar 2023 – Dec 2024
Lead Research Engineer Jan 2025 – Present

- **Program:** Structures Uniquely Resolved to Guarantee Endurance (SURGE), funded by the Defense Advanced Research Projects Agency (DARPA)
  Role: Co-PI
  Project summary: Current efforts to qualify additively manufactured (AM) components focus on perfecting the operation of individual AM machines, but this is costly, time-consuming, and non-transferable to other machines or material systems. The goal of the SURGE program is to develop a new approach in which the life of every unique part is predicted at the point of production, based directly on data captured during manufacturing. Our team is developing a microstructure-sensitive fatigue lifetime estimation framework using digital microstructure and twin models generated from in-situ process monitoring data and physics-based process modeling. As co-PI, I advise two graduate students in developing, calibrating, and integrating crystal plasticity and fatigue crack initiation and growth finite element models using experimental mechanical and characterization data.

- **Program:** Growing Additive Manufacturing Maturity for Airbreathing Hypersonics (GAMMA-H), funded by the Department of Defense, Manufacturing Technology Program as a CUI project
  Role: Research Engineer
  Project summary: Traditional manufacturing processes are inadequate for producing the complex geometries required in advanced hypersonic vehicles. Additionally, the government's supply chain for these components is constrained, with limited opportunities for small businesses and non-traditional defense contractors to contribute during times of need. This program leverages commercial off-the-shelf (COTS) AM thermal history process modeling software, alongside mechanical testing, to develop a digital twin of hypersonic components. The digital twin will compare variability in part distortion and porosity, as well as the associated reduction in mechanical properties due to porosity, predicted using different COTS software and experimentally characterized by several small business vendors selected to manufacture demonstrative hypersonic components. As team lead, I manage day-to-day research activities, mentor three undergraduate student researchers that I recruited for the project, and interface with the project sponsor and software representatives.

- **Program:** Towards a standard for rapid qualification of additive manufactured materials based on defect structures, funded by the National Institute of Standards and Technology (NIST)
  Role: Postdoctoral Research Associate
  Project summary: Widespread adoption of AM relies on the ability to rapidly qualify AM materials and reliably assess the impact of pore defects on fatigue resistance. I integrated component-scale fatigue tests, crystal plasticity models, high-energy x-ray diffraction experiments, and machine learning to quantify the reduction in fatigue resistance due to porosity in Ni-based superalloy IN718. This work promotes a hybrid approach combining experimental mechanical tests with microstructure-based simulations, aiming to reduce reliance on traditional mechanical testing for AM material qualification. These efforts have resulted in three first-author journal publications, with several others in preparation.

- **Program:** Hypersonics Advanced Manufacturing Technology Center (HAMTC), funded by the Department of Defense, Manufacturing Technology Program as a Controlled Unclassified Information (CUI) project
  Role: Research Engineer
  Project summary: Development of new and affordable hypersonics capabilities is critical for national security. As a research engineer at HAMTC, I supported projects on i) the redesign of a scramjet to leverage additive manufacturing capabilities by developing thermal and structural finite element models, ii) advancing critical joining technologies for ceramic components in boost glide vehicles through close mentorship of graduate students, and iii) novel niobium alloy development for additive manufacturing through meetings with collaborators and internal research engineers and graduate students.

- As a senior member of the research group, I have mentored five undergraduate, three master's, and eight doctoral students on projects including those listed above as well as:
  - Identifying hydrogen-density based laws for plasticity in polycrystalline materials
  - Influence of porosity, surface treatment, and cold-dwell on fatigue performance in AM Ti-6Al-4V
  - Efficacy of cold spray aluminum as an AM repair technique
  - Mesoscale thermomechanical modeling of woven carbon composites

School of Mechanical Engineering, Georgia Institute of Technology, *Atlanta, GA* Aug 2016 – May 2021
Dr. David L. McDowell Research Group
Graduate Research Assistant

Thesis: Integrated Computational Materials Engineering Workflows for Microstructure-Sensitive Fatigue of Advanced Alloys
Project summary: The high cost and data variability of physical fatigue experiments, particularly in the High Cycle Fatigue (HCF) regime, requires a paradigm shift to efficiently assess the fatigue criticality of metallic components. Integrated Computational Materials Engineering (ICME) presents an attractive additional pathway that employs microstructure-sensitive simulations given accessible process paths and resulting microstructures to assist and augment decision-support from experiments. I implemented Python workflows to study the effects of intrinsic and extrinsic microstructure attributes, boundary conditions, strain states, and model sample sizes on fatigue resistance. Digital microstructure models of Duplex Ti-6Al-4V and Al 7075-T6 were simulated using crystal plasticity finite element constitutive models, with extreme value fatigue response as the primary performance requirement. Fatigue Indicator Parameters (FIPs) were used as surrogate measures of the driving force for fatigue crack formation. A major contribution of this work is the open-source PRISMS-Fatigue framework, which is a highly efficient, scalable, flexible, and easy-to-use community ICME platform.

X-ray Science Division, Argonne National Laboratory, *Lemont, IL* May – Sep 2020
Materials Physics and Engineering (MPE) Group
Graduate Researcher

- Analyzed high-energy x-ray diffraction microscopy data collected in situ during fatigue testing of Ti-6Al-4V
- Reconstructed digital microstructure for crystal plasticity simulations using data fusion approaches
- Supported automated workflows to streamline in situ data reconstruction and guide experimental protocols

PEER-REVIEWED PUBLICATIONS (Summary: 10 first-author, 12 co-author)

22. H. Gaddam, T. A. Hodes, **K. S. Stopka**, and M. D. Sangid. Experimental and microstructure sensitive fatigue modeling of the effects of periodic dwell and overload on additively manufactured Ti-6Al-4V. (*in review)*
21. **K. S. Stopka** and M. D. Sangid. A unified model for microstructure-sensitive fatigue crack initiation across low and high cycle fatigue. (*in review)*
20. L. Zisis, **K. S. Stopka**, M. I. Alam, Z. D. Harris, M. D. Sangid. Modeling the influence of hydrogen on Ni201 plastic behavior through integration of experimental observations and multiobjective optimization. (*in revision)*
19. J. Solano, S. E. Gustafson, P. J. Noell, **K. S. Stopka**, J-S. Park, P. Kenesei, K. Johnson, and M. D. Sangid. Quantifying precursors to void nucleation and coalescence in Aluminum. *Acta Mater.*, **296**, 121295 (2025) doi
18. L. Loiodice, **K. S. Stopka**, and M. D. Sangid. Pore defects' influence on the local, near threshold fatigue crack growth behavior of additively manufactured Ti-6Al-4V. *J. Mech. Phys. Solids*, **202**, 106173 (2025) doi
17. P. E. Morrison, **K. S. Stopka**, J. I. Ferguson, and M. D. Sangid. Evaluating the damage tolerant behavior of cold spray repaired aluminum alloys. *Int. J. Fatigue*, **190**, 108607 (2025) doi
16. **K. S. Stopka**, A. Desrosiers, A. Andreaco, and M. D. Sangid. A methodology for the rapid qualification of additively manufactured materials based on pore defect structures. *Integr. Mater. Manuf. Innov.*, **13**, 335-359 (2024) doi
15. R. Bandyopadhyay, **K. S. Stopka**, and M. D. Sangid. Initializing intragranular residual stresses within statistically equivalent microstructures for crystal plasticity simulations. *J. Mech. Phys. Solids*, **184**, 105529 (2024) doi
14. **K. S. Stopka** and M. D. Sangid. Modeling fatigue behavior of additively manufactured alloys with an emphasis on pore defect morphology. *J. Mech. Phys. Solids*, **181**, 105429 (2023) doi
13. M. Yaghoobi, **K. S. Stopka**, D. L. McDowell, L. Graham-Brady, and K. Teferra. Effect of sample size on the maximum value distribution of fatigue driving forces in metals and alloys. *Int. J. Fatigue*, **176**, 107853 (2023) doi
12. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, N. Krutz, A. Andreaco, and M. D. Sangid. Intentionally seeding pores in additively manufactured alloy 718: process parameters, microstructure, defects, and fatigue. *Addit. Manuf.*, **66**, 103450 (2023) doi
11. T. Gu, **K. S. Stopka**, C. Xu, and D. L. McDowell. Modeling the statistical distribution of fatigue crack formation lifetime in large volumes of polycrystalline microstructures. *Acta Mater.*, **246**, 118715 (2023) doi
10. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Microstructure-sensitive modeling of surface roughness and notch effects on extreme value fatigue response. *Int. J. Fatigue*, **166**, 107295 (2023) doi
9. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Simulated effects of sample size and grain neighborhood on the modeling of extreme value fatigue response. *Acta Mater.*, **224**, 117524 (2022) doi
8. A. Lakshmanan, M. Yaghoobi, **K. S. Stopka**, et al. Crystal plasticity finite element modeling of grain size and morphology effects on yield strength and extreme value fatigue response. *J. Mater. Res. Technol.*, **19**, 3337-3354 (2022) doi
7. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Effects of boundary conditions on microstructure-sensitive fatigue crystal plasticity analysis. *Integr. Mater. Manuf. Innov.*, **10**, 393-412 (2021) doi
6. M. Yaghoobi, **K. S. Stopka**, A. Lakshmanan, V. Sundararaghavan, et al. PRISMS-Fatigue computational framework for fatigue analysis in polycrystalline metals and alloys. *npj Comput. Mater.*, **7**, 38 (2021) doi
5. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational multiaxial fatigue of Al 7075-T6 and duplex Ti-6Al-4V. *Int. J. Fatigue*, **133**, 105460 (2020) doi
4. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational estimates of driving forces for surface versus subsurface fatigue crack formation in duplex Ti-6Al-4V and Al 7075-T6. *JOM*, **72**, 28-38 (2020) doi
3. **K. S. Stopka**, T. Gu, and D. L. McDowell. Effects of algorithmic simulation parameters on the prediction of extreme value fatigue indicator parameters in duplex Ti-6Al-4V. *Int. J. Fatigue*, **141**, 105865 (2020) doi
2. T. Gu, **K. S. Stopka**, C. Xu, and D. L. McDowell. Prediction of maximum fatigue indicator parameters for duplex Ti-6Al-4V using extreme value theory. *Acta Mater.*, **188**, 504-516 (2020) doi
1. A. E. Tallman, **K. S. Stopka**, L. P. Swiler, Y. Wang, et al. Gaussian-process-driven adaptive sampling for reduced-order modeling of texture effects in polycrystalline alpha-Ti. *JOM*, **71**, 2646-2656 (2019) doi

PUBLICATIONS IN PREPARATION

2. L. Loiodice, **K. S. Stopka**, and M. D. Sangid. A framework for fast microstructure-sensitive fatigue life predictions.
1. **K. S. Stopka**, J. Solano, J-S. Park, P. Kenesei, H. Sharma, and M. D. Sangid. Fatigue and micromechanical in situ synchrotron characterization of an additively manufactured superalloy with porosity.

CONFERENCE PROCEEDINGS

2. **K. S. Stopka**, J. Smallwood, A. Chokshi, S. D. Heister, and M. D. Sangid. Structural and fatigue analysis of a rotating detonation rocket engine. *American Institute of Aeronautics and Astronautics (AIAA) SciTech Forum* (2023) doi
1. **K. S. Stopka**, G. Whelan, and D. L. McDowell. Microstructure-sensitive ICME workflows for fatigue critical applications. *Society of the Advancement of Material and Process Engineering (SAMPE)* (2019) doi

CONFERENCE PRESENTATIONS AND TALKS

27. **K. S. Stopka** and M. D. Sangid. A unified microstructure-sensitive model across low and high cycle fatigue for additively manufactured IN718. Poster at the *International Symposium on Advances in Metallurgy*, London, UK, July 3, 2025.
26. **K. S. Stopka**, J. Solano, P. Kenesei, J-S. Park, H. Sharma, and M. D. Sangid. Synchrotron in situ characterization of fatigue crack initiation influenced by intentionally seeded porosity in an additively manufactured superalloy. *The Minerals, Metals & Materials Society (TMS 2025)*, Las Vegas, NV, March 26, 2025.
25. **K. S. Stopka** and M. D. Sangid. Modeling fatigue crack initiation and propagation life in additively manufactured alloys across fatigue regimes. *TMS 2025*, Las Vegas, NV, March 26, 2025.
24. P. E. Morrison, **K. S. Stopka**, J. I. Ferguson, and M. D. Sangid. Fatigue resistance of aluminum alloy components repaired using cold spray. *TMS 2025*, Las Vegas, NV, March 25, 2025.
23. **K. S. Stopka**, Y. Sun, P. Kenesei, J-S. Park, J. Solano, A. Desrosiers, et al. Rapid qualification of additively manufactured materials with pore defects. *Future Leaders in Aerospace Symposium*, Stanford, CA, May 17, 2024.
22. M. D. Sangid, **K. S. Stopka**, and K. Jung (joint presentation). Scientific examples and demonstration of fast Fourier transform-based simulations with x-ray experiments to explore deformation and fatigue in structural alloys. *Advanced Photon Source (APS) 2024 User Meeting,* Lemont, IL, May 8, 2024.
21. **K. S. Stopka**, Y. Sun, P. Kenesei, J-S. Park, J. Solano, A. Desrosiers, et al. Multimodal characterization and modeling of additively manufactured alloys with intentionally seeded pores. *TMS 2024,* Orlando, FL, March 7, 2024.
20. **K. S. Stopka** and M. D. Sangid. Crystal plasticity fatigue modeling of additively manufactured materials with various pore defect morphology. *TMS 2024,* Orlando, FL, March 5, 2024.
19. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, N. Krutz, A. Andreaco, and M. D. Sangid. Intentionally seeding pores in laser powder bed fusion IN718: microstructure, defects, and fatigue. *TMS 2023,* San Diego, CA, March 22, 2023.
18. **K. S. Stopka** and M. D. Sangid. Modeling fatigue resistance in additively manufactured alloys with porosity defects. *TMS 2023,* San Diego, CA, March 22, 2023.
17. **K. S. Stopka**, J. Smallwood, A. Chokshi, S. D. Heister, and M. D. Sangid. Structural and fatigue analysis of a rotating detonation rocket engine. *AIAA SciTech Forum,* National Harbor, MD, January 26, 2023.
16. **K. S. Stopka** and M. D. Sangid. Experimental validation of crystal plasticity models with additively manufactured defects. *AIAA SciTech Forum,* National Harbor, MD, January 23, 2023.
15. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, A. Andreaco, and M. D. Sangid. Examining the micromechanical response of additively manufactured Alloy 718 intentionally seeded with pores. *Workshop on High-Energy Diffraction Microscopy analysis using Microstructural Imaging using Diffraction Analysis Software (MIDAS),* Lemont, IL, November 9, 2022.
14. INVITED: **K. S. Stopka** and M. D. Sangid. Micromechanical modeling of porosity defects in additively manufactured alloys. *International Conference on Additive Manufacturing (ICAM 2022),* Orlando, FL, November 3, 2022.
13. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, A. Andreaco, and M. D. Sangid. Progress towards a standard for rapid qualification of additively manufactured materials based on defect structures. *ICAM 2022,* Orlando, FL, November 2, 2022.
12. INVITED: **K. S. Stopka**, M. Yaghoobi, J. E. Allison, D. L. McDowell, and M. D. Sangid. Modeling fatigue using digital microstructures: applications of DREAM.3D. *2022 Workshop on Methods for Three-Dimensional Microstructure Studies,* Pittsburgh, PA, August 17, 2022.
11. **K. S. Stopka**, M. Yaghoobi, A. Lakshmanan, J. E. Allison, and D. L. McDowell. Microstructure-sensitive modeling of surface roughness and notch effects on extreme value fatigue response. 2022 *Annual PRISMS Center Workshop,* August 12, 2022, virtual event.
10. **K. S. Stopka,** M. Yaghoobi, J. E. Allison, and D. L. McDowell. Effects of boundary conditions on microstructure-sensitive fatigue crystal plasticity analysis. *The 6th World Congress on Integrated Computational Materials Engineering (ICME 2022)*, Incline Village, NV, April 25, 2022.
9. **K. S. Stopka** and M. D. Sangid. Micromechanical modeling of porosity defects in additively manufactured alloys. *TMS 2022,* Anaheim, CA, March 2, 2022.
8. **K. S. Stopka,** M. Yaghoobi, J. E. Allison, and D. L. McDowell. Microstructure effects on the extreme value fatigue response of FCC metals and alloys: effects of sample size and grain neighborhood. *TMS 2022*, Anaheim, CA, March 1, 2022.
7. **K. S. Stopka**, M. Yaghoobi, A. Lakshmanan, V. Sundararaghavan, J. E. Allison, and D. L. McDowell. PRISMS-Fatigue: overview and case studies. 2021 *Annual PRISMS Center Workshop,* August 3, 2021, virtual event.
6. **K. S. Stopka**, J-S. Park, H. Sharma, et al. Reconstruction of microstructure and defects in an Alpha + Beta processed Ti-6Al-4V plate product using High-energy X-ray Diffraction Microscopy and DREAM.3D. *5th International Congress on 3D Materials Science (3DMS 2021)*, July 1, 2021, virtual event.

5. **K. S. Stopka** and D. L. McDowell. Effects of surface roughness on microstructure-sensitive computations of fatigue crack formation driving force in duplex Ti-6Al-4V and Al 7075-T6. *TMS 2020*, San Diego, CA, February 26, 2020.
4. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational estimates of driving forces for surface vs. subsurface fatigue crack formation in Duplex Ti-6Al-4V and Al 7075-T6. *Materials Science and Technology (MS&T) 2019*, Portland, OR, September 30, 2019.
3. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational multiaxial fatigue. *12th International Conference on Multiaxial Fatigue and Fracture (ICMFF12) 2019*, Bordeaux, France, June 24, 2019.
2. **K. S. Stopka**, A. E. Tallman, L. P. Swiler, Y. Wang, et al. Gaussian-process-driven adaptive sampling for reduced-order modeling of texture effects in polycrystalline alpha-Ti. *TMS 2019*, San Antonio, TX, March 12, 2019.
1. **K. S. Stopka** and D. L. McDowell. Computational statistics of formation and early growth of microstructurally small cracks in Ti-6Al-4V. *MS&T 2018*, Columbus, OH, October 17, 2018.

MENTORSHIP

Georgia Institute of Technology, *Atlanta, GA* Aug 2018 – May 2019
Leadership Education and Development (LEAD) Coach

- Met one-on-one with undergraduate and graduate students for personalized coaching sessions
- Coached a total of six students during the 2018-2019 academic year

Purdue University, *West Lafayette, IN* July 2021 – Present
Postdoctoral Research Associate and Lead Research Engineer

- Mentored an undergraduate students during the 2021 Summer Undergraduate Research Fellowship (SURF) program and three others during the Spring 2023 and Summer 2024 term within Dr. Micheal D. Sangid's research group
- Mentored seven doctoral students and three master's students through weekly meetings

SERVICE

The Minerals, Metals & Materials Society (TMS) Mar 2021 – Present

- Committee member: Integrated Computational Materials Engineering (ICME), Mechanical Behavior of Materials
- Co-organizer (2024-2025) and lead organizer (2025-present) of Fatigue in Materials: Fundamentals, Multiscale Characterizations and Computational Modeling symposium

Peer reviewer (84 total manuscript reviews) for the following journals, Publons Profile Mar 2019 – Present

- Acta Materialia
- Additive Manufacturing
- Applied Science
- Engineering Failure Analysis
- Engineering Fracture Mechanics
- Frontiers in Materials
- International Journal of Fatigue
- International Journal of Fracture
- International Journal of Plasticity
- JOM
- Materialia
- Materials Science and Engineering: A

Grant proposal reviewer for the following organizations: Aug 2023 – Present

- Deutsche Forschungsgemeinschaft (German Research Foundation)

PROFESSIONAL DEVELOPMENT

Georgia Institute of Technology, *Atlanta, GA* Fall 2019 – Fall 2020
Tech to Teaching, Center for Teaching and Learning

- Completed two graduate-level courses and a capstone teaching experience to prepare future faculty
- Delivered six lectures in graduate-level courses on *Fatigue of Materials and Structures* and *Fundamentals of Fracture Mechanics*

LANGUAGES

- English – Native proficiency
- Polish – Native proficiency
- Spanish – Elementary proficiency

HONORS AND AWARDS

- International Symposium on Advances in Metallurgy travel grant – Imperial College London (2025)
- Bravo+ employee recognition program – Purdue University (2024)
- Outstanding Pole Abroad (Chicago & Midwest region), Science Category – Consulate General of the Republic of Poland in Chicago (2024)
- President's Fellowship – Georgia Institute of Technology (2016 – 2019)
- Graduate Scholarship – Polish National Alliance (2016 – 2019)

INDUSTRY EXPERIENCE

B/E Aerospace, *Rockford, IL* Dec 2015 – Jul 2016
Project Engineer

- Conducted Root Cause Analysis to improve reliability of Vacuum Pump
- Worked with customers / suppliers to improve Vacuum Pump performance for multiple aircraft
- Collaborated with design engineers to redesign Embraer Vacuum Waste System

GE Aviation, *Evendale, OH* Jun – Aug 2015
GEnx Engine Performance Intern

- Remedied process of deriving humidity and condensation fan speed adders for production
- Calculated Test Vectors to support new 76K thrust rating for Boeing
- Determined effects of engine's physical turbine deviation on thrust and SFC

Space Exploration Technologies (SpaceX), *Hawthorne, CA* Sep – Nov 2014
Structures Intern

- Designed testing fixture for v2.0 Landing Leg weather seal Research and Development
- Directed tensile, fatigue, torch, and vacuum testing to validate Pyron and Nomex felts as replacement for cork as Temperature Protection System on Falcon 9 Landing Legs
- Evaluated strength of Carbon Fiber samples with Composi-lok fasteners for v2.0 Landing Legs

GE Aviation, *Rockford, IL* Jun – Aug 2014
Manufacturing Engineering Intern

- Appraised LEAP combustor Nacelle Anti-Ice Valve drawings for manufacturability and cost
- Enhanced Qualification Matrix to expand site worker versatility
- Created drawings and process plans for developmental parts using SolidWorks

Tesla Motors, *Fremont, CA* Sep 2013 – Feb 2014
Craftsmanship Vehicle Engineering Intern

- Determined root cause and solution to Model S Instrument Panel fitment inconsistency
- Enriched Research and Development for Model X program to study what competitor vehicles are doing and set competitive or class leading margins for interior and exterior components
- Sourced an E-Cube and Blue Buck project to aid Model X future dimensional quality
- Lead and assisted in custom Model S builds to assess new and modified components

GE Aviation, *Terre Haute, IN* Mar – Aug 2013
Manufacturing Engineering Intern

- Completed weld certifications and gathered dimensional data for Passport and LEAP combustors
- Interpreted GD&T blueprints for online characteristic accountability system
- Updated operation sketches, part routers and check sheets

Diesel Radiator Company, *Melrose Park, IL* Jun – Aug 2012
Design and Manufacturing Engineering Intern

- Reduced steel scrap by an average of 9.7% for high quantity radiator jobs
- Designed facility apparatuses, such as stainless-steel ductwork, and a brass uncoiler and shear rail
- Resolved day to day computer numerical control issues affecting production