

2023-2025 Kent D. Peaslee Junior Faculty
Year-End Report 2024-2025
Enhance Student Participation in Steel Industry

Mario Buchely, PhD

Technical Contact:

Mario Buchely, PhD
Assistant professor, Materials Science and Engineering.
282 McNutt Hall, 1400 N. Bishop,
Missouri S&T, Rolla, MO 65409
Phone: 573-3416972; Mobil: 573-612-4109
buchelym@mst.edu

Administrative/business contact

Kamal Khayat
Vice-Chancellor of Research & Innovation
Office of Sponsored Programs (OSP)
202 Centennial Hall, 300 W 12th St
Missouri S&T, Rolla, MO 65409
Phone: (573) 341-6211
kkhayat@mst.edu

Proposed period of performance: 3 Years.

Year 1: August 2023—July 2024

Year 2: August 2024—July 2025

Year 3: August 2025 - July 2026

Estimated Budget: \$150,000.00 total.

Year 1: \$50,000.00

Year 2: \$50,000.00

Year 3: \$50,000.00

Table of contents

1	Project Summary.....	5
2	Project Goals.....	5
2.1	Forging-in-the-box.....	5
2.2	Outreach in social media.....	7
3	Dissemination of Results:	11
3.1	Establishing Connections with Steel Companies and Industry Suppliers	11
3.1.1	Collaborating with the Peaslee Steel Manufacturing Research Center (PSMRC) and steel-related research projects	11
3.1.2	Inviting steel-related professionals/professors to present in the MSE seminar: ...	11
3.1.3	Connecting with steel-related projects in senior design projects.....	13
3.1.4	Attending conferences and committees related to steel processes.....	14
3.1.5	Organization of committee meeting at S&T	17
3.2	Building Interest in Steel Industry	17
3.2.1	Visiting steel-related companies.	17
3.2.2	PSRMC Undergraduate Research opportunities.....	19
3.2.3	Engaging MA Student Chapter and AFS Student Chapter in Steel-Related Projects and Competitions.	19
3.3	Plans for a steel related student campus event and other programs to obtain direct student contact with the steel industry.	26
3.3.1	ASM materials Summer camp	26
3.3.2	Outreach K-12 students with demos at fairs and elementary-high Schools	26
4	Timeframe and Milestones	27
5	Measuring of success	28
6	Estimated distribution of total cost by year	29
7	Mentors contact information.....	29
8	References.....	30

1 Project Summary

This report highlights the second year of Dr. Mario Buchely ongoing contributions as the 2023–2025 AIST Kent D. Peaslee Junior Faculty Award recipient. Building upon the foundation laid in the first year, Dr. Buchely has expanded his efforts to enhance student engagement in the steel industry through continued development of the “Forging-in-the-Box” educational tool—now upgraded with a custom water-cooled coil and chiller system. He has also strengthened connections between Missouri S&T and the steel industry by integrating steel-related topics into senior design projects, facilitating plant tours, mentoring student interns, and serving as Co-PI or PI on multiple new steel research projects. Through expanded outreach, both in person and via digital platforms, Dr. Buchely remains committed to inspiring the next generation of metallurgical engineers and fostering meaningful collaborations between academia and industry.

2 Project Goals

2.1 Forging-in-the-box

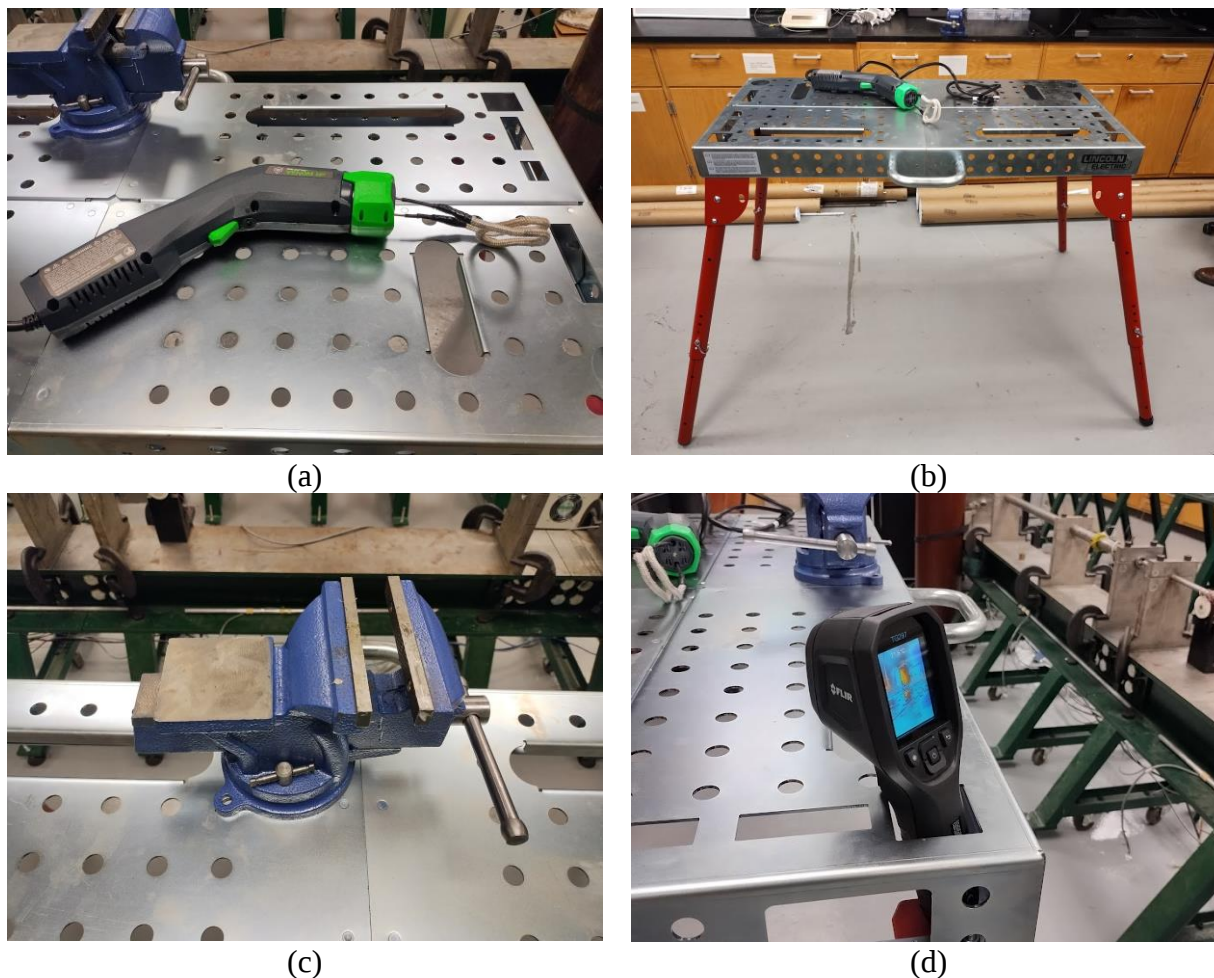


Figure 1. Equipment that from first year to assembly the “Forging-in-the-box” tool (a) Induction gun, (b) Metallic table, (c) bench vise, and (c) Thermal camera.

In the 2023–2024 report, Dr. Buchely introduced the innovative "Forging-in-the-Box" concept, which was developed using a portable induction heating device known as the Mini-Ductor Venom HP (Figure 1a). This compact tool enabled rapid surface heating of small metal samples without requiring a chiller system, making it ideal for outreach demonstrations. The initial setup also included a portable folding workbench (Lincoln K5334-1, Figure 1b), a bench vise for securing samples (Figure 1c), and a FLIR TG297 thermal camera (Figure 1d) to visualize heating during demos and enhance student engagement.

Building on that foundation, the 2024–2025 cycle introduced a significant upgrade to expand the heating capabilities of the setup. A custom-designed water-cooled induction coil was implemented (Figure 2a), allowing samples to reach substantially higher temperatures than previously possible with the air-cooled system. This enhancement supports demonstrations involving high temperatures for forging or heat treatment of steel samples. To accommodate this upgrade, a compact chiller unit was integrated into the setup (Figure 2b), which is connected to the water-cooled induction coil.

These implementations are focused on improving the original "Forging-in-the-Box" concept (Figure 3), expanding the educational value of this tool while also enabling demonstrations that more accurately reflect industrial steel processing conditions. This continued evolution of the system demonstrates Dr. Buchely's commitment to enhancing outreach experiences and providing students with exposure to real-world metallurgical practices.

Dr. Buchely has recently used this upgraded equipment in class lectures and various outreach events, effectively showcasing the expanded potential of the "Forging-in-the-Box" concept. Looking ahead, further development is planned to elevate the system into a fully functional educational forging station. This includes the integration of modular molds to shape forged parts.

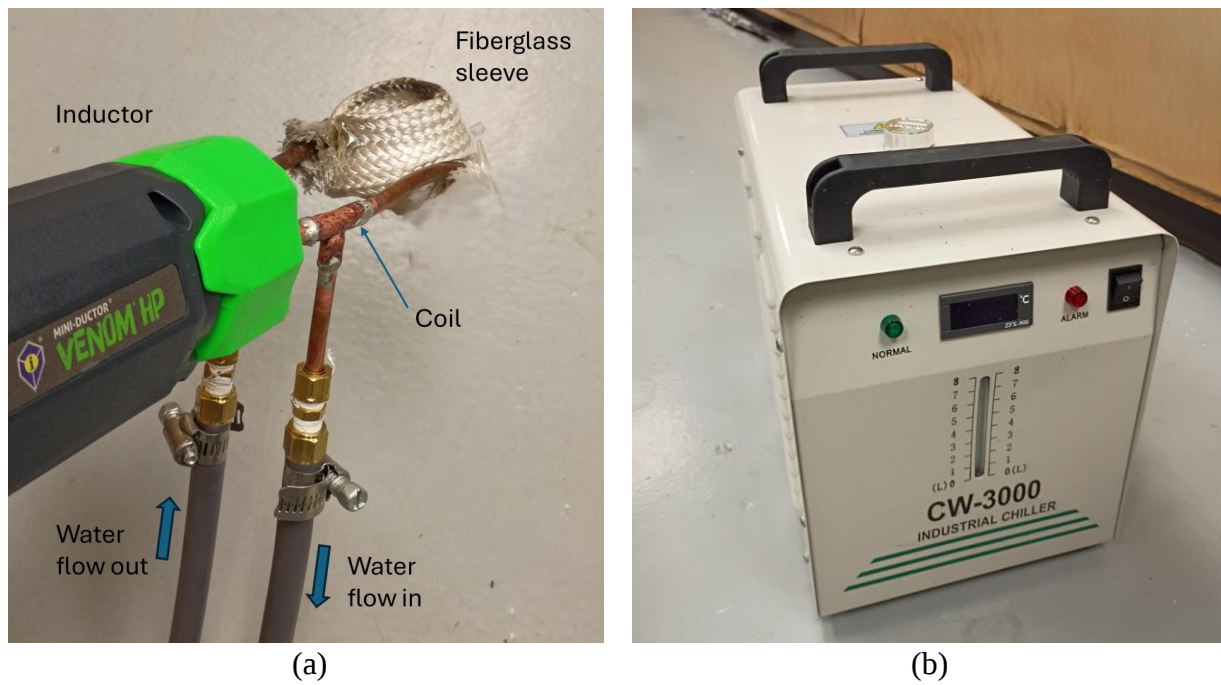


Figure 2. Implementation of new parts for the "Forging-in-the-box" setup: (a) water-cooled induction coil, and (b) compact chiller unit.

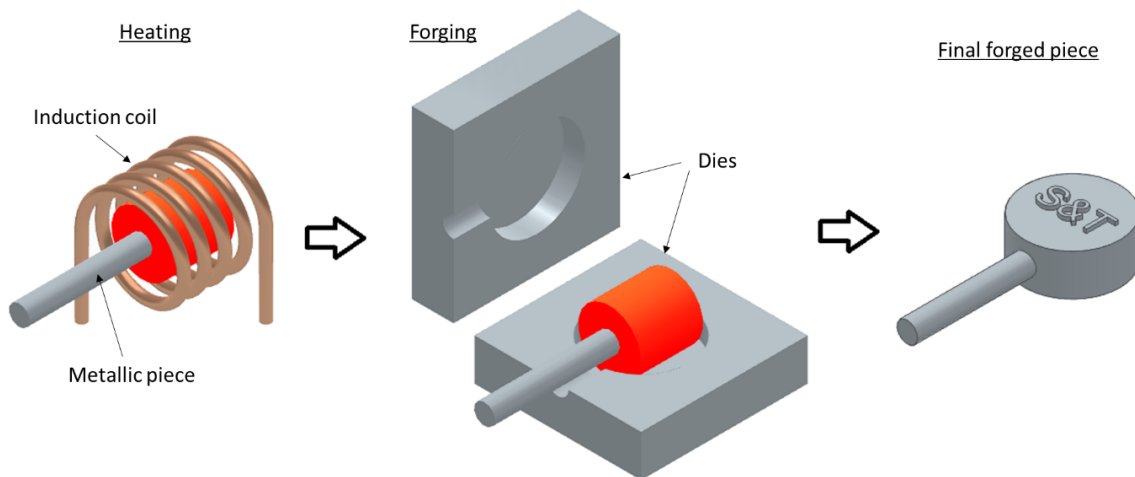


Figure 3. Schematic concept of Forging-in-the-box.

2.2 Outreach in social media

To strengthen his outreach efforts and make his educational and research content more accessible, Dr. Buchely has consolidated all his online platforms into a single, centralized location using Linktree, as shown in Figure 4. Through this hub, accessible at <https://linktr.ee/buchelym>, students, educators, industry professionals, and the general public can easily explore his websites, social media accounts, and educational tools. This integration enhances the visibility of his work, facilitates engagement across diverse audiences, and supports his mission to promote metallurgical engineering and the steel industry through modern digital channels.

Dr. Buchely has already established a dedicated YouTube channel (refer to Figure 5) that showcases his work and expertise. The channel can be accessed through the following link: <https://www.youtube.com/channel/UCXr6nkSUcIAbSkzGdZRC4pg>. Dr. Buchely's YouTube channel has emerged as a valuable platform to expand his influence in the field of metallurgical and materials science. Over the past year, he has significantly increased the channel's content, adding 13 informative videos plus 3 shorts (short video format in YouTube) to bring the total to 83 videos. This growth is reflected in a subscriber base in an increment of ~45%, rising from 157 to 231 channel subscribers. The cumulative viewership has also seen a substantial increase, jumping from approximately 18.3K to 28.8K views across all videos. Notably, a video called "Building Custom Fe-C Diagrams in JMatPro: The Isopleth Method" (174 views) and the short video "Tensile testing in three different metallic samples" (523 views) have garnered significant attention.

Dr. Buchely has continued expanding his Instagram account in the last year (Figure 6). At the moment, he has shared 28 posts (15 posts the last year), including short videos and pictures showcasing his various activities in the field. The profile has gained 47 followers and 2,069 views in the last 90 days. You can find him on Instagram at <https://www.instagram.com/buchelym7/>.

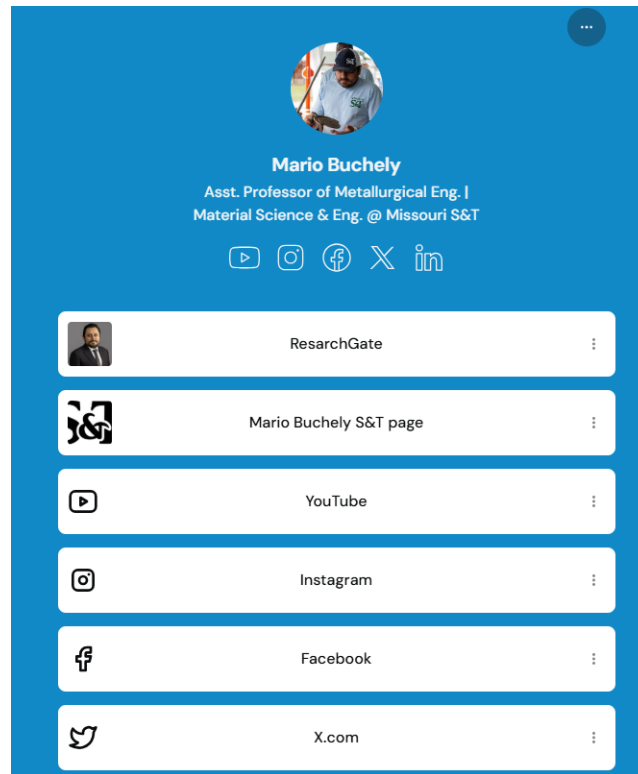


Figure 4. Screenshots of Mario Buchely Linktree page (<https://linktr.ee/buchelym>).

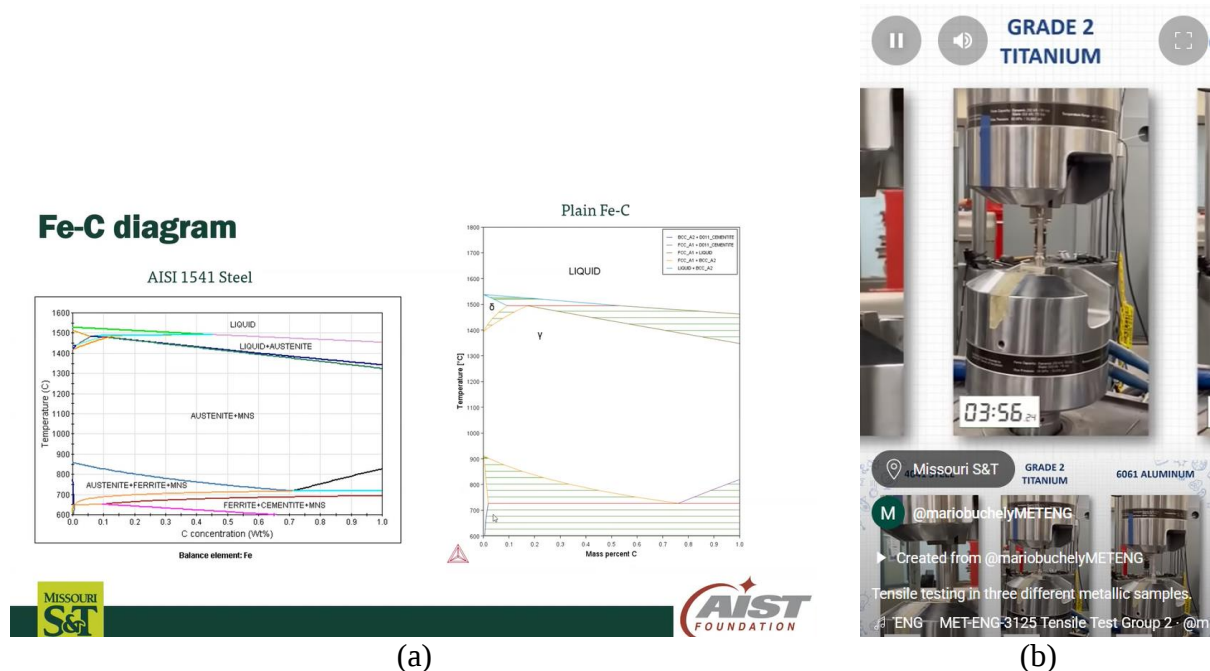


Figure 5. Screenshots of Mario Buchely YouTube channel most popular videos in the last year: (a) Building Custom Fe-C Diagrams in JMatPro: The Isopleth Method (<https://youtu.be/GNwdMy0mvoc>), and (b) Tensile testing in three different metallic samples (https://www.youtube.com/shorts/oc4e6ak_ktw).

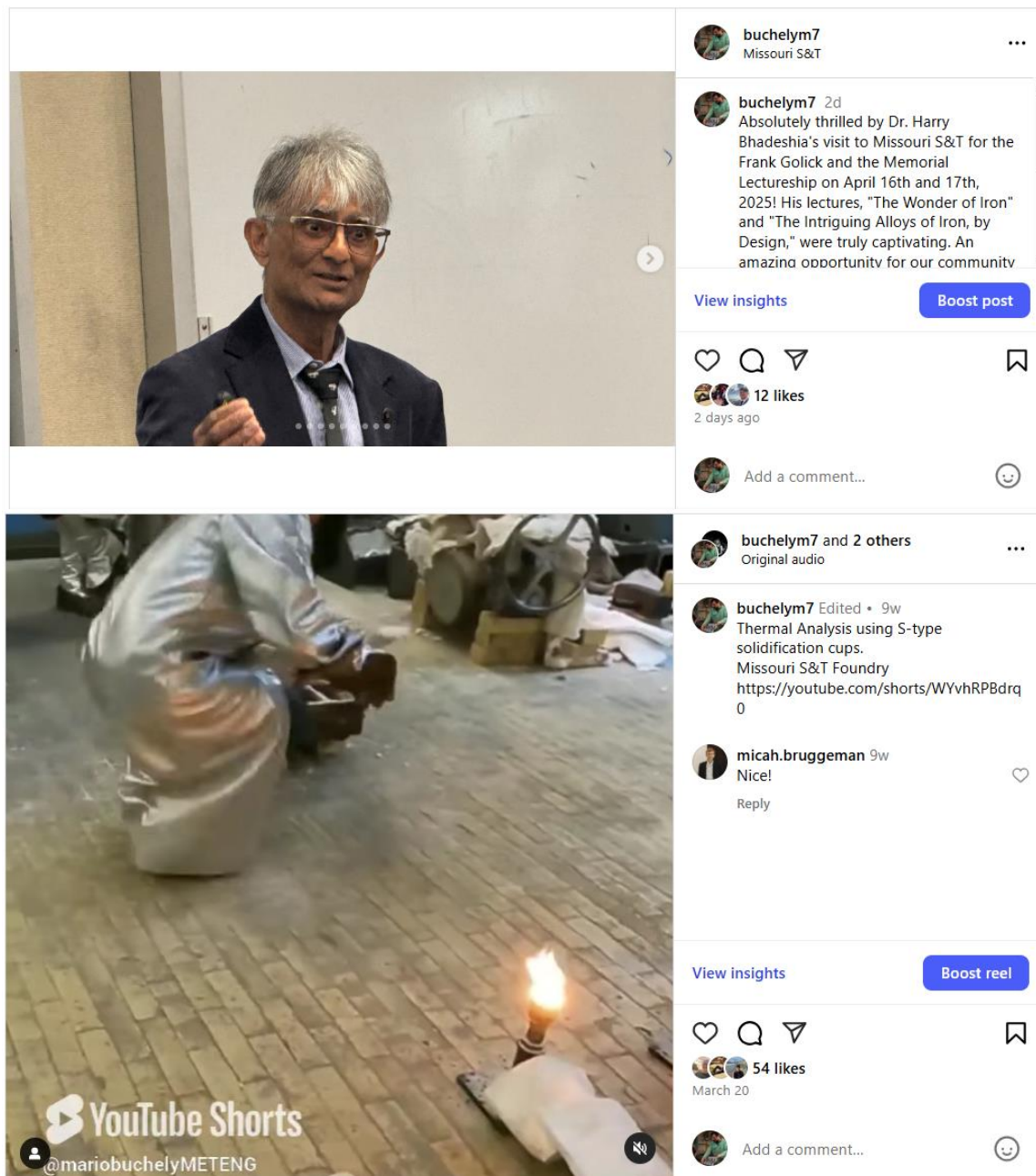


Figure 6. Screenshots of Mario Buchely Instagram posts: (a) Dr. Bhadeshia visit to Missouri S&T (<https://www.instagram.com/p/DJ7ycH8MCrz>), and (b) Hot rolling trails (<https://www.instagram.com/reel/DHbVdCcANnV/>).

Dr. Buchely has continued developing his Facebook page (Figure 7) as part of his broader outreach strategy. Although still in the early stages, the platform is steadily gaining visibility and has begun to attract new followers. It holds strong potential as a tool for future engagement, particularly during conferences, educational fairs, and community events, where content can be shared directly with a broader audience interested in steel-related education and research.



Figure 7. Screenshots of Mario Buchely Facebook profile: (<https://www.facebook.com/profile.php?id=61555455400118>).

Dr. Buchely has also launched a new X (formerly Twitter) page (Figure 8) to further broaden the reach of his educational content. Although still in its early stages, with seven posts published and a growing follower base, the platform presents a promising avenue for real-time updates and engagement with both academic and industry audiences interested in steel-related topics.



Figure 8. Screenshot of Mario Buchely X profile (<https://x.com/buchelym7>).

Dr. Buchely's commitment to creating high-quality content remains steadfast. He will continue to produce engaging tutorials, demonstrations, and discussions that offer valuable insights into the field of materials science and engineering. This content will be tailored to resonate with a diverse audience, from students and professionals to anyone with a curiosity for this fascinating realm.

3 Dissemination of Results:

3.1 *Establishing Connections with Steel Companies and Industry Suppliers*

3.1.1 Collaborating with the Peaslee Steel Manufacturing Research Center (PSMRC) and steel-related research projects

Over the last year, Dr. Buchely has expanded his research portfolio by launching multiple new industry-driven collaborations. These initiatives not only underscore his commitment to advancing applied research in steel processing but also highlight his ongoing efforts to connect students with real-world challenges. Through these partnerships, Missouri S&T continues to deepen its engagement with key players in the steel industry. Notable new projects initiated this year include:

New projects during the last year as PI:

- Novel Soft Magnetic Materials. Honeywell Federal Manufacturing & Technologies. Partially supporting one graduate (PhD.) Student in Materials Science and Engineering: Choji Jeremiah Daches.
- Mn Steel Wire Feedstock Assistance for WAAM applications. ArcelorMittal. Partially Supporting one graduate (PhD) Student in Materials Science and Engineering: Ugochukwu Agbedo.

These new projects broaden PSMRC's research scope, strengthen Missouri S&T's leadership in steel innovation, and offer graduate students meaningful, hands-on industry collaboration.

3.1.2 Inviting steel-related professionals/professors to present in the MSE seminar:

Over the past year, Dr. Buchely has continued his efforts to strengthen connections between Missouri S&T students and the steel industry by facilitating guest speaker engagements for the MSE departmental seminar series during the Fall 2024 and Spring 2025 semesters. Through these seminars, distinguished professors in metallurgical engineering were invited to share their industry knowledge and research insights, providing students with direct exposure to real-world applications and emerging challenges in the field. Details regarding the invited speakers, their presentation topics, and highlights from their campus visits, including photos, are presented below.



(a)



(b)

Figure 9. MSE seminar on Sept. 12th, 2024. (a) Dr. Nilesh Kumar, Assistant Professor in the Department of Metallurgical and Materials Engineering at University of Alabama. Seminar Presented by Dr Kumar: interaction with student at MSE Missouri S&T (b). In the picture, Dr. Kumar (center) with graduate students Jacob Iticovici, Princewill Ojiako, Naram Meesala, Fabian Calderon and undergraduate student Clark Nguyen.



(a)



(b)

Figure 10. MSE seminar on Feb. 27th, 2025. Dr. Sarah A. Hornby, Global Strategic Solutions Inc. Seminar Presented by Dr Hornby: “The Green Steel Revolution” a AIST John F. Elliott Lecture. (a) Dr. Hornby presenting her lecture during the MSE seminar, and (b) Lunch of Dr. Hornby with MSE graduate students Barshan Saha, Henry Haffner, Fabian Calderon, Helin Sasan, and undergraduate students Zoey Snyder.



(a)



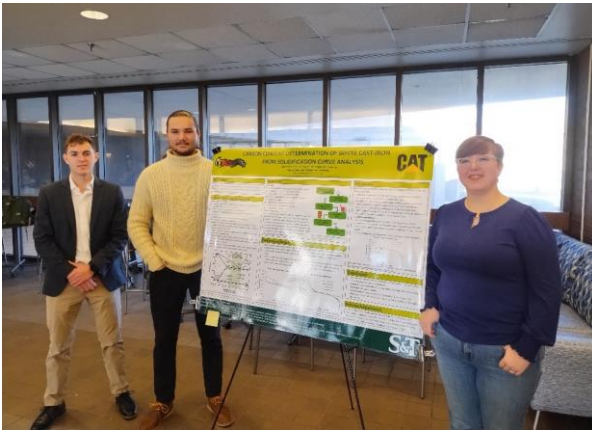
(b)

Figure 11. MSE Golick Lectureship on April 16th and 17th, 2025. Dr. Harry Bhadeshia, Emeritus Tata Steel Professor of Metallurgy at the Cambridge University. (a) Dr. Bhadeshia (right) with Dr. Buchely (left). (b) Seminar presented by Dr. Bhadeshia: “The Wonder of Iron” and “Intriguing alloys of Iron, by design?”.

3.1.3 Connecting with steel-related projects in senior design projects

Dr. Buchely continues to strengthen the integration of academic learning with industrial relevance by mentoring senior design projects that focus on steel and metallurgical applications. Building on previous efforts, he supported a new senior design team in the 2024–2025 academic year, guiding five undergraduate students from the Missouri S&T Materials Science and Engineering (MSE) program.

The team’s project, titled "Carbon Content Determination of White Cast Iron from Solidification Curve Analysis," was conducted in collaboration with Caterpillar Inc. This project offered students valuable hands-on experience with steel characterization techniques and industrial problem-solving. Through regular mentorship and technical guidance, Dr. Buchely helped the team bridge theoretical knowledge with practical applications, reinforcing key concepts in phase transformation and thermal analysis.



(a)



(b)

Figure 12. Senior design team: (a) A. Ventura, M. Scruggs and K. Mazella, presenting their Poster research “Carbon content determination of white cast iron from solidification curve analysis” sponsored by Caterpillar Inc. Senior Design MSE, Missouri S&T, Nov.11th, 2024. (b) First heat performed by the senior design group, Foundry Missouri S&T, Feb. 27th, 2025.

3.1.4 Attending conferences and committees related to steel processes.

To remain at the forefront of steel process innovation and strengthen industry-academia engagement, Dr. Buchely has remained highly active in key professional gatherings. Over the past year, he attended major conferences such as MS&T 2024, the Shanghai Symposium, and AISTech 2025, where he engaged with peers, presented research findings, and explored new collaborative opportunities.

In addition to participating as an attendee and presenter, Dr. Buchely has taken on a leadership role in the international community by serving on the Organizing Committee for the upcoming International Rolling Conference, to be held on September 16–18, 2025, at the Hyatt Regency DFW in Dallas, TX. This appointment highlights his growing influence in the field and reflects his commitment to shaping the future of steel processing on a global stage.

Details of these activities, along with photos and highlights from each event, are presented below.

- MS&T 2024 conference, Pittsburgh PA, Oct. 7th – 9th, 2024 (Figure 13).
 - Oral presentation: Buchely M.F. “Microalloy Additions Strategies for Increased Yield Strength of Bearing Steels”.
 - Participation at AIST Foundation Steel to Student Recruiting Reception. Oct. 7th, 2024.
 - Participation at AIST Foundation University-Industry Relations Roundtable. Oct. 8th, 2024.
 - Committee meeting: AIST Metallurgy - Processing, Products & Applications Technology Committee (MPPTC). Oct. 8th, 2024.



Figure 13. Participation in MS&T 2024 conference, Pittsburgh PA, Oct. 7th – 9th, 2024: a) Dr. Buchely presenting the Adolf Martens Memorial Steel Lecture Award to Amar K. De, (b) Front slide of presentation during MS&T 2024, (c) Dr. Buchely in the exhibit hall at AISTech 2024, and (d) Dr. Buchely sharing with S&T faculty and students during the conference.

- 2024 International Symposium on Strip Casting Technology, Zhangjiagang, China, Nov. 4th - 6th, 2024 (Figure 14)
 - Oral presentation: Buchely M.F., R. O'Malley, Y. Du, and P. Kelly. “Advancement in Dip-testing Technology for Improved Strip Casting Analysis in High Si Steels”.



Figure 14. Participation in 2024 International Symposium on Strip Casting Technology, Zhangjiagang, China, Nov. 4th -6th, 2024: (a) Dr. Buchely during his oral presentation, and (b) Dr. Buchely visiting Shangan Steel plant.

- AISTech 2025, Nashville TN, May 6th – 9th, 2025 (Figure 15).
 - Committee meeting: AIST Plate Rolling Technology Committee. Nashville TN, May 5th, 2025.
 - Committee meeting: AIST Metallurgy - Processing, Products & Applications Technology Committee (MPPTC). Nashville TN, May 6th, 2025.



(a)

(b)

Figure 15. Participation in AISTech 2025 conference, Pittsburgh PA, Oct. 7th – 9th, 2024: (a) Dr. Buchely in the exhibit hall at AISTech 2025 and Committee meeting, and (b) Dr. Buchely sharing with S&T faculty and students during the conference.

3.1.5 Organization of committee meeting at S&T

Dr. Buchely successfully coordinated and hosted the AIST Hot Sheet Rolling Technology Committee (HSRTC) Fall 2024 meeting at Missouri S&T on September 18–19, 2024 (Figure 16). The event brought together professionals from across the steel industry and provided an excellent platform to strengthen the university's connection with AIST. The program also featured an AIST presentation on student engagement and career development opportunities, fostering direct interaction between industry representatives and Missouri S&T students. This event further solidified Missouri S&T's role as a hub for steel industry collaboration and education.



(a)



(b)

Figure 16. Missouri S&T hosted the AIST Hot Sheet Rolling Technology Fall-24 committee meeting. Missouri S&T, Sept. 18th and 19th, 2024: (a) HSRTC chair Raymond Young presented a plaque of appreciation to Dr. Buchely, and (b) AIST presentation for student opportunities.

3.2 Building Interest in Steel Industry

3.2.1 Visiting steel-related companies.

Over the past year, Dr. Buchely has organized and facilitated multiple visits to steel and metal casting facilities, providing students with invaluable exposure to real-world industrial practices. On February 10th, 2025, Missouri S&T faculty and students toured Amsted Rail and O'Fallon Casting in the St. Louis area (Figure 17), where they observed steel and casting processes firsthand and engaged with industry professionals. Additionally, on March 11th, 2025, students and faculty visited Alpha Foundry and participated in the AFS St. Louis Chapter meeting in Wright City, MO, (Figure 18) further reinforcing ties with regional foundries and professional networks. Dr. Buchely also coordinated an industrial visit to S&T campus on March 10th–11th, 2025, when Elwood City Forge Group and North America ForgeMasters visited Missouri S&T for a laboratory tours and industry-academia discussions (Figure 19). These activities reflect Dr. Buchely's ongoing efforts to bridge classroom learning with industry realities, enhancing student awareness and engagement in steel-related careers.



Figure 17. Plant Visit with S&T students: “Amsted Rail” and “O’Fallon Casting”, St.Louis area, MO, Feb. 10th, 2025.



Figure 18. Missouri S&T faculty and students visiting Alpha Foundry and attending AFS St. Louis Chapter meeting, Wright City, MO, March 11th, 2025.



(a)



(b)

Figure 19. Visit of Ellwood Group and North America ForgeMasters to MSE Missouri S&T on March 10th and 11th, 2025. Calum Learn and Denise Villanueva. (a) In the picture, S&T Researches Brad Brauser, Mario Buchely, Katie Kiser (S&T), Calum Learn (NAF) and Denisse Villanueva (Ellwood). (b) Presentation of ELLWOOD and scholarship opportunities to S&T students, March 11th, 2025.

3.2.2 PSRMC Undergraduate Research opportunities.

During the last year, two undergraduate (Lucas and Whalen) students have been fully supported as undergraduate research assistants (URA), and other five students were partially supported as URA by this grant. The following list includes the students, their academic program and year and the supporter semester.

- Lucas Matz, Senior in Metallurgical Engineering, Fall-24 and Spring-25.
- Whalen Downs, Senior in Metallurgical Engineering, Fall-24 and Spring-25.
- Payton Watson, Junior in Mechanical Engineering, Fall-24.
- Abigael Rosendahl, Senior in Aerospace Engineering, Spring-25.
- Ashton Ventura, Senior in Metallurgical Engineering, Spring-25.
- Francisco De Durana, Junior in Mechanical Engineering, Spring-25.
- Jonathan Slama, Senior in Electrical Engineering, Spring-25.

Additionally, two undergraduates Clark and Samuel were supported from the Undergraduate Research Experiences (OURE) at Missouri S&T, and Dr. Buchely served as adviser. Below, there are details of those programs for these students:

- Fall 2024/Spring 2025 – Supporting Opportunities for Undergraduate Research Experiences (OURE) for MET student Clark Nguyen. Project: Thermo-Gravimetric Analysis (TGA) on Scale During The Heating Process. Experience Learning Office. Missouri S&T.
- Fall 2024/Spring 2025 – Supporting Opportunities for Undergraduate Research Experiences (OURE) for MET student Samuel Coartney. Project: The Impact of Quenchant Temperature on the Microstructure and Hardness of AIST 4330 and 4135 Steel. Experience Learning Office. Missouri S&T.

3.2.3 Engaging MA Student Chapter and AFS Student Chapter in Steel-Related Projects and Competitions.

During the last year, different student activities were fully or partially supported by this AIST grant. In the following list and pictures, you can find more information about the different events that were sponsored.

- Participated in AFS Student Chapter meetings (Figure 20), where Dr. Buchely promoted AIST student opportunities and personally sponsored the first-year membership fee for new Material Advantage members to encourage student involvement.



(a)



(b)

Figure 20. Participation in AFS student chapter meeting, MSE Missouri S&T, Aug. 27th, 2024.

- J. Alabi and E. Heidari (Figure 21). Support participation in 29th IFHTSE, ASM IMAT2024, Cleveland OH, Oct. 1-3, 2024. They presented the research work: “Impact of Quenching Intensity Conditions on using a Finite Element Model to Investigate the Microstructure and Hardenability of Low-Alloy Steel”. DOI: <https://doi.org/10.31399/asm.cp.ifhtse2024p0272>
- Kinsley Amatanweze (Figure 22). Support participation in ASM IMAT2024, Cleveland OH, Oct. 1-3, 2024, and 2025 Annual Convention, The National Society of Black Engineers (NSBE), Chicago, IL, March 5-9, 2025.
- Graduate student Princewill Ojiako (Figure 23). Adviser for: *Summer internship, Steel Dynamics*, Columbus, MS, Summer 2024.
- Undergraduate student Clark Nguyen (Figure 24). Adviser for: *Summer internship, Steel Dynamics*, Sinton, TX, Summer 2024.



Figure 21. J. Alabi and E. Heidari participated in the 29th IFHTSE, ASM IMAT2024, Cleveland OH, Oct. 1-3, 2024.



(a)



(b)

Figure 22. K. Amatanweze graduate student: (a) Best paper award during ASM IMAT2024, Cleveland OH, Oct. 1-3, 2024, and (b) Participation in the 2025 Annual Convention NSBE.



Figure 23. Graduate Student Princewill Ojiako during his 2024 Summer Internship. Steel Dynamics SDI, Columbus plant, MS.

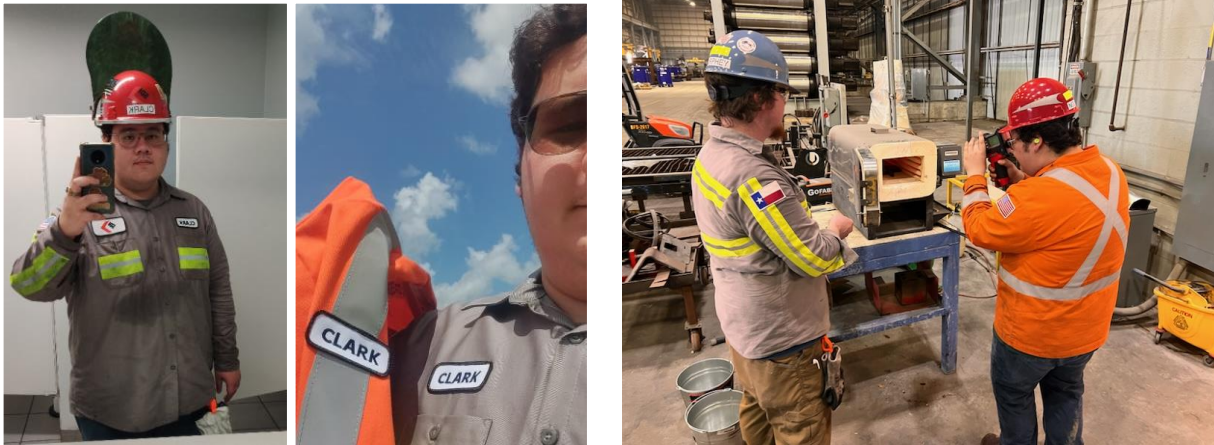


Figure 24. Undergraduate research student Clark Nguyen during his 2024 Summer internship. Steel Dynamics SDI, Sinton plant, TX.

- Ugochukwu Agbedo (Figure 25a). Presentation of his research “Examining the Transformation Temperatures in Cast Martensitic Stainless Steel” during the 19th Annual ISC Graduate Research Symposium at Missouri S&T, April 14th, 2025.
- Johnson Alabi (Figure 25b). Supporting participation in 3rd International Conference on Quenching and Distortion Engineering (QDE 2025), Vancouver, Canada, May 5th -8th, 2025. He presented the research work: “Influence of Quenchant Temperature on Microstructure and Hardness in Jominy End Quench Test for AISI 4330 Steel”. DOI: <https://doi.org/10.31399/asm.cp.qde2025p0096>.



(a)



(b)

Figure 25. Graduate students support: (a) U. Agbedo in the 19th Annual ISC Graduate Research Symposium at Missouri S&T; and (b) J. Alabi in QDE 2025 conference.

- Graduate students: E. Heidari, U. Agbedo, H. Haffner, B. Saha, N. Meesala among others (Figure 26). AISTech 2025, Nashville TN, May 6th – 9th, 2025. They presented their research work during the conference, as oral presentation and poster presentation.
- Clark Nguyen and Samuel Coartney (Figure 27). Support participation in Undergraduate Student Project Presentation Contest. AISTech 2025, Nashville TN, May 6th – 9th, 2025. During this competition, Clark was awarded with the third place, as shown in Figure 28.



Figure 26. S&T Faculty, Undergraduate and Graduate students' participation in AISTech 2025 conference.



(a)



(b)

Figure 27. Undergraduate Student Project Presentation Contest (a) Clark Nguyen, and (b) Samuel Courtney. AISTech 2025, Nashville TN, May 6th – 9th, 2025.



Figure 28. Undergraduate Student Clark Nguyen receiving his award for the 3rd place in the Undergraduate Student Project Presentation Contest, AISTech 2025, Nashville TN, May 6th – 9th, 2025.

In the 2024–2025 academic year, Dr. Buchely’s mentorship continued to yield significant recognition for student research and engagement. One notable achievement includes the 2025 Hunt-Kelly Outstanding Paper Award presented by AIME/AIST for the work titled "In-Situ Observation of the Solidification of X70 Steel Using High-Temperature Confocal Scanning Laser Microscope" (see certificate in Figure 29). Additionally, during the MSE Spring Banquet, Dr. Buchely was honored for the second consecutive year with the 2024–2025 Boots-Clayton Award (Figure 30), a student-nominated accolade recognizing the most caring Metallurgical Engineering professor within the department.

Building on this momentum, Dr. Buchely will continue to guide and lead student teams in a range of competitions and technical presentations at nationally recognized conferences, including AISTech, IMAT, TMS, and MS&T. These engagements provide invaluable opportunities for

students to share their research, strengthen their professional communication skills, and establish meaningful connections within the steel industry.



Figure 29. Hunt-Kelly Outstanding Paper Award, received during AISTech 2025, Nashville TN, May 6th – 9th, 2025.



Figure 30. 2024-2025 Boots-Clayton Award, Student voted most caring MET professor, Missouri S&T. April 25th, 2025.

3.3 *Plans for a steel related student campus event and other programs to obtain direct student contact with the steel industry.*

3.3.1 ASM materials Summer camp

During the summer of 2024, Dr. Buchely served as a tutor for the ASM Exploring Materials in Your World Camp, an outreach initiative designed to inspire high school students to pursue careers in materials science and metallurgy (see Figure 31). Hosted at Missouri S&T from July 21st to 25th, this program gave students hands-on exposure to fundamental materials processing techniques. Dr. Buchely led the Welding Lab, where participants explored three welding processes: Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), and Brazing. His engaging instruction helped demystify these processes while fostering interest in metallurgical careers. Dr. Buchely's enthusiasm and commitment to outreach have made a meaningful impact on these prospective students, and he is already scheduled to participate in upcoming ASM summer camps, continuing his dedication to early STEM education and workforce development in the steel industry.



Figure 31. 2024 ASM Exploring Materials in Your World Camp: Welding lab. Missouri S&T, July 21st - 25th, 2024.

3.3.2 Outreach K-12 students with demos at fairs and elementary-high Schools

Dr. Buchely has remained actively involved in K-12 outreach initiatives, using engaging demonstrations to introduce young students to the exciting possibilities within materials science and the steel industry. Over the past year, he participated in two key events: the Missouri State Fair in Sedalia, MO, August 8, 2024 (See Figure 32), where he represented the Missouri S&T MSE Department at the university's booth, and the Career Fair at St. Patrick School in Rolla, MO, January 27, 2025, (Figure 33). At the latter, Dr. Buchely captivated students with hands-on demonstrations using his educational tool, "Foundry-in-the-Box," sparking curiosity and enthusiasm for metallurgy. These outreach efforts are part of Dr. Buchely's continued mission to promote STEM education, increase visibility for Missouri S&T and its MSE department, and inspire the next generation of engineers and steel professionals.



(a)



(b)

Figure 32. Representation of MSE department in the Missouri S&T booth at the MO State Fair, Sedalia MO, Aug. 8th, 2024 (a) Dr. Buchely discussing with visitors at the fair, and (b) Dr. Buchely with Graduate students: Henry Haffner, Barshan Saha, Johnson Alabi and Naram Meesala.



Figure 33. Participation in Career Fair representing MSE Missouri S&T. Demos: “Foundry-in-the-box”. St. Patrick School, Rolla MO, Jan. 27th, 2025.

4 Timeframe and Milestones

The table below outlines the updated timeline, reflecting both the accomplishments of Year 2 and the planned activities for Year 3. Over the past year, Dr. Buchely successfully met key milestones M1 and M2, which involved advancing the development of the “Forging-in-the-Box” educational tool and sharing its impact through live demonstrations and public outreach events. Furthermore, his digital outreach efforts saw a notable expansion, increasing visibility and engagement through various social media platforms. All other activities outlined for Year 2 were completed as planned and are described in detail in the Measuring Success section. Building on this momentum, the focus for Year 3 will be to sustain and expand these efforts, continuing to strengthen ties between academia and the steel industry while enriching the educational experience for metallurgical engineering students.

Table 1. Timeframe and Milestones

		2023		2024		2025		2026																													
	Task Description	YEAR 1							YEAR 2							YEAR 3																					
Task		8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
1	Forging-in-the-box																																				
1.1	Conceptual design																																				
1.2	Detailed design																																				
1.3	Manufacture of the system																																				
1.4	Evaluation of the system and improvements																																				
	Demonstration of the system in lab demos, classes and fairs																																				
2	Outreach in social media																																				
2.1	Upload YouTube video to the channel																																				
2.2	Create an account on Instagram/Facebook and upload content																																				
2.3	Create an account on X (formed Tweeter) and upload content																																				
	Increase number of subscribers																																				
	Increase the number of views																																				
3	Establishing Connections with Steel Companies																																				
3.1	PSMRC proposal and steel related research																																				
3.2	MSE seminar invitation																																				
3.3	Senior design in steel related projects																																				
3.4	Attend Conferences and meetings																																				
3.5	Organize a committee meeting or seminar at MST																																				
4	Building Interest in the Steel Industry																																				
4.1	Visit steel companies with students																																				
4.2	Hire at least one undergraduate student in steel related research																																				
4.3	Assist with student competitions																																				
5	Contact student with steel industry																																				
5.1	ASM summer camp																																				
5.2	Visit fairs and high schools																																				
5.3	Kummer Colloquiums																																				
4.4	Participation in events online																																				

Shaded area indicates the activities and tasks covered during Year 1 and Year 2.

5 Measuring of success

The following table shows the data that will be collected and be represented of the measuring of success of this program. They are connected with the proposed Timeframe and Milestones from Table 1.

Data collected	Approximated goal	Achieved in Year 1
Number of demos utilizing “Forging in the box” and attending students	At least 1 demo per year (only 1 the first year)	1 demo, ~50 elementary school student
Number of subscribers and views in the current YouTube channel	Undefined for now	231 subscribers and ~28,800 views
Number of subscribers in the new social media channels	Undefined for now	54 followers, ~2,069 views.
Research proposal related to steel topics	At least 1 proposal per year	2 new projects
Invitation to MSE seminar	At least 2 visitor per year	3 speakers
Senior design projects	At least 1 project in steel related research	1 project
Attending conferences and meetings	At least 2 conferences per year	3 conferences and/or symposiums

Organize a Steel related seminar at S&T	At least 1 event in the 3 years of this award	1 AIST committee meeting
Number of visited steel companies and number of students	At least 1 visit per year	2 visits and more than 30 students
Number of students participating in related student competitions	At least attend 2 competitions per year	2 competitions
Number of attending student to ASM summer camp	At least 1 camp per year	1 with 6 students
Number of visit fairs and schools	At least 2 visits per year	1 demo for K-12
Number of students in Kummer colloquiums	At least 2 colloquiums per year	No colloquiums this last year
Number of presentations given in webinars and school online seminars	At least 2 presentations per year	1 class presentations
Number of students from MSE taking internships and Co-Ops with steel related industries	Undefined for now	3 MET students
Number of students taking positions in steel related fields	Undefined for now	11 students: 4 PhD and 7 undergraduate METs

6 Estimated distribution of total cost by year

Total budget – The values provided are approximate and may vary, but the total annual budget will remain fixed. The grant will be subject to evaluation on a yearly basis (12-month cycle).

	Year 1	Year 2	Year 3
Total per year	\$50,000	\$50,000	\$50,000

7 Mentors contact information.

Academic mentor

Dr. Ronald O'Malley
F. Kenneth Iverson Chair Professor
Director, PSMRC
Mat. Sci. & Eng. Missouri S&T
284 McNutt Hall, 1400 N. Bishop Ave.
Rolla, MO 65409-0340
Email: omalleyr@mst.edu
Phone: (573) 341-7683
Cell: (573) 201-9777

Industry mentor

Dr. Dmitry Tsvetkov

Hot Mill Metallurgist

Flat Roll Group Southwest

Sinton Division

Steel Dynamics, Inc (SDI)

Email: dmitry.tsvetkov@steeldynamics.com

Cell: (662) 549-7915

8 References

- [1] AFS, “DEMONSTRATIONS (FOUNDRY IN A BOX),” *American Foundry Society*.
<https://www.afsinc.org/demonstrations-foundry-box>
- [2] D. Austin, “2023 Internet Minute Infographic, by eDiscovery Today and LTMG!: eDiscovery Trends,” *eDiscovery Today*, 2023.
<https://ediscoverytoday.com/2023/04/20/2023-internet-minute-infographic-by-ediscovery-today-and-ltmg-ediscovery-trends/>