

SME Annual Report

2019-2020

Iron Range Engineering Student Chapter



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Officers

Incoming Officers: Connor Croft - President, Nick Zupetz - Vice President, Secretary - Katie Bily, Treasurer - Tristan Carlson/Kade Kukowski

Position	Fall 2019	Spring 2020
President	Kristina Heineman	Kristina Heineman
Vice President	Jared Dahl	Jared Dahl
Secretary	Megan Andrew	Katie Bily
Treasurer	Tristan Carlson	Tristan Carlson
Faculty Advisor	Christine Kennedy	Christine Kennedy/ Yuezhou Wang

President's Report

As the president of the Iron Range Engineering student chapter, I set goals for my leadership term when moving into this position. I will speak to those as follows:

My goals from this year:

1. Represent the Iron Range at this year's National SME Conference
2. Volunteer and educate the community especially with the Bell Program (see my second goal for a description of the Bell Program.)
3. Create an inclusive environment to introduce the upcoming members

My first goal that was set was to build relationships within the National SME community. Our small SME Chapter has made an appearance at the National Conference every year. This has allowed us to make connections with the innovators and companies around the country who associate with mining. In my personal experience, I have noticed that the National Conference sports a lot of copper and gold mining industries with small amounts of iron ore. I believe that our presence at this conference gives us a new outlook on mining and allows us the opportunity to represent our area.

My second goal that was set was to have our student chapter play a greater role in volunteering and outreach during the school year. This fall, Iron Range Engineering started a new program called the Bell Program. They brought in about 20 students from all across the country. The Bell Program is an upper division engineering program for students seeking a Bachelor of Science in Engineering degree. The program is 2.5 years in duration. The first half-year is on-site at Iron Range Engineering in northeastern Minnesota where students will complete the Bell Academy. The following two years are spent working as co-ops at companies anywhere in the world. A co-op is much like an internship position in which students are paid to work for an extended period of time. This Fall we spoke with the Bell students and explained what mining was in our community and how it impacts us and their education directly. Our SME chapter also participated in highway cleanup at Iron Range Engineering's highway claim North of Virginia, MN. This keeps not only outreach in our school community but also in our local area.

The third goal for our program was to develop a plan for new incoming officers to be ready once they take office. This included describing the roles before and during the voting process for next year as well as having members track and understand what this year's officers were doing to plan and set up events such as volunteering and recruiting.

I graduate this semester and leave the chapter in the more than capable hands of Connor Croft, Nick Zupetz, Katie Bily, Tristan Carlson, Kade Kukowski, and Christine Kennedy.

Vice President's Report

I had two main goals for this year in SME. My main goal for this year was to build connections while at the National Conference in Phoenix, AZ. I believe that with every encounter there is always something that I can take away from that conversation and use in my future as an engineer. The second goal I had was to educate the entire SME chapter about the importance of attending events like the SME National Conferences or the Duluth Conference. There are so many valuable takeaways, from making connections to learning about the new technology we may be working with someday. This is why I was so happy when we were told we could officially attend the trip.

The National conference was an incredible experience for those of us who attended and we were able to experience a variety of events, from informational sessions, student breakfasts, vendor dinners, exhibit hall experience and creating connections to help with projects at IRE and future careers. We were able to experience Phoenix's great city and participate in many activities around town and build relationships with students from other universities.

With this being my last semester at IRE I would just like to thank everyone who has helped with SME and made it possible for us to be able to create these incredible experiences and memories. When I first joined SME I wasn't sure really why I did. I had several friends in it, but after being involved for a year and a half I realized the importance of SME and encouraged everyone to join.

Secretary's Report

As the secretary of the Society of Mining and Metallurgy student chapter I would like to start out by thanking everybody for their hard work throughout this academic year. Iron Range Engineering is by far the smallest school to attend the national conference and without the exceptional leadership from both our members and officers that trip would not have happened.

As the secretary of the SME student chapter I was responsible for completing a variety of tasks including taking detailed meeting minutes, recording meeting attendance, and

answering any questions that the student body or members of the SME chapter may have.

It is critical that the secretary takes accurate meeting minutes. Every meeting that is held requires us to take meeting minutes. Content in the meeting minutes includes the date the meeting was held, attendees and the location of the meeting, and notes about the different topics that were discussed throughout the meeting. After the meeting the meeting minutes are posted in the google drive where everybody can view them.

The secretary position helps build his or her resume while gaining valuable experience that will benefit the individual down the road. Also this position is an excellent way to be involved in the community which will help students build excellent connections which will lead to success.

Treasurer's Report

The Iron Range Engineering SME Student Chapter began the academic year with a positive starting balance from the previous year's balance. The Chapter received dues throughout the year as new members joined. Dues were received from twelve students who either became or continued to participate as active Chapter members.

At the start of the year, the Chapter elected to seek funding from the Minnesota Section of SME to be used for various events and the SME National Conference. The Chapter Treasurer created an operating budget to be used throughout the year and to serve as a plan for possible income and expenses. The budget can be seen in Figure 1 below, with estimated and actual amounts listed.

Income	Budgeted Amount	Actual Amount
Starting Balance	\$28.00	\$28.00
SME MN Grant	\$4,500.00	\$4,500.00
SME National Travel Reimbursement	\$1,500.00	\$1,500.00
Expected Membership Dues (12 @ \$20)	\$240.00	\$240.00
Iron Range Engineering Grant	\$0.00	\$0.00

TOTAL INCOME	\$6,268.02	\$6,268.00
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Expenses	Budgeted Amount	Actual Expenditure
Student Life and Volunteering Events	\$100.00	\$0.00
UMD Tickets	\$0.00	\$0.00
Kunnari's Thanksgiving Meal	\$0.00	\$0.00
National Conference- Phoenix Feb. 22rd-26th, 2020	\$1,400.00	\$1,400.00
Flights- 10 People	\$3,000.00	\$2,458.00
VRBO- 10 People	\$2,000.00	\$2,003.00
Parking @ MSP	\$160.00	\$128.00
SME Endorsing Apparel / Gear	\$400.00	\$0.00
Savings for Next Year's Starting Balance for Fall 2020	\$200.00	
TOTAL EXPENSES	\$7,260.00	\$5,989.00
CURRENT BALANCE		\$279.00

Figure 1: IRE Budget 2019-2020

This year's SME club was able to maintain a budget throughout the semester and keep the numbers matching up well with what was budgeted for the year. We had some areas that we saved on money in hopes that we would be able to send all of the current members in the chapter to the National conference as we feel that this is a very beneficial opportunity for members to experience and bring back new things to gain interest in the group for other students at IRE that have not joined yet.

The largest expense this year was the SME National Conference in Phoenix, Arizona. This year we sent ten IRE students down to the National conference which is a big group and with the cost of airfare and accommodations, it used up most of the current IRE SME budget. One of the other events the chapter held was a student barbeque for all of the students in the IRE and Bell programs and tried to help educate some of the Bell students who are from around the country what SME is and provide them with a little more information on mining.

Tristan Carlson will remain the Treasurer for the IRE SME chapter for the fall semester of the 2020 school year and use this time to train in a new member (Kade Kukowski) as Tristan will graduate in December of 2020, at that time the group will vote in a new

Treasurer to take over the position. When we voted to get new leadership for the 2020-2021 year, no one was confident enough to take over the role and that is why with the training from Tristan, someone will be able to take the role over at the beginning of 2021.

Faculty Sponsor's Report

The location of the Iron Range Engineering (IRE) program lends itself to be immersed in mining. IRE is at the heart of iron ore mining country in Virginia, MN. Many of our students come from generations of miners who have lived mining their whole lives. They understand that mining truly supports our way of life. Therefore, it comes as no surprise that IRE's SME student chapter has again been the largest student group we have at our engineering program. The following paragraphs will talk about the groups involvement in the local and non local communities.

All of the SME student chapter members have been actively involved in the local community. They consistently work towards educating the college and area residents about what mining is and how it is necessary/beneficial. In a region that contributes 3.5 billion dollars to Minnesota's local economy, this is extremely important. The members also show how even though they are pro-mining, they are also pro-environment. Unfortunately, it is sometimes thought that these two cannot coincide. IRE's student chapter organizes a volunteer effort at the college for highway and campus cleanups multiple times throughout the academic year.

One of the ways that the SME student chapter gains interest in membership is through the attendance of the National conference each year. When the students return from the conference, they come back with a plethora of knowledge on mining and networking that they didn't previously have. This year, the SME student chapter asked to present what it was like to attend the conference to the entire student body. They did this during a class where all students were present. They talked about how fun it was while also emphasizing things that they learned.

For these reasons, I feel like the SME student chapter at IRE is the largest student group. They are dedicated to informing their communities about the importance of mining. They volunteer their own time and create networks throughout the country to achieve this reality.

Activities and Outreach

The members of IRE's SME participated in several outreach opportunities as well as organizing several activities for IRE. The main forms of outreach that took place over the last year are Highway Cleanup and talking with BELL students to educate them on the mining process in Northern MN. The activity we helped organize was a BBQ for everyone at IRE. We also attended the National conference in Phoenix, AZ and attended several student mixers, technical sessions, and expo hall to build connections.

Officer Elections

A few semesters ago our student chapter developed a new program, we like to call it the officer mentorship program. The goal of the mentorship is to bring the incoming officers up to speed with what the current officers are doing and have them understand more of the day to day workings with what each position does. We have implemented this because here at Iron Range Engineering our program graduates students every semester and that has caused issues in the past with some officers leaving halfway through the year and leaving the newly elected officer(s) to try and figure the position out by themselves. Thus, it is like starting over every time a new officer is elected into position and more time is spent just familiarizing yourself with the position than focusing on furthering the student chapter.

Another benefit of doing officer elections now is that it affords the chapter to have consistency going into the following semesters. Our student chapter has only seen a slight increase in membership, but we have been able to gain a few crucial members who are just starting their college careers and are going to be involved with SME for the next few years. This means we have great potential with these dedicated individuals to try and develop our chapter even further.

Consistency provides stability and if you are able to minimize the time that new offices need to adjust to being an officer, it means the more productive time that you will get from them. Our chapter saw this as a great point of concern this year and have decided to elect officers at the beginning of the semester and have the outgoing officer teach the incoming officer the duties of the job. This helps build a legacy of best practices for our student chapter.

We once again implemented this technique to better prepare the new officers for their new positions. This year, we had a decent amount of new members join which was great to see their interest in mining and its importance to our community. With these new members, we are confident that the future of the IRE chapter is in good hands.

Incoming Officers: Connor Croft - President, Nick Zupetz - Vice President, Secretary - Katie Bily, Treasurer - Tristan Carlson/Kade Kukowski

Membership

To become a member of the Iron Range Engineering student chapter of SME you must meet the following requirements:

1. Be in good standing with Iron Range Engineering and/or Mesabi Range Community and Technical College: Pre-Engineering program.
2. Pays any and all National and/or Local Chapter dues.

Fall 2019	Spring 2020
Kristina Heineman (President)	Kristina Heineman (President)
Jared Dahl (Vice President)	Jared Dahl (Vice President)
Megan Andrew (Secretary)	Katie Bily (Secretary)
Tristan Carlson (Treasurer)	Tristan Carlson (Treasurer)
Mitchell Masters	Mitchell Masters
Luke Vine	Luke Vine

Kade Kukowski	Kade Kukowski
Nick Zupetz	Nick Zupetz
Connor Croft	Connor Croft
Zach Jackson	Zach Jackson
Anthony Marinaro	Anthony Marinaro
Katie Bily	Megan Andrew
	Luiza Quintana Secco

Goals for 2020-2021

As the future president, I believe it is in our best interest to set goals for our chapter here at Iron Range Engineering. This not only benefits our local student chapter of IRE but the National SME club.

1. Attend more SME/Industry related tours

I think that the IRE chapter can do a much better job trying to reach out to various companies that are related to SME. This will not only give a better understanding of how these companies function but also widen our knowledge of the mining industry. From past experiences, I know how many different types of mining there is. Being able to introduce new and exciting experiences to the student SME chapter will help facilitate growth in the minds of all the members.

2. Have a larger SME student chapter

Currently, the Iron Range Engineering student chapter has 10 members. I am hoping to double that number by the spring of 2021. While attending the SME National conference in Phoenix, Arizona this past spring, I really understood how small our chapter is. Some SME chapters had 40+ students. By increasing the number of participants, our chapter can network with more individuals, helping both the student members and Iron Range Engineering.

SME National Conference Reports

The Iron Range Engineering Chapter attended the National SME Conference this year in Phoenix, AZ. Each of the members that attended wrote a paper summarizing what they learned and why attending the conference was a beneficial experience for them. These reports are shown below.

Jared Dahl SME Report

SME National Conference Technical Sessions:

I was one of the only 3 students that attended the SME National Conference the year prior in Denver Colorado. With this being my second time attending the SME National Conference I had a little better of an idea of what to expect from the technical sessions and what to look for in retaining important information. This first conference in Denver, the technical sessions were very overwhelming and it was difficult to try and get key takeaways from the presentations. This year with having that experience I found it much easier to find key takeaways from each session and how I can use them in my future not only in SME but in my future career. Listed below are my 3 key takeaways from all of the technical sessions I attended.

1. Seeing New Technology
 - a. At the SME National Conference, we were exposed to many new technologies that are being used in the mining industry. One of the cool ones that we saw was a company that had a VR headset to use in AutoCAD that allowed us to look through a mine in a 3D view that was built in AutoCAD. Overall, it was very valuable to be able to go to the expo hall and technical sessions to learn about all of the new technology being introduced to the mining industry.

2. Presentation Skills

- a. Another really important skill that we learn at Iron Range Engineering is the importance of presenting. Someone can be very intelligent and not have the best presenting skills, and it limits how well they can relay that specific information. At some of the presentations for the technical sessions, it would be hard to follow along with everything they are saying because they are not the best at presenting. It really just proves a point on how important presentation skills are and how we will benefit from them in the future.

3. Comprehending Technical Information

- a. Like I stated before, in these technical sessions the vast amount of information that is being conveyed can be overwhelming. A major strategy that I learned was that most presenters have an overview slide. If you write down those topics, you will not be as stressed and you can write down notes under those specific categories when the time comes.

Importance of Attending the National Conference:

I think having the IRE SME Chapter attend the National Conference every year is very important not only for the members, but for the school as well. I have several reasons for why I believe it is important for each listed below.

1. Members

- a. Making Connections
 - i. Students
 - ii. Industry
- b. Learning about different Types of Mining
- c. Learning about how many different industries are connected to mining
- d. Internships, Co-Ops, or Full-Time Job Opportunities

2. School

- a. Learning about New Technology
- b. Companies Learning about IRE
- c. Encourages others to join SME

I can honestly say that both of the SME National Conferences that I attended have had an impact on my life and on my future. It gave me the confidence to talk to people that I don't know much about. This really helped me with attending career fairs. It taught me the importance of having good presentation skills and most importantly it has created memories with my friends that I wouldn't trade for anything. I would like to end by thanking everyone that makes attending events like the SME National Conferences or

the Duluth Conference possible. Without all of the help students wouldn't be able to go and learn new information and create these memories.

Connor Croft SME Report

SME National Conference Technical Sessions:

Because this was my first SME conference, I really didn't know what to expect. Based on past conferences I have attended, I was expecting a moderately large conference where there were relatively few opportunities to communicate and connect with other people. When I first arrived, I was completely shocked at how large the conference was. The most interesting events I attended were the technical sessions every day. Below are the three biggest takeaways I learned from the technical sessions.

1. Understanding the world of mining.
 - a. Thanks to the technical sessions, I got a slightly bigger grasp on the mining industry. I truly had no idea how many different types of mining there are and all the cool locations these mines are located. Before, I knew of the Iron Range mines, but not much more after that. Not only did I learn about the magnitude of the mining industry, but all the technology that goes into it. I attended a technical session where they were using some type of modeling software to try to pinpoint gold deposits, which is extremely interesting.
2. Presenting Skills
 - a. At Iron Range Engineering, we pride ourselves on communication prowess. At the SME National Conference, some technical sessions were hard to follow from lack of preparation, nervousness, or some other factor. It was really unfortunate because their work is interesting, but becomes boring when the information isn't displayed and spoken in a professional manner. We also saw some presentations that were almost flawless. The material was interesting, the presenter was speaking with enthusiasm and was quite enjoyable to listen to. Also, the information was easier to understand. Presenting skills are a necessity in the real world and the SME Conference proves that.
3. Connecting with others
 - a. Finally, in between technical sessions, I was able to speak with the speakers and others attending the conference, which was debatably one of the best parts of the conference itself. Understanding how people got into the mining industry, where they come from, etc... really broadens your

horizons and helps you understand that the mining industry is so much bigger than Minnesota. Also, it helps you recognize the many different cultures around the world.

Importance of Attending the National Conference:

The National Conference was instrumental in my growth at IRE. I think that the application of what we learn at IRE at the Duluth and National Conferences helps us develop more skills at becoming better engineers. Also, it spreads the Iron Range Engineering philosophy. Below is a list of what I believe to be the biggest takeaways from the SME National Conference.

1. IRE SME Members
 - a. Connection opportunities
 - b. Internship/Co-Op opportunities
 - c. Technological advancements
 - d. Ability to put practices learned at IRE to use
2. School
 - a. Implementing new technologies
 - b. IRE philosophy grows
 - c. Helps develop more connections

Even though I have only attended one SME conference, I am so happy that I attended and would always recommend others to go. The conference has been instrumental in my growth and I will always cherish the time I spent exploring Phoenix and the world of mining with my friends at IRE.

Kade Kukowski SME Report

In this paper, I am going to reflect upon the conference topics and new information I learned on my Arizona trip I took with Iron Range Engineering's SME student chapter trip. Overall, the trip was a very great experience that I expanded not only my knowledge in mining up also made memories with my classmates that will last a lifetime.

GMS Mining Repair and Maintenance:

GMS focuses on underground mining, surface mining, and tunneling. GMS uses six different pillars of service; contract labor, contract mining, specialized services, pioneer conveyor, engineering services, and fabrication.

Contract labor: They have nearly forty years of experience in the field. GMS is the largest and most successful underground and surface mining labor provider in the United States. Through the use of their employee development programs and outside internal recruiters, they maintain an active pool of available skilled labor employees. They source many employees for deployment into multiple industries throughout the world.

Contract Mining: In addition to providing a very experienced labor staff, GMS can handle every aspect from production mining operations, whether it be surface or underground mines, material handling, equipment maintenance, mine design, drilling, blasting, cutting, excavating, scheduling, and budgeting.

Specialized Services: GMS offers leading-edge underground and surface technical services. They are experienced and proficient in many areas including ground control ventilation, belt terminal services, concrete, slope and drift excavation, shaft work, blasting, longwall services, and surface construction. Each of those technical service disciplines has its own dedicated managers and labor teams providing rapid response and effective resolution to their customer's most critical and technically demanding applications.

Pioneer Conveyor: Their partner company, Pioneer Conveyor is a leading bulk material conveyor manufacturer with complete engineering, machining, and fabrication capabilities to design and manufacture even the most complicated conveyor belt systems seen in different industries.

Engineering Services: Their technical sales reps work closely with anyone, their engineers, and fabrication experts to create the most appropriate customized solutions for any specific situation. They utilize state-of-the-art software in manufacturing equipment, to minimize the lead time and maximize efficiency while operating three fabrication facilities to simplify production and the transportation of logistics.

Fabrication: Using modeling and design software that is compatible with all of their customers, GMS provides seamless communication and quick-turn solutions to meet any high demand. Their engineering department along with their fabrication team, can custom design, engineer, and manufacture everything from replacement parts to large capital projects.

Safety: Lastly, safety is the foundation of everything GMS does. Their staff includes safety supervisors and safety foreman who provide training in different customer

locations throughout the world. They have a strict training certification, and continuous education protocol in place to ensure safety in everything they do.

This trip also again taught me the importance of connections. Everywhere you go and everything you do is being watched by someone. When doing the right things, the right people notice you. I had the chance to talk with many companies who ended up offering me a job if I ever wanted to move off of the Iron Range. I connected with many employers and hiring staff through my Linked-In account that I still keep in contact with to today. Lastly, it was fascinating making connections with other students and learning about the different kinds of college programs they are in. Overall, the trip was full of fun times and irreplaceable memories.

Zach Jackson SME Report

Any professional conference is a good method of learning more about the industry you are interested in, as well as being able to network with individuals and organizations in that field. At the 2020 Arizona SME conference, there were many different technical seminars, in which students and others were able to sit in and learn about a particular piece of the field of mining.

The first seminar I was involved with was one given by a Graphtek representative, who talked about an innovative way of surveying and using known data points on a site, to make it faster and safer for those involved. They went on to explain that they had the ability to capture inaccessible spaces, and offered a wide range of cost options, depending on the need. This product eliminates the need for ground control points and overall makes it much safer for those using it, however, it also has a dependency on the weather, and different regulations set in place by the sites.

Another seminar I went to was by a doctorate student at Colorado School of Mines, who talked about magmatic and hydrothermal fluid flow, and how it shaped the battle mountain mining in Nevada. In this seminar, the focus was mainly on how using different methods of dating minerals can help to determine where deposits of ore were, and what different terminology behind this was. It also went into how mining engineers should look for deep structure connectivity, and look for different zoning within the mining sites.

Another seminar, which talked about how mine blasts can dilute ore concentration in the ground, and how blasting can affect the chemical bonds within the blast zones. It basically discussed the profitability of mining operations, and how to optimize solutions to complex problems. The way they suggest to do this is by optimizing post-blast tonnes

of ore, rather than focusing on what is there pre-blast, as that is where your profit will lie after you process the ore. It also went into how harder rocks require higher energy to break, which leads to more change, and how to design your model with the highest resolution possible.

The last seminar that I attended was from Epiroc, which is based in Minnesota. In their seminar, they discussed the importance of drilling consumables, especially drill bits for drilling rigs. As they are a very important part of mining operations, the components that should be chosen should emulate this. From considering the geology of the area being mined, to hole dimensions, it is important to determine the most cost-effective bits and other drilling components for the area. It is also important for mine to consider all the different variables that affect drills, such as manufacturing capacity, the quality, global footprint of the supplier, and drilling training.

Throughout all of the seminars I attended, I had a clear takeaway and learned something new about the mining industry. Although some of the seminars had some more difficult concepts to understand, most of them did a good job of being able to explain them to both students, as well as the industry members that were partaking in them. It was very important that we all attended the seminars, and I can see why, as the takeaways from them definitely helped me to shape a new idea of what engineers do in the mining industry.

This event was also a very useful way for me to network with others. As there were vendors and organizations from all over the USA, in all positions in the mining industry, it was very intriguing to talk with them and discover different areas of engineering within mining. It was helpful for me to be able to talk with industry members, as there is a new dynamic when you are communicating with them on the same level, as engineers.

Tristan Carlson SME Report

SME National Conference Technical Sessions:

This was my first time attending the National conference for SME. I had previously attended the regional conference in Duluth which is a good experience but compares nothing to the National conference in size. I am not from the Iron Range and don't have a lot of experience with the mining process. This is the reason that I joined SME because I wanted to know about the process that supports a lot of the economy around the school we go to as well as get more people like me who aren't from the area to join the chapter to learn more about it. One thing that I noticed from the technical sessions

was how in-depth they go on the content they are talking about which is difficult for someone like me who doesn't know the process as well to understand. Listed below are some of the things that I learned from the technical sessions and expo hall.

1. Seeing New Technology

- a. At the SME National Conference, we were exposed to many new technologies that are being used in the mining industry. One of the cool ones that we saw was a company that had a VR headset to use in AutoCAD that allowed us to look through a mine in a 3D view that was built in AutoCAD. Another piece of technology that seems to be very popular to use is drones in the mining process. I sat through a couple of different technical sessions that discussed how companies are taking off the shelf drones and equipping them with their own software to get them to fly the way they need them to take accurate pictures so they can design the mine properly. Sitting through the technical sessions and also going to the expo hall was a great way to learn about the new technology being used in the mining industry.

2. Extracting Precious Metals from Coal

- a. One of the cool sessions that I attended at the conference was one from a professor from one of the schools on the east coast. He talked about their process of extracting precious metals from coal. He talked about how they are using machines like a scanner system like they use to scan luggage at an airport. Doing this, they have found that some of the material in the coal will have a different appearance in the machine that allows them to sort out which ones will have the precious metals in it.

3. Expo Hall

- a. Like stated above in the new technologies part, the expo hall gives all of us the ability to see lots of new technology that is being used. Another thing is that the expo hall gave us a lot of people that we knew from Minnesota as well as meet lots of new people from around the world. I was able to learn a lot about the products and services that these companies provide and got to see a lot of different types of mining compared to just the common iron mining in Minnesota. We get to use these connections that we make at the expo hall to introduce them to the school we go to as well as the region we are from and lots of things can be gained from this.

Importance of Attending the National Conference:

Attending the National conference is very important. It allows the students to learn lots of new things that they can hold onto for the rest of their lives. I think that it provides a lot of value for the students as well as the school. With the projects that we do at IRE, this gives us the ability to talk to different people in the industry and explain the way that our school works. This could lead to the possibility of one of these companies to possibly want to partner with the school to participate in a project with a group of IRE students. Below are some of the biggest benefits of attending the conference.

1. Members

- a. Making connections with other students and industry people. This gives us the ability to learn how other schools' engineering programs work and how it compares to ours. Meeting new industry people allows us to talk about the school as well our projects we work on.
- b. Learning about different types of mining. I didn't even realize how many different types of mining that are out there.
- c. It also gives us the ability to market ourselves for internships, Co-Ops, or job opportunities.

2. School

- a. This can definitely benefit the school as it could lead to other companies in the industry wanting to work with the school on the semester-long projects that we work on.
- b. We can use these experiences to get new people to join the chapter at IRE. We can use the new knowledge gained to better explain the mining process and get them excited about SME and the conferences that you can attend.

Overall, the experience has been very good for me. I got to spend some time with a lot of good people from the school and get to know them better. I also was able to learn a lot more about the mining process and all of the different types of mining out there. I would like to thank all of the people that make going to these conferences possible for us students.

Katie Bily SME Report

On Saturday February 25, 2020 our group departed from Iron Range Engineering to attend the Society of Mining and Metallurgy National Conference in Phoenix Arizona.

Our group arrived late Saturday night at our Airbnb. Sunday morning our group attended the student engagement breakfast at the Phoenix Convention Center.

Later on, that afternoon we visited the exhibit hall where many vendors had booths for conference attendees to learn more about the various companies. We then ramped up for the technical session which started the following Monday morning.

On Monday I went to various technical sessions that focused on the inclusivity of women in the mining industry. Many of the speakers at these sessions were women who worked in the middle eastern part of the world where women are considered second class citizens. The women talked about how they wore clothing attire to fit in with the culture over there. In fact, in the middle east I learned a large population of the workforce in the geochemistry labs were women. In fact, one of the sessions I attended on Monday was called "Women in Mining in Unexpected Places." This is because western mining professionals generally have the idea that it would be very difficult to have women employees and leadership in very religiously conservative countries. This has been proven to be not true because women have provided a lot of new innovations in mining in those countries.

After the technical sessions we attended the Komatsu dinner where a delicious meal and drinks were served. I also got a chance to talk with many students from all over the country at various schools. We also had the opportunity to play Blackjack and win prizes. There was a variety of music played as well as a dance floor.

On Tuesday I attended many technical sessions as well as the following evening I attended the Komatsu mining dinner. One of the technical sessions I found to be extremely intriguing was a session called "What I Wish I had Known at the Beginning of My Career." What I learned during this technical session was the importance of internships. The individuals in this panel were senior-level professionals. I also learned about the importance of asking questions. Never be afraid to ask questions because that is how you learn. Also, while you are in school that is the time to make mistakes. While you are in school you are practicing becoming the professional that you want to be.

After the technical sessions our group attended the "Friends of Minnesota Social" in the evening where I met many mining professionals around the state of Minnesota. There were professionals from places like Barr Engineering, Cliffs Natural Resources, and United States Steel. This was a great opportunity to seek possible summer internships. Our group then went to the "Freeport-McMoRan Social" which was located at the Hyatt

Regency in downtown Phoenix next to the convention center. At this social I got to speak with many professionals who were current employees at the company. Delicious snacks and drinks were served as well. This social really allowed students to learn more about the company. There were many students from all over the world where I learned about all kinds of different cultures.

Overall, I thought the conference was a very educational experience. One thing that was a challenge was that our Airbnb was a long distance from the conference, so we had to take Uber rides over to the convention center which got to be costly for the students. If we go to the conference next year, I think it would be worth looking into places closer to the convention center. I do know this year's trip was booked at the last minute so finding an affordable place to stay would have been a struggle.

On Sunday there was a panel of young professionals that were employed at Freeport-McMoRan. Students were able to stand up and ask them any questions about their experiences. I found the questions that were asked very educational and interesting. The breakfast that was served was also delicious. One thing I wish they would've talked more about is what kinds of prior experiences were required to get hired there. Overall, I thought it was a very good breakfast for students.

Later that day our group went down to the exhibit hall and had the chance to visit with many vendors from companies and I thought that was a very good experience. We really got to talk with the employees at the various companies on a one to one basis which was a great opportunity for us to get to know more about the various companies. One thing I found was I felt very overwhelmed by the number of exhibits there were, so I did not get the chance to go to all of them.

On Monday there were so many technical sessions dedicated to women in mining which was very uplifting to me. I really enjoyed hearing the women who work in the middle east stand up and speak about the experiences in mining. I really enjoyed this because over there women in any kind of industrial setting is very rare and they are not always treated well. I also thought it was very cool that many of these women had made many friends over in these countries. I also enjoyed seeing the portfolios of the women geologists over in Afghanistan.

I really enjoyed the Komatsu mining student engagement dinner that following evening. I really enjoyed meeting students from all over the world who were pursuing degrees in mining, engineering, and geology related fields. I had the opportunity to speak with

other students about both their obstacles that they have had to overcome and times of success while being in school.

On Tuesday I also really enjoyed going to the panel about what the senior professionals wish they knew when they started their careers. This was a great learning experience for me because I was able to ask them some questions about what to do during a summer internship when you feel like you don't fit in at the company. One individual in the panel said that they were in the same boat when they started but wished they had asked more questions when they were just starting out.

Later that evening when our group went to the "Friends of Minnesota" social I connected with many people on the Iron Range. I loved seeing people that I previously knew down in Arizona together. I talked to many people who worked for companies that hire interns, so it was a good way to possibly get my foot in the door at a very well-known company. After the "Friends of Minnesota" social our group attended the "Freeport-McMoRan" social which was an outstanding experience. I absolutely loved having the opportunity to visit with students from all over the world.

Nick Zupetz SME Report

SME National Conference Technical Sessions:

This was my first year in SME. Having said that this was also the first engineering conference that I had attended. I was in awe of all of the different technical sessions that were taking place during this conference. I was able to learn just how big of an impact mining has on the world around us. I was able to attend numerous technical sessions that included workplace safety, management, equipment, and innovative technology. Now this was all a lot of information to take in at the time as most of it was for vendors and high ranking individuals within the mines. However I was able to sum up my learning into three takeaways listed below.

1. Technology in mining

As engineers we are constantly practicing ways on how to be innovative. I really enjoyed attending the technical sessions that involved new and upcoming equipment. I was able to attend sessions that talked about how there are computer animated programs that help you track down veins of mineable material without digging into the ground. Along with that a computer system that was able to forecast the location of the blast and show where each cubic yard of material would be placed. One of the most

fascinating things was fully automated trucks that were to be used in underground mines. From this new technology it improves workplace safety, increases production, and also helps you succeed in the world of mining.

2. Importance of Safety

Coming from working in an industry that worked in the production of steel I was able to see how safety impacted the mining world. I was able to learn how much time upper management focuses on safety. Technical sessions involved questions bouncing back and forth of how to improve safety. Some of the topics that I attended were keeping workers safe around automated systems, underground mine safety, and blast safety. From what I was able to learn is that it all went down to my first topic of the new technology.

3. Company Recognition

Some of the technical sessions were vendors that were trying to sell a product to some of the mine representatives. These companies were able to teach me some presenting skills. The most important was hearing from companies that were relatively new to the industry. Some of the takeaways that I would like to use for my presentation skills was the enthusiasm that they had during the presentation. Along with that they were also asked really technical questions about their product. They were able to have an answer to every one of them. Coming prepared to a presentation will help myself and the future company that I am working for.

Importance of Attending the National Conference:

This was a huge development process in my engineering career. It was able to open up my mind into the world of mining. There is so much more to mining than on the iron range. There are thousands of different jobs around the world that have to do with mining. I was able to take away many different things from this conference. If I was to sum it up into a bulleted list it would go as follows.

1. Networking at the conference will open many doors for you
 - a. Potential internship/co-ops
2. Attend as many events as you can
 - a. Private dinners
 - b. SME hosted events
 - c. Student interaction
3. Attend the main SME session
 - a. Talk to different companies
 - i. Learn what they have to offer

- b. See what connections you can make
- c. Learn about new technology.

Mitchell Masters SME Report

This is my second year being a member of SME. Last year I was able to visit the Denver and Duluth conferences. One thing that proved itself is that all of the connections I've made at the prior conferences are very important. Not only did making connections matter but learning about companies, what they do, and their products helps out as well. I also learned a lot from the tech sessions. It so happened that I attended a session that was similar to one from Denver.

In Denver, it was quite the new experience to go up and talk to companies at booths. As nerve-wracking Denver was it made my experience in Phoenix much better. I felt very comfortable walking up and talking to new companies and companies I had visited with at the Duluth or Denver conference. One company, in particular, that was very beneficial to walk up and talk to was EuroDrive. In Denver, I talked with the company and learned a lot about what it was that they did. In Phoenix, I was able to learn they now focused on the automation side of things as I had some background on what they already did.

A tech session I had previously sat through was about using lidar on drones to map rivers. One that I sat through in Phoenix was about using lidar to map the pits. This allows for enhanced surface mapping of the pit to ensure the grade never becomes too steep from wash out. They use a software called Maptek Pointsudio, with this software you can even do kinematic analysis. Using Lidar and traditional methods of mapping you can provide the most accurate model of the pit.

Automation, its definition, the use of largely automatic equipment in a system of manufacturing or other production processes. Digital, its definition, relating to, using, or storing data or information in the form of digital signals. These two words are reshaping how we view mining. With using technology like lidar and by mapping out the mines it allows us to begin creating a digital mine. This allows the opportunity to begin automating some of our mining processes. Many mines are already beginning to implement automation into their mining process. The trucks are beginning to become automated, this reduces the risk of a driver being injured. Using these digital mines we can start creating full models of the plant and allows for constant updates to keep the model true to the plant.

One tech session, in particular, had messages that I've already been able to experience in my short time of working as an engineer. The session was Value Unextracted (Mine Plus), they covered how they were able to get a mine to begin turning more profit by switching what type of mining they were doing to allow for higher yields. One of their messages was that you will always be up against the "This is how it has always been done" mentality. I've seen this not only on my engineering internships at Furin & Shea and Iracore but also in my day to day life. Typically this is held to a higher standard in an operations plant like a mine then, per se, a retail job. In their case, they were able to convince the mine that the switch was crucial even though they had this mentality. They presented evidence as to why they were in their current situation and evidence as to how if they make the switch their yields would change. This is something I plan to take with me into my future as an engineer. It is important to understand how to properly pursue this mentality for the better. They ended on a note that mining always changes, I think my interpretation of this is that everything always changes.

One thing that is true in every business, operation, or job there is always a consumable. An artist has paint, ink, lead, etc; a welder has welding gas, welding wire, etc; and in the case of this Tech session, it was mining drill bits. Often we hear the phrase more expensive=more better (I know improper grammar just how I learned it as a kid). I remember my dad telling me to buy the cheapest versions of things you use up and the most expensive versions of things that should last. This thought process is the wrong one to take when it comes properly running a business. In the case of Drilling, what are the costs? The simplest version is the cost of operation (drill time) and the cost of the bit. You also have to take into consideration the ratings/efficiencies of the bit, they can be represented by the bit footage(how many feet the bit is rated to efficiently drill) and drill rate (this is commonly found from using the bit but it is shown as an average of feet drilled/hours drilled). With all of these things taken into account, we can create an equation $TDC = \text{Bit Cost} / \text{Bit Footage} + \text{Drill Cost} / \text{Drill Rate}$. It is important to take into account more than the bit footage and bit cost. This is true for any operation and its consumables. If you look into what functions your consumables perform you can begin to better select consumables to save your company money.

My final takeaway from the whole conference is how amazing it is to have students from all across the world attend these conferences. I was able to run into students I had met at the Denver conference. Seeing how mining affects each state differently and how we all view mining and its importance. It creates more than just an image I had of mining, I always thought of mining as "The Iron Range". Attending this conference makes me think of mining as more. When we begin to make mining more efficient, less dangerous, and less wasteful I believe more views of mining shall change. With better

technology and processes being implemented into mining I believe others will begin to think of mining as more as well.

Luke Vine SME Report

Geologic Graphing (02/25/2020)

This technical session was talking about the innovation of the Lidar (Light Detection and Ranging). It mentioned some of the positives of using Lidar to find minerals and map areas and a few of these positives are low shadow, large coverage areas, and minimal regulations. The second part of the technical session mentioned a few of the current disadvantages of Lidar and they were weather dependent, setting ground control points, long post processing times. The speaker then concluded with why use Lidar and a few of the key points that he said were that Lidar provides the most comprehensive data, pixel point analysis, and the potential to eliminate ground control points.

Autonomous Geomechanically Monitoring of Underground Mines (02/25/2020)

The speaker at this technical session was speaking about creating a digital mine, this included creating remote automation of autonomous vehicles and using this technology to ensure the safety of workers in underground mine settings and provide info to analyze ground failures as well. Some of the common tools for autonomously watching and inspecting mines are Lidar, photometry, and having a control process (workflow) of daily operations. The speaker then went on to talk about how geomechanically monitoring allows mines to not put people where they don't have to and using drones instead to help keep people safe and monitor the ground. Using 4D-representations of underground mines helps with safety and future monitoring of underground mines.

How to Bridge the Gap for Geologist (02/25/20)

The speaker of this technical session was a younger woman who was elaborating on bridging the gap from older geologists to ones that are currently entering the field. She was talking about how older techniques still worked like observation and field methods. Some of the keys to bringing the gap together were reaching out to more schools, networking, embracing ownership, and most importantly mentorship. She concluded her speech with talking about how 3D-Mapping technologies are helpful for geologist to be

more productive in their workplace and finding minerals that are essential to mining and further developing economic adventures.

Anthony Marinaro SME Report

SME National Conference Technical Sessions:

This was my first SME conference, I really didn't know what to expect. I was expecting to see a large conference based on what I was told by students that were previously at one, but it ended up being a lot larger than I expected. It was to be expected to see a large exhibit hall, but upon first seeing the magnitude of the conference the whole trip was put into a different perspective. One of the most intriguing parts of the trip were the technical sessions I attended.

New technology in Mining.

Most of the technical sessions I attended were on autonomous driving haul trucks. After learning about how these trucks operated and the technology that went into navigating these trucks, my understanding of the importance of redundancy in the mining process changed. Another topic I never thought about before these technical sessions were how important strong communication was. This varied on the type of application, for example, in an open-pit mine the autonomous trucks use a system of standard GPS signals to operate. And in an underground mine, I thought it was crazy that it was even possible to have autonomous systems without GPS, For this to work it used a system of laser sights for the mapping images. These technical sessions opened my eyes to how the technology in the industry is changing and was very interesting to hear about.

Networking with others

When I was not in a technical session, I was able to walk around the exhibit hall and talk to different students from around the country. Also, learn and network with a wide range of different companies that I would've never been able to hear about if I weren't able to attend this conference. Establishing these networking skills will be very beneficial for my future as an engineer. This is because I was able to expand my understanding of how mining is much larger than the small few iron ore mines here in northern Minnesota.

Presenting Skills

At Iron Range Engineering, presentation skills are taken very seriously. One of the largest things I noticed during the technical sessions were the presentation skills that the speakers had or the lack of skill you could say. One of the things I noticed was that most of the speakers were very nervous about speaking in front of the crowd. This made these speakers very hard to follow and understand throughout the session. This was unfortunate because the information they were presenting took a tremendous amount of achievement for these speakers, and not having good presentation skills doesn't allow you to relay your work to its maximum.

Importance of Attending the National Conference:

Attending the National Conference allowed me to learn a lot about mining outside of our small region here. It opened my understanding of the magnitude that mining really has and the scale of some of the operations that happen. Also, I was able to learn about the new emerging technology the industry has to offer, this was done by attending technical sessions, and talking to different companies throughout the exhibit hall.

Overall this was a great experience to be a part of. I am grateful for the opportunity to go on the trip, learn about all the different aspects of mining, and network with people from around the area to across the country.