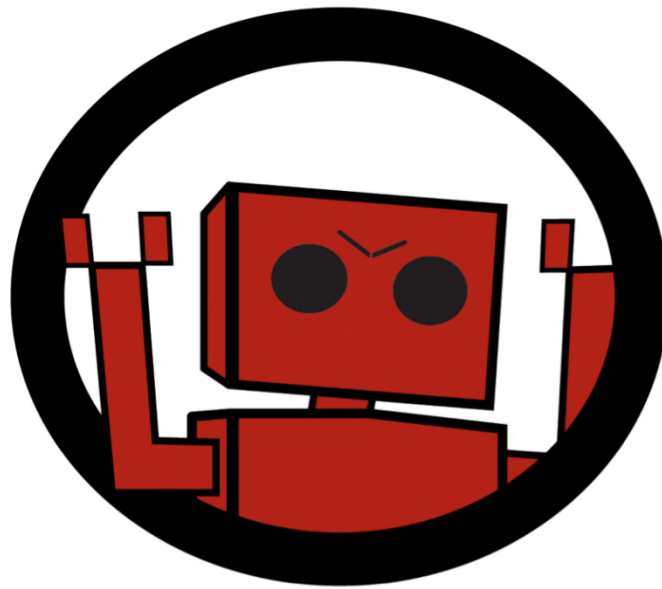


Mountaineer Area Robotics

MARS 2614



2021 - 2022 Business Plan

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1. Executive Summary

MARS Team 2614 was founded in 2008 by five student members of a champion FIRST LEGO® League team to continue the exploration of Science, Technology, Engineering, and Mathematics (STEM) education. MARS participates in robotics competitions under the umbrella organization, For Inspiration and Recognition of Science and Technology (FIRST), founded in 1989 to inspire young minds to participate in science and technology, while building both professional and life skills, promoting self-confidence, and increasing knowledge. FIRST provides programs for youth in grades K–12. MARS competes in the FIRST Robotics Competition (FRC), serving students in grades 8–12 and between the ages of 14–18. In addition, MARS sponsors and mentors teams in other FIRST programs: FIRST Tech Challenge (FTC), grades 7–12; FIRST LEGO League Challenge (FLL-C), grades 4–8; and FIRST LEGO League Explore (FLL-E) grades 2-4.

The MARS program consists of youth from North-Central West Virginia who dedicate themselves to a rapidly expanding, statewide robotics network. Through close partnerships with West Virginia University, NASA’s Katherine B. Johnson Independent Verification and Validation (IV&V) Facility, 4-H, Scouts of America, United Way, local school systems, and numerous corporate sponsors, MARS provides engaging educational opportunities and services to youth throughout the state. Since its inception, MARS members have received many accolades, winning a variety of awards and earning berths to the FIRST Championship fourteen out of fifteen years. In 2017, MARS won the FIRST Championship Chairman’s Award, entering the FIRST Hall of Fame and securing a place at the FIRST Championship until 2027. Using robotics as a foundation, MARS encourages West Virginia students to pursue post-secondary education. Maintaining this mission is important because as of 2018, 52.6% of West Virginia high school graduates enrolled in higher education institutions according to a report from the West Virginia Higher Education Policy Commission. The team is extremely proud that 100% of MARS graduates have graduated high school and pursued post-secondary education, many with a full or partial scholarship.

The following pages will detail the MARS team history, mission and objectives, business strategy and goals, and an internal and external risk assessment for the year 2022.

1.1 Legal Entity

MARS is a 501(c)(3) nonprofit organization offering sponsoring entities the ability to make tax-deductible contributions to the team. Below is a list of the board members for Mountaineer Area RoboticS (MARS):

Chairman – Dr. Earl Scime

Vice Chairman – Ryan Utzman

Secretary/Treasurer – Alex Stout

Board Member – Herb Baker

Board Member – Mark Lusk

Board Member – Mark Tennant

Board Member – Rhonda Fitz

Board Member – Dr. Todd Hamrick

Board Member - Melissa Giggenbach

2. Strategic Focus

2.1 Vision

MARS strives to provide a purpose-driven, creative outlet for its students through FRC while inspiring a change of culture in rural communities through outreach with FIRST and STEM programs.

2.2 Mission

By utilizing STEM programs through the MARS Plan, MARS works to inspire youth in rural and underserved areas in West Virginia and around the world to pursue their creative and intellectual passions. MARS does this through a hybrid (both physical and digital) approach to community outreach and the development of technical programs designed to instill superior practical life skills in students, including:

- Gracious Professionalism®
- Teamwork
- Leadership
- Coopertition®

MARS members also develop exceptional personal productivity skills such as:

- A strong work ethic
- Time management techniques
- Superior dedication and commitment to the team and community
- Highly developed organizational skills

2.3 Diversity, Equity, and Inclusion Statement

MARS welcomes all people without regard to race, ethnicity, religion, national origin, sex, gender identity, sexual orientation, ancestry, abilities, economic or family status, life situation, veteran status, or philosophy. MARS strives to be an inclusive environment for all individuals by advocating for and providing equal treatment to all.

2.4 Governing Values

The following are the values that form the culture and fabric of MARS. Team members and mentors are expected to display these values at all times as representatives of both FIRST and MARS.

- ***Self-Management*** - This is the team's primary governing value: all members (students and mentors alike) are expected to be in the right place, at the right time, with the right equipment and the right attitude for the activity in question.
- ***Knowledge*** - MARS team members are expected to be familiar with all aspects of the MARS organization and its operations including fundraising, community outreach, business planning, and technical expertise.
- ***Excellence*** - Team members are expected to complete tasks on time with a superior level of quality and workmanship. Everything the team produces is of high quality and contributes to the team's ability to represent the FIRST community.

- **Initiative** - Team members stay on task when direct supervision is absent. They recognize work that needs to be done and complete unfinished tasks on their own initiative.
- **Drive** - Team members are self-motivated to succeed and achieve their highest potential.
- **Courage** - This is where self-confidence meets enthusiasm. MARS students are bold enough to explore new avenues, take risks, think outside the box, and develop new solutions.
- **Dedication** - Students are willing to pledge their time, skills, and labor to MARS during both the peak build season and the off-season.
- **Safety** - Students are expected to maintain a constant safe workplace and state of mind when participating in all events, competitions, and practices.
- **Gracious Professionalism®** - (a registered trademark of FIRST) – Utilizing Gracious Professionalism®, MARS encourages high-quality work, emphasizes the value of others, and respects individuals in their community. This is a vital skill in today's workforce.
- **Coopertition®** - (a registered trademark of FIRST) – Coopertition® is the concept and philosophy that members of any organization can and should help and cooperate with each other even in the face of competition. MARS excels in this through the utilization of Tucker Teams at competitions, which are explained in Section 3.2.4

2.5 Keys to Success

In order to execute the MARS vision and mission statements, MARS considers the following to be essential keys to success for the program and states them in order of prominence:

- **Cultivating Strong Leadership** - To manage MARS, the program needs a strong workforce and leadership team to ensure that the group is meeting its mission. By pulling from schools all over North-Central West Virginia, MARS encourages a variety of youth to get involved. MARS also maintains a steady alumni force who are able to mentor younger students and ensure the continuation of the team's governing values. This leadership cultivation is the group's most vital key to success.

- ***Equipping Students in WV with STEM Experience*** - MARS teaches youth a variety of technical and personal development skills that motivate members to seek education past high school. In addition, sponsors and partners such as West Virginia University and NASA's Katherine Johnson IV&V Facility recognize the efforts made by these students and often aid them in entering post-secondary education.
- ***Maintaining Adequate Funding*** - Competing in FIRST is an expensive proposition. MARS operates on an estimated budget of \$80,000 per year. These funds provide year-round educational opportunities for team members, mentoring for other robotics programs, and community outreach activities. Given these significant costs, adequate funding through sponsors, grants, and fundraising activities is equally as important as the group's workforce.
- ***Assisting in the Development of Robotics Programs Throughout the State*** - By sponsoring and mentoring teams from elementary, middle, and high school levels, MARS works to actively encourage and develop promising talent in these students. This allows students to seek better opportunities after high school graduation.
- ***Increasing the awareness of FIRST throughout the world*** - Increasing the recognition of FIRST throughout West Virginia and the world is vital to the success of the youth. Consequently, it is important to increase awareness among community businesses and institutions, build an appreciation for FIRST, and improve local support for MARS' activities.
- ***Being Successful in FRC Competitions*** – MARS gains respect and recognition through its strong competition presence. This success helps the team maintain its credibility as a mentor to other teams, as well as to attract and retain adequate funding and sponsors.

2.6 Goals & Objectives

MARS is continually growing and evolving. Each year, MARS adjusts its goals and objectives to reflect the team's transformation. To successfully attain these objectives, considerable forethought and preparation are essential. In 2016, following the new team structure plan (see Section 3.2), MARS created individual Outreach Task Force goals. In 2018, the FTC and VEX Task Forces were combined due to the similarity of the programs. Also during 2016, MARS changed the previous five-year goal plan to a three-year goal plan. This allows goal

formation to accommodate the four-year student turnover and the team's frequent formation of new partnerships and initiatives. In 2021, MARS reviewed the subject and reintroduced the 5-year goals to focus more on sustainability and the team after students graduate, as well as streamlined team and task-force goals.

Below is the list of MARS' overall team objectives:

One Year Goals (Ending In 2022)

- Develop outreach data collection infrastructure, in line with the operational definitions provided by FIRST, to allow MARS to make more informed decisions
- Finalize scripts for a short video series explaining necessary FRC-related technical skills for basic robot construction.
- Build a platform for an FRC Virtual Help Desk where other teams would be able to request MARS' help answering technical and non-technical FRC questions.
- Establish a formal system to provide FLL-C teams in West Virginia with student mentors from MARS to strengthen their ability to compete.
- Develop branded packaging for STEMcrafts to enhance MARS' professional look.
- Make an online FLL-E and FLL-C informational hub to provide interested individuals and teams with program information and local events and competitions..
- Develop a list of vocabulary words from each subteam to increase team members' comfort with all aspects of the team.
- Revise the Branding Standards document to include secondary design colors and texts, emphasizing the need to revise the document on a regular schedule.
- Formulate a schedule to regularly scan physical documents into a digital form, and back-up vital team documents on a physical hard drive to ensure document security.

Three Year Goals (Ending In 2024)

- Rebuild the number of middle and elementary school robotics teams in West Virginia to 75% of pre-pandemic levels.

- Complete development of the FRC Skill video series, providing access to knowledge for other FRC teams and future MARS students.
- Expand outreach efforts throughout North-Central West Virginia to spread STEM to other counties and diversify the members of the MARS team.
- Re-establish the number of MARS assisted and hosted outreach events per year to pre-pandemic levels using both physical and digital events.
- Partner with NASA's Katherine Johnson IV&V Facility to help start VEX teams in Preston County schools in order to engage a larger audience in North-Central West Virginia.

Five Year Goals (Ending in 2026)

- Rebuild the number of middle and elementary school robotics teams in West Virginia to 100% pre-pandemic levels.
- Prepare a competitive Chairman's presentation for the 2027 season.
- Review the FRC Skill video series and update for relevance with modern technology.
- Diversify and expand the number of MARS' core sponsors to increase team sustainability..

2.7 The MARS Plan

In order to better organize and outline the team's outreach method, students created the MARS Plan in 2016. Structured to focus on the five main areas of growth and involvement, the steps of the MARS Plan include: Engage, Inspire, Sustain, Progression of Programs, and Creating Leaders and Innovators.

1. Engage: Community Presence and Visibility

The first step in this plan is to use team visibility to engage individuals, groups, and communities within West Virginia through visibility. Sometimes, MARS' strategy is simply to appear at public events such as baseball games and parades with a robot and wearing team

shirts. Through the years, MARS has found that just a single interaction can start an entire robotics program.

More often, however, MARS partners with local organizations to take part in STEM-focused initiatives: STEM nights at schools, summer camps, museum science days, and festivals comprise the majority of MARS' outreach events. In these settings, MARS talks face-to-face with both youth and adults to help them discover that with little aid, everyone can follow their passions.

At every event, MARS provides general FIRST information (flyers, brochures, etc.) for the public, as well as stickers, buttons, and pens to increase FIRST visibility. At outreach events, MARS students explain design decisions and systems of the capabilities of both the MARS competition robots and MARS' special outreach robot, Parade Bot. MARS also encourages participants to drive at least one of the robots.

Starting in 2015, MARS has employed a number of STEMcrafts as fun and engaging tools to teach K-8 students basic mechanical and electrical skills (like how a motor works and the behavior of an electrical circuit). With the addition of hybrid outreach in 2021, MARS began distributing kits to run a STEMcraft outreach event upon request. These kits include materials for the STEMcrafts, an instructional manual on how to run the event, and step-by-step videos for each STEMcraft on the MARS YouTube channel. This initiative has enabled local schools and organizations to independently run outreach events using STEMcrafts.

To enable a more comprehensive understanding of robotics, MARS created the "What's Inside a Robot?" visual tool that compares the MARS Parade Bot to a human body. MARS also provides copies of MARS storybooks to community organizations like pre-Ks and children hospitals to explain the engineering process in an easy-to-understand way.

On average, MARS attends 65 outreach events around the state per year, including many MARS-hosted FLL-E, FLL-C, FTC, and FRC outreach efforts.

2. **Inspire**: Starting FIRST/STEM Teams

MARS stays in contact with individuals who are interested in starting a robotics program. Through a delegated student or mentor, MARS provides informational documents and

contact information to interested individuals. MARS, alongside the teams' partners at NASA's Katherine Johnson IV&V Facility, also provides instruction for coaches.

MARS' partnership with NASA began in 2012 when MARS students worked with NASA's educational outreach program to use FIRST to promote STEM education. Since then, MARS has worked with NASA to create hundreds of robotics teams around the state.

MARS contributes direct funding to younger robotics teams in the form of payment for materials or registration costs and by locating other potential sources of sponsor funding. In addition to NASA's Katherine Johnson IV&V Facility, MARS works with other partners, like the United Way of Monongalia and Preston Counties, to provide as much funding as possible to aid interested groups in starting a robotics team.

3. **Sustain:** Mentoring and Supporting the Continuation of Teams and Programs

One of MARS' most important projects is to work as closely as possible with other nearby FIRST teams. In order to help sustain these teams, MARS stays in constant contact with them. Because of the often large distances between teams, MARS' email "blasts" to teams have become a key way to keep everyone connected and engaged. MARS also plans to provide a digital information hub that FLL-C teams and coaches can access to make running a robotics team less of a daunting task.

Student points of contact help MARS remain connected with teams who need more personalized assistance or answer questions. Sometimes, MARS students communicate only through email, but many times MARS students become integral parts of the FLL-C team they're mentoring and attend their regular practices. MARS plans to establish a formal system of providing FLL-C teams with mentors to promote this practice and aid more FLL-C teams in the area.

Another key component of the sustainability plan is to encourage teams to forge partnerships with local resources such as businesses, schools, and state/local governments. When a community's youth begin demonstrating their capabilities, it is not hard to convince these potential sponsors that this is a program worth investment. Many new teams that MARS supports began through connections developed over the last decade with other local organizations. These organizations often make FIRST part of their own outreach initiatives.

Partnerships with NASA's Katherine Johnson IV&V Facility and school administrations are great examples.

Finally, MARS provides travel funds for FLL-C/FTC students so that the expense of travel to the FIRST championship is not overwhelming. This encourages students to return to FIRST programs and perform at their maximum ability without being concerned with financial complications.

4. Progression of Programs: Encouraging Teams to Stay Involved in Robotics Programs

Along with their partners, MARS works hard to identify and support as many types of youth robotics programs as possible, to engage West Virginia students in STEM education. MARS actively helps groups evaluate their resources to identify programs that can succeed in their unique situation, but they also encourage students to progress to higher programs.

To do this, MARS encourages higher-level teams such as other FRC competitors to have active and supportive relationships with younger teams. Additionally, MARS communicates with teams' local government officials to find financial support. MARS also offers funding and information about grants to help these teams move from one level of FIRST to another.

MARS also commits a large part of their time and personnel to organizing, hosting, running, and assisting as many local, regional, and state events and competitions as possible for FLL-E, FLL-C, FTC, VEX, and FRC. The MARS-run FLL-E, FLL-C, and FTC state championships occur back-to-back at Fairmont State University to make higher-level robotics teams visible to younger participants and encourage the transition through FIRST. MARS also hosts an FLL-E and FLL-C qualifier in the team's workspace allowing for interested students to tour it after their competition.

5. Creating Leaders and Innovators: Inspiring Students and Alumni

The final goal of MARS' plan is to help students gain valuable life skills which will aid them as they head toward high school graduation and beyond. To support this continuation to higher education, MARS events are held at universities around the state such as West Virginia University (WVU) and Fairmont State University (FSU). This helps create a sense of familiarity with post-secondary educational institutions. Having information about the importance of,

and access to, higher education on a personal level for MARS team members is the key to their success.

MARS also provides information and advocacy for college attendance. MARS shares information (both to MARS students and other teams) about scholarship opportunities and has partnered with WVU and FSU to help students obtain scholarships at these regional institutions, including the three scholarships WVU offers to students who are chosen during the MARS hosted biennial FRC event, WVROX.

Through outreach initiatives, MARS team members become leaders. The power of youth leading STEM events, helping others, enjoying the work of creating something with a team, and volunteering their time for others fosters leadership qualities.

After graduating, alumni apply the skills gained at MARS in the workforce, which has allowed many to earn high-ranking jobs at places like NASA and Scouts BSA. Alumni then come back to MARS as mentors to share the skills they've learned in the workplace; this system creates a powerful and effective exchange of knowledge. As of 2021 MARS has 25 active mentors, of which 32% are previous students.

3. Organization and Management Summary

3.1 Outreach History

During the team's first two years, MARS began its outreach efforts by participating in many community events, developing an inclusive marketing plan, and beginning a successful FLL program by starting eight and sponsoring ten teams. To help other FRC teams, MARS developed an informational manual for rookie teams, *Searching for Rookie Team Inspiration (SERTI)*, which was translated into three languages. Although it was developed years ago and contains outdated information, it is still available on the MARS website. MARS also participated as a LabView beta test team.

In MARS' third season (2010), the team grew while also creating the curricula for a variety of summer camps. The team also began sponsoring 11 and mentoring 14 FLL teams in three counties. MARS-sponsored FLL teams swept the WV FLL state tournament, including first

place overall, first in technical, and first on the field. This was also the year that MARS created the WV Plan (now referred to as the MARS Plan), details of which can be found in Section 2.7.

In MARS' fourth season (2011), the team implemented the WV Plan, and the FLL program expanded dramatically to include teams in more than 15 counties. MARS also started a rookie FRC team at Winfield High School in Putnam County, WV, FIRST Team 3492 - PARTS. MARS-sponsored FLL teams once again swept the WV FLL state tournament. This was also the year that MARS began working with WV 4-H to run youth science summer camps.

In MARS' fifth season (2012), the FLL program spread to over 20 West Virginia counties and one Southwestern Pennsylvania county, widening the impact of the FIRST program with the WV Plan. The team also appeared for the first time at the October Sky Festival in southern West Virginia, while continuing to work with summer science camps.

In MARS' sixth season (2013), the team continued outreach throughout the summer and fall, expanding the FLL Program to 63 teams in 22 West Virginia counties and one Southwestern Pennsylvania county. In addition, MARS continued to host its annual FLL scrimmage with 24 FLL teams and over 230 students in attendance. The team worked with NASA's Katherine Johnson IV&V Facility and other FRC teams to produce the West Virginia State FLL Tournament. During 2013, the team once more conducted workshops at 4-H camps and with the Scouts BSA®. Projects such as these have helped MARS to reinforce the value of STEM education throughout the state.

During MARS' seventh season (2014), the team hosted and volunteered at numerous STEM summer camps for students, such as TekKids and StemPloy. MARS also continued its work with FLL, hosting its own pre-competition scrimmage and regional qualifier before helping NASA's Katherine Johnson IV&V Facility coordinate the FLL State Tournament. The team also added its first international outreach initiatives, officially renaming the WV Plan the "MARS Plan" accordingly. Two different projects were started in India, one by a team member in Jackal, India under the name Technology For All, and one by a team alumnus in Varanasi, India, where he was awarded a gap year by Princeton University. These two projects began working together to establish FLL teams in rural areas of the country and started gaining funding and sponsoring support both in the United States and in India. In the summer of 2014, MARS

hosted the first off-season, FRC robotics, 26-hour endurance event in FIRST history, West Virginia RObotics eXtreme (WVROX). It was the first FRC event held in West Virginia and attracted teams from 13 states and 2 countries. WVU, the gracious host and a generous partner to MARS, offered scholarships to the winning alliance team members.

In MARS' eighth season (2015), the team continued to support the First Lego League by running a scrimmage, qualifier and assisting in running the state tournament. Overall, MARS assisted over 100 FLL teams and 20 FLL Jr. teams in the state. While continuing efforts in India, the team also built connections in Harare, Zimbabwe in order to work through a pre-existing FLL team and start more FLL teams in rural parts of the country. The team also began a relationship with the Spark! Imagination and Science Center and attended five STEM nights at local elementary schools, plus four more events through local after-school programs.

In MARS' ninth season (2016), the team assisted in the growth of the WV FLL program by running mentoring sessions, a scrimmage, and a qualifier while volunteering at three other qualifiers and the state tournament. Through a partnership with the Spark! Imagination and Science Center, MARS attended several additional STEM nights at elementary schools around Monongalia and Preston counties, bringing their fall outreach total to 20 events. MARS continued its international outreach initiatives, specifically with Pragma S. who spent a gap year in India starting FLL teams, and Daphne B. who inspired the creation of FLL teams in the Philippines. In the summer of 2016, MARS ran WVROX for a second time, bringing 28 teams from the US, Canada, and China to the WVU Rec Center for over 26 hours of intense robot competition.

In MARS' tenth season (2017), the team continued to support the state FIRST network in partnership with NASA and ran the inaugural Mountain State FLL Invitational at Fairmont State University, attracting FLL teams from several countries. Continuing their community outreach, the team implemented a new "BrushBot" activity in place of "Doodle Bots," and increased their community presence by about 10 events, to 30 total. One of these new events was the Pittsburgh Maker Faire, which MARS attended with friends from the Steel City Robotics Alliance. During the fall off-season, MARS reorganized both the MARS Plan and their Student Leadership Structure, to better coordinate all team efforts. With this reorganization, Outreach Task Forces were created for each facet of MARS outreach. One Task Force with

immediate effect was the FRC Task Force, which began to expand regional FRC Tucker Team Help Desks with help from other FRC teams.

In MARS' eleventh season (2018), the team built upon the growth of the WV FLL Programs by continuing to run bi-weekly mentoring seasons, a scrimmage, and a qualifier. Additionally, MARS volunteered at other qualifiers in the area and the state tournament. MARS also assisted at the World Robotics Olympiad (WRO), logging approximately 200 man-hours. In community outreach, MARS recently established a new activity, the "Play-doh® Circuitry" initiative; which is designed to incorporate both art and STEM into a form that is easy for children to comprehend. 2018 marked the third successful 26-hour endurance event: West Virginia RObotics eXtreme (WVROX). MARS had 24 teams from 13 states, as well as one team from China, attend this event. MARS logged a total of 605 man-hours, with an average of 23 team members working at any given hour. Due to 100% of MARS students participating in outreach, it was deemed counterproductive to have a Task Force dedicated to that branch; therefore MARS redefined it as the Communications Task Force. This better prepares students dedicated to this Task Force for speaking with sponsors, judges, and the community. MARS also took part in the annual Civil Air Patrol presentation, running a mock robot game station and giving a presentation to several leaders within the organization. Additionally, during the off-season, students took inspiration from a 2012 Oregon-based project called "Go Baby Go" and mechanically altered a toy car's seating and steering wheel to gift to a young child with disabilities.

In MARS' twelfth season (2019), the team produced the "Play-Doh® Circuitry" initiative box. This contains everything a group would need to coordinate the activity on their own; Play-Doh®, batteries with their wire connectors, LED's, an explanatory handout covering the activity, a short page on battery safety, the MARS mission and vision document, and a business card so anyone will be able to reach out with questions or get involved in FIRST. MARS then donated this box to elementary schools, libraries, and the local children's hospital, as well as distributing the Marvin's Mighty Mission storybook to doctor's offices, libraries, and other organizations. While focusing on giving back to the community, MARS prioritized staying heavily involved in FIRST competitions at all levels. MARS students volunteered in the 2019 Mountain State Invitational FLL event as referees and table reseters, serving 62 teams from 11 different countries. MARS ran the annual MARS FLL Scrimmage for the 12th year in a

row, as well as the MARS Qualifier for the 6th year with half the participating teams advancing on to compete in the state tournament. Then, MARS assisted in the FLL Jr. Expo and the FLL and FTC State Tournament. Through these events and many others over the course of the off-season, students have logged over 2600 volunteer hours. MARS has reached more students through FRC than ever, helping one of four FRC teams in WV, Darkside Robotics, begin their journey as a team. MARS also has the phenomenal opportunity to watch them compete in the World Championship. MARS had the immense privilege of taking part in the Katherine B. Johnson IV&V Facility renaming, giving MARS the opportunity to interact with various major figures within the community. Through team coordination and outreach, MARS was able to grow internally, with over 20 new students applying to participate in MARS.

MARS' thirteenth season (2020) was affected in a multitude of ways by the worldwide COVID-19 pandemic; one of the most notable being the FIRST competition season drawing to an abrupt stop in March of 2020. Since COVID-19 made it unsafe for groups to meet in person, MARS opted to hold regular team meetings via Zoom, ensuring the sustainability of the program. In order to help the community, MARS crafted over 180 face shields and roughly 100 mask extenders and distributed them to healthcare employees. In October, MARS students worked with the 4-H Leadership Challenge to teach Elementary students introductory programming and engineering. MARS also took part in the Digital Day in The Park event with the NASA IV&V Educator Resource Center (ERC), speaking to hundreds of teachers and students in a segment about FIRST during their week-long streaming sessions. August of 2020 would have marked the fourth biennial WVROX, but due to the reality of FRC online, the event had to be postponed. As an alternative, MARS students opted to host a 22-hour event over Twitch in conjunction with FUN (FIRST Updates Now). This event, named World Wide West Virginia RObotics eXtreme, featured a kickoff presentation, event conclusion, and twenty other rotating hour-long presentations. These hour-long segments included presentations, games, and challenges led by MARS and eight other FRC teams in seven states. MARS also used this time to identify a new outreach activity, "Lightsicles", to be finalized and implemented in 2021. Lastly, MARS worked with West Virginia University to rehabilitate the first prototype for the West Virginia PRT car, the Starr Car, to be used in parades

In MARS' fourteenth season (2021), MARS introduced a hybrid outreach model, combining digital and in-person outreach to amplify its accessibility. In April, MARS put the hybrid model to the test through the lightsicles event at Suncrest Elementary School, where teachers used a step-by-step MARS-made "how to" video that taught students the scientific concepts behind the craft. Additionally, MARS attended in-person events, where students taught youth technical skills using STEMcrafts at Source summer camp at Skyview Elementary and at Mars, PA in an outreach event sponsored by NASA. Similarly, MARS devoted itself to rebuilding FLL-C by running a scrimmage, hosting mentorship sessions at the team's building, and sponsoring local teams by paying for their equipment and registration.

As of 2021, the team is 37 members and 25 mentors strong, with the program rapidly expanding. MARS offers a personalized learning experience for students. All graduates have advanced into post-secondary education, many with either a full or partial scholarship, with 87% of them majoring in STEM fields. Local businesses and corporations have offered internship opportunities for many MARS youth, either during or following their high school careers.

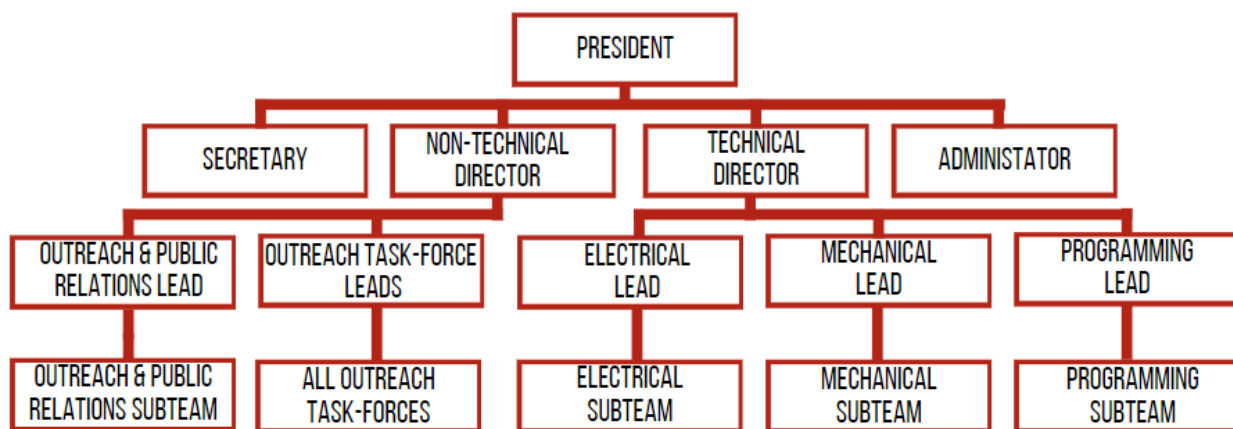
3.2 Team Structure

The Mountaineer Area RoboticS team (MARS) is divided into two major subsets; one which focuses on technical and one on non-technical efforts. The technical subset of the team includes the Mechanical, Electrical, and Programming subteams while the non-technical subset includes the Outreach and Public Relations subteam and the Outreach Task-Forces. Subteams are flexible, encouraging students to learn various skills and participate in many areas of the team. To keep subteams organized and facilitate communication, each subteam has an elected student leader to help set agendas and keep the team updated. Similarly, subteams are guided by adult and college mentors, who teach students skills and keep them on track during the season. At regional events, students from all of these subteams join together to form "competition teams".

The student leadership structure of MARS was re-created in the 2016-2017 season to ensure the productivity of each project as well as facilitate effective communication between members of the team. This new structure also provided a more official system for delegating

non-technical tasks to make outreach and public relations a more vital part of the experience for all students in MARS.

A five-person Leadership Council oversees technical and non-technical sub-team leads as well as outreach Task Force leads. Students in all leadership positions serve for one full year with elections being held between late May and early June; however, positions are obtained in different ways. The Student Leadership Council elections are held by a student graduating from the team or committed to not pursuing leadership. These elections follow a two-step process. First, all students on the team are given the opportunity to submit nominations for each position accompanied by explanations for the nomination. All nominations and explanations are then published for the whole team and any nominee is given a set amount of time (three days to one week) to accept or decline any and all nominations (no response is considered a decline). Then, all students gather to vote on each position, the winners requiring 51% or more of the vote. If a plurality is met for any position, all candidates are eliminated except the top two and a second vote is held. Each subteam lead is elected within their subteam with the previous lead holding the election. After these initial elections, the new Student Leadership Council appoints the Outreach Task Force leads.



3.2.1 Student Leadership Council

The Student Leadership Council typically meets once or twice a month to discuss progress throughout the team. This group of students also has a number of jobs they are required to complete throughout the year including, but not limited to: setting team goals, revising

MARS' mission and vision, analyzing and updating the team's SWOT analysis (seen in section 8.1), appointing task-force leads, organizing students into competition teams, giving presentations to sponsors, and additional tasks that further the team's efficiency. Below outlines each position of the council and its function.

- ***President:***
 - Sets agenda and facilitates discussion in student leadership council meetings
 - Runs student leadership council team meetings
 - Guides discussion of large or overarching team decisions
- ***Director of Technical Affairs:***
 - Reports on all technical sub-teams
 - Schedules and coordinates meetings between technical sub-team leads to ensure a steady stream of communication throughout the technical half of the team.
- ***Director of Non-Technical Affairs:***
 - Reports on all non-technical aspects, personnel, and Task-Forces
 - Schedules and coordinates meetings between Task-Force Leads to ensure a steady stream of communication throughout the non-technical half of the team.
 - Holds membership in each Outreach Task Force
- ***Administrator:***
 - Keeps the council on track and in line with MARS' vision and mission
 - Focuses on core values and set goals
- ***Secretary:***
 - Prepares and organizes relevant notes and documentation for the council
 - Liaison between student and mentor leadership
 - Organizes and documents meeting minutes and distributes them to the entire team.

3.2.2 Technical Team

Mechanical Sub-Team:

Fabrication Team: Through the use of heavy machinery, the fabrication team creates parts from scratch. This allows MARS to create readily available, specialized parts which saves time and resources.

Assembly Team: This team is in charge of assembling the mechanical aspects of the robot during the build phase. Student jobs vary depending on the direction of the build, mentors, and the abilities of the students. All members go through shop training to ensure the safety of all members and mentors.

Computer-Aided Design (CAD) Team: The CAD team uses Solidworks to create the CAD drawings for the construction of the robot. Team members are expected to attend additional meetings and go through software training. These students often work at home on projects to have them ready for team meetings.

Electrical Sub-Team:

Electrical Team: The Electrical team is the bridge between the mechanical and programming subteams. Through learning key work-based skills like soldering, this team is able to successfully wire and distribute power to all devices on the robot.

Programming Sub-Team:

Robot Programming: This team is in charge of developing code for all autonomous and teleop functions of the robot. Students focus on learning the LabVIEW programming language and advancing software capabilities during the off-season. They work on programming the robot during the season, often involving electronics, sensors, and control systems of the robot. Members also work with other programming languages to create, enhance, and debug additional software.

3.2.3 Non-Technical Team

Outreach and Public Relations (OPR) Sub-Team:

Communications/Public Relations Team: The communications team often speaks directly to the public, judges, and the media. At competitions, they are stationed outside the pit area to greet other team members and present the team image to the public. This team submits press releases and articles to the local news on a regular basis.

Media Team: The Media team takes and archives photos and videos of competitions as well as year-round outreach events. They produce the reveal video as well as promotional team videos. They run the team's social media accounts, including Twitter, Instagram, and Facebook.

Website Team: The Website team creates and maintains the MARS website. They work year-round to update and improve existing content, both at team meetings and at home.

Outreach Task-Forces:

Each member of MARS is placed into at least one Outreach Task-Force of their choosing (regardless of their subteam). These groups meet when necessary to discuss and organize projects regarding the different levels of FIRST. The facilitators of these meetings, Task-Force leads, are students designated by the Student Leadership Council based on merit and experience in each particular area of FIRST.

- FIRST LEGO League Explore Task-Force
- FIRST LEGO League Challenge Task-Force
- FIRST Tech Challenge/VEX Robotics Task-Force
- FIRST Robotics Competition Task-Force

3.2.4 Competition Teams

Competition teams are non-specific to sub-teams as a student in any subteam can be on any competition team. Students are organized into competition teams for each competition through a coordinated effort by the Student Leadership Council, sub-team leads, and mentors.

Drive Team: The Drive Team consists of a driver, a co-pilot, a human player, a technician, a back coach, a backup co-pilot, and a backup driver. The Drive Team is required to stay with the robot a majority of the time at the competitions. This group collaborates with the Scouting Team and the Pit Crew.

Scouting Team: Students on this team develop materials and methods to assess teams at competitions, providing the Drive Team with as much advantage as possible when choosing alliance members. At competitions, this team makes presentations to the Drive Team on Thursday and Friday evenings.

Tucker Teams: The Tucker Teams are composed of students from different parts of the organization. These students actively work during FRC competitions to provide other teams with help and instruction. They ensure that all teams are playing to the best of their abilities, and serves as the main outreach team during competitions. This ongoing initiative honors the ideals of the late MARS mentor, Mr. Phil Tucker.

Construction Crew: Once the competition season starts, the Construction Crew is responsible for the creation of the practice field at the team's secondary workspace. At competitions, their major responsibility is the maintenance of the robot and tools.

Pit Crew: Pit Crew consists of both non-technical students working with judges, the team's safety team, and Drive team. This group populates the pit during competitions repairing the robot and working with judges. These students are dedicated to sharing the MARS mission, values, and goals with teams and judges alike.

4. Branding

The team name, Mountaineer Area RoboticS, is critical to the success of the team as a whole. MARS' memorable and easily used abbreviation name (MARS) has contributed to its success in North-Central West Virginia and throughout the world. Both Mountaineer Area RoboticS and MARS may be used in formal or informal documents. This and the following uniformity

information is to remain consistent throughout the team unless a unanimous exception is made by the mentors and/or Student Leadership Council.

4.1 Uniformity

Students and mentors wear the standard MARS team t-shirt at all events, which has become widely recognized in both West Virginia and at FIRST events. The MARS shirts include the Valles Marineris (\$1000-\$4999) level sponsors and up, the logo, team number, and commonly display the Hall of Fame logo.

During competitions, the MARS team wears black dress shirts with black pants and a red bowtie for the team's "dress-up" day. These uniforms are fitted with MARS patches bearing the team logo, in order to maintain uniformity throughout the competition, as well as a Hall of Fame pin.

4.2 Documentation

Mars utilizes a standard for all printed documents. Anything posted on social media or handed out as official MARS documentation must fit certain requirements.

It is important to maintain consistency in everything used to represent the team. To do this there is a primary font family, Ubuntu, to be predominantly used in team media, and Orbitron to be used as headers and titles in media. Certain forms of media, like the MARS website that doesn't support the team's main font family, may use different typefaces. Robot names are stylized individually and are not subject to branding standards. MARS also stays consistent with the colors chosen to represent the team, along with the standard black and the "MARS Red," or #B32416 on the RGB color code.

Along with these standards, the MARS logo or Marvin are included on every printed marketing product. Only when necessary should a grayscale version be used. While in most instances the MARS logo should be featured on a white background, in 2016 the preferred background color became black to honor late mentor, Phillip Tucker.

It is important to keep the MARS logo area clear of distracting elements such as type, photographs, or textured backgrounds as it should always be seen clearly.

5. Products and Initiatives

All of MARS' products and services work within the MARS Plan to increase youth involvement in STEM programs, not only in their home state of West Virginia but also around the globe. The use of both products, initiatives, and the integration of the two, is key for MARS to achieve the first three steps of the MARS plan (which can be found in section 2.7).

5.1 Products

Products are the physical and digital goods that MARS provides to individuals or organizations.

NASA LEGO Models - MARS has designed and currently sells LEGO models of NASA's Magnetospheric Multiscale Satellite Spacecraft (MMS), NASA's Global Precipitation Measurement (GPM) space probe, and the Double Asteroid Redirection Test (DART) which all contribute toward funding MARS.

YouTube Videos - MARS has numerous informational videos and videos of competition events on its YouTube Channel. Following the 2021 plan to implement hybrid outreach, MARS has and will increase use of the channel to reach others and grow STEM. One planned step includes creating high-quality instructional videos based on STEMcrafts.

Access to FLL-C and FRC Fields - To help other teams with less resources, MARS constructs a replica of the current FRC game field and provides access to other FRC teams in the region for them to stay competitive. MARS also stores wooden FLL-C tables and provides access to teams for practice. .

Public CAD Drawings and Programming - In order to aid other teams in designing and programming their robots, MARS makes all of its CAD drawings and programming files public on Chief Delphi and the MARS website.

Story Books/Coloring Books - Over the course of the years, MARS has created storybooks and coloring books. The most recent publication was Marvin's Mighty Mission which outlines the process of designing and building a robot from the perspective of MARS' mascot Marvin.

FRC Robot Demonstration/Participant Driving - MARS brings one of its recently built robots to many outreach events. Usually, these are smaller robots from past years that are reprogrammed to have less complex controls so more MARS students can be trained on how to operate them and they can easily be understood by participants.

"What's in a Robot" Sign - The "What's in a Robot" sign details the different parts of a robot by comparing them to parts of a human to provide an easy-to-understand visual of each part of a robot and the function it performs.

MARS Promotional Material - MARS distributes numerous kinds of promotional material. These include, but are not limited to, bookmarks, buttons, wristbands, and pens. These are professionally made, and brought to outreach events and competitions to increase name recognition.

5.1.1 STEMcrafts

Starting in 2015 with doodle bots (discontinued in 2017) and expanding from there, MARS uses STEMcrafts to teach mechanical and electrical concepts with fun and engaging activities. These STEMcrafts are used during in-person outreach events and distributed in kits to classrooms and organizations. Each kit contains a link to the MARS YouTube channel which has videos detailing step-by-step processes on how to build each STEMcraft.

Brushbots - Designed in 2017, Brushbots are used to teach students basic concepts on how circuits work in relation to a motor by creating a mini circuit that when used with a foam

square, allows the bot to move. Since they resemble a popular toy, hexbugs, they have proven to be very engaging to kids of all ages.

Materials: Toothbrush head, motor, battery, foam squares, and a glue dot.

Play-doh Electric Circuitry - Designed in 2018, this craft resembles a basic electric circuit.

The Play-doh is used to create a variety of circuits made to teach students how electricity travels depending on the material. This STEMcraft is mainly for younger audiences and has shown most success at Elementary School STEM fairs.

Materials: LEDs, conductive Play-doh, non-conductive clay, a 9-volt battery, and an electric adapter made up of wires and clips.

Lightsicles - Designed in 2020, to resemble a flashlight. Lightsicles are used to teach students the basic concept of how a light switch works by creating a mini circuit that powers a lightbulb on a popsicle stick. This lightbulb can also be turned on and off using the binder clips representing a light switch. Lightsicles are also the first STEMcraft to use the MARS hybrid model of outreach wherein 2021 kits were sent to Suncrest Elementary School as teachers walked students through the craft with the help of MARS-provided videos.

Materials: Coin cell battery, medium-sized metal binder clips, jumbo popsicle sticks, a standard LED diode, copper tape, and non-conductive transparent tape.

5.2 Initiatives

Initiatives are all of the services MARS provides to individuals or organizations. These are mainly outreach programs that aim to develop an interest in the STEM fields. There are two main kinds of outreach, internal and external. Internal outreach includes FLL-E, FLL-C, FTC, FRC, and VEX programs. External outreach includes community outreach, STEM fairs, school-related events, and any other events that are not directly tied to robotics programs.

5.2.1 Internal Outreach Initiatives

FLL-E and FLL-C Competitions - In order to help FLL-E and FLL-C teams be competitive, MARS provides support including holding scrimmages and providing judging for teams. At state competitions, MARS also sends volunteers to aid in setting up and judging.

FTC Competitions - MARS helps run the FTC WV State competition at Fairmont State University. MARS students referee the FTC matches and help students prepare for their non-technical presentations. MARS also holds a booth with information and handouts from the team ranging from wristbands to flyers to engage and excite students in FTC about MARS and FRC in general.

Facilitating and Sustaining Growth in FLL-C Teams - MARS provides economic aid and key knowledge to facilitate the growth of FLL-C teams in North-Central West Virginia. This is done by sending funding to any teams that require it by purchasing spike prime kits and helping them cover the cost of registration. To help sustain teams, MARS also provides mentorship sessions where FRC students are able to meet with FLL-C students to answer any technical or non-technical questions they may have.

Tucker Teams - In memory of the late mentor Phil Tucker, MARS carried on his program (formerly Tiger Teams) that worked to aid other FRC teams at competitions with their mechanical, electrical, and programming skills. This is done through the set up of a Tucker Teams help desk at each competition MARS attends where other teams can ask for specific technical aid. In 2021, MARS opened a Digital FRC Help Desk that teams can fill out and submit through the MARS website allowing teams to ask certain questions or to set up a Zoom meeting about a certain technical concept. This enables teams to receive assistance year-round, instead of just during competitions.

WVROX/WWWVROX - Beginning in 2014, MARS began holding a 26 hour 14 minute (to mimic MARS' team number 2614) continuous FRC endurance off-season event alongside West Virginia University. Held at the WVU Rec Center, 23 teams from around the world come to Morgantown to compete in WVROX's many special matches ranging from mentor drive teams and lights-out matches. While the pandemic canceled the planned 2020 WVROX, MARS held WWWVROX, a 22 hour overnight stream where FRC teams from around the country each took

on hour-long segments to hold their own activities ranging from Minecraft building competitions to an overview of Labview basics (a programming software).

5.2.2 External Outreach Initiatives

School STEM Nights - With 13 elementary schools and 5 middle schools in the county MARS housed in, MARS is invited to and attends numerous STEM Nights on the Pre K, Elementary, and Middle school levels in an effort to instill STEM education in younger students.

Working with local Girl Scouts and Scout BSA troops - MARS works alongside other community organizations to further its mission in spreading STEM in North-Central West Virginia. Most prominently, MARS works with both the Girl Scouts of America and Scouts BSA programs, specifically with their robotics and programming merit badges.

Local Fairs and Parades - Fairs and parades have always been a staple of MARS outreach, from driving the MARS Parade Bot through downtown Morgantown accompanied by MARS students and mentors, to attending and setting up booths at county fairs in and around North-Central West Virginia.

Hybrid Outreach with STEMcrafts - In 2021 MARS began its system of hybrid outreach. One of the ways it's been implemented is through sending STEMcraft kits to schools with instructions on how to construct the craft along with instructions to step-by-step videos walking through how to build the said craft. These videos also explain the technical concepts that correspond to the STEMcraft.

5.3 Product-Initiative Integration

MARS relies on using products and initiatives in tandem to most effectively spread STEM, a number of these relationships exist throughout MARS' efforts; existing in both internal and external outreach.

MARS Promotional Material - At an outreach event, whether it be internal or external, MARS brings a number of promotional materials. MARS distributes these materials alongside its business cards to give people a way to remember the MARS name and have team contact information after any given outreach event.

FRC Robot Demonstration/Participant Driving - At outreach events, MARS allows participants to drive some of its past robots in safe and controlled environments to promote excitement about STEM in a hands-on fashion. While a participant is driving the robot one MARS student explains the technicalities of the robots, while another watches with a “kill switch” in case the person driving the robot loses control of it in any way. This method has proven successful in educating the public about robotics while making sure everyone stays safe.

5.3.1 Strategies for Internal Outreach Events

When volunteering or hosting an outreach event pertaining to any FIRST or VEX program, MARS uses the following products:

The lending of FLL-C Fields - MARS builds and sets up the FLL-C fields and game elements for the MARS-hosted scrimmages as well as the WV state FLL-C competition at Fairmont State University. These fields are crucial to the success of each event and are checked multiple times for accuracy and functionality.

Public CAD Drawings and Programming - MARS posts its CAD drawings and programming files to aid in the Tucker Teams mission in providing technical assistance to newer FRC teams.

5.3.2 Strategies for External Outreach Events

MARS employs a number of products when holding or attending a community outreach event not related to FIRST or VEX.

Storybooks - MARS brings storybooks to outreach events, where a team member reads the book aloud to introduce specific technical concepts through the adventures of the MARS

mascot, Marvin. The team members then pass out coloring books based on the storybook to keep students engaged with what they just learned.

STEMcrafts - At outreach events, MARS distributes STEMcrafts to teach mechanical and electrical concepts in a fun, hands-on, and youth-centered way. MARS students operate booths with STEMcraft materials at outreach events and demonstrate crafts with the public. MARS also has hybrid and fully digital approaches to STEMcrafts. This involves sending kits with STEMcraft materials accompanied by MARS-made YouTube videos that provide a step-by-step demonstration and explanation of each craft.

YouTube Videos - The MARS YouTube Channel is used in various ways, but when specifically pertaining to outreach, MARS uses the channel to promote hybrid and digital events, along with training and demonstration videos. MARS is able to expand its presence to places it may not be able to be physically present at through posting videos of MARS students reading through one of the MARS storybooks, walking through the steps of a STEMcraft, and explaining technical skills.

Programming with EV3s/Spike Primes - When MARS is presented with a more mature audience or an outreach event that requires more specific STEM involvement, MARS employs the use of EV3s and Spike Primes along with the basic build of an FLL-C robot. MARS students either select a specific FLL-C mission or design one of their own for students to try. This allows students to directly work through engineering and programming processes. This has proven very successful with audiences in middle to high school as well as for requirements for scout merit badges.

"What's in a Robot" Sign - Typically used for outreach events geared toward younger audiences, the "What's in a Robot" sign is shown as both a larger presentable poster and a smaller handout. Typically, a MARS student will distribute the handouts and explain each part of the sign using the larger poster. At larger events, a student accompanies the larger poster set up at a MARS booth and answers questions about the poster as people walk by.

6. Market Analysis Summary

To stay true to the MARS mission of getting West Virginia youth, as well as youth across the globe, involved in STEM, MARS has identified the following target markets:

- High School Students
- Middle School Students
- Elementary School Students
- Pre-K Students

6.1 Market Segmentation

High School Students: To extend robotics programs to high school students, MARS, along with NASA and other local partners, has helped start FTC, VEX, and other FRC teams in multiple areas of WV. To make sure these teams are competitive and engaged, MARS shares its knowledge in the form of Tucker Teams and shared CAD with other FRC teams. MARS also utilizes a feeder system for high school robotics programs (as outlined in Progression of Programs, in section 2.7) by strongly supporting FLL-C and FLL-E throughout the state. High school programs then provide an outlet for veteran FLL-C students, allowing them to stay involved with FIRST while acquiring more complex life skills.

Middle School Students: To expand interest in STEM among those students at the middle school level, MARS assists and/or mentors FLL-C teams across West Virginia. To better engage middle schoolers with FIRST, FLL-C scrimmages are held in middle schools where anyone at the school can come to see the robots at play. The FLL-C season was also extended going from fall to spring rather than summer to fall which more appropriately fits with an academic year. This additional exposure to robotics aids in spreading awareness and attracting people's interest in FIRST. MARS members also assist with a variety of youth summer camps, specifically targeted at this age group, as well as partner with other community organizations that specialize in this demographic example of this is when MARS helped members of a Scouts BSA troop obtain their robotics merit badges.

Elementary School Students: To actively engage students at the elementary school level, MARS has worked with numerous FLL-E teams to reach students. Storybooks are used as well such as Marvin's Mighty Mission as it engages students with illustrations of robots and STEM concepts. MARS also employs the use of STEMcrafts to teach basic STEM concepts with fun activities. MARS plans to record STEM crafts videos that will work with the hybrid model to use STEMcrafts remotely. These videos will have two versions, one for younger students which will explain basics, and one for older students which will explain more in-depth concepts.

Pre-K Students: MARS aims to spark an interest in STEM in the minds of WV youth by hosting frequent outreach events. MARS members actively facilitate read-alouds, robot demonstrations, and fun activities for youth in this age spectrum.

7. Website Marketing Strategy

The MARS website, www.marsfirst.org, is designed and updated by the MARS Outreach and Public Relations subteam and is used to supply information to those interested in the MARS program and FIRST. The team also uses the website as a way for new students to apply to the team and also provides a calendar to show all upcoming events. The website was redesigned in the summer of 2017 to include more information and resources for other FRC teams after MARS' Hall of Fame induction. The website was also greatly expanded beginning in 2021 as MARS began to shift toward having a larger online presence. The Digital FRC Help Desk and videos from the team's ever-growing YouTube channel are recent additions. MARS plans to add an FLL-C informational hub for FLL-C coaches in the future. For more information on the team website, please visit www.marsfirst.org.

8. Strategy and Implementation Summary

As circumstances within and outside of the state have changed throughout the years, MARS has adapted its strategy for growing STEM education in response.

In 2008, MARS created the “West Virginia Plan,” which was a strategy for beginning new FIRST teams around the state. In 2013, this was renamed the “MARS Plan,” as the team began to reach beyond state borders to share their vision of FIRST growth. The plan previously contained four main areas of focus when building a new team: community, partnerships, barriers, and sustainability.

In 2016, the MARS Plan was remodeled to be a more detailed and accurate description of the strategy which MARS implements when building new teams and taking part in general STEM outreach. The MARS plan then was structured to focus on the five main areas of growth and involvement; Engage, Inspire, Sustain, Progression of Programs, and Creating Leaders and Innovators.

In light of lockdowns caused to stop the spread of COVID-19, the MARS plan was reviewed in 2021 to better align itself with a hybrid model of outreach. MARS implemented a digital platform to broaden the impact of existing products and services in North-Central West Virginia and beyond, while also continuing in-person initiatives that have made MARS’ outreach successful in the past.

These consistent revisions of the team’s strategy have allowed MARS to remain innovative and effective in its outreach efforts.

8.1 SWOT Analysis

MARS performs an annual SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to aid in team advancement. The MARS SWOT analysis divides traits into two categories: internal and external environment. The first category, internal environment, defines the team’s Strengths and Weaknesses. The external environment is comprised of Opportunities and Threats that can affect MARS’ viability.

The MARS Student Leadership Council identified the following:

	Helpful	Hurtful
Internal	Strengths	Weaknesses
	<ul style="list-style-type: none"> • Funding • Mentors & Alumni • Facilities • Team Leadership • Team Character • Team Image 	<ul style="list-style-type: none"> • Lack of Enthusiasm • Internal Communication Breakdown • Distribution of Students' Ages • Distribution of Students' Residency • Weak Digital Security
External	Opportunities	Threats
	<ul style="list-style-type: none"> • Rural Communities inside West Virginia • National & International Underserved Area • STEM Programs in Schools • FIRST Hall of Fame Status • Increased Community Interest in Hybrid Outreach 	<ul style="list-style-type: none"> • Macroeconomic Fluctuations • Loss of Core Partners and/or Sponsors • Loss of Key Personnel • Inability to actively access facilities

These individual issues will be discussed in detail in the following sections.

8.1.1 Strengths

Funding - Funding was identified as one of the team's keys to success (see Section 2.4). MARS is blessed with funding from a variety of sources, as the team is both a good investment for foundations providing grants and for corporations seeking to reinvest in their community through tax-deductible donations. Over the years, MARS has developed a close working relationship with many of its sponsoring partners, which has allowed MARS a level of consistency in its funding from year to year.

Mentors - MARS is led by 25 mentors. These mentors are all highly experienced in their fields, including education, business, health care, and engineering. The level of instruction from these mentors allows students to perform well at competitions and in their academic careers.

Team Alumni - Each year, an average of five to ten students graduate from the program. Many of these students continue volunteering as mentors, returning over college holidays and weekend breaks to assist the team in many aspects. These alumni return whenever possible to set examples for younger members, providing students with a tremendous range of experiences to utilize.

Facilities - MARS has access to extensive facilities to aid them with their mission. West Virginia University graciously provides access to rooms, labs, computers, and machining workshops. The Monongalia County Board of Education provides an entire building for use as a full-sized practice field and mentoring facility. This practice facility benefits not only MARS but many FRC and FLL-C teams from the surrounding area, as MARS opens up the practice fields located there for other teams' use.

Team Leadership - In 2016, MARS revamped its team and leadership structure (see section 3.2.1). The team is led by a student leadership council, an elected five-student group, that facilitates communication between the different general areas of the team and makes broad team decisions. Under the technical and non-technical vice presidents, each sub-team has a student lead, who organizes tasks for that team. Each Outreach Task-Force also has a similar lead. This system has proven very beneficial for more organized and efficient task management.

Team Character - The organizational culture of MARS lends itself to a very close-knit, family-like atmosphere. Since the team is composed of rival schools as well as many home school students, the team cannot commit to the organizational culture of any one of its components. As such, MARS has developed its own unique culture. Teammates not only interact at MARS functions but in non-FIRST-related activities. Due to this bond, when

competition time rolls around, MARS naturally transforms into an extremely focused, unified group.

Team Image - MARS maintains a cohesive image throughout the community and within FIRST competitions. At all outreach and competitive events, students wear the standard team t-shirt, which has become widely recognized across the nation both within and outside of the FIRST community. On one day at regional competitions, MARS wears standard black dress shirts with black bottoms and a red "MARS bow-tie." These uniforms are fitted with MARS patches bearing the team logo, to maintain uniformity throughout the competition.

8.1.2 Weaknesses

Internal Communication Breakdown -As MARS has grown, sub-teams have become more separate and distinct from each other. While this increase in members allows for specialization, communication can weaken between the sub-teams. MARS is combating this by holding weekly team meetings (tri-weekly during build season) where students discuss important progress and announcements of each sub-team and plan for the week ahead. Additionally, the Student Leadership Council provides a channel for communication between the technical and non-technical sides of the team and encourages participation in the MARS cross-training system, developed to educate all team members about the important parts of each sub-team.

Lack of Enthusiasm - During competitions, MARS has a tendency to be viewed as showing disinterest or apathy towards the game or fellow teams. While this is just due to the busy nature of MARS students and lack of time to cheer on their drive team or others, it is a common perception that damages MARS' otherwise strong team image. To mitigate this weakness, MARS established a Spirit Squad that encourages students to get further involved in competition in ways such as volunteering at events.

Distribution of Students' Age - 51% of MARS students on the team and the entire Student Leadership Council are from the graduating class of 2023. The loss of knowledge and leadership after these students graduate the team is concerning. To minimize this loss MARS

has been retaining versions of important historical documents including the reasons for any edits. MARS also plans to create instructional videos detailing FRC-related technical skills for basic robot construction. These videos would preserve knowledge from the team's current students, and provide other teams with that knowledge via the MARS YouTube channel.

Distribution of Students' Residency - Despite MARS having students from three counties in North-Central West Virginia, 89% of students on the team come from Monongalia County WV, with 65% of the team being from Morgantown High School, a high school located in Monongalia County. To diversify this aspect of the team MARS plans to broaden STEM engagement with high school students throughout North-Central West Virginia.

Weak Digital Security - Most of MARS' outreach and communication operates through Gmail, and most of the team's documents are located on the team's Google drive. If for any reason the team's Google account was to be compromised this would be a catastrophic loss and jeopardize the functionality of MARS. In light of this MARS plans to institute a plan to routinely scan physical documents into a digital format, and download files from the team's Google drive to a physical hard drive.

At this point in time, none of these weaknesses have developed into significant issues. Both the students and mentors of the team have recognized these potential weaknesses and taken steps to mitigate them before they have a dilatory effect on the team's competitiveness.

8.1.3 Opportunities

Rural Communities Inside West Virginia - MARS began with a mission to promote STEM education and increase participation in post-secondary schooling among West Virginia high school graduates. As the team became more ambitious, they developed the West Virginia Plan, now The MARS Plan, which led to the rapid expansion of FIRST programs throughout the state. Graduates of these FIRST programs continue on to post-secondary educational venues. In order to reach more students within rural communities, MARS has integrated the hybrid model of outreach within the MARS plan to expand the accessibility of the team's knowledge and services.

STEM Programs in Schools – MARS has always sought to increase the interest of STEM in youth. By starting STEM programs in schools, students have the opportunity to expand their knowledge of STEM fields at an early age so that they are more likely to consider a career in STEM.

FIRST Hall of Fame Status - Through the 2017 FIRST Championship Chairman’s Award, MARS entered the FIRST Hall of Fame. Through the transition to this position, the team has gained a stronger connection to several other well-known FRC teams, and organizational leadership at FIRST. This offers a great opportunity for future partnerships or influence within FIRST. With this, MARS also gained the responsibility to assist other FRC teams, specifically with outreach and STEM expansion efforts.

Increased Community Interest in Hybrid Outreach - As the world was forced online in 2020 due to lockdowns caused by the COVID-19 pandemic, people became more comfortable with digital platforms. This has allowed MARS to implement new methods of outreach integrating traditional in-person strategies with new digital approaches utilized during the pandemic.

8.1.4 Threats

Macroeconomic Fluctuations - In addition to the facility, technical, and educational needs described above, MARS would be unable to function without the generous funding provided by its corporate sponsors and foundation grants. Unfortunately, fluctuations in the nation's overall economy can negatively affect the availability of funds for the team. International disputes can interrupt global supply chains hampering the team’s ability to effectively obtain crucial materials.

Loss of Core Partners and/or Sponsors - MARS has four core partners that sponsor a majority of their activities: WVU, NASA’s Katherine Johnson IV&V Facility, the Monongalia County Board of Education, and the United Way of Monongalia and Preston Counties. These partners provide a majority of the team's facilities, technical, financial, and educational support. While all the team’s sponsors are important, the loss of support by any one of these four would severely hamper the team's ability to operate at its current levels. However, since MARS has a variety of sponsors, one loss, while detrimental, would not end the program. For example, if NASA’s Katherine Johnson IV&V Facility was to decide to stop supporting the team, while

MARS would lose a major supporter being a NASA House Team, the team would still have access to all of its current facilities.

Loss of Key Personnel - The team's adult mentors provide the ongoing organizational and logistical support that makes the very existence of MARS possible. While all MARS mentors are valuable to the team, MARS identified two key personnel vital to the team and its ongoing operation, Dr. Earl Scime. and Mr. Phil Tucker. In 2015, Mr. Tucker passed away. While Mr. Tucker's loss was devastating for the team, the leadership of Dr. Scime and the willingness of other mentors to step in and shoulder new responsibilities aids the team in carrying on and moving forward while honoring Mr. Tucker's memory. Currently, Dr. Scime's expertise, experience, and contacts in the FIRST and business communities are instrumental to the team. In the event that MARS faces the loss of Dr. Scime, MARS is training mentor and alumni Ryan Utzman, program specialist for the NASA Education Resource Center, to step into the lead mentor position.

Additionally, MARS has mentors that provide various critical resources to the team, such as leading the building of the practice field. Without MARS' various critical mentors these things would still get done, but likely would not be done as efficiently or to the same quality.

Inability to Actively Access Facilities - While MARS does have two fully functional locations, the inability to access one without warning would cause significant difficulty as team resources are split evenly. During both 2020 and 2021, this turned to reality as the team lost access to its main workspace at WVU. However, the team was still able to sustain itself operating digitally through Zoom and out of its secondary building provided by the Monongalia County Board of Education.

While the above threats are indeed real and must be considered, they are survivable. In the end, there is little MARS can do to mitigate the risks other than to maintain good stewardship of its resources, be watchful, and plan accordingly.

9. Fundraising Strategy

MARS offers fundraising opportunities at a variety of levels to sponsors and grant providers on an annual basis. Sponsoring MARS is a wonderful way to support STEM education throughout West Virginia, while also offering a variety of avenues for promotion for local

businesses. One-hundred percent of all donations go towards registration fees, robot parts, outreach materials, and student lodging during travel to competitions. All donors are recognized in a variety of ways. Below is a list of the sponsorship levels and their associated benefits:

Olympus Mons Donor - \$5,000 and up

Listing in all team literature

Logo on the MARS website

Listing on the team T-shirt

Sponsor name on robot

Identification as a primary sponsor in formal team name

Valles Marineris Donor - \$1,000 - \$4,999

Listing in all literature

Logo on the MARS website

Listing on the team T-shirt

Sponsor name on robot

Trading shirt

Hellas Basin Donor - \$250 - \$999

Listing in all literature

Logo on the MARS website

Trading shirt

Utopia Planitia Donor - \$50 - \$249

Listing in all literature

Logo on the MARS website

9.1 2021-2022 Sponsor List

Below is a list of sponsors for the 2021- 2022 season.

- Advanced Research Corporation

- Animal Medical Center
- Apple
- Applied Physics Laboratory
- Beitzel Corporation
- Clear Mountain Bank
- Compton Metals
- Daniel Hill
- Dassault Systèmes
- EQT
- Halliburton Energy Services
- Leidos
- Margaret Mattson
- M & S Consulting
- Med Express Urgent Care
- Monongalia County Board of Education
- Monongalia County Commission
- MPL
- NASA Katherine Johnson IV&V Robotics Alliance Project
- National Instruments
- Novelis
- Phillip M. Tucker Memorial Fund
- Rotary Club of Cheat Lake
- Tanner's Alley
- United Way of Monongalia and Preston Counties
- US Cellular
- Women's Giving Circle of North Central West Virginia
- WV Space Grant Consortium
- WVU Benjamin M. Statler College of Engineering and Mineral Resources
- WVU College of Mathematics
- WVU College of Physics and Astronomy
- WVU Credit Union

For more information on the team's sponsors, visit the website at www.marsfirst.org.

9.2 Funding Forecast

To achieve MARS' fundraising goals, MARS receives its funding through four primary avenues:

1. Contributions
2. Grants
3. Fundraising
4. Carryover

9.2.1 Contributions

Sponsorships and donations are the primary funding avenue for MARS. Without the generous support of corporate sponsors and private donors, achieving the MARS mission would be nearly impossible. MARS projects \$60,000.00 through this avenue.

9.2.2 Grants

Grants are a vital funding source for MARS. Grants come from programs and organizational foundations. The projected funding through this avenue amounts to \$10,000.00.

9.2.3 Fundraising

MARS fundraising activities include the sale of LEGO® MMS models, LEGO® GPM models, and sales of t-shirts along with registrations for the MARS FRC Event WVROX. The projected funding through these avenues is expected to be \$1,000.00.

9.2.4 Carryover

MARS consistently maintains a positive cash flow. Financing a significant carryover is vital to ensuring a team rainy day fund since MARS is primarily funded through grants and local donors. In the case of an economic downturn, MARS can still sustain itself until new funding sources can be procured. MARS anticipates a carryover amount of \$44,000.00.

10. Financial Plan

MARS expects a funding growth of 5% per year to achieve its goals and objectives. This growth is expected to be obtained through the retention and renewal of current grants, the continued support of MARS' current sponsors and donors, as well as, the acquisition of new grants, sponsorships, and increased fundraising. At the current time, MARS intends to continue to operate on a cash basis and has no intention to use debt as an instrument to fund its activities.

MARS believes that by pursuing this strategy it can continue to grow its operations while still maintaining a surplus without the acquisition of any long-term liabilities. Below are the financial statements for the fiscal years (FY) 2018, 2019, 2020, and 2021. The team's fiscal year runs from January 1st to December 31st.

10.1 Surplus or Deficit Statement

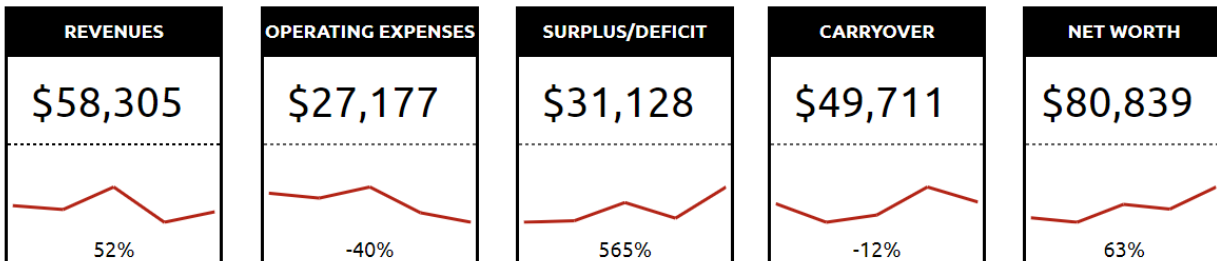
MARS operates on a cash basis by paying its bills at the time the expense is incurred. As can be seen in the statement below, MARS has no payroll expenses, as there is no paid personnel. All mentors and other support personnel are unpaid volunteers generously donating their time free of charge. To date, MARS owns no major long-term assets. As such, there are no depreciation expenses recorded. Funding trickles in throughout the duration of the year.

ANNUAL FINANCIAL REPORT

2021

Mountaineer Area Robotics - FRC Team 2614

KEY METRICS



ALL METRICS

METRIC	2021	2020	% CHANGE	5 YEAR TREND
REVENUES	\$58,305.20	\$38,307.32	52.20%	
OPERATING EXPENSES	\$27,177.45	\$45,001.62	-39.61%	
SURPLUS/DEFICIT	\$31,127.75	-\$6,694.30	564.99%	
SURPLUS/DEFICIT %	53.00%	-17.00%	411.76%	
CARRYOVER	\$49,710.76	\$56,314.46	-11.73%	
NET WORTH	\$80,838.51	\$49,620.16	62.91%	
STEM SUPPORT	\$5,009.38	\$14,691.73	-65.90%	
TRAVEL	\$731.05	\$5,136.47	-85.77%	
EVENT REGISTRATION	\$200.00	\$1,550.00	-87.10%	
ROBOT CONSTRUCTION	\$14,563.58	\$18,398.32	-20.84%	
EQUIPMENT	\$4,180.59	\$999.27	318.36%	
OPERATIONS	\$2,524.85	\$2,475.55	1.99%	
PROMOTIONS	\$32.00	\$1,750.28	-98.17%	

10.2 Statement of Cash Flows

Since MARS is a 501 (c)(3) non-profit organization, the team's Statement of Cash Flows is incredibly similar to the team's Surplus and Deficit Statement and the Statement of Financial Position. MARS continuously operates on a cash basis and has no financing or investing initiatives.

STATEMENT OF CASH FLOWS - 2021

BEGINNING CASH BALANCE	\$49,710.76
CASH INFLOW	
OPERATIONS FUNDING	
<i>Contributions</i>	\$47,305.18
<i>Grants</i>	\$11,000.02
<i>Subtotal Cash From Operations</i>	\$58,305.20
ADDITIONAL CASH RECEIVED	
<i>Sales Tax and Other Taxes Received</i>	\$0.00
<i>New Current Borrowing</i>	\$0.00
<i>New Other Liabilities (interest-free)</i>	\$0.00
<i>New Long-term Liabilities</i>	\$0.00
<i>Sales of Other Current Assets</i>	\$0.00
<i>Sales of Long-term Assets</i>	\$0.00
<i>New Investment Received</i>	\$0.00
<i>Subtotal Additional Cash Received</i>	\$0.00
TOTAL CASH IN	\$58,305.20
CASH OUTFLOW	
OPERATING EXPENSES	
<i>Promotions</i>	\$32.00
<i>Operations</i>	-\$2,524.85
<i>Equipment</i>	-\$4,180.59

<i>Event Registration</i>	-\$200.00
<i>STEM Support</i>	-\$5,009.38
<i>Robot Construction</i>	-\$14,563.58
<i>Travel</i>	-\$731.05
<i>Subtotal Spent on Operations</i>	-\$27,177.45
ADDITIONAL CASH SPENT	
<i>Sales Tax and Other Taxes Paid Out</i>	\$0.00
<i>Principal Repayment of Current Borrowing</i>	\$0.00
<i>Other Liabilities Principle Repayment</i>	\$0.00
<i>Long Term Liabilities Principal Repayment</i>	\$0.00
<i>Purchase Other Current Assets</i>	\$0.00
<i>Purchase Long-term Assets</i>	\$0.00
<i>Dividends</i>	\$0.00
<i>Subtotal Additional Cash Spent</i>	\$0.00
TOTAL CASH OUT	-\$27,177.45
NET CASH FLOW	\$31,127.75
CASH BALANCE	\$80,838.51