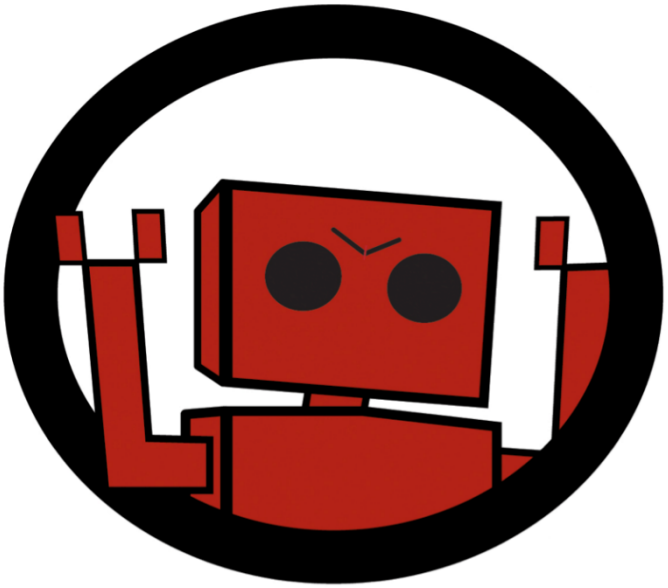
Mountaineer Area RoboticS

MARS 2614



Sustainability Action Plan

2022-2023

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The MARS Opportunity Process

The MARS Opportunity Process was created in 2023 to streamline the team's sustainability and advancement initiatives. This process consists of five fundamental steps of growth and survivability: Recruitment, Team Structure, Financing, Analysis, and Growth.

Recruitment: Attracting new students and mentors to the team by eliminating economic, geographic, and social barriers.

Team Structure: Separating student work responsibilities into groups to permit specialization. As tasks are divided, students focus on one area of expertise which encourages communication, structure, and efficiency.

Financing: Ensuring a stable funding stream from contributions, grants, carryover, and fundraisers.

Analysis: Utilizing archived historical documents, such as the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis, to examine potential problems and solutions while also providing a pool of experience for future and current members of MARS.

Growth: Developing a plan to advance MARS as a team and align MARS' growth with For Inspiration and Recognition of Science and Technology (FIRST) values.

1. Recruitment

By eliminating geographic, social, and economic barriers, MARS makes it possible for any interested mentors or students to join the team. MARS' strategy to recruit students revolves around supporting younger robotics programs such as FIRST Lego League Explore (FLL-E) and FIRST Lego League Challenge (FLL-C). This provides an outlet for veteran FLL-C students and allows them to stay involved with FIRST while developing more complex skills needed to succeed in the competitive environment of high school robotics. MARS also encourages parents of students to join the team as mentors and actively recruits possible mentors in

the local community. For many mentors, the process of witnessing student growth through involvement with MARS is special and worth participating in. For many mentors, witnessing student growth through involvement with MARS is special and underscores the value of the program.

1.1 Barriers and Solutions

Geographic: MARS ensures that geographic barriers to team participation are minimized as much as possible. Any individual may join, regardless of school affiliation or county of residence. This has allowed MARS to draw students and mentors from all over North-Central West Virginia. The team also focuses on sustaining STEM efforts and programs throughout West Virginia which then allows the entire state, including other FIRST Robotics Challenge (FRC) teams, to see reduced barriers to STEM participation and education.

Social: MARS strives to be inclusive to everyone by advocating for and providing equal treatment regardless of social intolerances present in today's society. To do so, MARS creates an environment of connection and inclusion between all team members. This is done by sharing team meals, traveling together to competitions, and encouraging communication between all team members regardless of experience or skill set. Additionally, MARS includes pronouns and fluent languages on competition name buttons.
To ensure a safe and welcoming team dynamic, MARS members attend Safe Zone Training provided by the WVU LGBTQ+ Center. The team has also recently created a MARS Diversity Committee to ensure an inclusive team environment, using its newly drafted Equity Action Plan (EAP) to introduce a set of goals to maintain MARS as a more equitable and welcoming environment in the coming years.

Economic: FRC can be very expensive as traveling, robot construction, and organizing all operations combine to make up MARS' roughly $140,000 annual budget. However, to eliminate economic barriers, MARS membership is completely free and the cost of travel is subsidized for all members. As a result, anyone in the community can join the team regardless of socio-economic status, and can travel to competitions regardless of potential monetary costs to the student. However,

team membership is capped at approximately 40 members due to limitations on workspace size and team financial constraints.

1.2 REC Foundation Drone Team

Starting in 2023, in response to an increased interest in joining the robotics team, MARS established its own Robotics Education and Competition Aerial drone team. This team is composed of mostly younger students who expressed interest in robotics but were unable to join MARS due to age restrictions. Drone team members are tasked with programming flying drones to accomplish missions and win points. Team members learn valuable skills in programming, game strategy, and game piece manipulation that translates directly to FRC. The aerial drone team is a step between an FLL-C team and the rigor of high school robotics, allowing students to engage with MARS without requiring an immediate full time commitment. The drone team is classified by MARS as an intermediate STEM activity and MARS plans to increase the number of these activities across the state.

2. Team Structure

To aid organization and increase efficiency, MARS is divided into four subteams that focus on specialized skills. MARS also has a Student Leadership Council which oversees all subteams and makes major team decisions. During regional events, students across all subteams join together to form competition teams. This increases team productivity and cohesion.

2.1 Subteams

MARS consists of four subteams: Mechanical, Electrical, Programming, and Outreach and Public Relations. Subteam membership is 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 update the whole team. Similarly, subteams are guided by adult and alumni mentors, who teach students skills and monitor progress during the season.

Mechanical Subteam:

Fabrication Team: The fabrication team uses machinery such as lathes and mills to create robot parts from scratch. This skill allows MARS to save time and resources by manufacturing readily available, specialized parts.

Assembly Team: The assembly team uses the fabricated parts to build the robot. Student tasks vary each year depending on the design of the robot that year, the skills of students, and mentor training. All members attend shop training to build machinery skills and to ensure the safety of all members and mentors.

Computer-Aided Design (CAD): While MARS does not have a dedicated CAD team, the team plans to create one. For now, certain students work with mentors to create CAD drawings used by the fabrication team for the construction of the robot. Team members attend design meetings and take part in software training. These students often work at home on projects to be prepared for team meetings.

Mars Innovation Process (MIP): In 2022, the team implemented the MARS Innovation Process (MIP), a new build-season principle to foster continued student-led design. With the assistance of a student MIP lead, students can model, prototype, test, and present new iterations of the robot's subsystems after the robot is initially built.

Electrical Subteam:

Electrical Team: The electrical subteam is the bridge between the mechanical and programming subteams. After the robot is fully constructed, this subteam completes the electrical wiring that distributes battery power to subsystems on the robot like the drive base and elevator. In order to complete these tasks, members must learn key work-based skills like soldering, crimping, and wire management.

Programming Subteam:

Robot Programming: The programming subteam develops computer code for all autonomous and teleop (directly controlled by a driver) functions of the robot, including sensors and control systems. Students learn the Java programming

language and advance their software capabilities during the off-season. Additionally, members work with other programming languages to create, enhance, and debug software.

Outreach and Public Relations (OPR) Subteam:

Outreach Team: The outreach team plans all of MARS' outreach events, provides advice to other robotics programs, and makes contact with and aids potential new robotics programs.

Media Team: The media team films and archives photos and videos of competitions, along with year-round outreach events. This team produces the robot reveal video and promotional team videos. They also run the team's social media accounts, including Twitter, Instagram, Facebook, and TikTok.

Finance Team: The finance team searches for and completes applications for financing, seeking either funding or in-kind donations. In addition, the team works on official MARS documentation and drafts essays for awards at competitions.

Impact Team: The impact team plans and executes varied projects to guide MARS' community initiatives. They also draft submissions and make presentations for the Impact Award judged during FRC competitions.

Team Attributes Booklet (TAB) Team: The TAB team creates the MARS TAB booklet each year by assembling photos and utilizing graphic design to create a general nontechnical overview of MARS' previous season. This booklet is used to compete for awards at competitions and to garner new local sponsorships.

2.2 Student Leadership Council

The Student Leadership Council typically meets once or twice a month to discuss team management. Throughout the year, this group of students sets team goals, organizes students into competition teams, passes potential MARS Innovation Process (MIP) initiatives, gives presentations to sponsors, performs the yearly

SWOT analysis, and performs 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

Administrator:

- Keeps the Council on track and in line with MARS' vision and mission
- Focuses on core values and sets goals
- Fulfills the role of President when the President is unavailable

Secretary:

- Prepares and organizes relevant notes and documentation for the Council
- Acts as liaison between student and mentor leadership
- Must be someone with at least one year of experience on the team that is not a senior
- Organizes and documents meeting minutes and distributes them to the entire team

Subteam Leads:

- Represent their subteams in Council
- Take Student Leadership Council ideas back to their subteams

MARS Innovation Process (MIP) Lead

- Suggests MIP process ideas to Council
- Advises Council on mechanical topics
- Does not have a vote in leadership council
- Non-voting member of Council

Diversity Committee

- Made up of seven members appointed by Council
- Advises Council on diversity topics
- Non-voting member of Council
- Maintains the Equity Action Plan (EAP)

2.3 Competition Teams

Students are organized into competition teams through a coordinated effort by the Student Leadership Council. There are no subteam-based restrictions on competition team membership.

Drive Team: The drive team consists of a driver, co-pilot, human player, technician, back coach, backup co-pilot, and backup driver. The drive team remains with the robot a majority of the time during competitions and ensures any damage incurred on the field is fixed. This group works with the scouting team and the pit crew.

Scouting Team: Students on this team develop materials and methods to assess other teams at competitions, providing the drive team and scouting lead with as much advantage as possible when choosing alliance members. To accomplish this, the team meets with the drive team on Thursday and Friday evenings to analyze data, plan strategy, and evaluate alliance partners.

Tucker Teams: Tucker teams are composed of students from different subteams. With the motto “no robot left behind” in mind, these students provide other teams with hands-on help and instruction during FRC competitions. They ensure that all teams are playing to the best of their abilities, and serve as the main outreach team during competitions. This ongoing initiative honors the ideals of the late MARS mentor, Mr. Phil Tucker.

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

3. Financing

MARS is a 501(c)3 nonprofit that relies on its members to raise funds to sustain the team. To achieve MARS’ fiscal goals, MARS receives its funding through three primary avenues:

1. Contributions

2. Grants
3. Carryover

MARS also participates in fundraising activities described below; however, these sales do not constitute a significant source of financing.

3.1 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. The team has 3 core sponsors who supply a significant amount of the team's resources and 28 sponsors total. The team keeps sponsors engaged and updated with the team through annual applications for funding, social media updates, and direct updates. MARS also works to attract new sponsors using similar methods. MARS projects $100,000.00 from this funding avenue.

3.2 Grants

Grants are another vital funding source for MARS. Grants come from programs and organizational foundations. Funding from grants supports specific programs like STEMcraft kits for outreach activities and also operational expenses like robot construction and travel. The projected funding through this avenue is $12,000.00.

3.3 Carryover

Sustaining a significant carryover is vital to financial viability. The team's largest financial outlay occurs during the first three months of the calendar year, yet contributions and grants are solicited in the second half of the year. Maintaining a large carryover allows the team to consistently maintain a positive cash flow. In case of an economic downturn, MARS can still sustain itself until new funding sources can be procured. MARS anticipates a carryover amount of $81,000.00.

3.4 Fundraisers

MARS fundraising activities include the sale of LEGO® MMS models, LEGO® GPM models, t-shirt sales, and registration for the MARS FRC Event WVROX, an

off-season event run by MARS. MARS does not project substantial funding from this funding avenue.

4. Analysis

MARS was founded in 2008 and is entering its 16th year as a team in 2023. As members of MARS all eventually graduate, the team places an emphasis on passing down knowledge from senior members to younger members and also on ensuring that members plan for the long-term survival of the team. MARS does this through skills training with new team members and through documentation such as MARS' annual SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis and updating the Sustainability Action Plan.

4.1 Training

Senior MARS members teach crucial skills to younger members to ensure team knowledge is retained. This includes teaching skills such as machinery usage, soldering, graphic design, computer-aided design, and programming languages. In addition, many MARS alumni become mentors or remain connected with the team giving MARS a wide pool of knowledge from which to draw.

4.2 SWOT Analysis

	Helpful	Hurtful
Internal	Strengths	Weaknesses
	• Funding • Mentors • Flexible Design • Facilities • Team Communication • Team Leadership • Team Character • Team Image	• Lack of Enthusiasm • Workspace Inaccessibility • Distribution of Students' Ages • Lack of Significant Presence Outside Monongalia County • Weak Digital Security

External	Opportunities	Threats
	• Rural Communities inside West Virginia • STEM Programs in Schools • FIRST Hall of Fame Status • Increased Community Interest in Hybrid Outreach • Intermediate STEM Activities	• Macroeconomic Fluctuations • Loss of Core Partners and/or Sponsors • Loss of Key Personnel • Underlying Cultural Bias

Strengths

Funding - Funding was identified as one of the team's keys to success. Over the years, MARS has gained numerous sponsors that have all aided in keeping the team sustained and prepared each year. MARS' core sponsors have also remained dedicated to funding the team, providing a stable source of revenue. Prior to the pandemic, MARS annual budget was roughly $80,000 but after the pandemic it rose to roughly $140,000. In response, the team increased fundraising efforts and MARS has managed to maintain a stable financed outlook.

Team Communication - MARS' team leadership structure ensures that all subteams and groups in MARS have a voice in the team's direction and goals. This permits every member of MARS to cooperate and communicate well with one another which supports team sustainability.

Flexible Design - MARS' MIP process allows for new robot design ideas to be proposed, quickly tested, and integrated, if proven successful. This, combined with an adaptable design process, gives MARS a competitive edge while allowing any team member to participate in robot design.

Team Character - 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.

Due to this bond, when competition time arrives, MARS naturally transforms into an extremely focused, unified group.

Weaknesses

Distribution of Students' Age - 52.5% of MARS students on the team and most of the Student Leadership Council are from the graduating class of 2023. Despite team efforts to pass down skills, the potential loss of knowledge and leadership after these students graduate from the team is concerning. To minimize this risk, MARS has been retaining versions of important historical documents including the reasons for any document edits and is increasing additional knowledge retention efforts in light of the larger than usual number of new members. MARS also plans to create instructional videos detailing FRC-related technical skills for basic robot construction.

Workspace Inaccessibility - MARS has access to West Virginia University's labs, rooms, computers, and machining workshops, along with a second workspace provided by the Monongalia County Board of Education. The inability to access one without warning, however, would cause significant difficulty as team resources are split evenly. During both 2020 and 2021, this turned into reality as the team lost access to its main workspace and many of its tools at WVU. However, the team was still able to sustain itself operating digitally through Zoom and out of its secondary building.

Lack of Substantial Presence Outside of Monongalia County - Despite having students from three counties and performing numerous yearly outreach events throughout North-Central West Virginia, MARS lacks a long-term substantial presence outside Monongalia County. To expand a long-term presence of STEM in North-Central West Virginia, MARS is providing aid to smaller robotics programs in different counties and is also trying to start new drone teams around the state.

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 toward mitigation before they have a deleterious effect on the team's long-term viability and sustainability.

Opportunities

Rural Communities Inside West Virginia - MARS began with a mission to promote STEM education and opportunity for all communities. The large rural communities within West Virginia provide crucial opportunities for expansion and growth of STEM in the state. In order to reach more students within rural communities, MARS has integrated a hybrid model of outreach (see below) to expand the accessibility of the team's knowledge and services.

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 opportunity allowed MARS to implement new methods of outreach integrating traditional in-person strategies with new digital approaches utilized during the pandemic.

Intermediate STEM Activities - Currently, West Virginia largely lacks the necessary resources and infrastructure to support an extensive network of expensive STEM programs such as FRC teams. Accordingly, MARS is seeking to create less intensive and more affordable intermediate STEM activities with which everyone in the state can engage with.

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

Threats

Loss of Core Partners and/or Sponsors - MARS has three core partners that provide a majority of the team's facilities, technical, financial, and educational support. These are WVU, NASA's Katherine Johnson IV&V Alliance, and the Monongalia County Board of Education. While the Monongalia County Board of Education does not provide funding like the other two, they provide the team with its secondary workspace. While all the team's sponsors are important, the loss of

support by any of these three partners 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. MARS is also focusing on expanding its list of partners after the pandemic harmed many sponsors' ability to donate.

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 aided 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 students and mentors to fill in the knowledge gaps that would be left by Dr. Scime's loss. The team is also actively seeking a dedicated mentor to train to fill Dr. Scime's shoes.
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 be completed, but likely would not be done as efficiently or to the same quality.

Underlying Cultural Biases - MARS has many students and mentors who come from diverse cultures and backgrounds. Some team members however are not entirely accustomed to this diversity. MARS aims to remedy this by providing educational training, a case-by-case policy to handle discrimination issues, and the implementation of an Equity Action Plan and Diversity Committee.

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 all risk other than to maintain good stewardship of its resources, be aware of threats, and plan accordingly.

4.3 Other Documentation

To pass down MARS history and experience, MARS keeps an assortment of documents for future members. These documents include the MARS Sustainability Action Plan which acts as a detailed annual summary of team viability as an organization, the MARS TAB Booklet which details important facts about MARS in an easily-readable format, and many more smaller documents which describe certain aspects of MARS. MARS also records knowledge in videos such as the team's programming videos which store basic programming knowledge for future members. Additionally, the team has a shared Google drive between all members of the team which allows for easy access to all MARS documentation.

5. Growth

5.1 Goals & Objectives

MARS is constantly evolving. Each year, MARS adjusts its goals and objectives to maintain team growth and to reflect the team's transformation. To successfully attain these objectives, considerable forethought and preparation are essential. In 2021, MARS created a five-year plan to focus on sustainability goals after students graduate and guide the team's future plans. 1, 3, and 5 year goals are set annually by the Student Leadership Council while 2 and 4 year goals, along with already set 1, 3, and 5, year goals, are carried over from the previous year. This way of setting goals allows students to think about their goals in terms of what they want to see done in the coming year, what they want to see done with their time on the team, and what they want to see done after they leave the team.

Below is the list of MARS' overall team objectives:

One Year Goals (Ending In 2024)

- Create one video per subteam that acts as an overview to describe their responsibilities and teach basic skills.
- Establish at least one intermediate STEM activity team outside of Monongalia County.

- Ensure that every programming member of MARS is fluent in Java and make infrastructure to quickly train new members in Java fluency.

Two Year Goals (Ending In 2025)

- Restore FLL-C and FLL-E team numbers to 75% of pre-pandemic levels.
- Have at least 33% of MARS outreach events take place outside of Monongalia County.
- Attain pre-pandemic outreach event levels (roughly 60 events per year).

Three Year Goals (Ending In 2026)

- Hold 2 yearly presentations at every high school in Monongalia County.
- Have at least one intermediate STEM activity team in the 4 WV counties that border Monongalia County.
- Establish a CAD team inside of the mechanical subteam that will specifically be trained to design robot parts.
- Establish an online FLL-C landing hub to provide information on how to start and run an FLL-C team in cooperation with other local FRC teams.

Four Year Goals (Ending In 2027)

- Restore FLL-C and FLL-E team numbers to 100% pre-pandemic levels.
- Update subteam overview videos with new technology and information.
- Gain at least two new sponsors in the top two sponsorship tiers and at least 5 new sponsors in the bottom five sponsorship tiers.

Five Year Goals (Ending in 2028)

- Establish a new FRC team in West Virginia.
- Create the Appalachian Alliance of Outreach in which MARS will collaborate with other FRC teams in the Appalachian region to spread STEM opportunities.

5.2 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.
- ***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.
- ***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.

6 Addendums

MARS STATEMENT OF CASH FLOWS - 2022		
BEGINNING CASH BALANCE (January 1, 2022)		$80,838.51
CASH INFLOW		
OPERATIONS FUNDING		
Contributions		$98,741.21
Grants		$12,186.15
Fundraising		$0.00
Awards		$5,000.00
	Subtotal Cash From Operations	$115,927.36
ADDITIONAL CASH RECEIVED		
Sales Tax and Other Taxes Received		$0.00
New Current Borrowing		$0.00
New Other Liabilities (interest-free)		$0.00
New Long-term Liabilities		$0.00
Sales of Other Current Assets		$0.00
Sales of Long-term Assets		$0.00
New Investment Received		$0.00
	Subtotal Additional Cash Received	$0.00
TOTAL CASH IN		**$115,927.36**
-		
CASH OUTFLOW		
OPERATION EXPENSES		
Promotions		-$478.82
Operations		-$4,105.10
Equipment		-$1,088.65
Event Registration		-$15,250.00
Outreach		$10,078.84
Stem Support		-$22,830.31
Robot Construction		-$20,191.34
Travel		-$53,080.92
	Subtotal Spent on Operations	-$127,103.98
TOTAL CASH OUT		**-$127,103.98**
NET CASH FLOW		**($11,176.62)**
CASH BALANCE (December 31, 2022)		**$69,661.89**