Team 4561: The TerrorBytes
Student Handbook
"The TerrorBook"

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1. Introduction

1.1 What is FIRST?

FIRST (For Inspiration and Recognition of Science and Technology) was founded in 1989 by inventor Dean Kamen to inspire young people's interest and participation in science and technology. Based in Manchester, NH, the 501(c)(3) not-for-profit public charity designs accessible, innovative programs that motivate young people to pursue education and career opportunities in science, technology, engineering, and math (STEM), while building self-confidence, knowledge, and life skills.

1.2 What is the FIRST Robotics Competition (FRC)?

The ***FIRST*** Robotics Competition (FRC) is the largest and most challenging program offered by ***FIRST***. In FRC, there is a completely different game every year. Teams learn the nature of the game in early January, then have about six weeks to construct a robot to compete in multi-day competitions that are open to the public. In addition to building a robot, FRC teams compete for awards, the most prestigious of which is ***FIRST*** Impact. A team's impact is defined by their efforts to spread STEM within their community.

1.3 Who are the TerrorBytes?

The TerrorBytes were founded in 2013 with a focus on participating in the ***FIRST*** Robotics Competition (FRC).

Our Mission Statement: *To utilize the resources of Research Triangle Park to encourage, empower, and create equitable STEM opportunities for the next generation.*

In addition to competing, the TerrorBytes meet throughout the year to participate in build challenges, technical electives, community outreach, and other STEM activities to prepare for competition. These lessons and projects are meant to give students first-hand experience with the challenges of modern engineering. In parallel with STEM education, students must also conduct business endeavors of the team: soliciting sponsorships and donations, preparing marketing materials, defining team branding, and directly interfacing with local businesses and business leaders.

The team is organized and managed by volunteer mentors from the community, including professionals from a variety of disciplines. These mentors help to facilitate all aspects of the team from STEM education to business and branding. It is their duty to keep students engaged and learning throughout the year.

A TerrorByte is someone who:

- Takes initiative for the team's betterment and sustainability.
- Proactively identifies and solves problems.
- Respects and appreciates all members of the team.
- Helps whenever anyone seeks it.
- Represents RTHS and ***FIRST*** values in the lab, at competitions, at robotics-related events and at all team activities.

2. Team Logistics

2.1 Admittance to the Team

It is always our goal to give as many students as possible the opportunity to participate. It is an unfortunate reality that the team cannot support an infinite number of students. We recognize that our ability to deliver a meaningful experience diminishes as the ratio of students to mentors increases. As such, during the “Pre-Season” period, students wishing to join the TerrorBytes must participate in a structured rookie trial period in order to qualify for admittance to the team. The best candidates excel in the following ways:

- Interviewing with team mentors
- Showing enthusiasm and commitment to be on the team
- Completing “micro-homeworks” weekly
- Accurately tracking personal attendance using the team’s selected system

Admittance to the team is not solely based on skill, knowledge, or prior experience. It is based on a passion for STEM, level of commitment, and completing requirements on time and with good faith effort. Mentors reserve the right to accept additional members based on hard-to-measure factors such as student passion and commitment. Student admittance will be finalized towards the end of September. Mentors and student leaders reserve the right to modify these requirements.

Members must maintain good standing with RTHS, even if they are not RTHS students. This includes a C average for academics, attendance, and discipline. Failure to meet RTHS standards will result in suspension from the team.

2.2 Attendance requirements for students

Attendance is one of the requirements for admittance to the team and students should plan to attend meetings throughout the year.

Attendance requirements:

- Off-Season (May to September): encouraged, but not required
- Pre-Season (September to December): 50% of Tuesday meetings
- Build-Season (January to May): 60 total hours
- Attend at least one district event

These requirements must be met by students each year in order to continue their membership. Otherwise that student will need to reapply.

During build season in January and February, the team will meet 3+ days per week in addition to Saturday meetings. Additional meetings will be established upon request by student leads and supervision of a mentor. In order for a student to attend competitions, they must have accumulated at least 60 hours of attendance during build season. Students are responsible for tracking their hours through the team's attendance tracking system.

2.3 Attendance requirements for student leaders

Leadership on the team is a great responsibility and you should only volunteer to be considered if you are willing and able to make the time commitment needed to fulfill the role. All leaders have a higher set of expectations for attendance. Subteam members should be notified in advance of any meetings that their lead will miss.

It is required that Captains, Leads, and Quartermasters attend all primary Tuesday team meetings during non-build season and 3 out of the 4 weekly build season meetings.

2.4 Student Fee requirements

While we raise as many funds as we can through grants and sponsorships, it takes a significant amount of money to run this team. Each year during pre-season, mentors determine the cost to be paid by each student participating on the team. **Fees must be paid by December 1st.**

If a student is having difficulty meeting the requirement, they (or their parent/guardian) should contact a head mentor to discuss options. The team can provide scholarship funds to support students with financial needs.

2.5 Business Visit requirements

Each student on the team must visit at least one local business yearly with the goal of forming a partnership. This partnership can take the form of a monetary donation, services, product discounts, mentor support, etc. All proceeds from business visits go

towards a student's FairShare. However, if the student delays making the visit, only a percentage of that money will go towards the FairShare. This only applies to proceeds from the business visit. The percentages are as such:

- Visit by 8/31: **150%**
- Visit by 10/31: **100%**
- Visit by 11/30: **75%**
- Visit by 12/31: **50%**

2.6 Grant Requirement

All students, as part of their annual requirements to complete for the team, must submit at least one FIRST, state, school, or community grant as assigned by the Sponsorships Lead. The Sponsorships Lead is exempt from this requirement but must complete the work associated with their position outlined in section 3.3. Bringing in a new grant and completing it also fulfills this requirement as long as the Grants Lead or a Business Mentor has approved the new grant.

2.7 Parent Volunteering

Volunteering is the best way for parents/guardians to have input with the team. They work to support the team in areas such as travel arrangements, fundraiser support, chaperoning during competitions, and food during events. The work of the Parent Volunteers has significantly improved student and team performance. We encourage all families to engage and help with the behind the scenes work needed to make our team successful. (Specific requirements are detailed in section 5.4 Competition Requirements)

2.8 Pre-Season

- **Week 1 (8-29-23)**
  - TerrorBytes Information
  - FIRST/FRC information
  - Spaghetti challenge
  - Micro-homework: Parent Permission Form, Info Form + Interview Signups
- **Week 2 (9-5-23)**
  - 10 minute rotations
  - Post meeting: rookie interview slots
  - Micro homework: Open Alliance Blog + Video Quiz
- **Week 3 (9-12-23)**
  - 45 minute subteam rotations
  - Post meeting: rookie interviews continue
  - Micro homework: 4561 Previous Year Match Scouting

- **THOR (9-16-23)**

  THOR (Thundering Herd Of Robots) is a one day pre-season FRC event where the previous year's game is played in the fall.
- **Doyenne (9-17-23)**

  Doyenne Inspiration is a one day pre-season event about empowering young female and nonbinary students through the FIRST Robotics Competition. Similar to THOR, for this event the previous year's FRC game is played.
- **Week 4 (9-19-23)**
  - Full meeting subteam activities
  - Post meeting: final rookie interview slots
  - Micro homework: Find Local Business Information
- **Roster is finalized (9-23-23)**
- **Week 5+ (9-26-23 through 12-12-23)**
  - Welcome new members!
  - FIRST registration + handbook deep dive
  - Pre-Season Training continues September through December
  - Each subteam will work on projects or activities that will help to prepare their members for build season

2.9 Build-Season

- **Kickoff (1-6-24)**

  At Kickoff, all teams around the world are given the new challenge for the season! FIRST NC hosts events across the state where teams gather to watch the global Kickoff broadcast and pick up basic parts.
  - <u>Requirements for attendance:</u>
    - All required forms and registrations completed
    - Visited assigned business
    - Met Fairshare requirement
- **Build Season: January & February**

  Competition robot is designed, constructed, and tested. Meeting times:
  - Monday: 5 PM to 8 PM
  - Tuesday: 5 PM to 8 PM
  - Thursday: 5 PM to 8 PM
  - Saturday: 10 AM to 4ish PM

  More Meetings may be added depending on mentor availability and the status of the robot/award submissions.

- **NC District Event 1: February - March | NC**

  FRC District events are two-day-long competitions taking place on a

weekend. The team will compete against approximately 30 teams from across the state.

- Requirements for attendance:
  - All required forms and registrations completed
  - Complete business visit
  - Accumulated 60 hours of attendance during build season
  - Met Fairshare Requirement
  - Participated in 2 team meals

- **NC District Event 2: March | NC**
  - Requirements for attendance:
    - Same as district event 1 above

- **NC District Championship: beginning of April**

  After the district events, FIRST NC holds the District Championship for those teams who placed highly at the qualifier events. This event can be twice the size of the district events and lasts for 2 days.
  - Requirements for attendance:
    - Same as district event 1 above

- **FIRST Championship: mid to late April | Houston, TX**

  If we do well enough at the above competitions, we may qualify to attend the Championship competition in April!
  - Requirements for attendance:
    - Same as district event 1 above, and
    - Must have attended at least one district event, or the NC District Championship

2.10 Off-Season

- **Sub-Team Lead and Key Role Interview and Selection: Spring - Summer**
- **Handbook townhall**
- **MiniFRC!**

3. Team Leadership

3.1 Student Leadership Expectations

Student leaders are responsible to:

- Engage and grow fellow team members.
- Be role models of maturity and gracious professionalism.
- Include rookies to have a meaningful part in team activities
- Update the team's project management tools.

3.2 Captains and Team Manager

Team captains are the foundation of student leadership. Captains spearhead pushing the team forward in spirit and in substance. They are responsible directly (or by delegation) for the training, engagement, and growth of all team students. Captains will be nominated and elected by student members of the team at the end of each school year. In order to vote, students are required to attend the Election Day. The captain positions to be elected are:

- **Engineering Captain**
  The Engineering captain is responsible for all technical projects that the team undertakes. This includes small projects, off-season events, and the ***FIRST*** competition robot build. The Engineering captain will need to track the progress of all engineering tasks and will work directly with the team manager and subteam leads to ensure that tasks can move forward. This captain will be responsible for the success of our technical projects.

- **Business Captain**
  The Business captain is responsible for all non-technical aspects of the team. This includes outreach events, acquiring sponsorships, team branding, budgeting, and team attribute awards. It will be this captain's responsibility to work with subteam leads to ensure that we maintain contact with our sponsors, apply for grants, pursue new business opportunities, and engage the community in a beneficial way. This captain will be responsible for the success of our team's growth and impact.

- **Team Manager**
  The team manager is responsible for updating the project management tool and communication between Business and Engineering. They can also take on work from both Engineering and/or Business. Certain responsibilities available to them each year include overseeing student ambassadors, assisting with drive team

selection, organizing leads meetings, documentation, and staying up to date on the general progress and projects of both Engineering and Business.

Captains/Manager don't assume leadership positions (Drive team, Pit Boss, Rose, Chrysanthemum) at competitions unless deemed absolutely necessary by head mentors but can still participate on a shift at competition with being placed on a shift at lower priority (Scouting, Pit Crew)

3.3 Leads

Leads are responsible for managing the projects and tasks that are needed within their subteams. They will be required to work with captains and mentors to make sure that their tasks are moving forward. Students wishing to be a subteam lead should interview for the position in late spring after captain elections and will be selected by the captains and mentors.

- **Design Lead**
  This role is responsible for leading the Design subteam. The Design lead's first priority is training and distributing tasks to new designers. Communication with all team members is important, especially the Engineering captain and Fabrication lead. Design skills are useful but not a prerequisite for this role; creating designs is not the focus of this role.

- **Fabrication Lead**
  This role is responsible for leading the Fabrication subteam. The Fabrication lead's priority is training and distributing tasks to new fabricators and maintaining safety in the lab. Communication with all team members is important, especially the Engineering captain and Design lead. Fabrication skills are useful but not a prerequisite for this role; producing parts is not the focus of this role.

- **Control Systems Lead**
  This role is responsible for leading the Controls subteam. This lead is responsible for all control, design and fabrication tasks related to technical projects. This officer will work under the Engineering captain to ensure that electrical and control systems designed for robotics projects are robust and on schedule.

- **Programming Lead**
  This lead is responsible for leading the Programming subteam in all coding tasks undertaken by the team. This includes all robot programming, application development, etc. This lead will work under the Engineering captain to lead the programming subteam.

- **Outreach Lead**
  The Outreach lead is responsible for leading the effort of planning and executing outreach projects. The focus of outreach projects are to spread STEM and “Build Better People” in our community.

- **Sponsorships Lead**
  The Sponsorship lead is responsible for acquiring team sponsors, whether it be through grants or Business team corporate visits. The Sponsorship lead works with the Business captain and mentors to ensure that all tasks are completed. The Sponsorship lead must also facilitate the completion of each student's grant requirement by keeping a schedule of grant due dates, assigning grants to other students, and helping students review grant submissions. Most importantly, the Sponsorship lead is responsible for motivating and training students for the sustainability of the team.

- **Media Lead**
  The Media lead is responsible for defining team branding and producing official team content. This lead will work under the Business captain to ensure that the team has a strong media presence through website updates, sponsor communications, thank you letters, marketing materials, etc. This lead is also responsible for recording and documenting the team's activities and progress. This includes all pictures and videos used in our publications as well as wearing the “Media” badge at competitions to take field-side pictures and video.
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- **Awards Lead**
  The lead is responsible for any submitted awards our team pursues, such as ***FIRST*** Impact and Woodie Flowers. They are also responsible for preparing our team for success in judged awards, such as Engineering Inspiration, and training Pit Crew members to speak with judges.

- **Engineering Manager**
  The Engineering Manager is primarily responsible for maintaining and updating the project management tool related to the technical projects of the team. The Engineering Manager would help with technical tasks and help balance the Engineering Captain’s workflow. They can represent the Engineering Captain for meetings at which the captain is not there. The Engineering Manager is more hands-on compared to the Captains. They would coordinate and communicate with Engineering subteam leads to keep projects on schedule and create plans for meetings. They will also be a student ambassador and hold those responsibilities as well.

- **Business Manager**
  The Business Manager is responsible for assisting in the non-technical aspects of the team. They would help with non-technical tasks and help balance the Business Captain's workflow. They can represent the Business Captain for meetings at which the captain is not there. The Business Manager would coordinate and communicate with Business subteam leads to keep projects on schedule and create plans for meetings. They will also be a student ambassador and hold those responsibilities as well.

3.4 Key Roles

Students in key roles are similar to subteam leads. Depending on the task, members in key roles will work on tasks directly or with team members to maintain their responsibilities. Key roles will be selected by captains and mentors, except for student ambassadors who will be elected by students. Key roles will be selected at the same time as lead selections, except project managers, who will be assigned as needed.

- **Student Ambassadors**
  There are two student ambassadors. These students serve as impartial resources for students who might want to talk about something but may not want to speak with mentors. This can be anything as simple as wondering about getting on Drive Team to more serious matters such as harassment. Students having negative experiences or experiencing harassment of any kind are encouraged to speak with mentors or fill out the anonymous form, but the student ambassador can be a low pressure alternative.

- **The Quartermaster(s)**
  A Quartermaster is responsible for the maintenance, storage, and organization of the lab and the team's property. This lead will work under the Engineering captain and with other subteam leads to help ensure the safety and efficiency of the lab, optimize the team's ability to use its resources, and manage supplies and purchases throughout the build season. A Quartermaster has input into selecting the Pit Crew for competitions.

- **Project Managers**
  Throughout the season we have a large number of tasks that must be completed in order to work efficiently; to offset the workload of subteam leads, we have the project manager role. Project managers will be selected throughout the season as needed.
    - **Open Alliance (OA) manager**: This role's primary task is to manage the team's OA presence by creating posts on our Chief Delphi thread; this

task is active from preseason through build season. They should publish a post at least once a week, although more is always welcome. They are not expected to be the primary writers of all posts; however, they should always review work they didn't do themselves.

- **Subsystem Managers**: This person is responsible for the manufacturing and testing of prototypes in a timely manner so that the team can proceed in their strategic design choices. They are responsible for ensuring their subsystem Height (project management software) thread is kept up to date.
- **Strategy Manager:** This role emerges in the beginning of the build season with a primary goal of creating a strategy for the design team to execute. This role tends to dissolve around week 2-3 of build season.

3.5 Subteam roles

- **Design Subteam**
  The Design subteam is responsible for producing robust and elegant designs for team projects. During the FRC season, the Design subteam will work with the Strategy subteam (see below) to create goals. The Design subteam will use these goals to architect one or multiple design concepts for a competition robot. Using feedback from all team members, Design will finalize the concept (Design Freeze) and produce 2D and 3D robot CAD based on that concept (CAD Freeze).

  Design is responsible for communicating details about part material, priority, and tolerance to the Fabrication subteam. Tolerance on any part is implied to be +/- 0.03 inches unless otherwise specified.

- **Controls Subteam**
  The Controls subteam is responsible for constructing and maintaining the electrical framework of the robot. This includes motors, motor controllers, wires, control system elements, pneumatics, sensors, etc.

- **Fabrication Subteam**
  The Fabrication subteam is responsible for team machining and assembly tasks. The focus of this subteam is producing fabricated parts and assemblies on schedule and with a high standard of quality. Completed parts may be inspected for tolerance. If necessary, as determined by the Engineering captain, parts may need to be re-fabricated.

- **Programming Subteam**

The Programming subteam is responsible for collaboratively developing innovative code solutions, which are stored in GitHub. In addition to programming each year's competition robot, they develop applications, enhance and refactor code, and build skill sets to improve themselves throughout the season. They work closely with Fabrication throughout the build season to ensure plans align. After each project manager completes a task or subtask, any subteam member may review its functionality in order for the task to be considered "complete".

- **Media Subteam**
  The Media subteam manages all aspects of TerrorBytes digital and print media. This deals with a wide array of responsibilities, including creating Instagram posts; filming, editing, and producing YouTube videos; keeping the website up to date; and even making engaging TikTok content. Additionally, the Media subteam handles marketing tasks such as creating visually-appealing newsletters, pamphlets, and the sponsorship packet for Business Visits.

- **Awards Subteam**
  The Awards subteam is responsible for all awards that the team is aiming for. There are two categories of awards: submitted and judged. Submitted awards include ***FIRST*** Impact, which highlights the team's outreach accomplishments, and Woodie Flowers, which celebrates a mentor who excels at communication. For judged awards, which are decided during competitions, this subteam is responsible for training all members of Pit Crew to talk to judges and inform them about the team in a well-spoken manner. Members of the Awards subteam will be doing tasks such as writing essays for awards, creating the ***FIRST*** Impact presentation, and presenting at events.

- **Outreach Subteam**
  The Outreach subteam is responsible for planning and executing projects that help improve our community and portray the team's mission to Build Better People. Outreach projects include robot demonstrations at local middle schools and community outreach events such as Farmers' Markets and the Strawberry Festival. The Outreach subteam also organizes each year's MiniFRC events (a quarter-scale robot competition). Each team member is responsible for participating in at least one of these projects.

- **Sponsorship Subteam**
  The Sponsorship subteam is responsible for writing grants and working on obtaining corporate sponsorships. Each team member can work together to split up the necessary tasks to efficiently complete them. Most grants are due at the beginning of the school year, so this team begins work in the off-season.

- **Strategy Subteam (temporary)**
  The Strategy subteam is responsible for driving prototype ideas and producing effective strategic goals for the team's robot. This subteam comes together for the first few weeks each build season. It will consist of the Engineering captain, Engineering leads, and anyone else who wants to participate in the strategy discussions.

  Each season a “Strategy Freeze” date will be set, usually one week after kickoff. At this point, the Strategy subteam will deliver a set of prioritized strategic goals to be followed for the rest of the build season.

4. Competition Roles

During a competition, all students will be assigned a primary competition role:

- **Captains (year-long)**
  There to provide leadership and support for the team at competition as well as facilitating interactions with other teams outside of the robot game (making friends and introducing people). Captains/Manager would default to this role when not on another shift and can opt to be dedicated to only this and not have any other competition role.
- **Drive Team (year-long)**
  Responsible for driving the robot during competition.
- **Pit Crew**
  Responsible for maintaining the robot and pit during competition.
- **Scouting**
  Responsible for collecting data about competing robots (including our own) so we can have a good strategy for matches.
- **Batmanning**
  Responsible for helping out other teams' robots if they need help with it.
- **Safety Captain**
  This lead is responsible for promoting safety throughout the team pits and competition as a whole. They coordinate, deliver, and promote safety for the individual team members and other teams' members as well. They work directly with the Quartermaster and the subteam leads to ensure safety throughout the season.

4.1 Drive Team

The Drive Team is responsible for driving and transporting the robot at the competition and is limited to the number of participants outlined in the game rules. Students selected for Drive Team need to have the maturity and social graces to interact with other drive teams in stressful situations.

The Drive Team is on the field and seen by the audience and other teams, so they should be presentable and represent the team, Research Triangle High School, and North Carolina.

Drive practice and Drive Team selection occur during November/December before the upcoming season.

4.2 Drive Team Selection

The goal of our team's Drive Team selection is to pick the most cohesive team which can work as a unit on and off the field.

- Selection will be carried out by captains and mentors, and leads not seeking drive team positions selected by the captains.
- The order of selection will be Drive Coach -> Driver -> Operator -> Human Player -> Technician. (see the current year's FRC game manual for role information)
- As a student is selected for a position, they will be brought into the discussion room and notified of their role. They can provide input on who they think would best work to create a cohesive team while considering the necessary skills to have a competitive drive team.
- Drive Team applicants and their parents will not be in the room while that applicant is being discussed.
- Once all roles have been selected, a pair of mentors will pull the applicants aside and inform them of the role decisions. They will have time to process before the announcement to the team.

4.3 Pit Crew

Pit Crew is responsible for ensuring the proper operation of the robot and performing maintenance between matches. This includes repairing damage to the robot and replacing components. Pit Crew members are responsible for interacting with judges, VIPs, and members of the public to explain the operation of the robot and the competition

Pit Crew members perform robot maintenance and interact with judges. The Engineering captain is responsible for ensuring pit members are trained to perform their engineering related tasks. The Awards lead and Business captain are responsible for ensuring that Pit Crew members are trained to talk to judges.

When selecting desired pit crew roles, a student may mark that they would like their subteam captain to comment on their abilities or readiness for the desired role. Before pit roles are selected subteam leads will receive notification of those that wished for a comment, then the leads will write positives, and negatives of having that person in their desired role, as well as any additional notes the lead would like to add. During pit crew selection comments left leads will be taken into consideration.

There are 5 Pit Crew members per shift:

- **Pit Boss**

This person is responsible for making sure the robot is ready before matches and the pit checklist has been completed. They should encourage other Pit Crew members to complete their roles. They are in charge of tracking pit shift timings and switching on/off efficiently. This role will be the same throughout all of competition season but will have backup roles that can fill-in based on circumstance

- **Safety Captain/Saluter**
  This person is responsible for keeping the team's area safe. If anyone comes by the pit (Such as Judges, Pit Scouters, etc.) they are the designated person to speak to them.
- **Pit Programmer**
  This person will be responsible for bench testing the robot and ensuring there aren't issues before matches. This position is more flexible in regards to pit shift timings so the pit programmer may switch off more often with other members to address issues with the robot.
- **Battery Czar**
  This person is responsible for ensuring that there is a charged battery in the robot before every match. They will also keep track of the battery log.
- **Pit Member**
  This person is responsible for focusing on getting the robot ready for matches and assisting other Pit Crew members wherever needed. They will also be the shadow for their pit boss and is the second in command of their shift.

Space in the pit is limited and only the Pit Boss, Safety Captain, Pit Programmer, Battery Czar and Pit Crew members who are on shift should be in the pits. Mentors are typically in the pit at competitions to provide assistance and guidance. There should not be more than 2 Mentors in the pit unless there is an emergency. Mentors and Captains work together to select Pit Crew for each competition.

4.4 Scouting

Scouts are responsible for collecting data on ALL competition robots. This data helps the team have a strategy for each match and make a picklist when it comes time for alliance selection. Scouts need to be good at multitasking and focusing in a loud environment. Scouts must be dedicated because if the team does not have good data, the process of making strategy and a picklist will be much harder. In addition, scouts must show up on time for their shift to ensure scouts on the previous shift do not get tired.

In order to be eligible for being a member of Scouting, students must:

- Complete requirements for attending competition
- Complete Scouting training during build season

Scouting roles:

- **Scouting Chrysanthemum (“Mums”) (2)**
  These people are the face of the Terrorbytes Strategy. They understand the rules as well as the strategies which we employ during matches to effectively communicate and win matches with our designated alliance partners. In addition they lead the pick list discussion.

- **Scouting Daisies (2)**
  These people will work directly under the Scouting Chrysanthemum. These people will be expected to help with scout training and focusing on more subjective aspects of robots in matches.

- **Scouting Roses (about 12)**
  These people work alongside Daisies on gathering the objective data for each robot in a given match working in shifts to provide ample breaks at the competition.

5. Rules and Expectations

5.1 Code of Conduct

This code of conduct applies to all activities when a team member represents the TerrorBytes or can reasonably be seen as associated with the TerrorBytes, including online activities beyond official team communication channels.

- Time management is the student’s responsibility. Students are expected to check their email and team calendar frequently and inform their parents of meetings and events.
- Students are expected to take initiative during team meetings. If they have nothing to do they should be seeking out tasks from their peers and leaders or mentors on the team.
- Students must stay up to date with all team communication. This includes the TerrorBytes Discord server, the team calendar, and school email accounts.
- Obey all federal, state and local laws.
- Students shall be respectful of the facilities, tools, equipment, and all things being used by the team.
- When finished using a tool, it will be returned to its designated location in the lab.
- Students shall be respectful and appreciative of one another at all times, treating each other with dignity and gracious professionalism.

- During meetings, students are expected to inform mentors if they leave the lab or are leaving early. Failure to do so is a violation of the Code of Conduct.
- Students may not roam the school during meetings. They must stay in robotics designated spaces. Notify a mentor if a need arises.
- No loafing. We are here to have fun and learn, but this kind of fun takes commitment and awareness.
- Students at corporate/sponsor sites are guests of the companies and must be courteous and respectful. While at a corporate site, students are expected to follow the general rules and safety rules posted at the site.
- Students are expected to follow all RTHS rules while at team activities.
- Students are expected to follow the team structure and may not overstep their power.
- **Respect other teams. Remember gracious professionalism, and always be respectful.**
- Stay with the group. If you need to go anywhere, let a student lead or chaperone know and find a reasonable time to do so. If you're needed and you're not there, it will reflect poorly on you.
- Students will be given warnings when they are marked unproductive, so they know what behavior was at fault and should not be replicated.
- ***Violation of these rules will result in probation, and further violations will result in probation or expulsion from the team.***

5.2 Breach of Conduct

The TerrorBytes work hard to maintain an atmosphere of mutual respect and trust. We trust that students will maintain that atmosphere, but when that trust is breached team mentors will work to repair it. Breaches will be handled based on the severity of the actions.

- **Level One**: Overly disruptive behavior
    - Example: Intentionally disrupting others' work or disobeying rules.
    - Consequence: Private discussion with a mentor.
- **Level Two**: Harassment; verbal, written, or emotional
    - Example. Intentionally saying hurtful things, refusal to stop bothering someone
    - Consequence: Private discussion with multiple mentors
- **Level Three**: Repeated instance of the above;
    - Example: A pattern of harassment.
    - Consequence: Placed on probation
- **Level Four**: Sexual Harassment/Assault

- Example: Sexually inappropriate or derogatory comments, inappropriate touching, etc.
- Consequence: Immediate placement on probation, grounds for immediate expulsion, inform and engage with school administration.

If a student feels unsafe or harassed during team activities we strongly suggest that they fill out the school's anonymous report form linked on the TerrorByte Discord server. A student can provide as much or as little information as they want. Reporting is the only way for mentors to address the situation. If a student is uncomfortable filling out the report we recommend they speak with a Student Advocate for guidance.

5.3 Tools Safety Standards

The TerrorBytes safety philosophy is *"Safety Always".* Building an FRC robot is not an easy task and is not without risks. It involves the use of power tools, high power systems, and large stored energy devices. As such, safety is always a priority and proper tool and robot usage are taken seriously. No student is allowed to use any tools until they are qualified with a "Craftsman Rank." Students from other teams are not allowed to use the power tools unless given permission by Mentors. Students may progress up the Craftsman Ranks in order to use the larger power tools available in the lab. Every student on the team will be trained and given safety briefs on each of the various tools. The ranks for the large tools are as follows:

- **Apprentice:** Student can use tool with mentor supervision
  - Mentors must train students and approve apprenticeship
- **Journeyman:** Student can use tool without mentor supervision
  - Journeyman level must be approved by the student's parent/guardian and then be tested by a mentor.
- **Master:** Student can train others to *Apprentice* level on this tool
  - Reserved for students who show the utmost respect and skill with the tool

These ranks may be demoted or removed at the discretion of the mentors at any time if the student is found behaving in a way unbefitting of the rank. **Intentionally creating a dangerous situation of any kind is grounds for automatic expulsion from the team.**

5.4 Competition Requirements

To attend competitions, students must have:

1. All required forms and registrations completed
   a. Completed FIRST registration
   b. Completed the FIRST NC permission form

    c. TerrorBytes Robotics Liability/Permission form
    d. TerrorBytes Robotics Member Information form
2. Performed a Business Visit (see appropriate section for requirements)
3. Completed Fair Share requirements.
4. Participated in at least one outreach event that year
5. Attended at least 50% of pre-season Tuesday meetings
6. Completed a minimum of 60 hours during build season
7. Helped provide 2 team meals
    a. This can be satisfied by providing 2 entrées, where 2 side dishes/desserts can count as a single entrée
8. Parents should attempt to provide a carpool to an event or outreach
9. Maintained good standing with RTHS
10. Agreed to follow all travel rules for hotels, buses, curfews, and visits to cities and locations. Failure to follow travel rules will result in termination of your trip and you will be immediately sent home at your own expense.

5.5 Expulsion

If a student repeatedly breaks the rules specified in the Code of Conduct, that student may face expulsion (removal from the team). We as a team try to foster an inclusive environment, but we will not tolerate people who seek to disrupt this environment.

5.6 Fledgling Alumni Rule

Students who have just left any FRC team cannot be a TerrorBytes mentor until at least one year after they have left. Any alumni of a FIRST NC team cannot be a TerrorBytes mentor until every student they participated in events with is no longer on the team (nominally 3 years). This rule is in place to encourage students to make a clean departure and grow separately from the team while maintaining the safety of the students on the team.

5.7 Reasonable Accommodations

The TerrorBytes seek to make our team accessible to all students, regardless of disability. We will make any reasonable accommodations necessary to ensure a student's ability to be involved with robotics. However, as the team is a non-curriculum activity, team mentors are not permitted to view a student's IEP or 504 plan and are not aware of any student's individual needs. Students with disabilities or parents of students with disabilities should speak with mentors privately to request accommodations early. Requests for accommodations (for example, having additional time turning in assignments or forms) which are made after the fact may not be honored.

5.8 Authority of Handbook

The rules and policies set forth in this handbook are binding and must be followed by ALL team members. The handbook is updated by students and mentors during the off-season. Mentors have the authority to modify the handbook at any time, with mid-year changes not being retroactive. All students will be notified of any modifications. All students must acknowledge the Authority of the Handbook by signing the contract below.

6. Best Practices

6.0 Strategy

1. You do not have to do everything
2. Go for RP
3.

6.1 Design

1. Designers should use 'top-down' practices (mastersketch, single part studio, multi-document, etc.) to increase organization and ease of integration between subsystems
2. Tolerance on any part is implied to be +/- 0.03 inches unless otherwise specified
3. Design should include easy access for battery and control elements
4. Design should take into consideration the resources and manufacturing abilities of the team
5. KISS (Keep It Simple, Stupid!)
6. Use bearings for things that spin
7. Design the bumpers such that people can use drills to fasten the bumper to the robot

6.2 Fabrication

1. Robot frame should be structurally sound
    a. Use 2x1s for the frame that is no thinner than ⅛”
2. Not all bolts need to be as tight as you can make them
3. Use loctite!
4. Do not drill, cut or make dust/shavings anywhere near the electronics

6.3 Controls

1. Plan out the paths of the wires, make a wiring diagram
2. IMU (Pigeon) should be in the center
3. Battery should be in the L/R center and low
4. Main breaker needs to be easily accessible
5. For small wires like CAN bus, solder wire together, don't use wagos
6. Wire the CAN in a daisy chain pattern not the tree & branch method
7. Use hot glue on all connections
    a. Only exceptions are soldering and power poles
8. Use zip ties to provide strain relief
9. Use zip ties every ~4”
    a. Zip tie wires to robot directly, no zip tie anchors
10. Keep dust, dirt, and metal shavings out of electronics

6.4 Programming

Software development and project organization

1. Simulate and log everything, there will never be enough robot time
2. Do this to tune PID

> For a discrete mechanism
>
> 1. Start with PID all at zero and motion profile cruise velocity extremely slow (think 3-4 seconds to traverse the mechanism' range of motion)
> 2. Increase proportional gain until measured motor velocity and cruise velocity graphs line up nicely
> 3. Steadily increase cruise velocity until the motor is commanding 12 volts at cruise velocity, adjust proportional gain if the motor speed and the motion profile speed are deviating (make sure acceleration is high enough it's hitting cruise velocity and the profile isn't a triangle)
> 4. Increase acceleration until the motor is running up against current limits
> 5. Ignore integral and derivative
>
> For a continuous mechanism
>
> 1. Find kS by slowly increasing the value until just before the mechanism begins to move
> 2. Find kF by dividing 12 volts over maximum mechanism speed (use the specs for the motor or just measure the velocity while applying 12 volts)
> 3. Add very small proportional gain to address steady state error and help the mechanism get up to speed faster

3. Only tune PID & current limits with logged and graphed data
4. Adopt strict hardware abstraction in code to allow for simulation, log replay

Vendor API Idiosyncrasies

1. Avoid REV devices/Smart Motion for any precise position or velocity control
2. Use TalonFX and MotionMagic for precise position/velocity control
3. TalonFX position control requires 0 degrees to be horizontal, negative below horizontal, positive above horizontal
4. Use Motion Magic for large position changes, ordinary PID for smaller changes/target following
5. Avoid using NEO encoder for velocity readings:
6. Use absolute encoders integrated into motor controllers, or fused CANCoder
7. Match angle conventions in code to data received from hardware API
8. Limelight OS updates are released without warning, check every week in offseason and daily in build season
9. **REV Software is not good and poorly documented, CTRE software is mostly good and documented.**

Path Planning and coordinate conventions

1. Never deviate from using the standard Blue axis based origin
    a. The front of the robot should point towards the red alliance wall when against the blue alliance wall
2. Simulate path planning early and often

Competition Strategy

1. Log robot data via AdvantageKit/Oblog/DogLog/WPILib logging to an external USB, analyze logs after every match
2. Take a video of every match the robot is in, and unrelated matches if possible. API Issues and venue internet issues will occur.
3. Perform a thorough, checklist based, systems check before and after each match
4. Drive practice is separates winners from second best, weigh it against adding new features
5. Bench test the robot before every match
    a. Use the upcoming match battery

Command Structure

1. Minimize logic in periodic/updateInputs functions
2. Use command factories whenever possible, minimize command classes
3. Understand the [4 functions in commands and types of basic command groups]

Swerve Offsets

```
+       // IMPORTANT: How to adjust Absolute Drive Encoder Offsets,
+       // Step 0: To be more exact, set all offsets to 0,
+       // Step 1: Point all modules forward, with the bevel gear facing out, while either disabled or turned off,
+               // Note: Make sure the modules are aligned with each other using a straight object, like a 2 by 4, or hex shaft,
+       // Step 2: Open adventage scope, inside, open advantagekit and drive sections,
+       // Step 3: Select the module you want to adjust, and pull the Turn Absolute Position into the line graph,
+       // Step 4: Pause the line graph and select a point to making viewing easier, then copy the Turn Absolute Position,
+       // Step 5: Add the copied position to the Steer Offset of the module (IN CODE), if there is already a value add the 2 together,
+               //Note: Repeat step 5 until the Turn Absolute Position is below 0.01,
+               // Note: Make sure if the Turn Absolute Position is negative that the number added is also negative,
+       // Step 6: Test by driving forward, 2 of the complete modules should be running in the same direction while aligned,
+               // Note: If the modules are alined but one drives in the opposite direction,
+                       // flip the module going the wrong direction around, then repeat steps 1-6 for that module, bevel gear out,
+                       // If the modules are not aligned the offsets are wrong, repeat step 5.
+
```

6.5 Awards

1. Start IMPACT early, before the season starts
2. Document everything as it happens for IMPACT
3. Practice, practice, practice
4. IMPACT presentations should have a single theme each year which defines the presentation style (e.g. puzzle, clock)

6.6 Outreach

1. Include head mentors on copy on all external emails
2. Limit outreach to external venues to single day events, no longer than 3 hours

6.7 Sponsorship

1. Apply to every grant we find which we are eligible for
2. Do business visits in localized areas when possible to maximize efficiency

6.8 Media

1. Make sure a mentor is actively logged in to all social media accounts

6.9 Competition

1. Bench test after installing the match battery
2. Before exiting the pit for the match, verify there are no warning lights from Robot Self-Test.

7. Distinguished Fellows

Here we recognize exceptional TerrorBytes students who are highly motivated and talented. They serve as exemplars of their respective fields on the team and have spent multiple years going above and beyond for the team, regardless of their titles. The mentors recognize that their skills have surpassed our own in many ways, and they are trusted to pass along their knowledge to the next generation of TerrorBytes.

Year	Name	Skills
2024	Alexander Trent	Design, Leadership
2024	Panav Patel	Design, Sponsorships
2024	Jackson Doyle	Controls, Training
2024	Ethan Privette	Programming
2024	Ria Saheta	Programming, Training, Management
2024	Sarah Dias	Design, Fabrication, Mentorship
2024	Siri Pillutla	Awards, Outreach, Leadership
2024	Srideekshitha Sureshkumar	Outreach, Sponsorships
2024	Julien Amazan	Design, Fabrication

8. History and Mentor Info

Year	Event	Awards/Importance
2012	4561 begins competing in the FIRST Robotics Competition	N/A
2016	NC District - Guilford County Event	Innovation in Controls Award
2016	NC District - Campbell University Event	District Event Finalist Industrial Design Award
2016	NC FIRST Robotics State Championship	Quality Award
2017	NC District - Raleigh Event	Gracious Professionalism Award
2017	FIRST North Carolina State Championship	District Championship Winner Industrial Design Award sponsored by General Motors
2018	NC District - Pitt County Event	District Event Finalist Gracious Professionalism Award
2018	NC District - UNC Asheville Event	District Event Winner Gracious Professionalism Award
2018	FIRST North Carolina State Championship	District Championship Finalist Gracious Professionalism Award
2018	TerrorDome (Practice Field) at 10 Park Dr.	Practice Field and Extra Storage Area
2019	NC District - Wake County Event	District Event Winner Industrial Design Award
2019	NC District - UNC Asheville Event	District Chairman's Award
2019	FIRST North Carolina State Championship	Excellence in Engineering Award
2020	NC District - Wake County Event	District Event Finalist District Engineering Inspiration
2021	Game Design Challenge - Krypton	Engineering Design Award
2021	FIRST North Carolina Event	Woodie Flowers Finalist Award
2022	NC District - ECU County Event	District Event Winner District Engineering Inspiration Award
2022	NC District - Guilford County Event	Judges' Award
2022	FIRST North Carolina State Championship	Regional Engineering Inspiration Award
2023	NC District - UNC Asheville Event	District Impact Award
2023	NC District - Wake County Event	Innovation in Control Award

2024	NC District - UNC Pembroke Event	Gracious Professionalism Award Woodie Flowers Finalist Award
2024	NC District - Wake County Event	District Event Winner District Engineering Inspiration Award District Dean's List Award

Mentor Name	Subteam	Mentor Profession
Teesh Shahi	Head Mentor	Site Reliability Engineer
Anna Cloud	Head Mentor	Teacher
Braeden Mathieson	Controls	Automation and Controls Engineer
Casey Privette	Fabrication	Data Scientist
Jackie Mone	Fabrication	Research Scientist
Jacob Williams	Design	Computer and Electrical Engineer
Jai Mathur	Student Support	Computer Programming
JoAnne Amazon	Business	Administration
Manbir Guron	Programming	Embedded Software Engineer
Shane Trent	Controls	Electrical Engineer
Nancy Dias	Student Support	Professor
Ambika Shankar	Programming	Software Engineer
Courtney Trent	Engineering	
Jim Walker	Student Support	Sales Engineer
Morgan Chu	Controls	Engineering Student
Nick Chen	Programming	
Megan Pottenger	Business	Project Manager
Alek Lewis	Programming	
Julian Berla	Business	