



27th ONTARIO TECHNOLOGICAL SKILLS COMPETITION

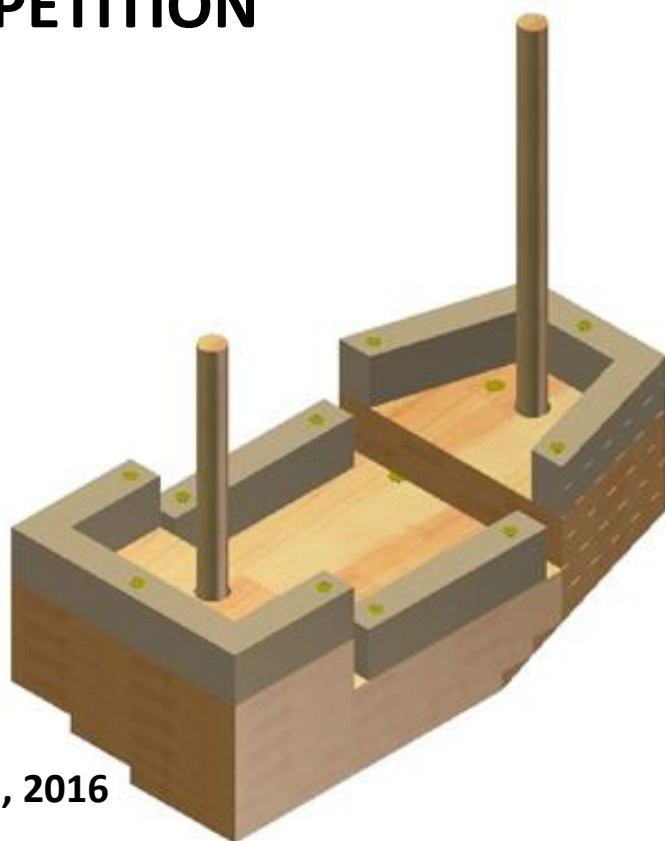
2016 ROBOTICS Contest

Ship Building

Secondary – Team of 4

Contest Date:

Monday, May 2 and Tuesday, May 3, 2016



Technical Chair - Bob Tone, [Tech On eh!](#)

TECHNICAL COMMITTEE MEMBERS:

Mario Blouin, Chef des Études Technologiques, École Secondaire de Hearst,
Mark Dimonte, Radio Control Expert

Table of Contents

Technical Committee	Page 1
Table of Contents	Page 2
Major Changes	Page 3
Contest Status, Location, Purpose of Contest, Skills & Knowledge to be Tested	Page 4
Equipment & Materials	Page 4 & 5
Safety, Rules & Regulations	Page 5 & 6
Job Interview	Page 6
Clothing Requirements, Meal, OTSC Agenda	Page 7
Closing Ceremony, Spectators, Team Ontario, SCNC	Page 8
Additional Information	Page 9
The Game Overview	Page 9
Ship's Component Collection / Exclusive Use Team Space	Page 10
Ship Component Placement Process	Page 12, 13, 14 & 15
Pit Area / Court Access	Pages 16
Medal Requirements / Game Scoring	Page 16 & 17
Scoring Sheet	Page 18
Rules and Regulations	Page 19
Tournament Play	Pages 19 & 20
Playoff Play	Pages 21
Court Layout	Page 22
Robot Restrictions / Start of the Game Robot Status	Page 22
Overall Robot Size	Page 23
Power Sources / Management	Page 23
Non-Electrical (Battery) Energy Sources	Page 23 & 24
Robot Controllers	Page 24
Pit Area	Page 24
Overall Court Dimensions	Page 24
One Team's Exclusive Use Space Details	Page 25
Pre-inspection for Compliance with Safety and Design Rules	Page 26

Appendix

Paint and Plywood	Page 27
Assembly Base Component Details	Page 28
Hull Component 1 Details	Page 29
Hull Component 2 Details	Page 30
Fore Deck Details	Page 31
Fore Railing Details	Page 32
Aft Deck Details	Page 33
Aft Deck Railing Details	Page 34
Side Railings Details	Page 35
Ship Overview	Page 36
Fore and Aft Mast Details	Page 37
Ship Cross Section	Page 38
Moncton Hill Details	Page 39
Moncton Hill Parts Collection Details	Page 40
Plywood Cutting Pattern Details	Page 41

MORE INFORMATION:

To ensure that competitors have a positive experience at the Ontario Technological Skills Competition (OTSC), a competitor and their educator should review the scope document well in advance, as well as check back to the website for updated versions of the scope up until the event.

For technical questions that are contest specific, please contact the technical chair – Bob Tone at bobtone@rogers.com or the Skills Ontario competition department at otsc@skillscanada.com.

For questions about the **registration process and eligibility** please refer to the Competition Information Package www.skillsontario.com

MAJOR CHANGES MADE

The Technical Committee has made some major changes to the scope document this year, which can be found throughout the document, but has been listed here for ease of access:

- **The restriction on channels allowed to be used has been lifted**, and therefore robots can utilize an unlimited amount of channels between their transmitter and receiver.
- Since no restriction is placed on the number of channels, 2 transmitters can be used with 1-2 drivers, alongside a spotter, allowing for a maximum of 3 team members being allowed to play a game at a time. However, if 2 drivers are chosen to be used, they must remain in their respective driver's area.
- **The robots overall available size has been reduced from 8 cubic ft. to 6 cubic ft.**
- Spotters and drivers can use two-way communication. This means that driver(s) can use two-way radios to communicate between each other, such as headsets, CB radio, etc.
- Overall court size is now reduced from 24' x 24', to 18' x 18'.
- There are no restrictions on parts used in the building of the robot. This includes system platforms such as VEX, Lego Mindstorm, Arduino, Raspberry Pi, etc.

CONTEST STATUS:

- **This contest is offered as an official contest**
- **This contest is offered at the Skills Canada National Competition (SCNC)**
- **2016 is a qualifying year for WorldSkills***
 *To be eligible to advance to the WorldSkills Competition you must NOT be older than 22 years in the year of the competition (2017) and successfully complete a World Skills Trial.

LOCATION / ENDROIT

All contests at the 2016 OTSC are hosted onsite at RIM Park and Manulife Financial Sportsplex, Waterloo Ontario

PURPOSE OF THE CONTEST:

To create an engineering project to encourage individuals with different skill sets to form co-operative teams to design, fabricate and operate a robot. The intent of the challenge is to have teams of students independently designing / fabricating / operating robots capable of completing the competition tasks in competition with other student-fabricated robots. Teams are not allowed to develop or implement strategies based on interfering with their opponent's ability to complete the competition task set.

SKILLS AND KNOWLEDGE TO BE TESTED:

- Drafting
- Mechanics
- Electronics
- Metalwork
- Woodworking
- Communications

EQUIPMENT AND MATERIALS:

Supplied by Skills Ontario Technical Committee:

- Playing Field, including Team Home Area
- One worktable with access to a 120V (min 1000W) power outlet

Supplied by Competitor:

Competitors must bring the following items at a minimum:

- Robots
 - Easily accessible fuses
 - Easily accessible kill switch(es)
- Robot accessories (including batteries, controller(s), battery charger, spare parts)

- Table top robot stand
- Tool box including the various tools required to modify and repair robots onsite
- Safety equipment, including mandatory eye protection
- Power Bar
- Completed Pre-inspection Checklist
 - Wiring diagram
- Résumé for Job Interview Component

Media devices, such as cell phones, smart phones, mp3 players or PDAs are not permitted on the contest site.

Prior to attending the OTSC, students should be familiar and competent in the use of the tools and equipment listed above as well as what safety precautions will be observed during the OTSC.

SAFETY:

Safety is a priority at the Ontario Technological Skills Competition. At the discretion of the judges and technical chairs, any competitor can be removed from the competition site for not having the proper safety equipment and/or not acting in a safe manner.

1. It is mandatory for all competitors to wear CSA approved eyewear (including side shields for prescription eyewear) when doing any fabrication work on the robots.

*Competitors will not be permitted to compete until they have the needed safety equipment. Competition judges will have final authority on matters of safety.

Competitors must show competence in the use of tools and/or equipment outlined in this scope and can be removed at the discretion of the judges and technical chairs if he/she does not display tool and/or equipment competency.

RULES, REGULATIONS AND ELIGIBILITY / RÈGLES, RÈGLEMENTS ET ADMISSIBILITÉ:

Please be sure to review [all eligibility criteria](http://www.skillsontario.com) in the complete Competitor Information Package, available online at www.skillsontario.com.

Eligibility Criteria:

Secondary students must:

- Be **21 years of age or younger** as of December 31st **in the competition year** (2016).
- Compete in only one contest at the OTSC. Students competing at a Qualifying Competition who do not advance in their designated contest area are not permitted to then register for a different contest at the OTSC.

- Possess a Canadian citizenship or landed immigrant status and be a resident of Ontario.

Other Rules and Regulations all competitors need to be aware of prior to attending the OTSC:

- Translators or other assistants (e.g. hearing impaired) are permitted in the contest site **only if this request was made during the registration process and approved in advance by the Skills Ontario office.**
- During the contest, no one will have access to the contest site except the Technical Committee Members, Judges, Skills Ontario staff and Competitors. Spectators, including teacher/advisors, will be provided a viewing area if possible.
- If there is any discrepancy between the English and French information in the scope, the English will be taken as the correct information.

Immediate disqualification may occur at the discretion of the technical chair if a competitor displays any one of the following:

- Acts inappropriately
- Shows disregard for the safety of themselves or those around them
- Breaks the established rules and regulations including:
 - Uses equipment or material that is not permitted
 - Dishonest conduct (cheating, plagiarism)
 - Speaks with those outside the contest area
 - Arrives to the contest site late

Sign-in for all contests will happen on the contest site the morning of the competition.

Registration must take place prior to the deadline of March 25, 2016.

JOB INTERVIEW / ENTREVUE D'EMPLOI:

To assist competitors in preparing for their eventual job searches there is a "job interview" incorporated into this contest. It is expected that all competitors will arrive **WITH A RÉSUMÉ** and be prepared for interview questions and discussion. All Robotics team members will be interviewed in individual interviews.

Performance in the job interview will be used as the tie breaker if there is a tie after tournament play is over.

Sample interview questions and a scoring breakdown are available at www.skillsontario.com/hr.

Please note there are no facilities on site for printing.

CLOTHING REQUIREMENTS / TENUE VESTIMENTAIRE:

Competitors are to be dressed in a clean and appropriate manner. Competitors are not permitted to wear clothing with logos or printing. The exception to this rule is the logo of the school, school board, college or MTCU District that the competitor is representing. ONLY the logo of the institution under which the space is registered can be visible. Corporate logos or names are not permitted on a competitor's clothing.

MEALS / REPAS:

Skills Ontario will provide a basic lunch and a beverage for competitors. Lunch will be confirmed closer to the competition; no alternative meals will be provided. If the competitor has specific dietary needs, specific tastes or feels that they may require additional sustenance, it is recommended they bring the necessary food with them. If the competitor is part of a contest of a physical nature, it is highly recommended they bring additional snacks.

ANY FOOD BROUGHT TO THE VENUE MUST BE NUT FREE. ANY NUT PRODUCTS FOUND ON SITE WILL BE REMOVED.

OTSC AGENDA:

Monday, May 2 and Tuesday, May 3, 2016

Ontario Technological Skills Competition / Olympiades ontariennes des compétences technologiques

Monday, May 2 - Day 1 – Tournament Play

7:00am – 7:30am	Sign-in at the contest site
7:30am – 8:00am	Orientation^
8:00am – 9:00am	On-court practice time and Job Interviews
9:00am – 11:30am	Tournament Games
11:30am – 12:30pm	Lunch
12:30pm – 3:30pm	Tournament Games
*3:30pm – 4:30pm	*Open Court for teams to practice
*To ensure all teams receive an equal number of games, this practice time may be reduced. All teams must be off the court and out of the pit area by 4:30pm. Robots must remain in the Pit Area overnight.	

Tuesday, May 3 - Day 2 – Tournament Play in the morning, Playoffs in the afternoon

8:30am – 9:00am	Practice Time on Court
9:00am – 11 :30am	Tournament Games
11:30am – 12:30pm	Lunch
12:30pm – 4:30pm	Playoff Games
3:45pm	Bronze Medal Game
4:15pm	Gold Medal Game

Wednesday, May 4 - Closing Ceremony

9:00am – 11:30am	Closing Ceremony
12:00pm – 1:00pm	Team Ontario Meeting

Contest Location: RIM Park and Manulife Financial Sportsplex, 2001 University Avenue East Waterloo.

Closing Ceremony Location: Waterloo Memorial Recreation Complex, 101 Father David Bauer Drive, Waterloo.

- Each competitor will receive one wristband at the contest orientation. This wristband identifies competitors as such and will also be used as the competitor's closing ceremony ticket on May 4. Competitors must ensure that the wristband remains on his/her wrist from the beginning of the competition until after the closing ceremony.

SPECTATORS :

Competitors are encouraged to invite spectators to attend. It is free of charge to attend the OTSC, but there is a \$10 fee for attending the Closing Ceremony.

TEAM ONTARIO / ÉQUIPE ONTARIO:

The Gold-medal winning competitor(s) in this contest may be eligible to advance to the Skills Canada National Competition (SCNC), hosted June 5-8, 2016 in Moncton, New Brunswick.

For a student to represent Ontario at the SCNC they (or someone representing them) MUST be present at the Team Ontario meeting (taking place immediately following the OTSC Closing Ceremony) and must be ready to commit to attending the SCNC at that time.

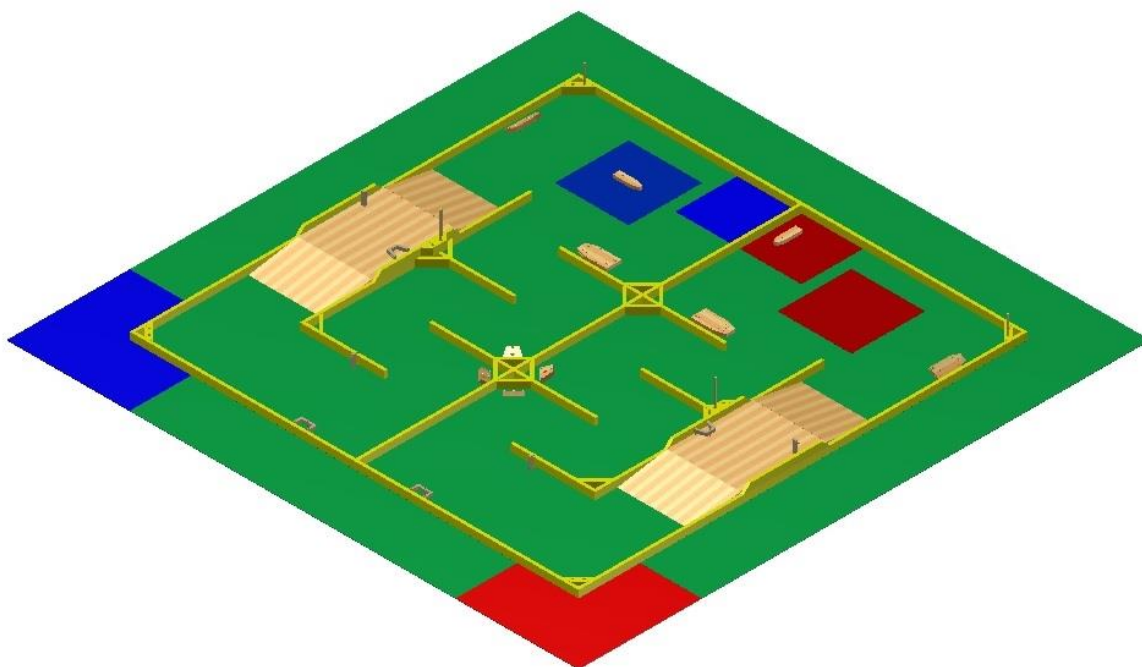
SKILLS CANADA NATIONAL COMPETITION (SCNC)/ OLYMPIADES CANADIENNES DES MÉTIERS ET DES TECHNOLOGIES (OCMT):

The SCNC will be hosted, June 5-8, 2016 in Moncton, New Brunswick. Competitors should consider preparing for this event prior to attending the OTSC by reviewing the national scope as well. The national scope is available online at <http://skillscompetencescanada.com/en/programs/skills-canada-national-competition/>

ADDITIONAL INFORMATION / RENSEIGNEMENTS SUPPLÉMENTAIRES:

- The Competition Information Package can be found at www.skillsontario.com.
- The Robotics Question and Answer Document will be posted below the scope at www.skillsontario.com. This document will be updated periodically throughout the year.
- Results for the OTSC will be posted online starting Wednesday, May 11, 2016, at www.skillsontario.com.
- Information on the Conflict Resolution Procedure can be found on our website in the Competition Information Package at www.skillsontario.com.
- If you have any questions regarding the OTSC or this contest, please contact Skills Ontario or the technical chair prior to April 22, 2016, as all staff will be onsite setting up the following week.

THE GAME

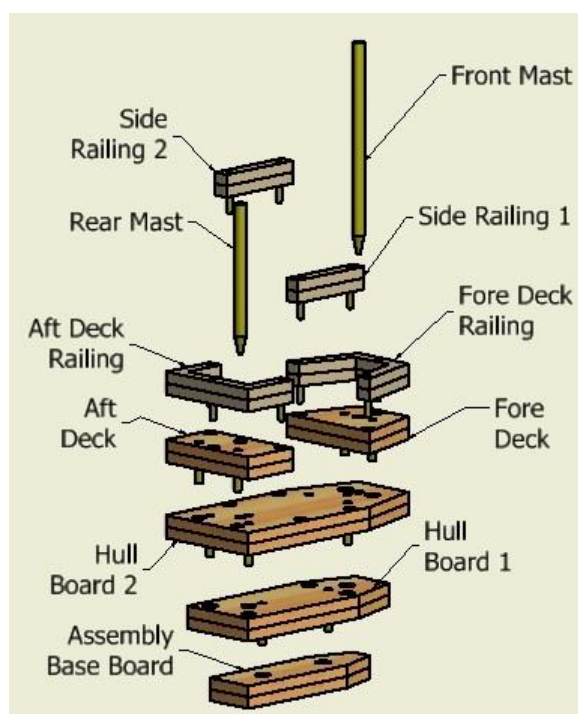


Game Overview

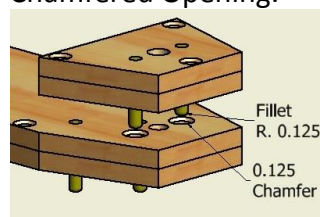
The core game situation is that a customer has requested a ship building company to build a ship for them, from parts lying around the warehouse. Unfortunately, due to unforeseen circumstances, many of the ship pieces are in disarray throughout the warehouse. The student's task is to assemble the ship with their student built robots. The assembled ship must be in the designated Ship Building Space and completely free of contact with the robot at the end of the game.

- Games will involve Two Robots at a time.
- Robots have exclusive use of a court area with:
 - An open smooth surface
 - A 30 by 30 inch Robot Starting Position
 - A 36 by 36 inch Ship Assembly / Display Area
 - A 30 inch wide Winding Path Maze with 2 by 4 sides
 - One Moncton Hill: A 36 inch wide, 10 degree double sided ramp leading to a 42 by 36 inch Hill Top
 - A Collection of Ship Parts positioned within their assigned court space
 - A Ship Base Component positioned in a Team selected / identified start of the game location
- Robots will attempt to assemble the ship, and deliver it to the Assembly / Display Area.
- Robots must stop all operation when the time ends.

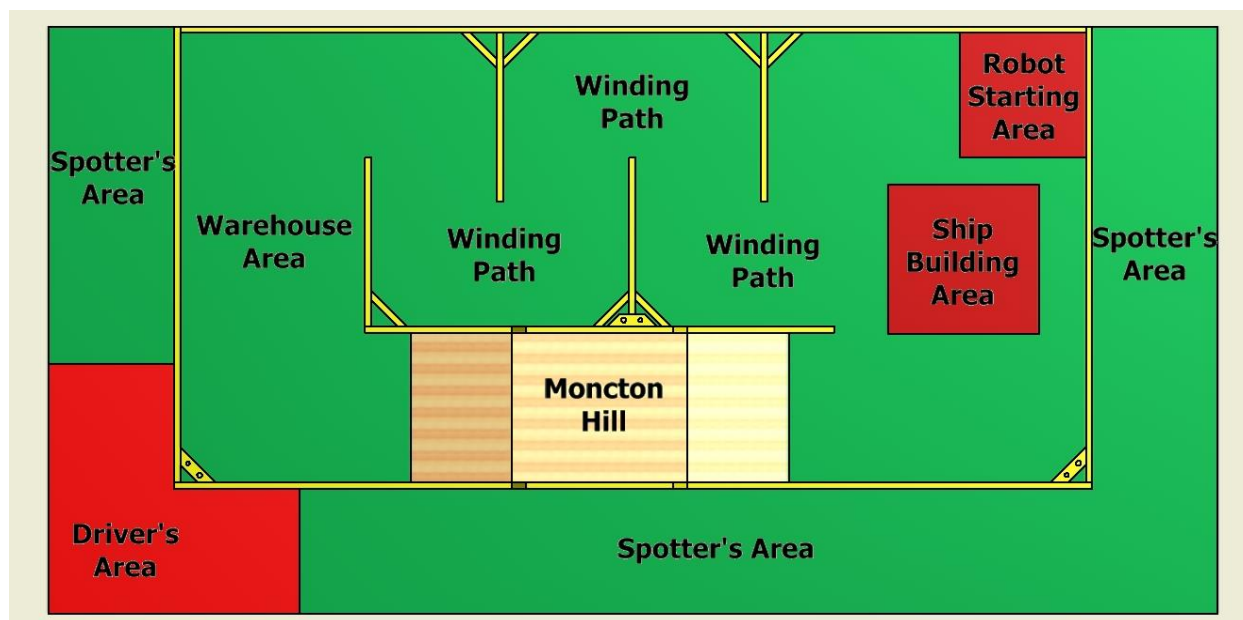
The Ship Components Collection



- There are 11 Ship Components
- Teams are in possession of the Assembly Base at the start of the Game.
- It is a Team decision where they position the Assembly Base, either on their Robot or in the Ship Building Area at the start of the game.
- Ship Component Connections are based on placing One Component's Set of Pegs in the Holes in the component below.
- Pegs are either 0.375 In. Dia. Or 0.5 In. Dia. and ALL Pegs have a 0.125 In. R. Filleted End.
- Receiving Holes are either 0.625 In. Dia. or 0.75 In. Dia. and have a 0.125 In. Chamfered Opening.

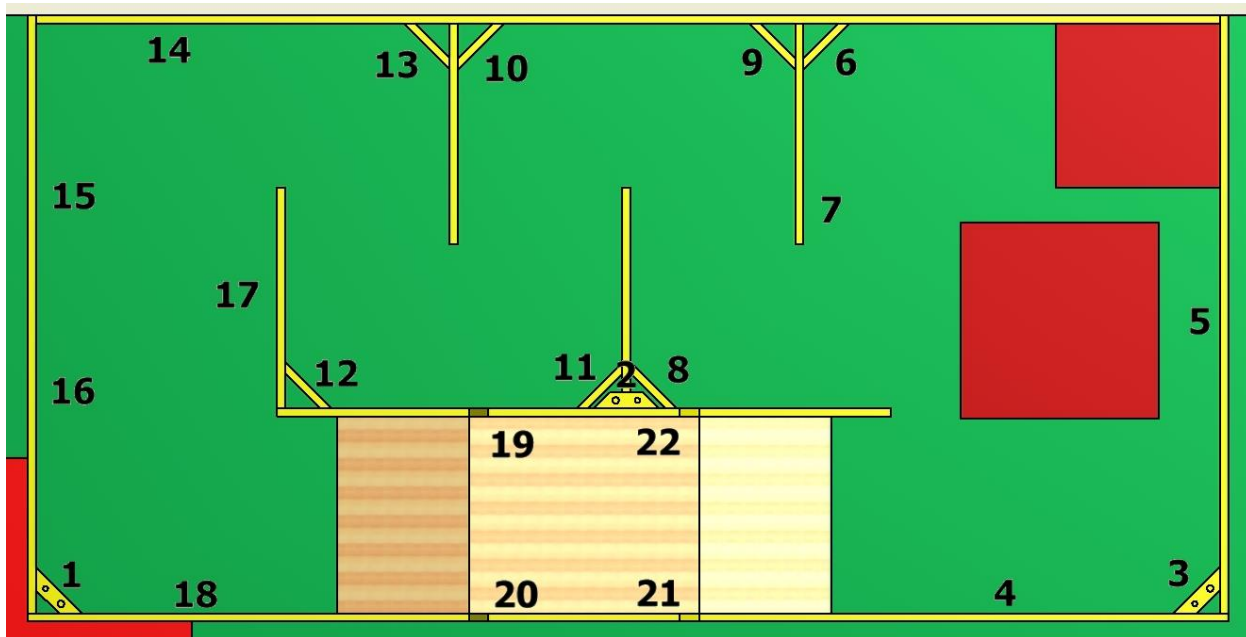


- Ship Components Details are provided in the Appendix of this document.
- Each Team will have Exclusive use of a Court Space.



- The Ship Component Placement Pattern will be randomly set 3 Times :
- First at the Start of Competition Day One,
- Second at the Start of Competition Day Two, and,
- Third the Playoff Ship Placement Pattern will be set just before Lunch on Competition Day Two.

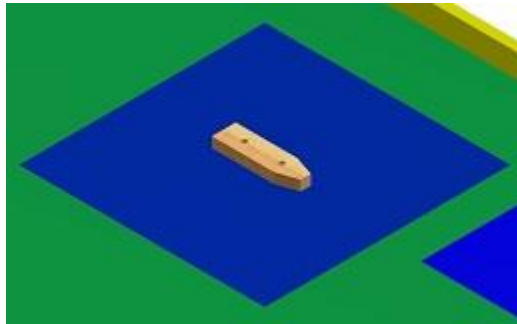
Ship Component Placement Process



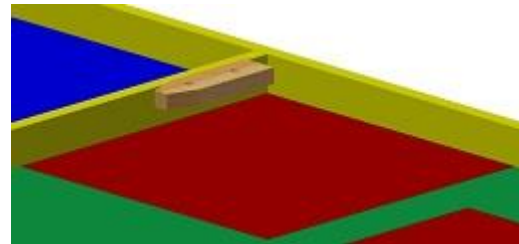
- The Fore and Aft Masts will be placed in Positions 1, 2 or 3
- The Hull 1 Component will be placed in one of Positions 4, 8 or 12
- The Hull 2 Component will be placed in one of Positions 7, 13 or 16
- The Fore Deck Component will be placed in one of Positions 6, 17 or 20
- The Aft Deck Component will be placed in one of Positions 14, or 22
- The Aft Railing Component will be placed in one of Positions 9, or 21
- The Fore Railing Component will be placed in one of Positions 5 or 18
- One Side Railing Component will be placed in one of Positions 10, or 19
- One Side Railing Component will be placed in one of Positions 11 or 15

Ship Component Placement is directly on the Court Floor, the Top of Moncton Hill, or, in one of the Masts Stands

Assembly
Base
Component

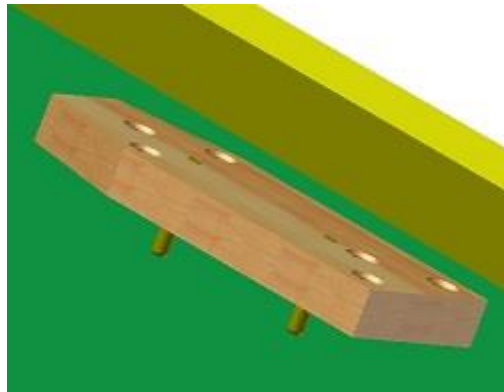


- Component is On the Floor in the Ship Building Area



- Component is on the Robot in the Starting Area

Hull 1
Component



Hull 2
Component



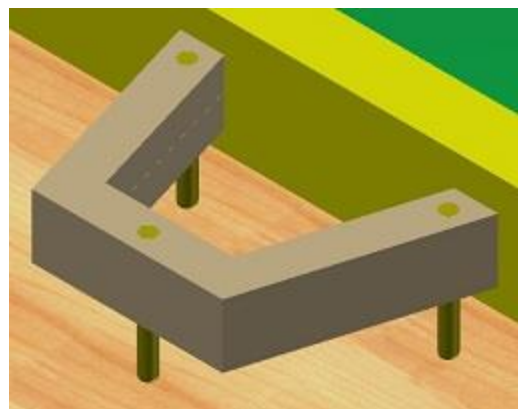
Fore Deck
Component



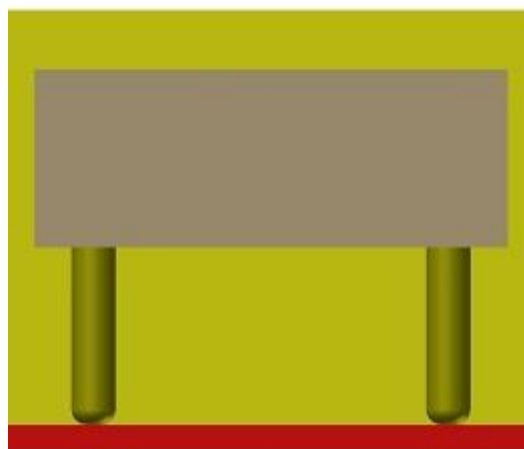
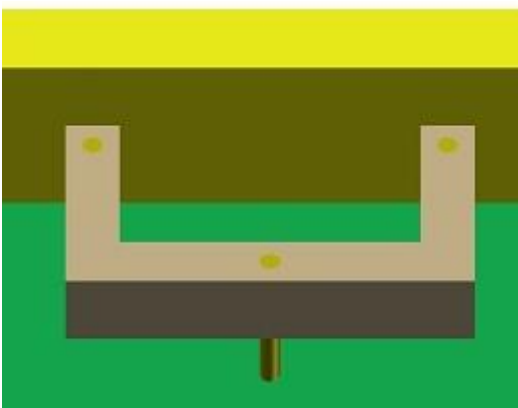
Aft Deck
Component



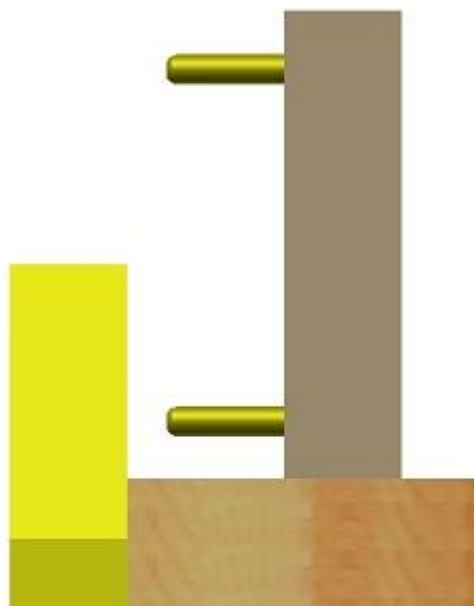
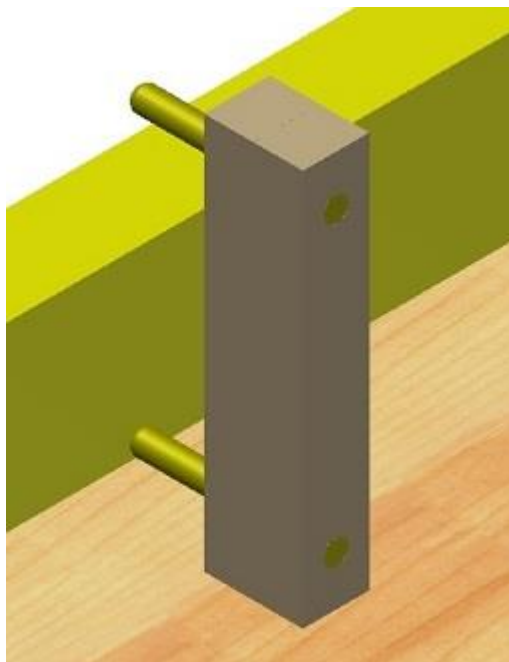
Fore Deck
Railing



Aft Deck
Railing



Side Railing



Masts



PIT AREA AND COURT ACCESS

Robots must be designed and built by students to the criteria outlined in this document.

A pit area is provided so that students may make repairs and improvements to their robots between games. (Note: Teachers are not permitted in the pit area once the competition has started).

Teams MUST bring their Robots into the Competition Space when they sign-in the morning of Day 1. Teams are NOT allowed to remove their robot from the competition area during the over-night period between Competition Day 1, and Competition Day 2 of the competition.

The pit area and competition court may be available to teams to work or practice during lunch breaks. Strategies aimed at deliberately damaging or interfering with other robots are not in the spirit of the competition and will not be allowed.

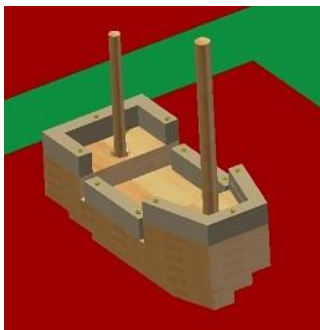
Medals will be awarded based on:

- Robot on the court performance in the competition task as identified through the results of tournament play and playoffs.

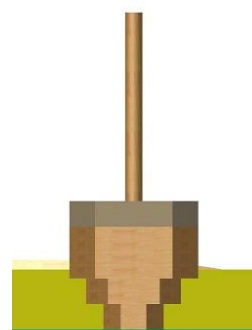
SCORING

Teams will be awarded Game Points on the following basis:

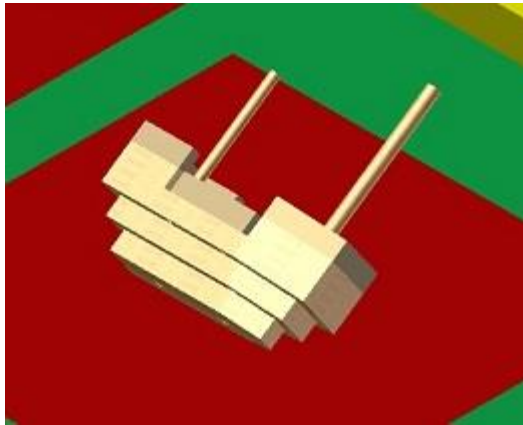
1. Ship Components must be Completely FREE of contact with the Robot to be eligible for Points
2. One point will be awarded for each Ship Component delivered into the Ship Building Area: **Maximum 10 Points**
3. One point will be awarded for each Ship Component correctly placed in a standing upright Ship Model.
Note: If a Ship Model tips over on its' side a Team can 'Right the Ship' by returning it to an upright orientation. **Maximum 10 Points**



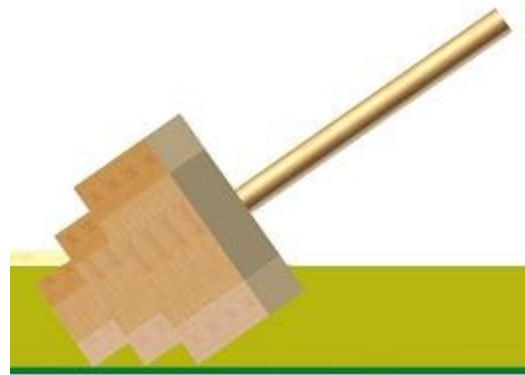
Upright Ship Model Iso View
Assembly Points Awarded



Upright Ship Model Front View
Assembly Points Awarded



Tipped Ship Model Iso View
No Assembly Points Awarded



Tipped Ship Model Front View
No Assembly Points Awarded

4. Points will be awarded for Winning or Losing an Individual Game on the following basis:
 - a. **FIVE** Points will be awarded to the first Team completing their Ship Model before the 4 Minute Game Clock expires.
 - b. **FOUR** Points will be awarded IF a Team loses a game but has completed their Ship Model BEFORE the 4 Minute Game Clock expired.
 - c. **THREE** Points will be awarded to a Team that has an Incomplete Ship Model when the Game Clock Expires BUT has a more complete Ship Model than their Opponent.
 - d. **TWO** Points will be awarded to a Team that has assembled a Minimum of the Hull Component 1 placed in the Assembly Base Component in the Assembly Area. Note: This applies to both games where an Opponent is present as well as Games where your Opponent has defaulted.
 - e. **ZERO** Points will be awarded when a Team has **Defaulted** or has not created the minimum Hull Component 1 placed on the Assembly Base in the Delivery Area.
5. Maximum Single Game score is 25 Points.
6. Tournament Standing will be based on the Total Number of Points scored by a Team in ALL of their Tournament Games combined.

2016 Skills Ontario Robotics Score Sheet					
Game #	Team Name	Total Number of Ship Components Delivered into the Ship Building Area Value: One Point Each	Total Number of Ship Components properly positioned in the Ship Model IN the Ship Building Area Value: One Point Each	Single Game Win / Loss Points Value: Zero to Five Points Five Points = First Completed Model under 4 Minutes Four Points = Completed Model in under 4 Min. but Lost the Game Three Points = Incomplete Model but won the Game with more components in place than Opponent when Time Ran Out Two Points = Minimum of Hull 1 positioned on the Assembly Base in the Boat Building Area when Time Ran Out Zero Points = Default or NO Components positioned on the Assembly Base in the Boat Building Area when Time Ran Out	Total Game Score
Team Signature:					
Game #	Team Name	Total Number of Crop Objects Delivered onto Shelf One Value: One Point Each	Total Number of Crop Objects Delivered onto Shelf Two Value: Two Points Each	Single Game Win / Loss Points Value: Zero to Five Points Five Points = First Completed Model under 4 Minutes Four Points = Completed Model in under 4 Min. but Lost the Game Three Points = Incomplete Model but won the Game with more components in place than Opponent when Time Ran Out Two Points = Minimum of Hull 1 positioned on the Assembly Base in the Boat Building Area when Time Ran Out Zero Points = Default or NO Components positioned on the Assembly Base in the Boat Building Area when Time Ran Out	Total Game Score
Team Signature:					

RULES AND REGULATIONS

1. Each Team will be assigned Exclusive Use of a Court Space.
2. Each Team will be assigned a Start of the Game Position for their Robot.
3. It is a Team decision where the Assembly Base Component will be positioned at the start of a game, either:
 - a. On their Robot, or,
 - b. In the Ship Building Area
4. Each team will be assigned a Driver's Area at a Corner of the Square Court outside the Court Wall Diagonally Opposite from their Start of the Game Robot Position.
5. Robots may reach over / drive over the 2 by 4 walls within their Assigned Court Space that define the sides of the Winding Pathways and Moncton Hill.
6. Teams may NOT install a camera or other image generating device on their robot for the purpose of sending a signal / image to an outside the court surface lap top or other type of signal receiver visible to either the Spotter or Driver.
7. A robot may be in possession of an unlimited number of ship components at a time.

TOURNAMENT PLAY

1. Tournament Standing will be based on the total number of points scored in all games played by each team.
2. Teams will play in an equal number of Tournament Games.
3. If Time Permits, Teams will participate in an equal number of games against each opponent Team.
4. Tournament games will last 4 minutes.
5. The amount of time between games will be determined by the number of participants. This information will be provided to teams at the start of the tournament.
6. Between tournament games, battery changes and repairs to robots may be completed at the team's assigned Pit Area Worktable.
7. During the competition, protective safety glasses and appropriate Personal Protective Equipment is expected to be worn while performing material removal tasks (cutting, drilling, etc.).
- 8. During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.**
9. Damaging the court area is illegal. If a robot's design causes damage to the ship pieces, or court pieces, then it will not be allowed to compete until it can operate without causing damage. Games missed due to this situation will be forfeited.

NOTE: Damage is considered to be BREAKING court components. Robots bumping into court components and causing them to shift position without breaking any court element will NOT be

- considered to be damaging the court. It is expected that all court components will be fixed firmly in place so that the court is a Neutral Factor in the competition.
10. Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
 11. If a robot is malfunctioning and represents a hazard to participants, other robots or itself in the opinion of the Referee, then, the referee may stop the clock, and may authorize the shutting off of the robot during a game. Disabled robots or parts of robots not generating any safety concerns will be left on the court until the game time expires.
 12. Up to two drivers and one spotter are allowed in the competition area. Driver(s) and spotters may switch roles during a game. The driver is the competitor holding the robot controller and controlling the robot. The spotter is the competitor providing navigational guidance to the driver(s).
 13. Drivers must remain in their Assigned Area throughout the game.
 14. Spotters may move freely within the shared spotter's areas.
 15. Spotters may **not** enter an opponent team's Drivers area.
 16. At the start of a game, robots are expected to be in their assigned starting positions. Robots arriving AFTER the game has started will be allowed to enter the game and use the Time remaining in the 4 min. game.
 17. Robots must not leave the competition court at any time during a game.
 18. It will be a referee's ruling that decides if an 'End of the Game Boat Piece Delivery' took place before or after the game-ending buzzer sounded.
 19. Game objects landing outside the court boundaries, as a result of robot behavior, **will not be returned** to the competition court.
 20. No aerial robots are allowed.

PLAYOFF PLAY

1. The top 16 teams will advance from tournament play into the playoffs
2. Initial playoff game pairings will be based on the round robin tournament standings
3. If there is a tie in the tournament standings after tournament play is complete, the score of the Job Interview component will be the tie breaker
4. Two robots will play on the court in playoff games
5. Playoff games will be standard game length (4 minutes)
6. Playoff games cannot end in a tie. If a tie score exists in a Playoff Game then an additional 4 minute period will be played (as many as needed) until one of these extra periods ends with one team ahead
7. The playoffs will be structured on a double knock-out format. Teams will need to lose TWO Playoff Games to be eliminated

Winner's Bracket

16 Team Double Elimination



THE COURT

COURT LAYOUT

Please note: Although great pains will be made to keep the court in compliance with the drawings, some inaccuracies in construction may occur. **Please make your robot designs allowing for a possible ½ inch tolerance.**

The primary court items that have a direct bearing on robot design are:

- 1) The open court surface will consist of the good side of a 'good one side plywood sheet' **OR** the facility floor **OR** the smooth side of Masonite Sheeting.
- 2) The perimeter court wall and winding path areas are made from 2 by 4 inch planks laying on their narrow side.

Detailed court information has been included in the Appendix Section of this scope document.

THE ROBOT

RESTRICTIONS

All robots must **pass** a pre-competition inspection for compliance with the safety and design rules before they will be allowed to participate in tournament games.

Note: Robots must remain in compliance with these rules throughout the competition. If teams fall out of compliance with these rules then they will not be permitted to compete and will forfeit all of their scheduled games until they have corrected the problem.

START OF THE GAME ROBOT STATUS

When a robot's main power is turned on prior to the start of a game the robot must be in an overall 'Idle State' and the following conditions must exist:

1. The Robot must be stationary in its assigned starting location.
2. The Robot must be in compliance with the Maximum Overall Size Restriction of **6 Cubic Feet.**
3. All systems may be ON.
4. Air System Circuits may be fully charged to 100 PSI and their compressors can be ON.

OVERALL ROBOT SIZE

Robots must not exceed an overall size of **6 cubic feet** (10,368 cubic inches) at the start of each game. Robots may expand to a larger size once a game has started.

Overall robot size will be calculated by using the maximum single dimension in each category of the robot(s), not average dimensions.

All pieces associated with the robot completing the task must fit within the 6 cubic feet restriction, and the configuration the robot is measured in is the configuration the robot must be the robot's starting position.

This overall size maximum will allow a robot to be any variation that does not exceed **10,368** cubic inches, using the following formula:

$$\text{Volume} = \text{Length} \times \text{Width} \times \text{Height}$$

POWER SOURCES / MANAGEMENT

1. The total voltage in any individual circuit **cannot** exceed **24 Volts**.
2. The **maximum continuous** power rating allowed in any circuit is **240 W**, which will be limited by voltage and fuse selection. To calculate power in any given circuit, use the following formula:
$$\text{Power (Watts)} = \text{Voltage (Volts)} \times \text{Current (Amps)}$$
3. Teams are reminded that it is the purpose of a fuse to protect the students themselves and the equipment in their circuits. Teams must develop circuit diagrams, and calculate the appropriate values for all circuits on their robot. Teams must submit a wiring diagram of their robot's circuits.
4. Each current branch path from the battery must include either an **in-line fuse, resettable fuse, circuit breaker**, or be connected to a dedicated fuse in a rack.
5. Batteries must be completely sealed commercial battery packs.
6. Robots must be able to be turned off with a single motion. Robot Controller receivers may be in an independent circuit.
7. No explosive materials of any kind may be used (ether, gunpowder, acetylene etc.).

NON-ELECTRICAL (BATTERY) ENERGY SOURCES

Pressure based energy sources (air or other) may be pre-charged to a maximum of 100-PSI pressure in their reservoirs (cylinders) at the start of each game.

1. Air pressure systems using Competitor-made or modified air pressure hardware are **NOT** permitted.
2. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.

3. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.
4. The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.
5. Tension-based energy sources (elastics, springs or other) may be in either a relaxed at rest state or in a tense / compressed state at the start of each game.
6. Laser devices are prohibited.

RECOMMENDED ROBOT CONTROLLERS

1. It is recommended (not required) that all teams use 2.4 GHz “non-crystal” control systems.
2. **Teams are allowed the use of an unlimited amount of channels managed through the use of up to two transmitters to on the robot control systems. However, teams assume full responsibility if any interference is to occur with their respective communication systems that could render the robot(s) useless.**
3. Robots may not transmit audio/visual information to off the robot devices. (Ex: Having a camera transmit images real time to the driver, etc.)

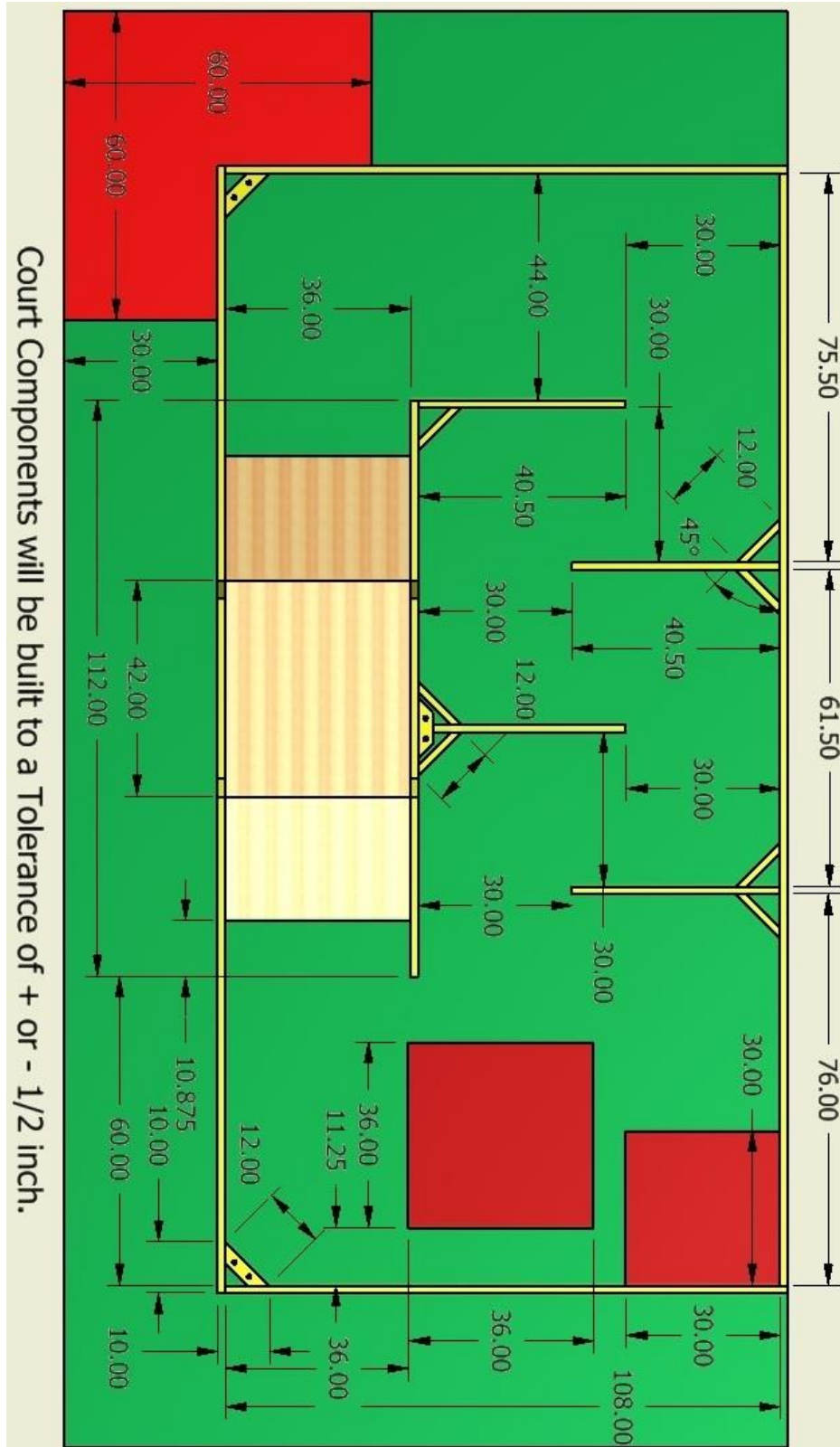
PIT AREA

1. Competitors **MUST** wear safety glasses when doing fabrication work.
2. Only registered robot competitors are permitted in the pit area.
3. Designated teacher/industry team advisors are permitted in the pit area **only** to inspect the worktable setup of their team prior to the start of the tournament.
4. Designated teacher/industry team advisors are **not** allowed in the pit area during tournament and playoff play.
5. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
6. Teams will be provided with a pit area workspace on a standard 72x30 inch project table.
7. Each pit area table will have access to one electrical outlet minimum of 1000W. Teams are requested to bring a power bar as part of their equipment.
8. It is required that teams fabricate a **tabletop stand** for holding their robot in the pit area. This stand should hold the robot securely and be capable of preventing the robot from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

Overall Court Dimensions:

- The Court Playing Surface will be an 18’ by 18’ square.
- Individual Exclusive Use Team Spaces are 9’ by 18’ rectangles.
- The Perimeter Court Walls will be made using 2 by 4 inch planks.
- This wall will as a result be approximately 3.5 inches tall.
- The court surface may vary between concrete, Masonite, or plywood.

One Team's Exclusive Use Space Details:



PRE-INSPECTION FOR COMPLIANCE WITH SAFETY AND DESIGN RULES

- ☐ Mandatory Wiring Diagram provided
- ☐ Table Top Robot Stand
- ☐ **Overall volume $\leq 6 \text{ ft}^3$ or $10,368 \text{ in}^3$**
- ☐ No explosives/combustibles
- ☐ No lasers
- ☐ All batteries are sealed commercial batteries in good physical condition
- ☐ Batteries wired in series should be the same amp hour rating (ex. both 1500 mAh) and batteries in parallel are of same voltage (ex. both 12 volts)
- ☐ Batteries securely mounted
- ☐ Total voltage in any individual circuit does not exceed 24V
- ☐ No circuit exceeds 240W (Voltage x Fuse Current Rating, easily accessible)
- ☐ All circuits have a fuse or breaker (breakers must have **DC rating**) and all Fuses / Breakers must be readily accessible
- ☐ Mandatory Pressure System Circuit Diagram provided
- ☐ No Competitor-made or modified air pressure hardware being used
- ☐ Only commercially manufactured Pressure Tanks (cylinders) can be used
- ☐ Pressure indicator
- ☐ Pressure in tanks does not exceed 100 psi
- ☐ Over-pressure safety valve
- ☐ Pressure tanks and related gauges and controls are shielded from damage due to collisions
- ☐ **Robot is able to be turned off with a single motion.** Radio receivers / Logic circuits may be independent of the kill switch.
- ☐ Control unit to support operator to robot communication are being used
- ☐ Demonstration of robot functionality

Additional concerns:

--	--

Robot Evaluator Signature

Team Representative Signature

Ship Details



<http://www.homedepot.com/p/Unbranded-Maple-Plywood-Common-3-4-in-x-4-ft-x-8-ft-Actual-0-750-in-x-48-in-x-96-in-263012/203600599>



\$39.98 / each

Maple Plywood (Common: 3/4 in. x 4 ft. x 8...

★★★★★ (17)

