

# The Rules of Collegiate Mechatronic Football

This document sets forth rules of the game of Collegiate Mechatronic Football (CMF).

## 1 Players and Squads

1. The game is played by two opposing squads known as Blue Squad and Gold Squad.
2. Each Squad consists of up to 11 remotely controlled mechatronic machines, referred to as "Players".
3. No more than 8 Players from one Squad are allowed on the playing field during a play, i.e. the game is 8 on 8. A 5 foot delay of game penalty is assessed against the Squad with the excess of Players.
4. A Squad is required to be able to field a minimum of 5 Players on the field. Failure to do so results in a forfeiture of the game by the offending Squad.
5. Humans are not allowed on the field of play, except for one player from the Offensive Squad, who will be allowed to
  - (a) place the ball on the Center before an offensive play is initiated
  - (b) place the ball in the kicking tee for a Kick Off or
  - (c) place the ball in punting jig for a Punt.

This individual is not allowed to touch any other Player on the field and can touch the Center only to place the ball on it. Positioning the Center is not allowed. A violation results in an interference penalty of 20 ft. This person does not have to be off the field within the 25 second clock, but must make a sincere effort to do so.

6. Players can only be DC powered, with a maximum of 24 volts.
7. Any lead acid batteries must be sealed.
8. Players must have a kill switch mounted externally to their top surface. The switch should disconnect the main power to the system. It is recommended that you use a lever type battery cut-off switch made for automotive applications.
9. The kill switch must be readily identifiable and colored red. A good example can be found at, <http://www.pegasusautoracing.com/productdetails.asp?RecId=4913>  
The switch cannot have a removeable key, such as in the kill switch found at, <http://www.pegasusautoracing.com/productdetails.asp?RecID=1465>
10. No Player can weigh more than 25 pounds.
11. A coin toss before the game determines initial possession. Each Squad will designate one individual as the Captain. The Captain will be present for the coin toss.
12. Each Squad will designate one individual as the Coach. The Coach will act as the sole representative of the Squad in all communications with the Referees.
13. Squads may substitute Players between plays and during time outs.
14. Players will be remote controlled using controllers provided by the Commissioners of CMF. Squads may modify their remote controllers as they see fit, however they cannot interfere with the signals broadcast from the opposing Squad *if* the opposing Squad has not modified their controllers.
15. Embedded intelligence and autonomous actions by Players is strongly encouraged.
16. Players must incorporate a microprocessor in some significant fashion.

17. The Commissioners will provide each Squad with 11 tackle sensors. The tackle sensor is a digital accelerometer. The details of the code that determines whether a tackle has occurred, based on the accelerometer's output, will be provided to each Squad.
18. The Commissioners will provide each Squad with a system of 5 high intensity LED lights. The LED light holder is shown in Figure 1. Four light holders must be mounted uniformly spaced around the

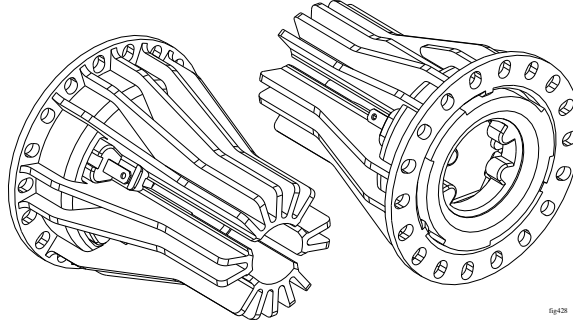


Figure 1: LED Light Holder

sides of a Player, with their centers at an elevation of  $8(\pm 1)$  inches above the playing surface. The fifth light holder must be mounted anywhere on the top of the Player. Each light holder weighs  $0.15\text{lb}_f$  and generates  $1.5\text{W}$  of heat. The weight of the lights is to be included in the weight of the Player. For dimensions refer to the website,

[www.tycoelectronics.com/catalog/bin/TE.Connect?C=1&M=BYPN&TCPN=2008675-1&RQPN=2008675-1#features](http://www.tycoelectronics.com/catalog/bin/TE.Connect?C=1&M=BYPN&TCPN=2008675-1&RQPN=2008675-1#features) where you will find CAD models and product specifications.

19. The light holders must be mounted internally to a player and the lens should be recessed .1 inches, to avoid damage to the lens as a result of impacts between Players.
20. When a tackle is detected by the sensor, the tackle sensor will signal the lighting system to turn green for a 2 second period of time.
21. When a tackle is detected by the sensor, the tackle sensor will provide a signal to the Player's micro-processor, indicating that it has been "knocked down", and that Player must remain immobilized for 2 seconds. This applies to all Players, not just ball carriers. In fact, the tackle sensor is better thought of as a knock-down sensor.
22. A tackle sensor must be rigidly mounted to a horizontal interior surface of each Player's base.
23. A Player's base must be made of HDPE.
24. A Player's base must be able to be directly contacted from any horizontal direction. This means that no part of a Player may protrude beyond the base. Fasteners for example will need to be countersunk. Nonconforming players cannot take the field.
25. Stiff arming is not allowed. Violation of this rule results in stoppage of play, loss of down and 15 feet.
26. A Player's base can be no thinner than  $1/2$  inch, continuously.
27. A Player's base must be solid. A reasonable number of clearance holes for fasteners and wires are allowed.
28. The centerline of a Player's base must be located  $3(\pm 1)$  inches above the playing surface.
29. There are no restrictions on the shape of a base or Player other than the Player must fit within a 16 inch square, 24 inch tall box.

30. All Players, except the quarterback, must be contained within a 16 inch square footprint before the start of play. Only the Quarterback may reach out from beyond this footprint, and only for the purpose of taking the ball from the Center.
31. Systems for kicking and punting the ball may be attached and detached from Players, and are not included in rules 1.10, 1.25, 1.29 or 1.30. A Player with an attached kicking or punting system cannot advance the ball.
32. Suspensions and shock absorbing systems are not permitted.
33. Pneumatic tires are not allowed.
34. Foam tires are allowed, but they can be no thicker than 1/2 inch and no softer than 30 Shore.
35. Tires must be mounted on rigid, solid, wheels. Plastic is acceptable.
36. Players must be identifiable as to which Squad they belong.
37. Players must have visible numbers.
38. Players can have no more than 2 extensible arms.
39. No Player, at any time, can extend its arms more than 18 inches in any direction.
40. Arms can consist of only rotational joints.
41. Arms can have no cross sectional dimensions greater than 3 inches, except for the terminus of the arm.
42. The terminus is considered the final 4 inches of the arm and that portion is constrained to have a cross sectional dimension no greater than 5 inches.

## 2 The Playing Field & and Ball Positioning

1. The game will be played in Stepan Center. The roof of Stepan Center leaks.
2. The game will be played on a field 94 feet long and 50 feet wide, as shown in Figure 2.
3. End zones extend 15 feet past the goal lines.
4. From end to end, the playing field is divided into three equal  $\frac{94}{3}$  feet (i.e. 376 inch) sections.
5. At the beginning of each half, after a Touchdown and after a Field Goal, the Defending Squad kicks off to the Receiving Squad from the one-third field mark of their own territory.
6. Each Squad will develop their own kicking tee. The kicking tee can elevate the lowest portion of the ball no more than 1 inch above the playing surface.
7. The kicking tee may be an integral part of the kicking system.
8. The clock is started and play is initiated when the Kicker contacts the ball.
9. A kick is caught by the first Player touching the kicked ball.
10. If that Player can take possession of the ball, before being tackled by an opponent, the Player may advance the ball.
11. Prior to passing the middle third of the field, only the Receiving Squad may catch the kicked ball.
12. After passing the middle third of the field, either Squad can catch the kicked ball.
13. If a ball is kicked out of bounds, the Receiving Squad has the option to

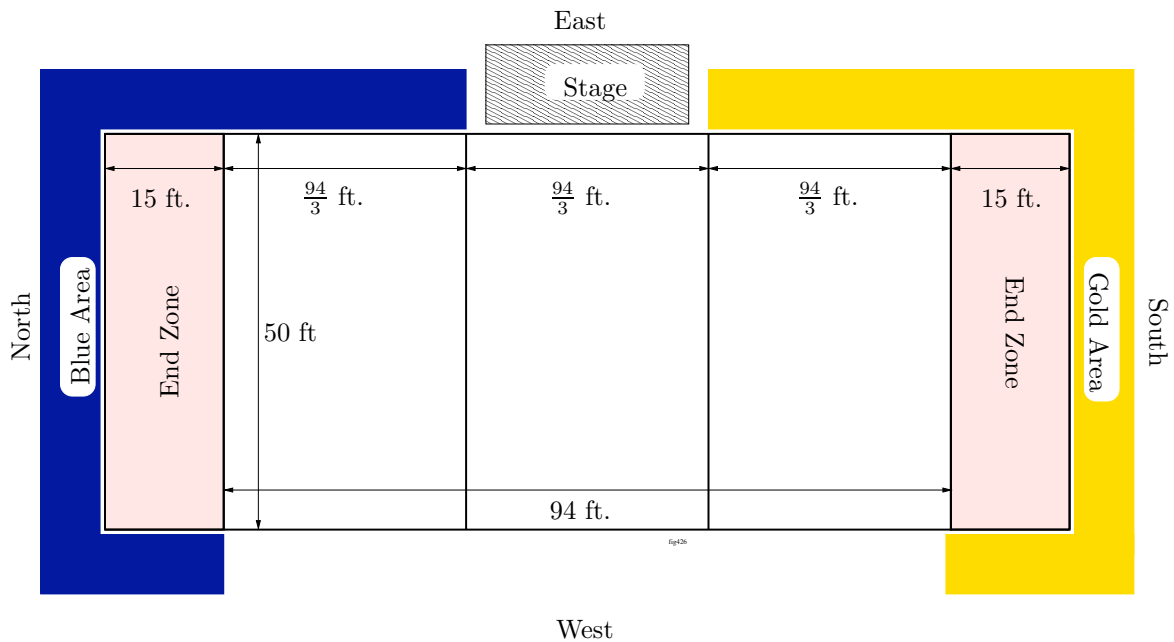


Figure 2: Playing Field Dimensions

- (a) take possession of the ball from the point on the field where the out of bounds occurred, or
  - (b) take possession of the ball at the one-third field mark of their territory.
14. If a ball is kicked into or past the End Zone, the Receiving Squad takes possession of the ball at the one-third field mark of their territory.
  15. A first down is realized when a one-third span (376 inches) of the field is covered within 4 plays.
  16. The Offensive Squad is allowed to Punt the ball at anytime, if not within the one third field mark of the Defensive Squad.
  17. Each Squad will develop its own punting jig, which holds the ball so that the lowest point on the ball is at least 3 inches above the playing surface.
  18. The punting jig may be an integral part of the punting system.
  19. The Referee initiates the punting play by blowing a whistle.
  20. The Punter cannot kick the ball earlier than 2 seconds after the initiation of the play. The penalty is a replay of the down and a loss of 15 feet.
  21. The Squad receiving the Punt will take possession at the point where one of its Players touches the punted ball. If that Player can take possession of the ball ,before being tackled by an opponent, the ball may be advanced.
  22. If a ball is punted out of bounds, the Receiving Squad takes possession at the point of the field where the out of bounds occurred.
  23. If the ball comes to rest in the End Zone, or if the ball is punted out of the End Zone, the Receiving Squad takes possession of the ball at the one-third field mark of their territory. The Receiving Squad has the option of picking the ball up in the End Zone and advancing the ball.
  24. A Player is considered out of bounds when any portion of its footprint is crossing the inside of a sideline.

25. Each Squad will have a sideline area on one half of the field, see Figure 2. Humans controlling the Players, and service to injured Players, is restricted to this area.
26. No members of either Squad are allowed on the Stage.
27. After each play, the Referee spots the forward progress of the ball with a pointed toe touching the ground. This is called a “toe spot” and it marks the new line of scrimmage. If yardage was gained in the previous play, the ball will be toe spotted at the point of maximum forward progress of the ball. If yardage was lost, the ball will be toe spotted at the point where the ball was located when the Player was tackled.
28. The Offensive Center will line up with its leading edge on the line of scrimmage as indicated by the Referee’s toe spot.
29. The ball will be toe spotted on the hashmarks closest to the side of the field where the play ended. The hashmarks divide the field equally in the lateral direction, see Figure 3.

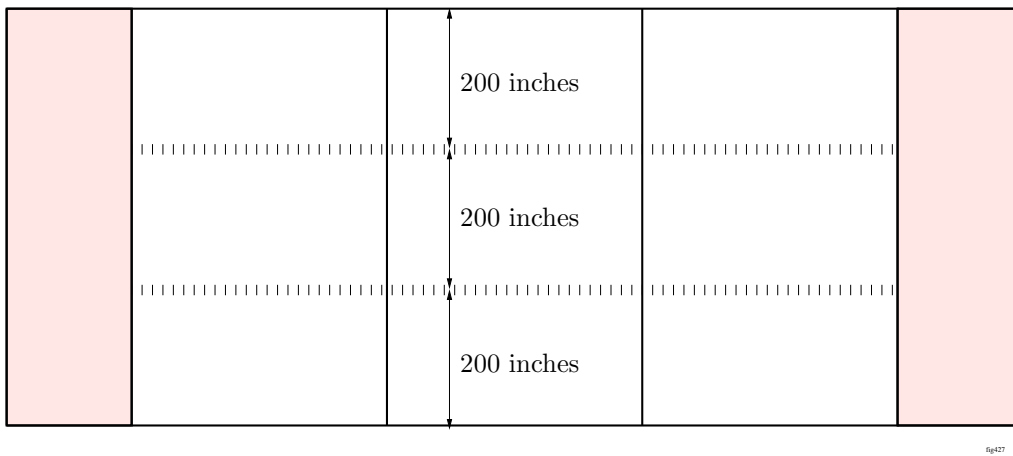


Figure 3: Hashmarks

30. A Player that
  - (a) loses their tackle sensor,
  - (b) has a tackle sensor that is not energized, or
  - (c) does not provide the 2 second immobilization signaled by the tackle sensor
 cannot take the field.
31. If a ball carrier loses control of the ball and the ball touches the ground, the ball is considered fumbled.
32. The Squad which first touches a fumbled ball gains possession. If the Player who touches the fumbled ball can take possession of the ball before being tackled by the opposition, that Player may advance the ball.
33. If the Quarterback should drop the ball or cause the ball to fall to the ground from the Center, it is considered a fumble.
34. The game can end in a draw, no overtimes.

### 3 Game Timing

1. The game consists of two 15 minute halves and a 10 minute halftime.
2. Running time is used. After a play, the game clock and the 25 second play clock are restarted when the Referee toe spots the ball.
3. The Offense has 25 seconds from the time when the Referee toe spots the ball to initiate a play. Failure to do so results in a 5 ft delay of game penalty. The 25 seconds is indicated by the play clock.
4. Clock stoppage occurs when,
  - (a) the ball carrier steps out of bounds, or
  - (b) when there is an incomplete pass, or
  - (c) when there is a change in ball possession, or
  - (d) when a Field Goal, Touchdown or Safety is achieved, or
  - (e) when a time out is called.
5. Referees may call an official time out at any time, for any purpose and for any length of time.
6. Other than for Kick Offs, Punts and kicked Point After Attempts, a play is initiated the moment the Quarterback separates the ball from the Center.
7. Each Squad is allowed 2 time outs per half. A time out can only be designated by the Squad Coach, by forming a T with their hands. Each time out is of 1 minute duration maximum. The game clock and the 25 second play clock are started after the 1 minute time out has expired.
8. If a Squad calls a time out after all time outs have been used, that Squad will be charged with a 5 foot delay of game penalty.
9. The Referee may allow whatever time is necessary for Medics to remove an injured Player from the field.

### 4 Scoring Rules

1. A Touchdown is worth 6 points.
2. A kicked Point After Attempt (PAT) is spotted at the one third field mark and is worth 2 points.
3. A PAT may also be run in, or passed in, and is then worth 1 point. If passed in, the completed Pass has its own value as well, see rules 4.5 and 4.7 below.
4. A Field Goal is worth 5 points.
5. A completed Pass of 5-15 forward feet is worth 7 points. This is a *short pass*.
6. If a short Pass is intercepted, 2 points and possession of the ball are awarded to the defense.
7. A completed Pass of more than 15 forward feet is worth 10 points. This is a *long pass*.
8. If a long Pass is intercepted, 3 points and possession of the ball are awarded to the defense.
9. A ball downed in an Offensive Squad's End Zone results in a Safety, with 2 points being awarded to the Defensive Squad. The team charged with the Safety punts the ball from the one-third field mark of their territory. All rules regarding punting apply.

## 5 Offense

1. The game is played using the miniature souvenir football provided by the Commissioners. The ball may not be modified in any way and must be pressurized to the pressure stated on the ball.
2. A play initiated before the end of a half can extend beyond the half.
3. Before the game can begin, each Squad's Offense must demonstrate the ability of the Quarterback to take the ball from the Center. If a Squad's Offense is not capable of this, that Squad forfeits the game.
4. Only 1 Player in the backfield can be in motion at the snap of the ball and that Player must be running parallel to, or away from, the line of scrimmage. More than 1 Player in the backfield can initially shift, however all backfield Players must be set for 1 second before the Player goes in motion. Violation results in a backfield in motion penalty of 5 feet from the original line of scrimmage.
5. All Players, including the linemen, are eligible to run down field and catch passes. Receivers can all line up on one side. There does not have to be a balanced wide receiver set.
6. The Quarterback must take the ball from the Center. The Center cannot transfer the ball to the Quarterback in any way.
7. A Player carrying/holding the ball must expose at least 60% of the ball's surface area. As such the ball is referred to as being "held", otherwise the ball is said to be "contained". The exception to this rule is the Quarterback. During a passing attempt the ball may be contained by the quarterback. When the ball is contained by the Quarterback, the Quarterback will not be awarded any yardage gained by rushing. To advance the ball by rushing, the Quarterback must return the ball to a held position behind the line of scrimmage *before* beginning to advance the ball.
8. The ball cannot be held in a net, bag, or anything of the like.
9. A Pass is considered as caught or intercepted by a Player when that Player contacts the ball before the ball touches the ground. If that Player can take possession of the ball, before being tackled by an opponent, the Player can advance the ball.
10. A passed ball which touches the ground before touching a Player is considered an incomplete pass.
11. Reverse laterals, pitches or passes are allowed. If the reverse lateral, pitch or pass is incomplete, the ball is considered fumbled.
12. The Quarterback must be behind the line of scrimmage when passing.
13. A Field Goal or kicked PAT is scored when the kicked ball crosses the goal line between the hashmarks before touching the ground.
14. All rules pertaining to the kicking tee in Kick Offs, apply to the kicking tee used in PATs.
15. A play attempting a kicked PAT is initiated by the Referee blowing a whistle.
16. The Kicker cannot kick the ball earlier than 2 seconds after the play is initiated. The penalty is a replay of the down and a loss of 15 feet.
17. If a Field Goal attempt outside the Defending Squad's one third field mark is missed, the Defending Squad takes possession of the ball at the point of the Field Goal attempt.
18. If a Field Goal attempt inside the Defending Squad's one third field mark is missed, the Defending Squad takes possession of the ball at its one third field mark.

## 6 Defense

1. Full rush is allowed on every down. The Defense may not make contact with the Offensive Center until the Quarterback has taken the ball from the Center.
2. “Bump and Run” on a Receiver is allowed within 5 feet of the line of scrimmage. Beyond the 5 feet, there should be no *significant* contact between Receiver and Defender. The Player guilty of initiating the contact will be charged with Offensive or Defensive pass interference.
3. A Player is considered tackled if, due to the presence of other Players, is unable to move the ball in any direction, within a 2 second period. This is known as “lack of forward progress”.

## 7 Offensive & Defensive Penalties

1. There is a 4 inch neutral zone on either side of the line of scrimmage. The only Player allowed in the neutral zone before a play is initiated is the Offensive Center. A Lineman will be considered offside when it breaks the neutral zone prior to the snap, even if there is no contact made with the opponent. The penalty will be 5 feet from the original line of scrimmage and a replay of the down.
2. When a defender makes contact with any ball carrier in a manner that is not deemed by the Referees and Commissioners as an attempt to either knock the ball loose or to tackle the ball carrier, the defender is guilty of a “roughing” penalty of 30 feet. In the event of such a penalty, if the ball carrier has been damaged, it becomes the discretion of the Referees to either disable an equivalent Player on the offending Squad or require the offending Squad to forfeit the game.
3. After releasing the ball, there may be no significant contact between the Defense and the Quarterback. The penalty is 30 feet for roughing the Quarterback. If the Quarterback is then damaged, the offending Squad forfeits the Game.
4. The Offense and Defense are both required to have at least 4 Players on the line of scrimmage at the time of the snap. The 4 Players can be anywhere on the field laterally, as long as they are within 1 foot of the line of scrimmage. If either Squad fails to have 4 Players on the line at the start of the play, a 5 foot delay of game penalty from the original line of scrimmage results.
5. Defensive pass interference will result in an automatic first down and 10 foot penalty marked from the spot of the foul.
6. Offensive pass interference will result in a loss of down and 15 foot penalty marked from the original line of scrimmage.
7. Taunting or verbal abuse by Humans will not be tolerated. First offense results in a warning to the individual. A second offense results in a 20 foot penalty for unsportsmanlike conduct. A third offense by the individual results in immediate ejection from the game.
8. Offended Squads may decline penalties.