Mech Warfare Rules
2017 Robogames Edition

Name of Event:	Mech-Warfare
Robots per Event:	Two
Length of Event:	8 minutes
Robot Weight Range:	Under 15 pounds
Robot Dimensions:	Less than 36 inches high
Arena Specifications:	15 ft x 15ft or 15ft x 22.5ft
Robot Control:	Teleoperated
Engineering Principles:	Mechanical engineering, electrical engineering, machining, vision systems, and computer science
Event Summary:	In the spirit of the giant walking combat machines popularized by Battletech and Japanese Anime. Mech Warfare is a contest of humanoid robots fighting in a scaled down cityscape. The contest envisions that an actual human would be driving the four-story scale "vertical tank" in a urban combat setting. Robots are human controlled, but the operator must use a camera mounted on the robot for vision - no direct viewing of the field by operators is allowed. Robots have impact sensors to detect how often they've been shot.

All Mechs are subject to final approval by an official before competing, and may be rejected if considered unsafe for human bystanders or not keeping in the spirit of the event. To elaborate, these rules here are intended to keep things balanced and fair, while I'm sure there are little loopholes that can be found for most things, have a sense of honor and respect for your opponents, and don't try to 'gimmick' your way to a win.

Mech Warfare (MW) s a robotics competition. Our goal is to create a real-life robotic combat competition that mirror the scenarios found in sci-fi universes such as Battletech, Warhammer 40k and Armored Core. Competitors will build 1/24 scale armed robots which they will pilot through a wireless first-person POV system.

MW Official Event Organizers:
Don Croft – ghengisdhon@yahoo.com
John Harkey - harkeyjohn@gmail.com
David Fong - davidgfong@gmail.com

MW Event Organizers are the people in charge of the Mech Warfare event at Robogames. If you have questions about something Mech Warfare related (online or in person) these are the people who you need to talk to. Please do not email David Calkins, if it is Mech Warfare specific. While he is the Robogames event organizer, he defers anything related to MW to the MW Event Organizers.

All disagreements will be deferred to the MW Event Organizers for ruling. The MW Lead Judge will make the final decision for a final ruling. The MW Lead Judge for Robogames 2017 will be John Harkey.

Section I - Leagues of Play
For the 2017 Robogames, there will only be one (1) league of competition.(In future years, other leagues may return.) The 2017 Mech Warfare League is the Airsoft Classic League and is defined as:

1. The *Airsoft Classic* league is open to all walking robots with 4 or less legs. This is the main competition event.

Teams with multiple Mechs in their hangar have two options: Register and compete with the Mechs separately, or register as a single pilot/team with multiple mechs at their disposal. Mechs may not be switched out in the final matches.

Section II – Mech Construction
All competitors are subject to final approval by Mech Warfare event organizers or their appointed official. As part of the qualification process, each competitor must be presented to an official for a *Safety and Technical Inspection* before competing, and must be re-inspected after any major alterations. A Mech may be rejected from competing if it is deemed to be unsafe for human bystanders or not in the spirit of the event. All Mechs should be designed within the spirit of the game. Do not try to 'gimmick' yourself to a win. If you have a question about a particular part of your robot, ask the event organizers beforehand.

1. Mechs are to be true walking robots. Legs must be servo/actuator driven. No cam-driven, wheeled, or treaded configurations..
2. Mechs may have up to 4 legs.
3. Average Mech size is expected to be between 8" and 18" tall. No robot may be taller than 36".

4. Mechs that weigh less than 3 pounds are considered a lightweight machines.
5. Mechs may be remotely-operated or autonomous.
6. Pilots may only view the match through their first person POV (FPV) camera mounted on their Mech, further:
    1. Pilots are not allowed to view the arena or match directly. Up to two pilots are allowed per mech.
    2. Cameras should be mounted roughly in the center of the mass of the robot, where the 'cockpit' would be. The intention is to simulate piloting the Mech, not having cameras on your guns mounted to extensions so you can fire around corners without fear of being shot. This would fall under the 'Gimmick Clause'.
    3. Wireless 5.8GHz analog video is the preferred Mech Warfare video feed system. We have found this to be the most effective video system and recommend it for all competitors. It is preferred transmitters be 250 mW or less to avoid interfering with other competitors at the Robogames event. A multiband transmitter and receiver is also recommended. Channels will be assigned to competitors to avoid interference and may be adjusted throughout the day as needed to minimize interference..
    4. Wireless IP Cameras will not be supported by the event organizers at Mech Warfare for video feed but competitors are welcome to still use Wireless IP Cameras.
    5. Two cameras are allowed per Mech.
7. All Mechs must use the approved target scoring system. A set of target plates will be loaned to the contestants for each match. The mechanical and electrical interface shall be identical on each robot. The target plates will be certified prior to Robogames and verified before and after each match. The technical data package will be available for all to build their own target plates prior to Robogames so each contestant can have their own target plates. The new target plates are backwards compatible with the legacy transponder card as well as the current transponder cards.
8. Mechs should not intentionally separate, or leave pieces of themselves behind, especially beacons or debris that would inhibit other competitors.
9. Mechs should not intentionally cause damage to the arena. Event Organizers will disqualify any Mech intentionally causing damage to the arena. Unintentional damage is fine but should be minimized. This is not a destruction derby.
10. No intentional entanglement type (any device that restricts the movement of another Mech) device is permitted by a Mech.

Section III – Weapons Systems
Only Airsoft class will be held at the Robogames 2017 Mech Warfare Event.

1. The *Airsoft* weapons class allows the use of electric Airsoft guns. Guns are to use standard Airsoft 6mm plastic BB ammo. Guns must not be so powerful as to cause damage to the Target Panels or Arena. AEG and "Defender" style weapons are allowed, anything more powerful will need to be tested beforehand.
2. In all weapons classes, any Mech that is capable of shooting without explicit human input must have a verified remote kill switch and a visual indicator that they are "armed". We will not have Skynet go live on our watch.

3. Weapons designed to interfere in any way with an opponent's camera or wireless control are strictly forbidden.
4. Close-in melee weapons that poke or whack an opponent's target plates are allowed as long as intentional damage to the arena or opponent's mech is avoided.

Section IV – Arena

1. The airsoft arena is approximately 15'x15' or 15' x 22.5' depending on available floor space at Robogames 2017.
2. The walls of the arena will be non-transparent and of approximate 18" of height.
3. Buildings, averaging 1.5 to 2 feet tall, will be provided for cover. Building layout will be consistent throughout the event for ranked matches, however layout may not be finalized until the event. Exhibition matches may have varied building layouts at coordinator's discretion.
4. All 'streets' will be approximately 36" wide.
5. All sizes are approximate. Your Mech must be able to deal with any small changes in these dimensions.
6. The Arena buildings may vary in size. First person POV can be a bit disorienting navigating the arena. Distinguishing markings may be put on the arena wall or buildings by the MW event organizers.
7. The arena floor is covered with ⅜" thick EVA anti-fatigue foam. This provides a uniform controlled walking surface. For 15 pound and under robots this surface is stiff. People walking on it will find it slightly compliant.

Section V - Qualification

All competitors must complete a qualification trial prior to competing during Friday's regular hours (typically 10AM-8PM. This will be dependent on the event organizers travel plans and Robogames scheduling.). Prior to the event, your team will be given a timeslot for qualifications, you must be available during this time. Only competitors that have completed a qualification trial will be placed in the competition bracket. It is expected that your Video and Scoring System be 100% functional prior to attempting your qualification round. This will be tested prior to your qualification round. Certified Robogames target plates will be used to qualify.

1. You will first be required to demonstrate that your Mech has a working video link using your camera. You must also confirm and demonstrate that every individual Target Plate of your scoring system is functional, and registering correctly on the scoreboard PC. If you're scoring system and/or scoring Xbee needs programming, arrange this prior to your qualification attempt.
2. You have a maximum of 10 minutes to complete this setup phase on your first qualification attempt. The qualification round runs for 5 minutes. Subsequent qualification attempts only allow for 5 minutes of setup time.
3. A qualification round consists of the following: The Mech will start in a corner of the arena. Each corner will contain a small Target Beacon (such as a aluminum can) mounted 8-12" from the ground. The Mech must pilot and hit all 4 Target Beacons in under 5 minutes. Each Target Beacon must be hit using the Mech's primary weapon system, melee is not allowed. If there is

time remaining after the 4 Target Beacons are hit, the Mech must continue the same pattern and demonstrate that it can function for a full 5 minutes continuously.

4. The qualification trial will run under the same technical requirements as regular matches: in particular, pilots cannot view the arena directly and may not be assisted by spectators. This trial is intended to show that your Mech can walk and that your camera and guns work. You must maintain control, wireless video feed, and mobility requirements during the entire qualification round.

5. The qualification process may be attempted as many times as time permits, however, competitors who have already attempted must wait on the end of the longest line. If you do not show up or are not ready by the time your time slot comes up, you will be moved to the back of the line.

6. There will be an option to submit a pre-qualification video in lieu of the "qualification round". A thread will be created in Trossen Mech Warfare forum that will allow for competitors to submit a video of their Mech performing the qualification round for 5 minutes. A standard household item such as a plastic cup can be used in place of the Scoring Beacons. The Mech Warfare arena does not have to be simulated in the pre-qualification video. The pre-qualification video must show that the Mech can move and shoot at Target Beacons for a minimum of 5 minutes. Submissions can be made from Feb 15th 2017 through April 15th 2017. The primary goal of this is to provide a bonus to competitors who are showing up prepared, but does not replace the on-site qualification requirement. Any competitor who submits an approved pre-qualification video will be awarded with a 1 HP "battle-hardened" bonus to their Mech for that year. Timeslots will be handed out on a first-come-first-serve basis.

Section VI – Match Rules
A match consists of two Mechs facing off in an arena, trying to reduce one another's Hit Points (HP). The winner is the Mech with the most HP left at the end of a match. The Scoring system consists of target plates and a transponder unit which wirelessly relays information back to a base station.

1. Structured match play will be scheduled throughout the day on Saturday and carry into Sunday. Structured match format will be determined by the number of Mechs registered and qualified and will be announced prior to the event. All qualified Mechs will be guaranteed at least two rounds of match play. The Championship round will be the best two out of three rounds and will be held on Sunday after match play finishes. Open/pickup play will be allowed after the Championship play finishes depending on time available.

2. At the start of each day the match play schedule (time slots) will be posted on a bulletin board. We will follow this match play schedule as close as possible, environment permitting. The bulletin board will be updated as necessary throughout the day. The initial match play schedule will be determined once the final tally of qualified Mechs is determined. All Mechs are expected to be present at the start of their scheduled match play. Match schedules may slip throughout the day but none will occur prior to the initial match play schedule. Any mech not present at the start of their match play, will forfeit the round.

3. Prior to beginning the match, each competitor has 10 minutes of staging time. If your Mech is not ready for a match, it will forfeit that match. Builders will be given one 2-minute extension to use

throughout the weekend. If you are next up for a match, we expect you to be staged and ready to set up as soon as the current match is finished.

4. Each Mech will start a match with 20 hit points (HP), bipeds will receive a 15% bonus in HP for 23 HP total. Light weight Mechs will start with 11 HP. Remaining HP will be reduced as the transponder unit registers hits, or when penalty hits are assessed.

5. Matches have a maximum length of 8 minutes. A match ends when either one of the Mech's has it's HP reduced to 0, or when the match clock runs past the 8 minute limit. The Mech with the higher HP at the match's end wins. A Mech must have scored at least one hit upon its opponent to be eligible for a win. If neither Mech scores a hit during the match, winner will be determined by coin toss or any other random method.

6. If at the end of the match both Mechs have equal HP remaining, the winner will be determined by a coin toss or other random method.

7. Mechs will start in opposite corners of the arena facing the center. The corners will be masked off with 3'x3' squares taped on the floor, a Mech will start in the center of the square. All of a Mech's feet must fully cross the corner tape before it can score a hit on its opponent.

8. Competitors reduce an opponent's HP by scoring hits on an opponent's target plates

9. The scoring system will not score more than 1 hit per second, regardless of how often it is hit. This is determined by the software running on the Transponder board.

10. (Optional Rule - to be determined by the Event Organizers prior to the event start) Each target plate will score up to 15 hit points. This is determined by target system software. Additional hit points can be scored on other target plates. This is meant to promote mech movement in the arena and avoid a standing shootout between two mechs.

11. (Optional Rule - to be determined by the Event Organizers prior to the event start) If a Mech health points are below 10 hit points the Mech will regain a health point for every 30 seconds no hits are registered. If a Mech health points are below 5 hit points the Mech will regain a health point for every 15 seconds no hits are registered.

12. A collision or knock over will score as a hit if the scoring transponder detects it. During the event that your Mech falls over and is unable to right itself, the match will be paused while the Mech is assisted. Bipeds are penalized 1 HP of damage, quads are penalized 5 HP. The clock will not stop during any assistance.

13. If a target plate, properly mounted according to Section VII.a.3, should fall off of a robot, the plate will be re-attached, and the Mech will be assessed one hit point.

14. Forfeit: If you feel you cannot continue the match for whatever reason, you have the option of forfeiting the match.

15. Spectators/team members will be able to view the full arena and match, however they cannot provide hints, tips or assistance to pilots. Any team member viewing the match directly and giving information to their pilot will cause an immediate forfeit of the match. The only people allowed to communicate with the pilots are refs and MW event organizers.

16. In all matches, at least 1 event organizer and at least 1 referee (who will be or be appointed by the event organizers) will oversee the match.

17. MW event organizers have the authority to request any MW competitor not currently competing in the ongoing match to turn off any wireless transmitting device (WiFi Routers, Wireless IP

Cameras, Scoring Transponders, and/or Wireless 5.8 GHz video transmitters) during a match to reduce wireless interference.

Section VII – MWScore Transponders
Scoring Transponders shall conform to the Robogames 2013 Mech Warfare event. Certified target plates will be loaned to each competitor.

1. **Target plate specifications:**
    1. Full sized target plates are 3.5"x3.5", with an active area of 3.5"x3", weighing approximately 34 g. Half-size plates are 1.75"x3.5".
    2. Quadrupeds must carry 4 full-sized plates, one on each side of the body. Bipeds must carry a full front and rear plate, as well as half size plates on each side of their body or arms (depending upon which provides an unobstructed view). Light weight Mechs will carry one half size plate on each side of the robot mounted in a vertical or horizontal orientation.
    3. Target plates must be reasonably and FIRMLY mounted on a Mech, with their entire face located between 2" and 22" off the ground, and not obscured by any limbs. Plates should be mounted on a flat, vertical surface, using two vertical strips of 3.5" length velcro, so that the target plate is perpendicular to the ground. (An in depth description of Target Plate mounting will be posted on the Trossen Robotics Mech Warfare forum prior to the event. In any case, if you have any questions on Target Plate mounting, contact the event organizers.) Target panels cannot be mounted to legs. Use common sense when choosing a mounting location, and keep in mind the spirit of the game. If you are firing on an opponent, they should be capable of hitting your scoring plates. Every effort should be made to have all target plates on a Mech in the same vertical plane. If a mechanical design exists that does not allow for this, full plates can have no more than 1" of vertical separation. This cannot be used to specifically give a Mech a defensive advantage.
    4. In order to allow autonomous bots, and those using visual tracking, competitors may bring a visual fiducial of any color which may be applied to an opponent's target plates using tape of any color. Fiducials should be no bigger than 3"x3". As these fiducials may become damaged during use, it is suggested to bring a decent quantity of them with you.
2. **MWScore transponder unit specifications:**
    1. Transponders are approximately 1.75"x 1.75" weighing approximately 13 g.
    2. The unit requires a power connection capable of providing 6-20 (max) VDC at up to 500 mA.
    3. The unit will send out a 50, 100, 150, or 200ms high pulse (depending upon which target panel is hit) each time it reports a hit. This can be tied into your robot to allow your control solution to register hits.
    4. The unit will be programmed with the appropriate firmware and ID information when distributed. The Event Organizers reserve the right to require firmware upgrades at the competition, so be sure that the In-System Programing header on the transponder is easily accessible.

5. A separate LED sub-board is required and included with the scoring system. It must be mounted facing up in a clearly visible area, preferably the top of the Mech. All efforts should be made to ensure it is visible from all sides of your Mech. If your mounting is questionable, get it approved by an event organizer prior to qualification. The purpose here is so that both humans and opposing Mechs have a visual indicator of when a Mech is taking damage. Generally speaking, protecting this with a clear piece of thin lexan or PTFE is advisable.
6. Scoring displays will be set up in locations visible to both competitors and spectators.

Section VII – Safety
1. When outside the competition arena, all guns must have a physical barrel lock in place which prevents BBs from being fired. Failure to follow this rule, as observed by the MW event organizers or appointed officials, will result in a warning to the violating Mech Warfare team. A second violation will result in disqualification from the MW event.
2. If at any time outside of the competition arena and observed by the MW event organizers or appointed officials, a gun is fired and a BB exits the gun (not stopped by the barrel lock) the violating Mech Warfare team will be disqualified for the remainder of the event.
3. Ultra-bright lasers (greater than a class 2 laser) are prohibited. All lasers must have an off switch or cover when they are outside of the arena.
4. When inside the competition arena, safety glasses must be worn. Safety glasses will be provided for use by the MW event organizers.
5. Anyone entering the competition arena must receive approval from the MW event organizers or appointed officials prior to entering the ring.
6. A small tent will be provided at Robogames to test fire your gun for debugging and calibration purposes. The Mech with the gun can be placed inside the tent and the tent zipped up to prevent projectiles from escaping. The tent walls are netted so the results can be observed.

Section VIII – Record of Changes

1. June 22, 2009 - Document created from 2009 rule set
2. June 23, 2009 - Slight changes, notes added. Removed weight limit (we will have weight classes some day).
3. July 29, 2009 - Final highlighting changes before release to general public.
4. December 7, 2009 - Revision for final release.
5. April 6, 2010 - Actually posted (yay!)
6. April 27, 2010 - Began revisions for 2011
7. May 24, 2010 - Posted draft for 2011
8. September 22, 2010 - Revision for final release.
9. April 9th, 2012 - Revision for final release.
10. April 26th - Revision for 2013 Ruleset.
11. January 20, 2016 – Draft Revision for the 2016 Robogames Mech Warfare Event
12. January 30, 2017 - Draft Revision for the 2017 Robogames Mech Warfare Event