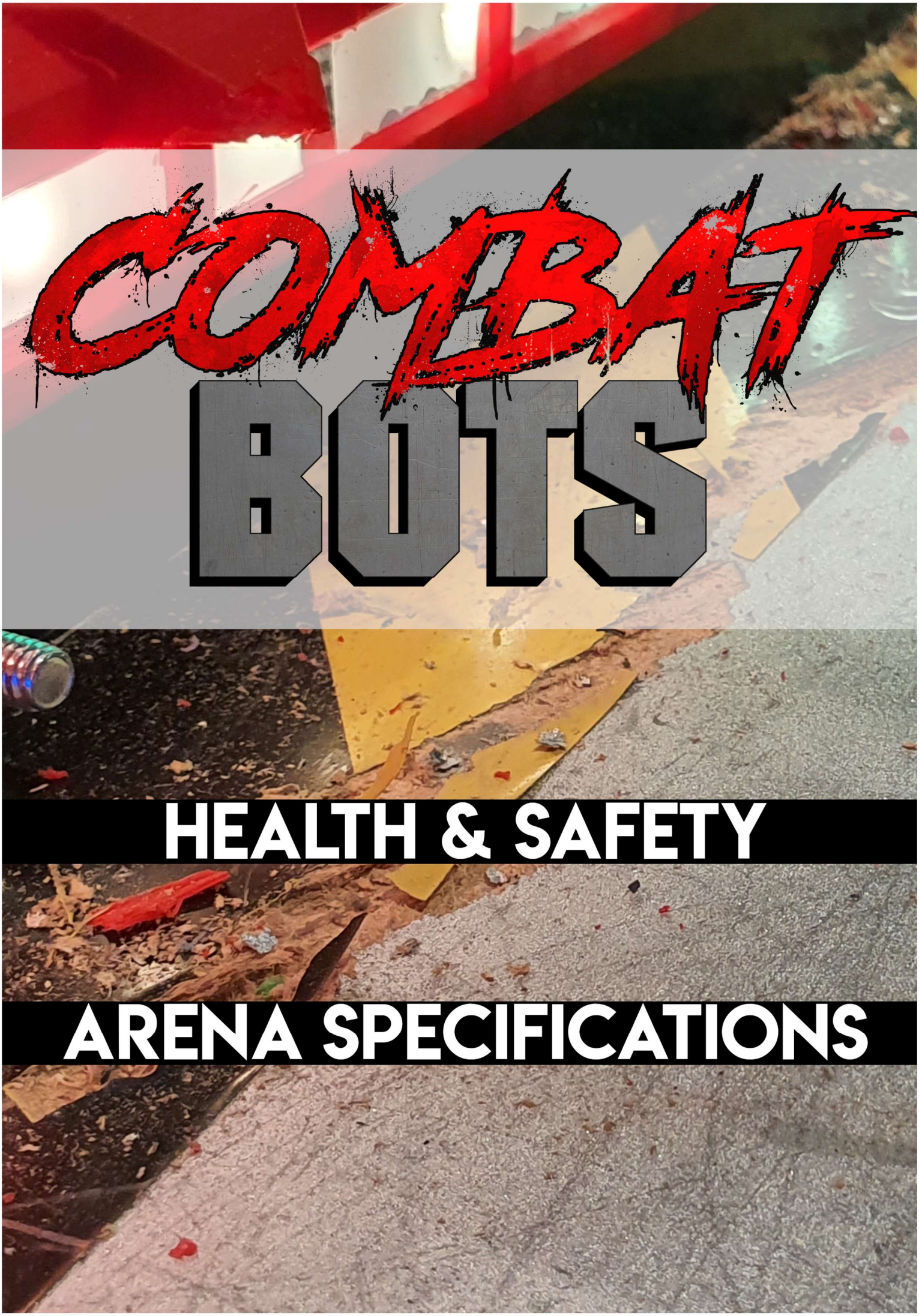
COMBAT
BOTS
HEALTH & SAFETY
ARENA SPECIFICATIONS

INTRODUCTION:

The 'Combat Bots' competition is a high energy competition which features 150g, ant-weight category, robots destructively fighting each other. This has a lot of risk as weapons can be sharp, rotate at high speeds and can store a lot of energy. As such, all operations of these robots must be performed within a safe, contained environment. This environment must be built to withstand any weapon type that could be produced by the combat bots competing and must be transparent to allow for competitors to watch and follow their robots.

Figure 1- Combat Bots Arena MK1 Clean

The battle arena must be large enough to comply with the standardised rules associated with the ant-weight fighting robot rules and regulations.

ARENA RULES:

- All battles must take place in an arena, regardless of weapons being used in the battle.
- Arena doors must be closed before any fight begins, regardless of weapon type.
- An arenas safety enclosure must fully enclose the arena during fights.
- 4mm polycarbonate is the minimum recommended thickness for an arena safety enclosure.
- Small sacrificial kick plates are recommended where the arena fighting surface and external walls meet.
- The arena will be a raised platform with a recommended area of at least 30 inches (762mm) square.
- It is recommended that at least 25% of the edge of the arena must be un-walled, to allow robots to drop directly into the pit or drop off that surrounds the arena.
- The minimum recommended gap in the arena floor for pits and drop offs is 140mm.

ARENA FLOOR:

Figure 2- Damage caused to the Arena Floor

The arena floor is the aspect of the arena that is prone to receiving the most damage and is recommended to be easily replaceable. The floor surface ideally needs to be one that has a high friction to allow robots to grip. It is also recommended to be fire-proof or fire sealed as there may become an occasion in which a Li-Po battery is punctured, and a fire is generated. Fire Retardant Plywood/MDF or with an appropriate sealant coating is recommended with a floor thickness 15+mm. This is because robots with cutting blades or disks may cut deep into the floor.

ARENA WALL:

The Arena wall is recommended to be built up of 2 stages. An inner, kick plate, layer and an outer layer. The inner layer may be subject to direct high energy contact from robots and weapons. The outer layer may be subject to indirect high energy contact from robots and weapons.

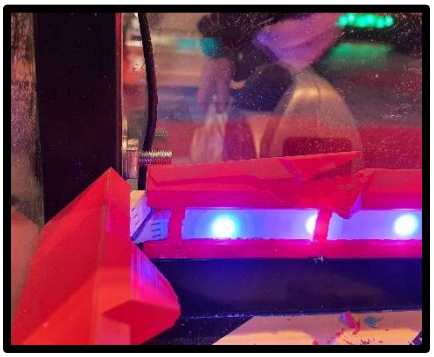

Figure 3- Damage caused to the Arena inner wall

Inner layer: This can be any material; however, it is recommended to have a maximum height of 75mm. This is to allow for robots to be thrown over it to be immobilised. If the arena features a pit, this is not necessary.

Outer Layer: The outer layer of the arena must enclose the entire arena and be made from high strength, transparent, polycarbonate. Other materials are available; however, they may shatter due to their brittle nature. Polycarbonate has a high impact strength and is the main protective element to protect competitors and spectators. This must be at least 4mm thick and shock mounted. Shock mounted means that there are rubber bushings between its mounting and the frame of the arena. This is to allow the material to flex, as this will disperse a lot more energy, reducing the damage to the wall, and the risk of breaching.

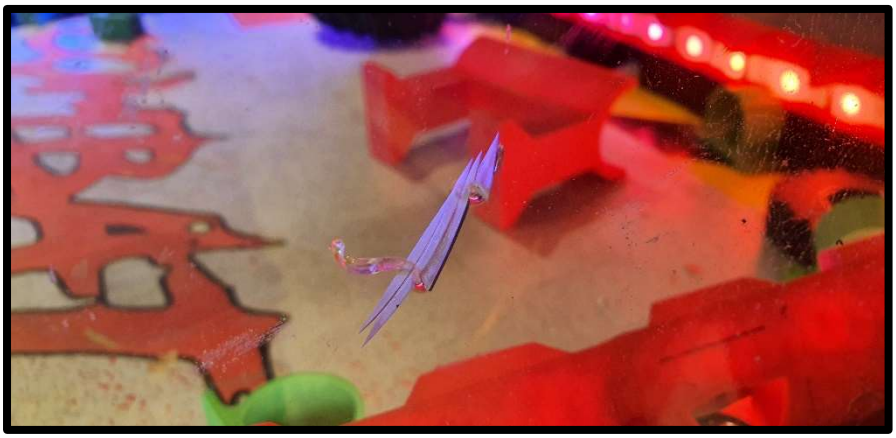

Figure 4- Damage caused to the Arena polycarbonate enclosure

ARENA HAZARDS:

Figure 5- Robot immobilised in the pit

Pit: The pit needs to be large enough for a robot to drop into, without any means of getting out. The pit also must be formed from a strong box in which the robot would fall. Robots that fall into the pit may have high energy weapons and as such the pit needs to be able to resist these impacts. It is recommended for the pit to measure equal or greater than 150mm square. The pit must be activated remotely, either electronically triggered, or by remote latch, to prevent any risk to a user opening the pit.

FIRE SUPPRESSANT:

The is a high chance that a battery may be penetrated in a combat bot competition, as such, fire suppressant is required during any operation of the arena or multiple robots. Many robots choose to use Lithium battery packs. These batteries can leak electrolyte if punctured and this consists of a lithium salt in an organic solvent (lithium hexafluorophosphate) which is highly flammable. These batteries contain very little, or no metallic lithium and as such a class D fire extinguisher is not required. For best results dowsing a Li-ion fire, use a foam extinguisher, CO2, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate) as you would extinguish other combustible fires.

Figure 6- Damaged Li-Po Battery

If the fire of a burning lithium-ion battery cannot be extinguished, allow the pack to burn in a controlled and safe way.

COMBAT BOTS ARENA MK1

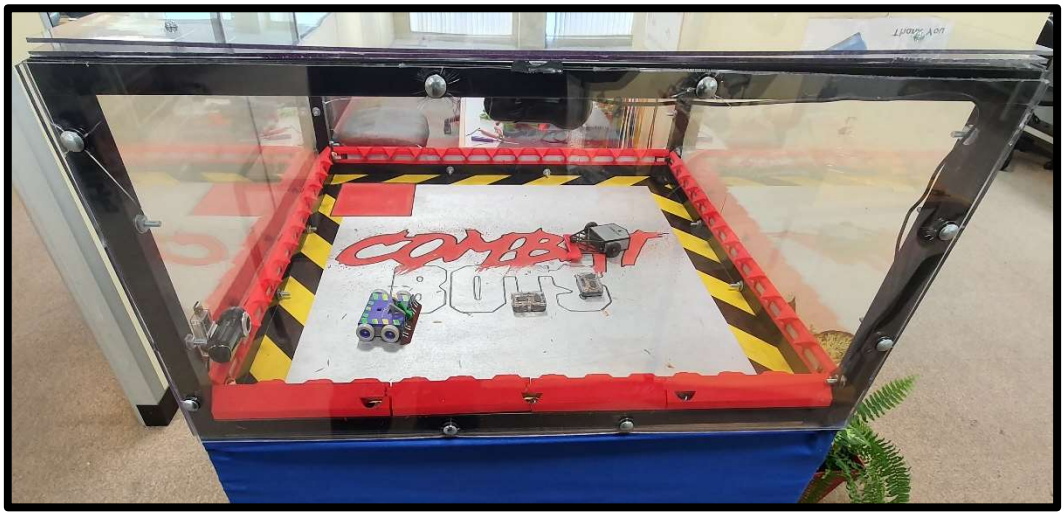

Figure 7- Combat Bots Arena MK1 - Full Arena

For the initial competition, the Combat Bots arena featured double shock mounted polycarbonate. This included 2 layers of 4mm thick polycarbonate, separated by rubber bushings. The arena floor was 16mm thick and featured 2 layers of treated MDF. A top ‘stage’ layer, and a bottom reinforcement layer. The inner arena wall was made from two parts. The lower part, which

was also the main structure for the arena, was 25mm tall and made from 25mm square aluminium box section. This featured additional extended bolts to act as arena hazards. The top half of the inner arena wall was 34mm tall. This was a 3D printed section featuring sharp edge spikes and an addressable strip of RGB LED lights shielded behind a 4mm thick frosted polycarbonate layer.

The highest kinetic energy achieved by a combat bot that entered this competition was over 200 joules. This was high enough to penetrate through the inner layer of the double shock mounted arena enclosure but could not exit through or penetrate the second layer. As a safety precaution, the arena enclosure has now been changed to a single, shock mounted, 8mm thick polycarbonate layer. All other aspects of the arena proved to be suitable.

Figure 10- Damage caused to the aluminium arena frame

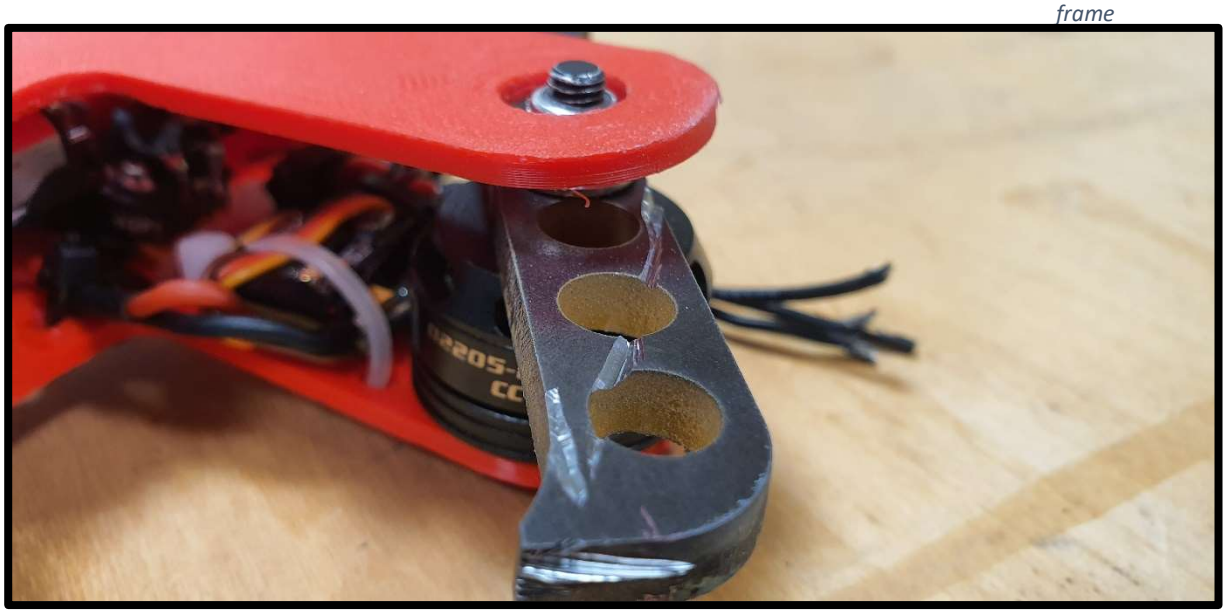

Figure 9- Damage caused to the 5mm mild steel blade of the robot 'deadline'

Figure 8- Damage caused to the weapon motor of the robot 'Deadline'