

# Rotary Racer 10 Build Plan - 2016

## 1. Introduction

This is a overall build plan for RR10

## 2. Objectives

1. To design and build a car more efficient than RR9 and go more miles than RR9.
2. To match the new 2016 rules.
3. To try and win races and the national final.
4. To have as much younger team member involvement in the build as possible at all stages.
5. Try and keep RR9 intact at least until RR10 is ready to run. Maybe RR9 can be modified for F24+ in the future ?

## 3. Research and Design Ideas

1. Generally the same as RR9, build on top of that design.
2. Safe (Good roll-bar, Drivers safety cage, side impact bars, roll resistant etc).
3. Needs to be more aerodynamic than RR9. Experiment with different 3D CAD designs in VWT to get better shape.
4. Better balance weight on wheels by moving batteries forward to just behind front wheels. (No longer need to change batteries in a race).
5. Lighter as much as possible.
6. Should fit up to about 1.850m tall drivers (adults).
7. Rotating lower front wheel fairings ??
8. We could look at making the car bodies top and sides in one piece carbon fibre or other material instead of using plywood and foam.

The Shape changes are:

1. Body curves downwards more after front of cockpit opening. This reduces drag from cockpit with the larger cockpits now in use.
2. Less sloped underside bot in the front and rear.
3. Fully enclosed front wheels.
4. More curved in sides behind rear wheels as wheels are further forward.

## 4. Design

1. Generally the same as RR9, differences below.
2. Use same basic chassis design as RR9, 25.4mm aluminium tube with plastic bung joints. Same basic shape but with modifications to shape from 3D CAD/VWT work. Should have a drivers "safety cage".
3. Same rear rollbar/axle design but more sloped with rear wheels further forward to improve rear aerodynamics. (Maybe have arms holding axle further forward ?)
4. Motor mounted to rear of rollbar where there is more space now batteries have moved forward. Provide enough movement for F24+ gearing.
5. Look at ways of simplifying gearing and/or a gear change mechanism. (With motor behind there is more

room for this possibility). Use 8mm chain.

6. Batteries fitted in just behind front wheels.
7. Same basic steering arrangement, with slightly less caster angle as front weight is higher and king pin inclination will provide higher self centring forces.
8. Floor made with good quality 3mm ply with CarbonFibre/Kevlar strengthening under driver. Could go with full CarbonFibre/kevlar floor if we get extra money.
9. Bonnet made from 3mm ply. Could use a carbon fibre/fibreglass shaped bonnet with integrated windscreen. Hinged by driver.
10. Use foam for sides, perhaps hollowed out for weight. Could make some carbon fibre sides in the future.
11. Fully enclosed rear wheels. Shaped ply/cf moulding or other to fit over the wheel opening and fair in the top of the wheel.
12. Fully enclosed front wheels. Shaped ply/cf moulding or other to fit over the wheel opening.
13. Use 16inch wheels. Make new ones so RR9 can continue and so we have some spares.
14. Tail could be detachable for ease of transport.

## 5. Electronics

1. Use GpSpeed controller.
2. New electronics driver display and buttons.
3. New main controller with GPS and Telemetry modules on single STM32 board.
4. Radio comms to driver.

## 6. Materials

Material	For	Have
Ali tube: 25.4 x 1.6 mm	Main chassis	Yes
Steel tube 25.4 x 1.6mm	Rear subframe, front steering bits. Rollbar seamless cold drawn steel tube.	Yes
Plywood 3mm	Floor and top surfaces	
Plywood 8mm	For front bulkhead	
Carbon/Kevlar Fibre	For floor strengthening, bonnet and body parts	Yes
Epoxy resin	For floor strengthening, bonnet and body parts	
Bungs	Main chassis bungs	Yes
Bung bolts		Yes
Steel bar	For front steering bits	Yes
Aluminium bar, 25.4mm	For rear axle	May have ?
Joystick parts	Steering	May have ?
Ball joints	Steering.	Yes
Wheels	Need rims and spokes have hubs	Yes
Wheel bolts (12mm ?)	Hardened steel bolts	
Nuts,Bolts and Screws	General	
Aluminium sheet	General	

<b>Material</b>	<b>For</b>	<b>Have</b>
Cloth and webbing	Seat	
Harness	6 Point Harness	
Foam	For nose cone and sides	Yes
Foam protection	Beside driver	
Gears and chain	Drive	
Motor	Have old one (needs testing)	Yes
Wheel gear mount	Aluminium turned	
Throttle, wiring, electronics	Control	

## **7. Build**

### **7.1. Plans**

1. Create 2D tube plans from 3D design.
2. Look at where to put and fasten components.

### **7.2. Chassis**

1. Bend top tubes to shape. Cut to final length at the end.
2. Cut cross members to length (Tube cutter, Minus tube end shoulder lengths).
3. Fit tube ends (punch depressions to hold in place and/or self tapping small screws).
4. Drill holes for bolts in tubes (6mm inside, 10mm outside ?)
5. Bolt together.

### **7.3. Steering**

1. Make kingpin top in lathe.
2. Make kingpin bottom in lathe.
3. Make wheel mount in lathe/mill.
4. Cut kingpin tube.
5. Weld wheel mount to bottom part.
6. Braze tube to parts.
7. Drill wheel axle hole and tap.
8. Make brake calliper mount plate and fit (Mount wheel with disk and brake calliper to align).
9. Make steering lever and weld in place (Get Ackerman angle correct and steering gearing correct).

### **7.4. Rollbar and rear axle**

1. Bend rollbar to shape. (Could do externally ?)
2. Make rollbar cross member.
3. Weld at top and cross member.
4. Cut and weld top and bottom chassis mounting tubes.
5. Make chassis mounting brackets and weld in place.
6. Make axle tube and weld in place (Make sure length is correct and is level !).

7. Make axle stubs from 25.4mm aluminium bar (Lathe, drill and tap 12mm).

## **7.5. Joystick steering**

1. Cut aluminium bar and tube to length.
2. Mill groove in bar for pin.
3. Weld joystick handle to bar (external ?)
4. Make pin mounting and dual pins (dual for safety).
5. Make clamp mounting (Cycle seat clamp).
6. Make tie rods and fit
7. Make over tie-rod covering sheets and fit (aluminium sheet).

## **7.6. Wheels**

1. Lace wheels (see separate info).
2. Axles bolts need to be purchased and Allen heads ground down to fit.

## **7.7. Fit Wheels and Brakes**

1. Fit disks to wheels.
2. Fit callipers to kingpins and align.
3. Fit brake lever and brake cables and adjust.

## **7.8. Motor Mount and Gears**

1. This needs to be designed and made.
2. The gears need to be purchased and the grubscrew holes drilled and tapped.
3. The Wheel gear mounting needs to be made (Lathe aluminium bar).

## **7.9. Seat**

1. Sew seat material with internal padding and webbing reinforcing straps.

## **7.10. Nose Cone**

1. Front 8mm plywood bulkhead needs to be cut and fitted to the front of the chassis.
2. The foam nose cone needs to be made with layered foam and shaped.

## **7.11. Top and bottom**

1. Cut 3mm ply to shape and fit with CS self tapping screws to tube.
2. Finally trim edges to match tube outer with aluminium sheet applied.
3. Add carbon/kevlar to area underside driver glued to ply and tubing.

## **7.12. Battery mounts**

1. Make battery mounting boxes (Ply/carbon/kevlar ?).
2. Fit to car and tubes.

### **7.13. Electronics mounting**

1. Make electronics mounting boxes (aluminium sheet).
2. Fit switches, breakers and fuses.
3. Fit electronics.
4. Fit motor cooling fans.
5. Fit wiring.

### **7.14. Aluminium/Foam sides**

1. Cut aluminium sheet to fit sides.
2. Fit aluminium sheet with pop rivets.
3. Cut foam to basic shape.
4. Glue together front pieces with epoxy glue (thin).
5. Rout foam and glue in plywood mounting plates.
6. Fit foam to tubing with screws into plywood plates.
7. Shape foam to shape wanted and to top and bottom plywood.

### **7.15. Wheel covers**

1. Cut 1mm plywood to shape.
2. Rout foam to allow fitting with smooth shape.
3. Reinforce plywood with carbon fibre.
4. Fit to car with Velcro pads (Indent foam with router for pads).

### **7.16. Tail, Fairings and mirrors**

1. Fit internal 1mm ply sheets to cover wheel openings.
2. Make tail and fit.
3. Make and fit behind head fairing.
4. Make and fit fairings as needed.