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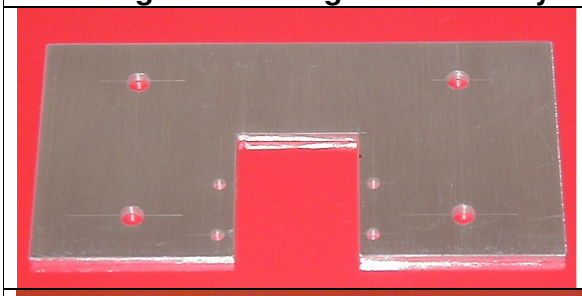
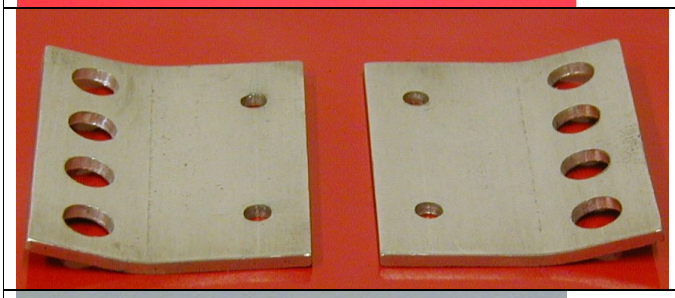
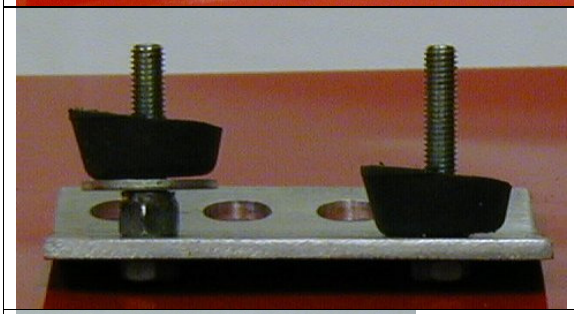
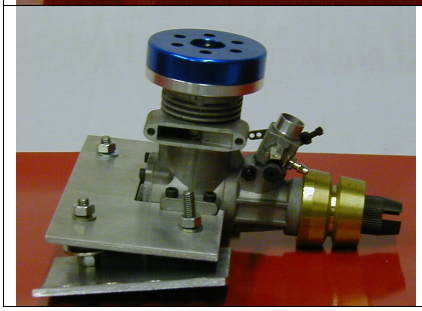
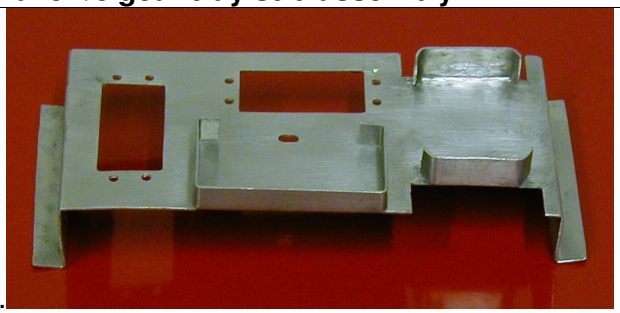
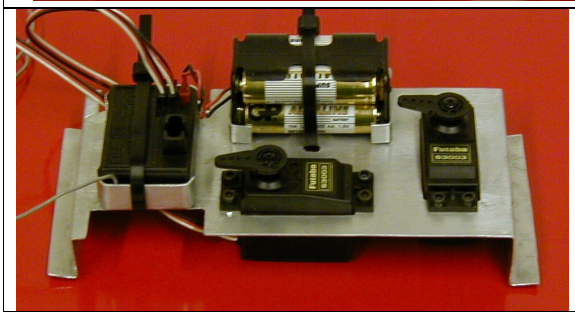
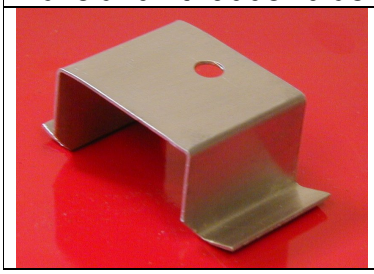
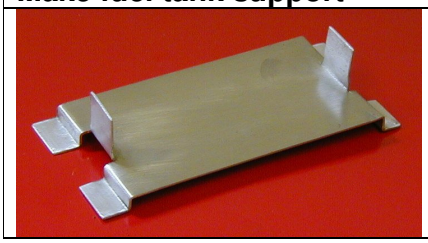
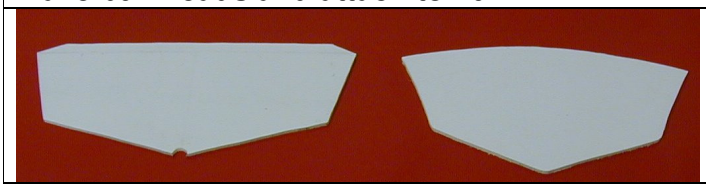
I.C. CRAFT BUILD GUIDE

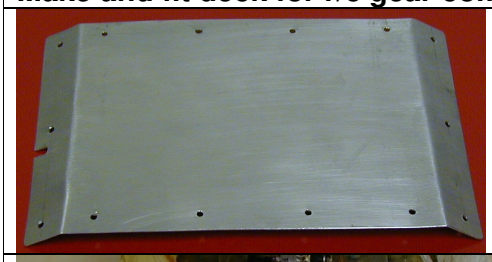
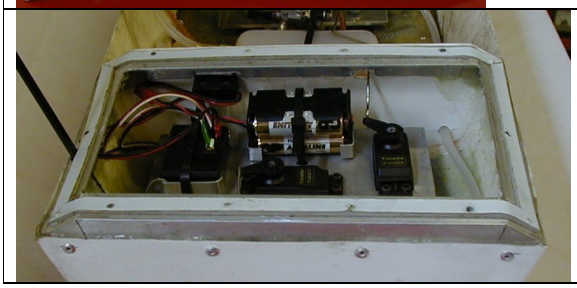
These are not line by line instructions, but an outline of the critical stages in producing a boat that will perform reliably. You can change many details to suit your own design, but it is a good idea to follow the basic stages to get a working boat fairly quickly.

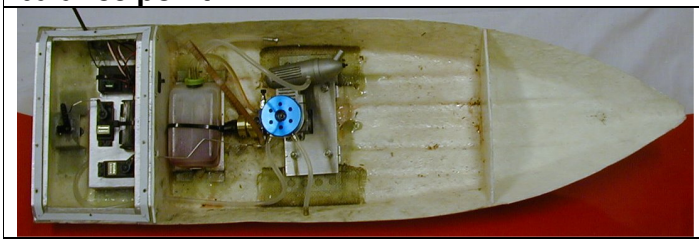
Exact dimensions are not critical; it is better to scale the components to fit the engine and hull. In total it will take about two days to produce a working craft, and from there you will have to allow plenty of time to test the engine and handling before Race Day.

Stage	Description
Make engine mounting sub-assembly	
	**Engine mounting plate** Material: 3mm aluminium sheet
	**Engine supports** Material: 3mm aluminium sheet Bend to suit hull shape (Large holes are to improve bond to hull)
	**Shock absorbers** Material: Rubber feet 20mm dia x 10mm thick Cut feet to desired angle with craft knife Fix screws tightly with nyloc nuts
	**Engine sub-assembly** Use washers as spacers Use nyloc nuts **Important**: Remove nut from back of flywheel before attaching coupling tightly (hold flywheel in vice)

Make r/c gear tray sub-assembly 	Material: 1mm aluminium sheet Bend feet to suit hull shape
	Assemble components to tray Attach receiver and battery pack with cable ties Adjust angle of actuator arms if necessary
Make and fit rudder bracket 	Material: 1mm aluminium sheet Bend feet to suit hull shape Attach to hull using fibreglass and resin
Make fuel tank support 	Material: 1mm aluminium sheet Do not attach to hull yet
Make bulkheads and attach to hull 	Material: plastic sheet or thin plywood Make holes for r/c switch, throttle linkage and cooling water pipe before fitting Attach to hull using silicone sealant (rear bulkhead 150mm from stern)
Cut slot in keel for stern tube	Approx position: 110mm to 180mm from stern
Make hole for rudder shaft, and fit rudder assembly	Cut hole in keel directly below hole in rudder bracket Seal shaft sleeve in hull with resin or filler

Make and fit cooling water inlet and outlet	Material: 4mm o/d brass tube Angle inlet tube forwards, and position well aft in r/c gear compartment so that pipe joint is accessible Attach with fibreglass resin

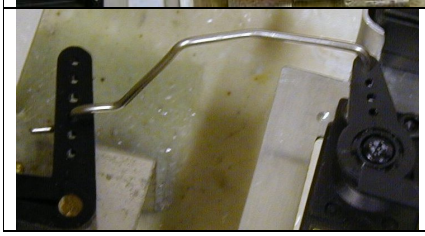
Make and fit deck for r/c gear compartment  	Material: Deck 1mm aluminium sheet Mounting 18x18x2mm aluminium angle **Important:** This compartment must be made as waterproof as possible Attach angle to hull with pop rivets, with silicone sealant behind Seal corners with fibreglass resin Fit sealing strip between angle and deck Attach deck with self-tapping screws

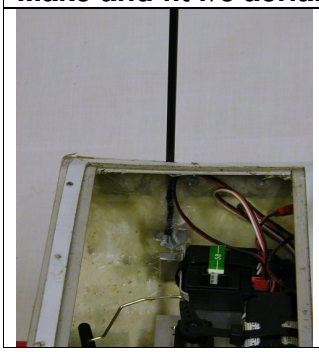
Lay out all components in hull to find fore-aft balance point 	(Photo shows finished assembly) Adjust engine position so that fore-aft balance point (with fuel tank empty) is 35% of waterline length (= approx 242mm) from stern Mark engine position

Shorten stern tube/propeller shaft	Pull bush out of one end of tube Cut tube and shaft to suit engine position, allowing 5-10mm clearance between propeller and rudder Cut M5 thread on shortened end of shaft Reassemble, and attach propeller. Screw up propeller locknut tightly, allowing ½-1 mm clearance to tube Attach coupling to front end of shaft. Ensure coupling drive pin is fixed permanently and cannot drop out

Attach stern tube and engine and fuel tank mounting plates to hull	**Important:** Ensure engine and propeller shaft are aligned Attach to hull using fibreglass and resin Fit fuel tank mounting last Ensure a good bond between stern tube and hull. Add triangular filler piece as shown. Fill gaps with body filler Remember to fit starting belt (it cannot be fitted later!)
	

Fix fuel tank to mountings	Attach with cable tie

Make throttle and rudder control linkages	Material: Stainless steel wire or welding rod Use appropriate holes in arms to achieve required movement Include 'zigzags' to allow final adjustment Ensure throttle linkage can be disconnected easily at carburettor
 	

Make and fit r/c aerial	Material: Flexible plastic tube Thread aerial wire through tube Attach tube to hull with fibreglass resin or silicon adhesive.
	

Attach fuel and cooling water pipes	Ensure fuel supply pipe to engine is weighted inside tank Ensure fuel pipes do not foul starting belt

ENGINE START-UP - CHECKLIST

ON LAND

- Fuel and cooling water pipes connected
- Fuel in tank
- Fuel to carburettor (turn engine over briefly to ensure fuel is drawn through)
- Propeller tight on shaft and turning freely
- R/c gear switched on
- R/c hand control switched on
- Rudder and throttle actuators working, and giving correct movements
- Starting motor correct way round (engine runs anti-clockwise looking at flywheel end)
- Glow-plug electrical supply healthy (plug should glow white / orange; red or dull yellow indicates insufficient voltage and is no good)

IN THE WATER

Cooling water flowing from outlet (amount not critical; full flow better)
Engine fuel mixture has to be rich to give power at the 'top end'

ENGINE FAULT-FINDING

Symptom	Possible cause	Action
Engine will not start	Glow-plug not hot enough (NB: Plug must glow white)	New/recharged battery. Use separate battery for starting motor to avoid voltage drop
	Fuel starvation	Check fuel level Draw fuel into carburettor by turning engine over Check supply pipe in tank is weighted and below surface
	Incorrect fuel mixture	Adjust mixture by rotating black screw on inlet side of carburettor (clockwise = weaker, anticlockwise = richer) NB: If in doubt err towards richness
	Insufficient compression	Check cylinder head bolts tight
Engine will not rotate	Engine seized	Allow engine to cool fully Remove cylinder head to withdraw/check liner Remove front crankcase cover to check big-end bearing Check cooling water flowing before attempting restart
	Propeller shaft seized	Check propeller locknut is tightened against propeller not tube
Engine will not run freely, or dies	Incorrect fuel mixture	Adjust mixture (see above)
Engine will not tick over	Incorrect slow-running setting	Adjust slow running by rotating small black screw on carburettor. Tighten locknut NB: Engine must be warm