



Club Aeromodelling

IIT Kanpur

R.C. HOVERCRAFT



What is a hovercraft ??

Hovercraft is...

- A vehicle capable of travelling over surfaces on a cushion of slow moving, high-pressure air.
- The air is ejected against the surface below and contained within a ***skirt***.
- A propeller *in the vertical plane* used to provide the thrust, to move forward.

Real Hovercraft

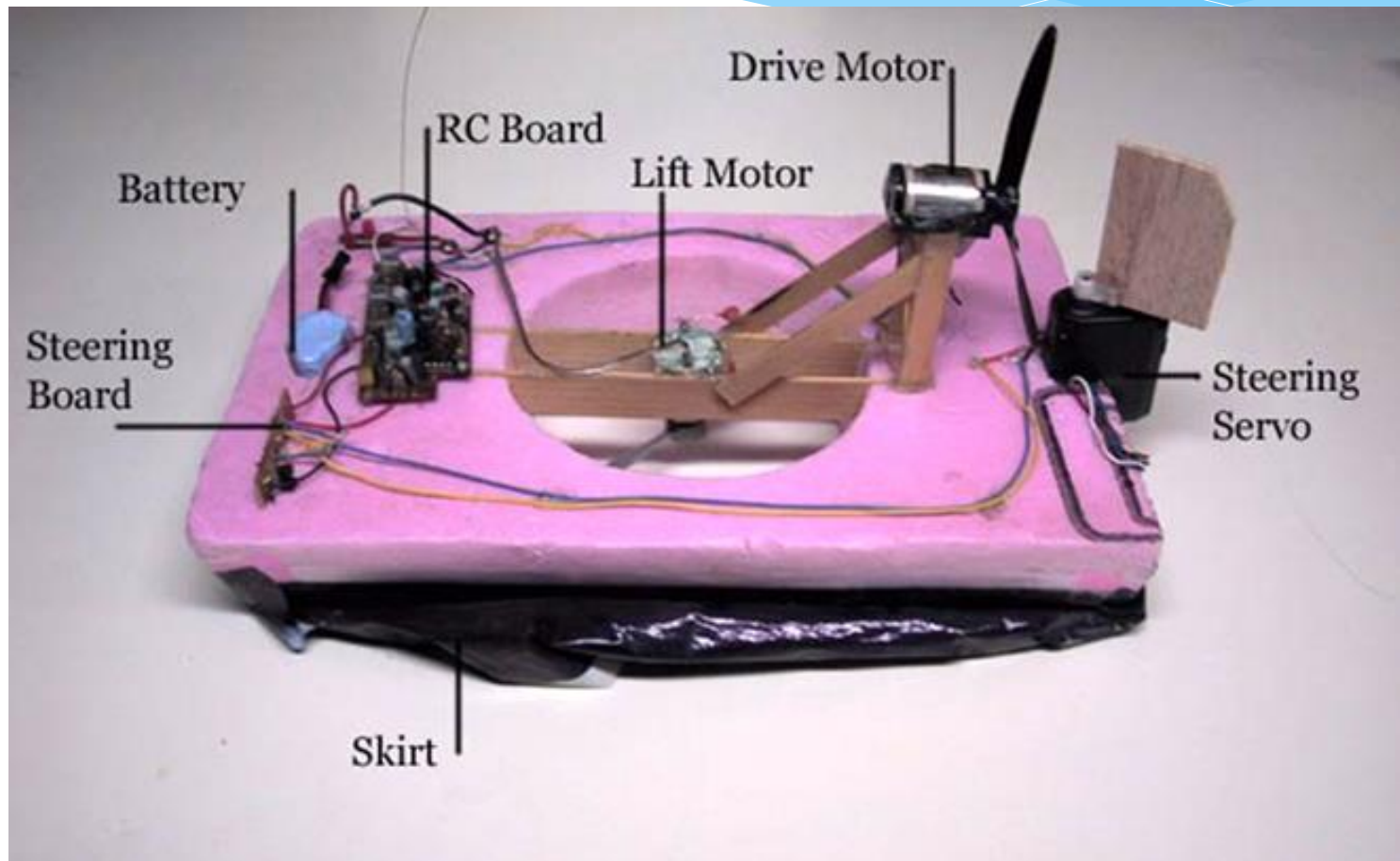


Today's Lecture

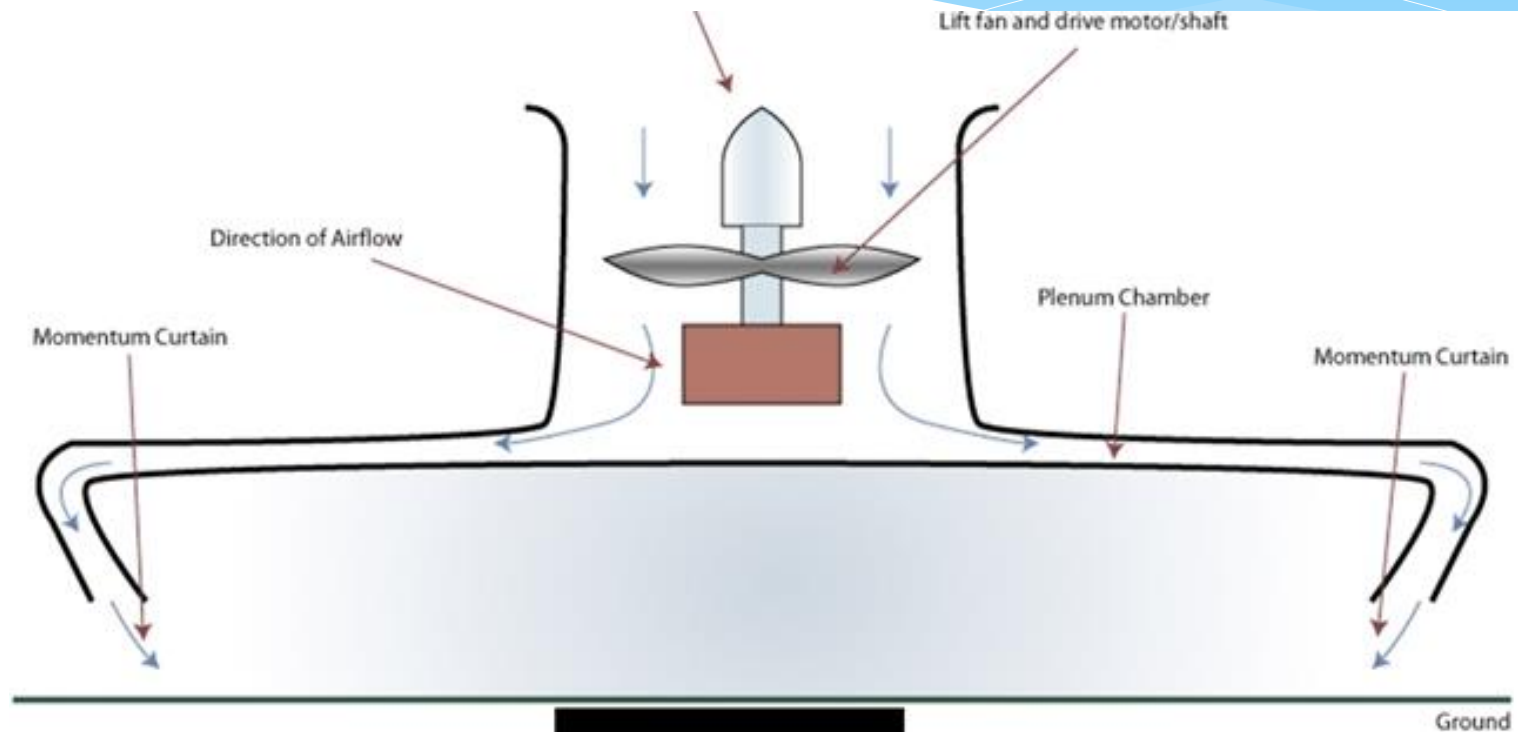
Topics to be covered

- Definitions & Terminologies
- Forces on the craft
- Types of RC hovercrafts
- Hovercraft Controls
- Skirt Design and Lift Generation
- Propulsion design
- How to make your hovercrafts(motor mount, servo mount)
- Duct designing
- Few other designing tips

Basic Terminologies



Forces on Hovercraft



Basic Principles of the Hovercraft:
The Momentum Curtain effect

LIFT

Thrust Mechanism

- Propeller motor system in the vertical plane produces thrust.
- *Thrust mechanism can also be integrated with the lift mechanism of the craft.*

Types of Hovercraft



Single propeller Hovercraft

Multi propeller Hovercraft



Single propeller Hovercraft

- Lift and propulsion mechanisms integrated.
- A vertical/slightly inclined motor propeller system.
- Duct provided to push some amount of air through below the mainframe into the skirt.
- Efficiency depends on better duct designing.
- Lift dependent on thrust.
- Maximizing air flow for *lift*, not compromising on thrust.

Can it hover at a place???

Multi propeller Hovercraft

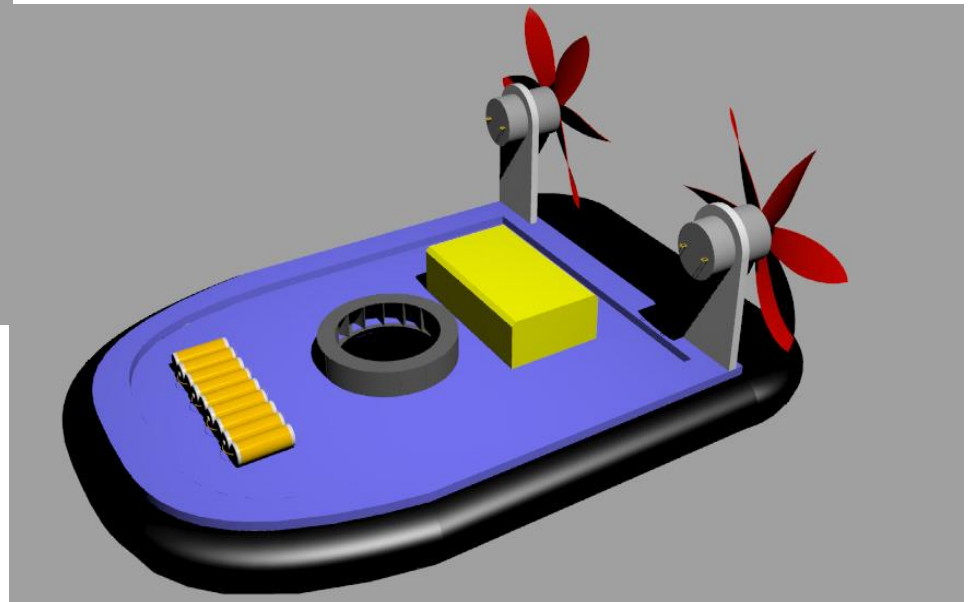
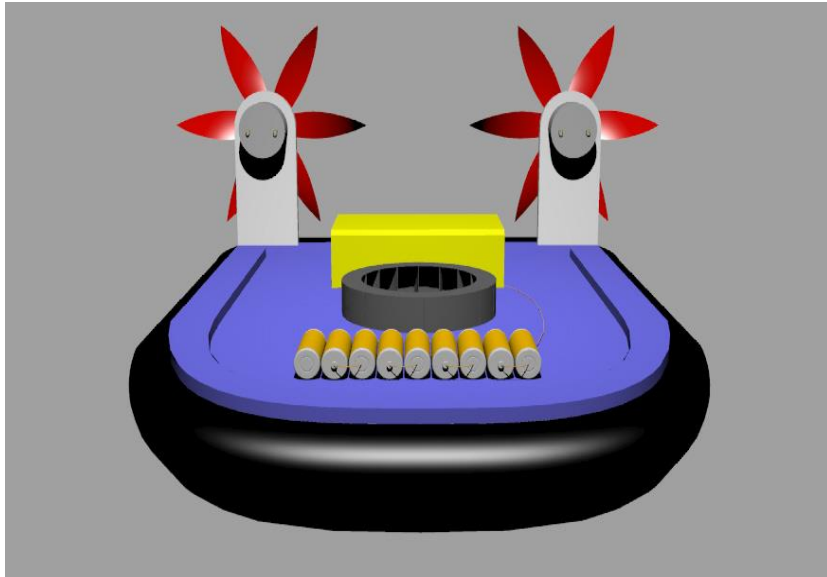
- 2 different motor-propeller systems for Lift and Thrust mechanisms.
- Has the ability to hover at a place!
- Amount of lift independent of the amount of thrust.
- Horizontal plane - lift mechanism.
- Vertical plane - Propulsion mechanism, integrated with controls.

Generally used for large scale purposes.

Controlling

- Speed i.e. throttle depends on the rear vertical motor.
- In case of single propeller crafts, it affects the lift too.
- ***Rudder*** attached, behind the thrust motor to maneuver.
- ***Thrust Vectoring*** can also be used.
- ***Twin thrust motor*** with/without rudders are also used.
- Any other mechanism you might think!!!

Twin motor Hovercraft



Hovercraft's skirt

- ❑ Skirt is made of cloth type material which does not allow air to leak through it.
- ❑ Used to ***contain*** high pressurized air

Skirt sections

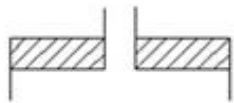


Figure 1a - Strip of fabric skirt

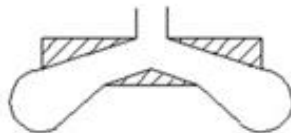


Figure 1d - Coated porous bag skirt

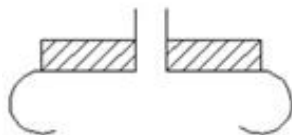


Figure 1b - 'C' type skirt

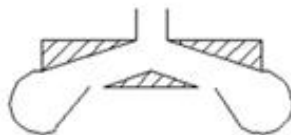


Figure 1e - Vented bag skirt

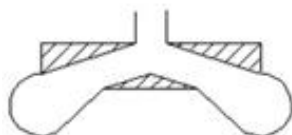


Figure 1c - Porous bag skirt

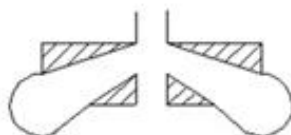
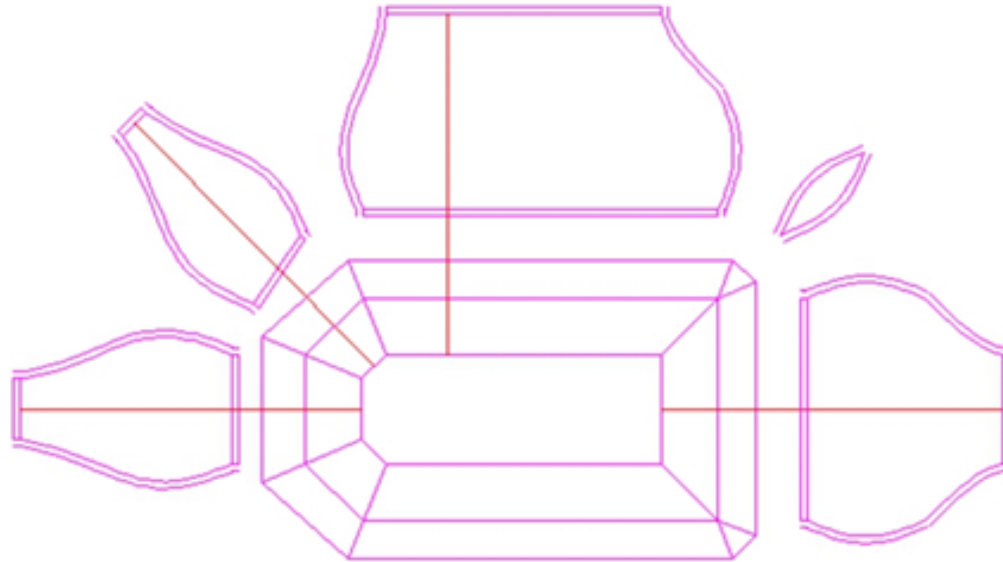


Figure 1f - Enclosed bag skirt

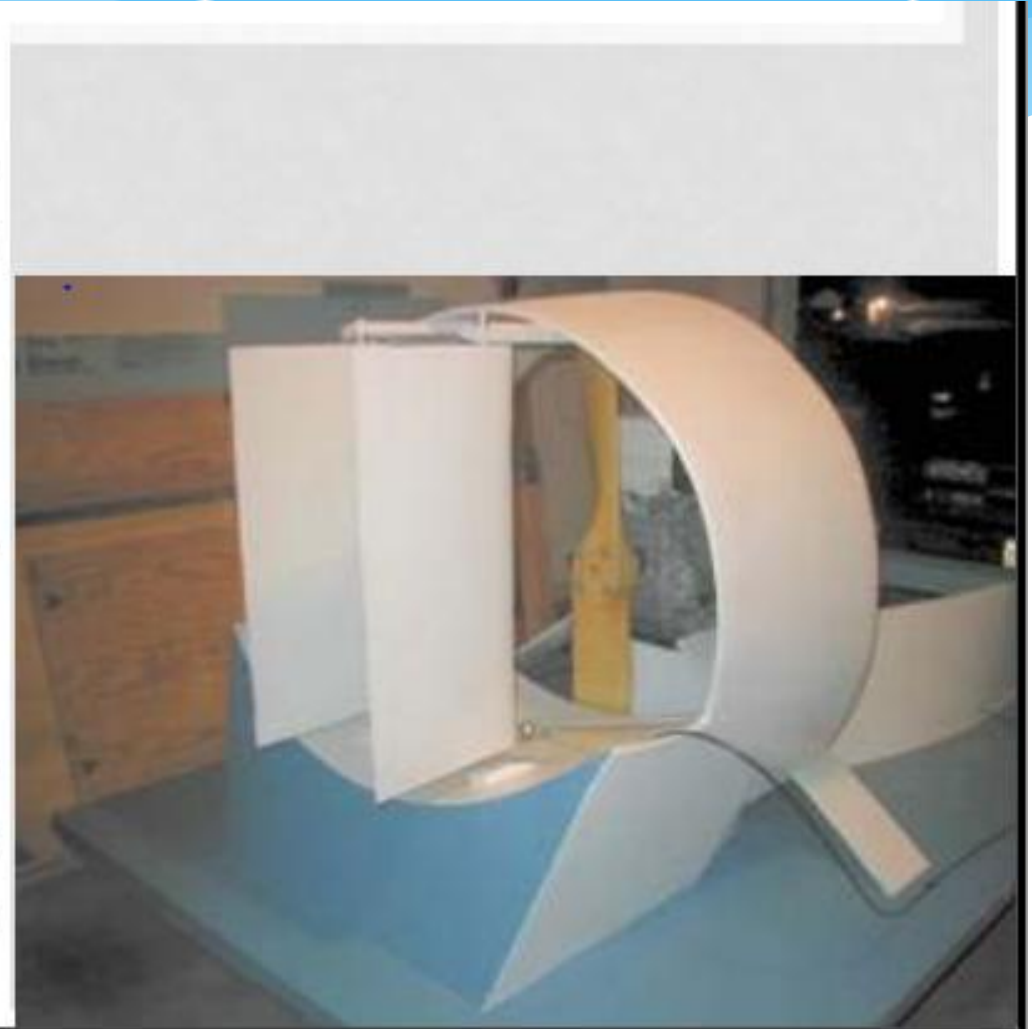
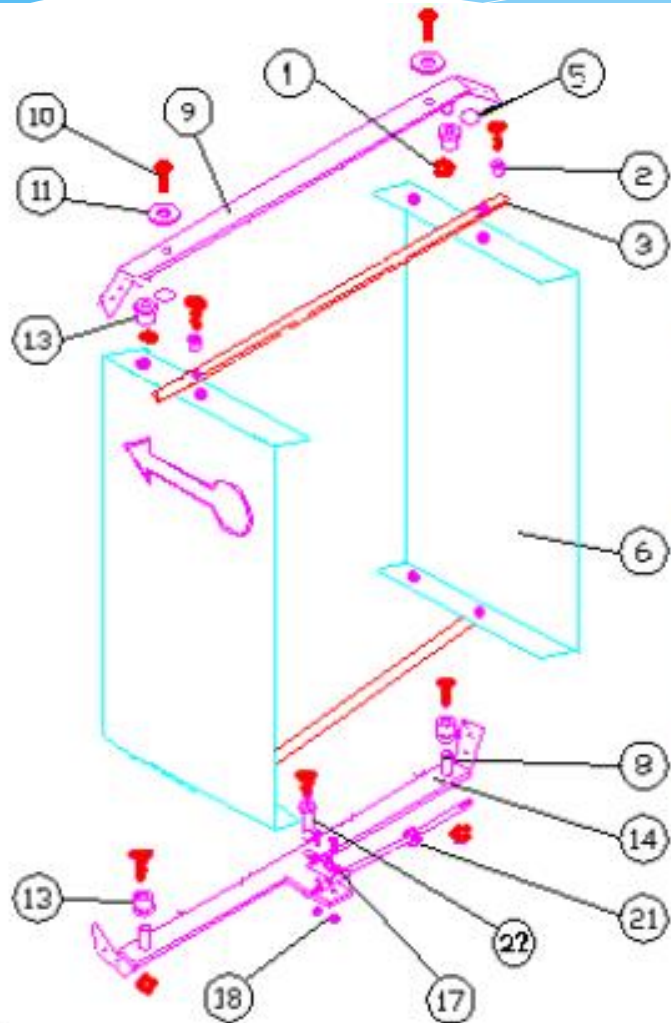


Hovercraft's skirt

- ❑ Notice the curved side parts to give it a wrinkleless blown up shape.

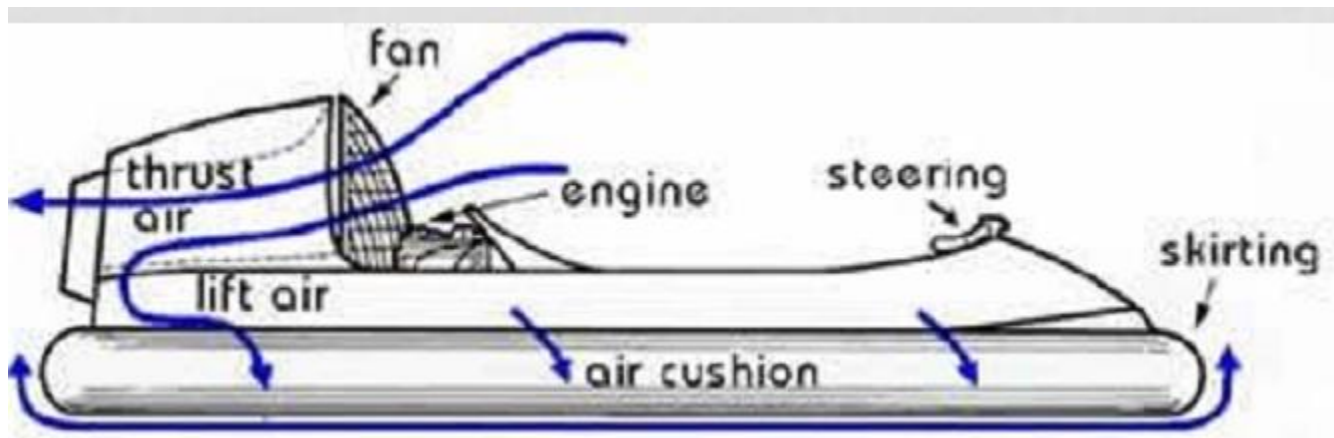


Rudder Assembly



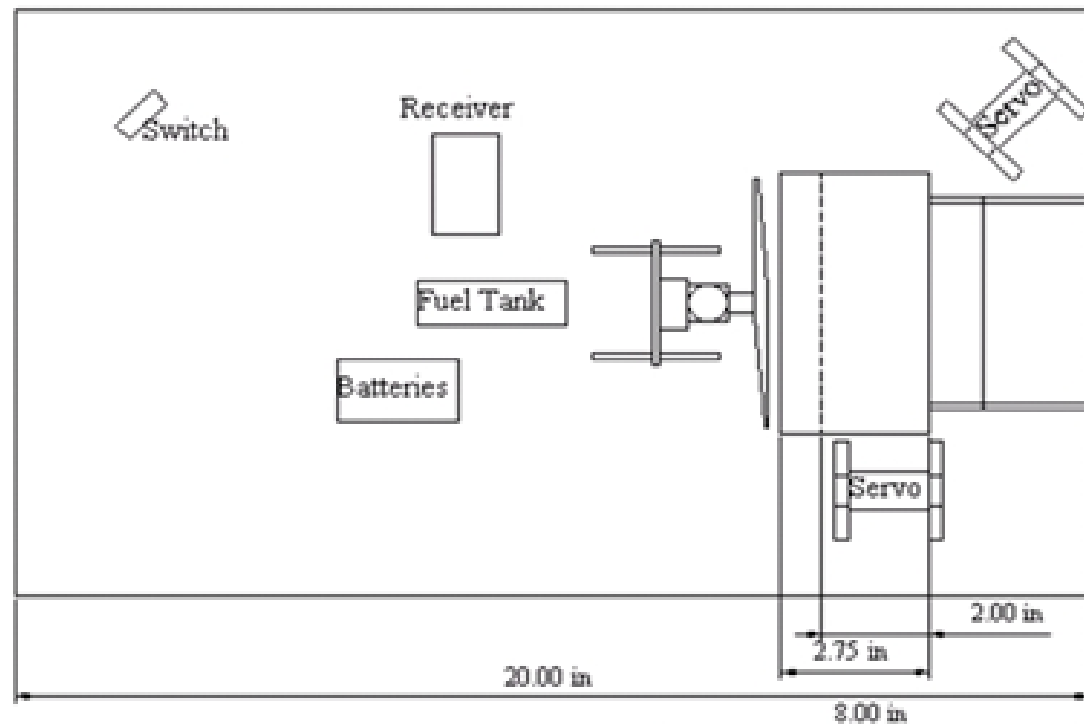
How to make R.C. Hovercrafts in the Workshop?

- ✓ Overall dimensioning
- ✓ Designing (making a plan)
- ✓ Part dimensioning
- ✓ Duct designing
- ✓ Get it verified from your *guide*



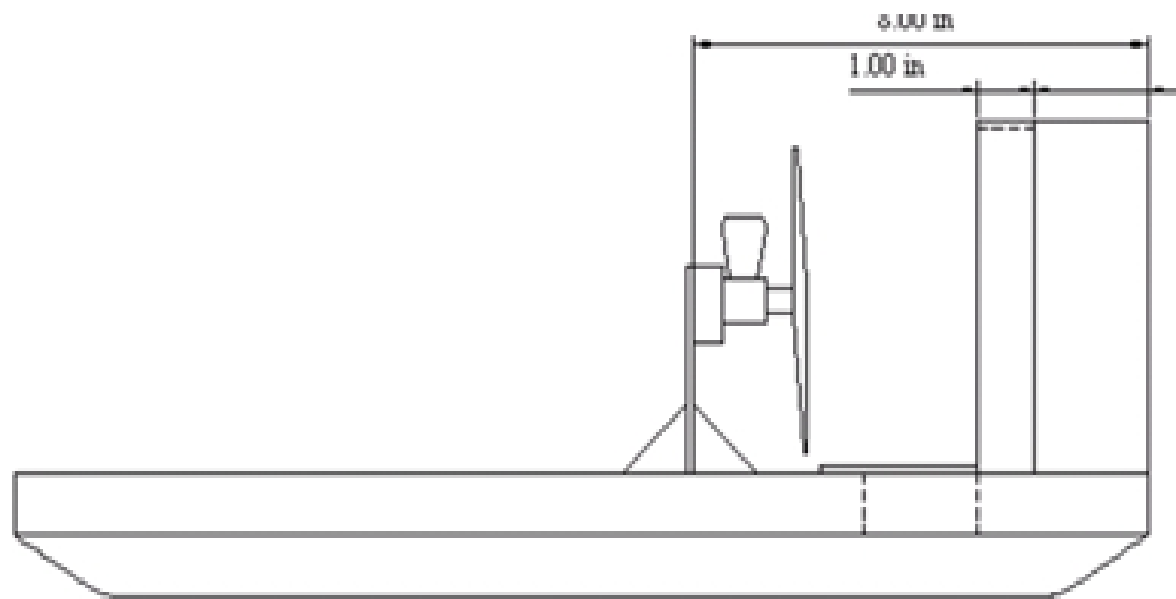
Paper work

Top View



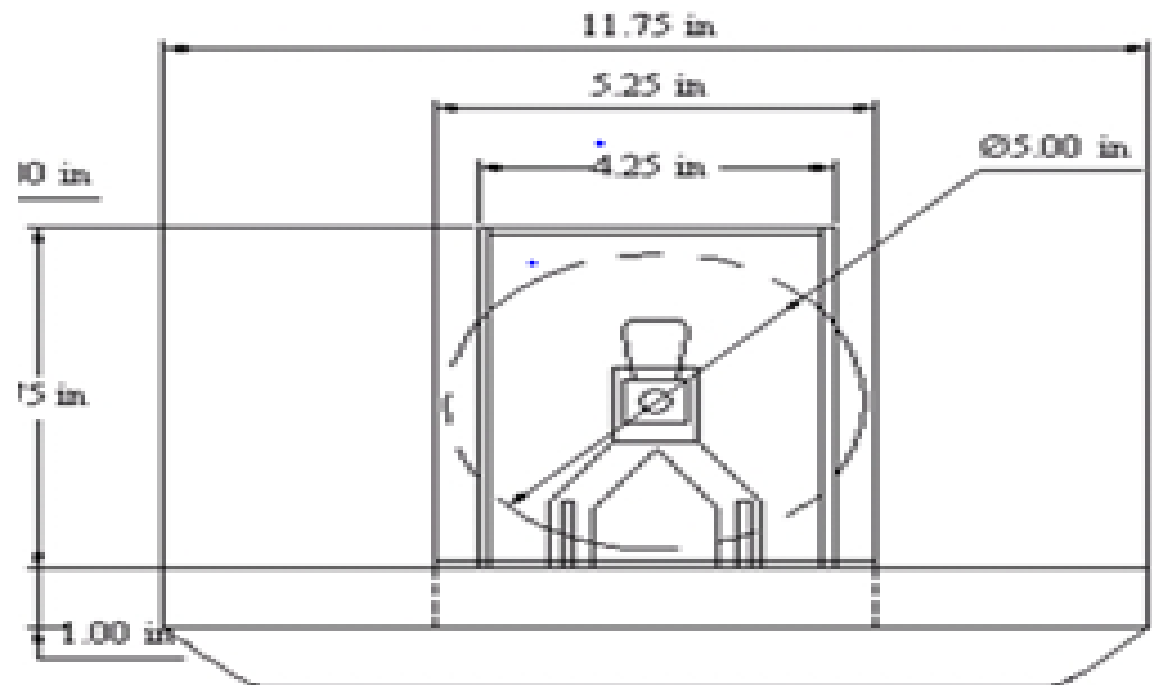
Paper work

Side View



Paper work

Front View



Construction Materials

- Coroplast - main structure, rudders, duct
- Styrofoam - skirt boundaries, duct
- Wood - motor mount, rudder structure, strengthening
- Adhesives - Bond Tite, Bond Quick, Tape

Caution: Strengthening only where required.

Duct Designing

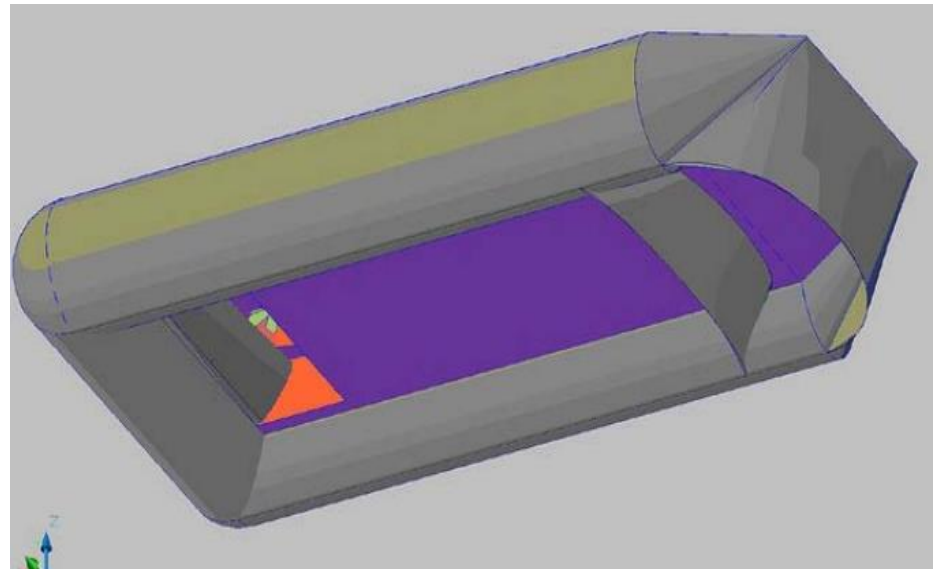
- Proper intake area
- Back should not be perpendicular to the craft board
(Why so??)
- Below the duct will be the passage for air to go below.
- Rudders will be mounted on the duct

Total airflow should be well divided between lift and thrust!!

Skirt Design and Duct Integration

- Styrofoam sheet boundaries will be attached to the main-board boundaries below the craft.
- A coroplast plate-type structure can be provided just below the duct to ensure air goes elsewhere in the skirt also.

Bottom View



Motor and Servo Mount

- Motor to be mounted **ON** the duct front face.
- Servo can be on/at the side of the duct.

*Remember that servos and motors are temporary.
Keep that in mind while designing their mounts.*



Electronics required

- 1 Motor
- 1 Propeller
- 1 Servo
- 1 Battery
- 1 ESC
- Transmitter - Receiver

All these will be mounted on the craft only at the end of the workshop, during testing and removed back after the test.

Few Other Tips

- Remember: its *Aeromodelling... so weight matters.*
- Motor mount should be strong.
- Try side walls, if time permits, to maximize air intake.
- Ducted Fans can be used for better performance.
- *Any thing that increases air intake can be implemented.*

Thank You!



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