

## Design of a wing-in-ground vehicle in joined-wing configuration

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Wing-In-Ground (WIG) vehicles have the advantages on the basis that they are more efficient than equivalent aircraft and faster than equivalent marine vessels. Therefore, WIG may well provide the reason for many particular applications on future marine transportation. While theoretically an improvement in efficiency is gained by flying in ground effect, this efficiency is reduced by design compromises required of the WIG craft. Such compromises include strengthened hull structures, reduced aspect ratios and larger control forces. The accurate determination of hull loads in the takeoff and landing phases would lead to more efficient structural design. Increased safety and better cruise performance may need well maneuverability to fly over different obstacles under various sea states.

The Joined-Wing aircraft is an unusual configuration that incorporates two wings in which the forward wing is swept back positive dihedral to join the aft wing, which is swept forward anhedral, usually from the top and front view forming a diamond arrangement. Some of the advantages stated for the Joined-Wing are:

- Light weight
- High stiffness
- Low induced drag
- High trimmed maximum lift coefficient
- Reduced Wetted area and parasitic drag
- Direct lift control capability
- Direct side force control capability

Between these advantages, the weight saving, less drag, high control capability, make the Joined-Wing configuration a promising advance in WIG vehicle. This research provides the processes involved in determining the span, planform area, incidence, dihedral and sweep angle of the wings. Also the hull design allows for high speed acceleration in taking off. In this design, both simulation analysis and tests are conducted, such as wind tunnel and water tunnel tests. Finally a small scale prototype WIG in 2m span width is fabricated. Through the fly tests, it is found that the lift and turning movement produces outstanding stall characteristics and is also quite stable.

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