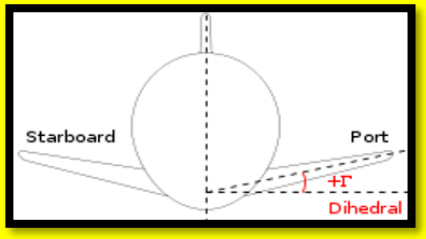
WAMASC Newsletter

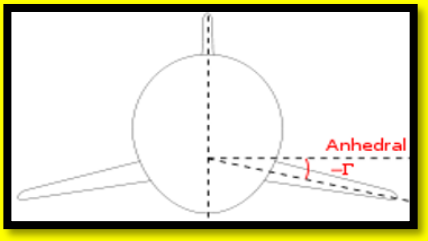
June 2020

A Word from the Editor

2020/21 Membership

Anhedral Vs Dihedral





should any individual have anything at all they would like to contribute, share or add to this newsletter, please feel free to contact the ***editor*** *through the* ***Club Secretary*** *via* ✉ ***secretary@wamasc.com.au*** *– enjoy*

A word from the Editor

The previous month of May has given us all much to think about. The fluidity of change has been extremely hard to keep up with as the goal posts have changed each day with such regularity and speed that it left many bewildered. Our own agencies, police, and emergency services etc, have often been caught out and left behind as what was once kosher the day before, suddenly changed overnight.

Indeed, this COVID-19 environment that we all now find ourselves living in is not an easy one; but there is light at the end of the tunnel, and we will, with time and patience find the end to it all.

To date we have gone through a phase and progression of 'panic buying' (by some) to occasions where it was safe for a grandparent to hug their grandchild and the next – it was not. We have seen the introduction of rules such as '**social distancing**' and watched as Clubs, Pubs, and restaurant's closed. In addition, we closed our own borders to the world and even limited and restricted travel within our own state. This in turn has caused a huge knock-on effect; on not, just the nation, but the global economy with many losing their job(s). For a while we got used to take-away and home delivery as the norm with no sit-down areas being provided or available for the public. To say that we are now doing things a little differently would be an absolute understatement and to watch people, lose their businesses' has been very disheartening indeed.

To top it all off there remains a lot of grey areas with many having trouble with the constantly changing rules that are often misinterpreted or just not understood; there are many blurred lines. Yes – we certainly are living in very strange times and it is testing our resolve, patience, and mental

state. But, as stated, it will end and get better. How that occurs is up to us and how we continue to deal with the situation. It is worth noting that in the second week of last month school children returned to school for their second term. Those children went under the microscope and under constant surveillance being used as a 'litmus paper test' to confirm whether or not WA had in fact tamed the beast and held everything in check by closing its boarders to the world. A two-week duration passed without any positive spikes of COVID-19 outbreak within those school(s) thus giving the green light for further easing of restrictions within the State. Those restrictions arrived on Monday the 18th of May 2020 with congregation size doubling (from 10 to 20) and Pubs and Restaurants, dependent on size, being allowed to re-open for business giving us some resemblance of normality.

Who knows, only time will tell, but we may actually be able to go about business as usual in this state, even doing away with 'social distancing' restrictions, in the future as we await a vaccine? A vaccine incidentally that will start being trialled and tested on humans here in Perth this very month. Perth, WA has specifically been chosen for said trials as we lead the world in flattening the curve and control. I am so incredibly happy that I reside in Perth – it is a bit like winning the lottery. One must remember that this virus will not just go away and disappear; it has to be treated, cured, and controlled otherwise the hydra will just grow another head. Hopefully, the W.H.O. (World Health Organisation) and the Governments of this world will get together and suppress the source of these outbreaks and place better control procedures in place for the future.

That said, the month of May has seen much relaxation of rules and regulations pertinent to the control of COVID-19 with many caveats being lifted. Relaxation of these rules has seen **Aeromodelling Clubs**, such as **Whitfords & Districts**, **Wanneroo** and **WAMASC** etc, resuming business with certain caveats of there own in place. The main being the control of gatherings of no larger than ten personnel (initially) all the while ensuring social distancing protocol were adhered too. Have a thought for **13½ SQN MAC** who, unfortunately, are situated in close proximity to El Caballo Blanco in the hills on Wooroloo Prison Farm property. They were not able to get back on the sticks due to **travel boundary restrictions** until after the 18th of May 2020.

Fortunately, we were able to commence operations at the WAMASC Field starting on Saturday the 02nd of May 2020 adhering to the laid down caveats set by the **WA Government**, **MAAA** & **AWA**. It was no mean feat and a bit of a juggling act that saw your WAMASC Committee restricting numbers to ten (10) personnel at the Field at any one time via the use of a **COVID-19 Restricted Flying Roster**. All members with access to e-mail will have constantly been bombarded with this roster which was updated by the **Treasurer** daily. Some will be a little out of sorts not being able to get their exact day for flying or a little angry when the winter weather took away the only slot they had. Please remember that the committee has worked incredibly hard behind the scenes to even make this happen and allow flying during these times. The two blocks of four-hour daily sessions have been administered under the control of a **Duty Committee Member** who, with his presence, carried a lot of responsibility when at the Field during this restricted flying environment. Should our Club have contravening any restriction criteria it could have resulted in a minimum penalty of $50,000.00 with the maximum of $250,000.00 applied to all Club(s) and/or Body Cooperates. **Note: Attendance restrictions have now been increased to twenty (20)**

As mentioned there has been much going on in the background for flying to happen at WAMASC. On behalf of the Chairman and his Committee I would like to thank **Whiteman Administration** and our **Committee** for their efforts and diligence at this time. Special thanks and commendation go out to our Treasurer who worked tirelessly on the roster – thank you Eric.

2020/21 WAMASC Membership Renewal

Please note that all Membership(s) terminate on COB of June the 30th every year. The 2020/21 WAMASC Membership Form may be accessed using this hyperlink: https://www.wamasc.com.au/membership-renewals-only or may be procured at the Field – just ask and you shall receive.

Please note that as per the Secretary's recent e-mail the procedure for joining this year will be a little different. Members are asked to present their Forms to a Club Executive Officer prior to the 20th of June 2020 ensuring that said form is **correctly filled in** and **signed** – no monies are asked for at this time as you will receive an invoice for future payment. This will hopefully occur within the week and is being done to take advantage of the **MAAA's 'Early Bird' Rebate** of a **$10.00 discount**. You should pay your invoice within 7 Days to maintain your membership and insurance cover. Please remember that a non-financial member is not insured thus cannot be allowed to fly post the 30th of June 2020.

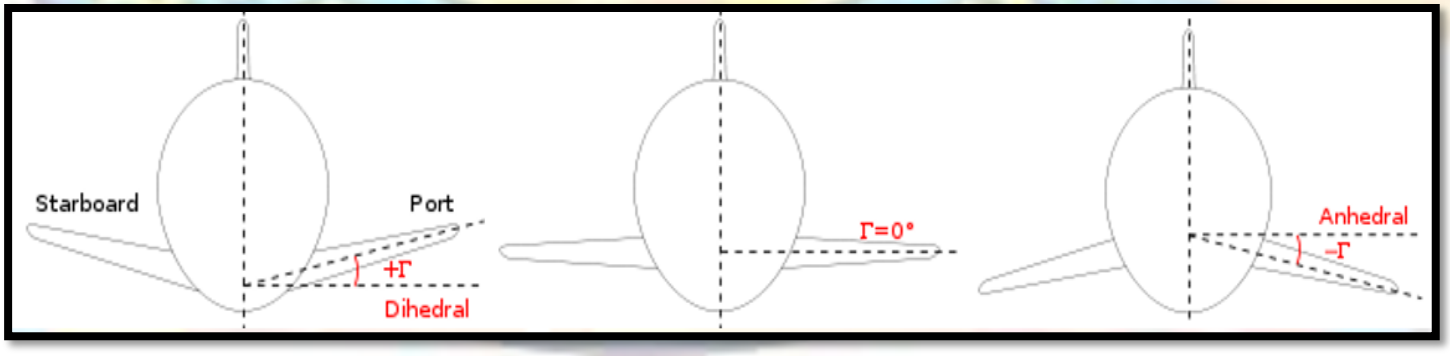
Anhedral Vs Dihedral

The purpose of both **dihedral** and **anhedral** is to create an aerodynamic coupling between **yaw** and **roll**. Both Dihedral angle and Anhedral angle have a strong influence on dihedral effect (which it is named after). 'Dihedral effect' is the amount of roll moment produced per degree (or radian) of sideslip.

Keeping things extremely simple to define dihedral it is simply the upward inclination of an aircraft wing in relation to the lateral axis; conversely, anhedral is the downward inclination of an aircraft wing in relation to the lateral axis (one could simply state that anhedral is negative dihedral angle).

One will stabilise an aircraft in flight the other is used to destabilise.

Note: When the term '**dihedral**' (of an aircraft) is used by itself - it is usually intended to mean dihedral angle. However, context may otherwise indicate that dihedral effect is the intended meaning. This has nothing to do with an aircraft's empennage as some aircraft do not have either a vertical or horizontal stabiliser. However, anhedral or dihedral may also be engineered into this area to assist with stability or instability when present.



Dihedral effect is a critical factor in the stability of an aircraft about the roll axis (the spiral mode). It is also pertinent to the nature of an aircraft's Dutch roll oscillation and to manoeuvrability about the roll axis (this is the reason that all modern-day fighter aircraft have anhedral – they are built inherently unstable to allow manoeuvrability). In short dihedral will help stabilise an aircraft while anhedral will do the opposite and destabilise.

If I could take a high wing trainer and replicate the same aircraft to scale using the same exact fuselage dimensions, wing design and cross section etc. Just by placing the wing in a low wing position would change the dihedral effect (I have not changed the angle of the wing – it has remained the same). However, the high wing would have a much greater dihedral effect than its counterpart.

Longitudinal dihedral is a comparatively obscure term related to the pitch axis of an airplane. It is the angle between the zero-lift axis of the wing and horizontal tail. Longitudinal dihedral can influence the nature of controllability about the pitch axis and the nature of an aircraft's phugoid-mode oscillation.

A common confusion is that dihedral effect is defined simply to be the rolling moment caused by sideslip and nothing else. Rolling moments caused by other things that may be related to sideslip have different names. Dihedral effect is not caused by yaw rate, nor is it caused by the rate of sideslip change. Since dihedral effect is noticed by a pilot upon applying rudder, many assume that the rolling moment is caused by one wing moving more quickly through the air and one wing less quickly.

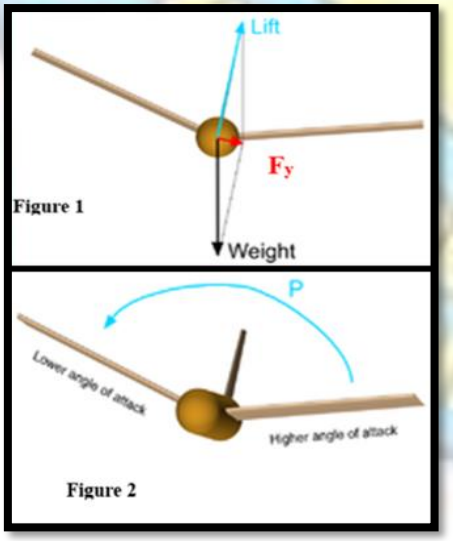
Indeed, these are actual effects, but they are not the dihedral effect, which is caused by being at a 'sideslip angle' - not by getting to one.

These other effects are called rolling moment due to yaw rate and rolling moment due to sideslip rate, respectively.

Dihedral effect is not roll stability in and of itself. Roll stability is less-ambiguously termed spiral mode stability and dihedral effect is a contributing factor to it, but dihedral effect is not any kind of stability by itself.

How dihedral angle creates dihedral effect and stabilizes the spiral mode: dihedral angle contributes to the total dihedral effect of the aircraft. In turn, the dihedral effect contributes to stability of the spiral mode. A stable spiral mode will cause the aircraft to eventually return to a nominally "wings level" bank angle.

Below **Figure 1** shows uncompensated lift component producing a side force F_y, which causes the aircraft to sideslip. **Figure 2** shows how non-zero sideslip sets the lower, upwind wing to a higher angle of attack, resulting in stabilising roll moment P (aircraft is shown flying directly towards the viewer).



If a disturbance causes an aircraft to roll away from its normal wings-level position as in **Figure 1**, the aircraft will begin to move somewhat sideways toward the lower wing.

In **Figure 2**, the airplane's flight path has started to move toward its left while the nose of the airplane is still pointing in the original direction.

This means that the oncoming air is arriving somewhat from the left of the nose. The airplane now has sideslip angle in addition to the bank angle.

Figure 2 shows the airplane as it presents itself to the oncoming air. It is a misconception that anhedral or dihedral create a roll torque because the left wing becomes "more horizontal" than the right wing, or vice versa, or one wing ends up with a "more vertical lift vector" or a "greater projected area", when the aircraft banks to one side. In reality, in the aircraft's reference frame, banking can be thought of as a change in the direction of the weight vector, acting at the CofG, while all the aerodynamic force vectors (drag, lift from left wing, lift from right wing, etc.) initially remain unchanged in the aircraft's own reference frame, at

least if we imagine that the aircraft has not yet began to move sideways through the air mass. This situation cannot produce a roll torque. If the aircraft does not move sideways through the air, anhedral or dihedral cannot produce a roll torque when the aircraft banks.

However, if the aircraft begins moving sideways through the air mass, then anhedral or dihedral will create a roll torque. The roll torque created by anhedral or dihedral when an aircraft is tipped into a bank is entirely dependent upon the fact that immediately after leaving the wings-level condition, the aircraft will initially begin to move sideways through the air to at least a small degree. This sideways motion is created by the fact that the flight path has started to curve, because the banked wing is generating a sideways (centripetal) force, but the aircraft's yaw stability or "weathervane effect" has not yet exerted sufficient yaw torque to overcome the aircraft's yaw rotational inertia and create the yaw rotation that is required to keep the nose of the aircraft aligned with the direction of travel at any given instant, i.e. to keep the nose of the aircraft pointing straight into the changing direction of the relative wind. So, the flight path starts to curve, the heading of the aircraft initially tends to remain constant, and this creates a sideways airflow over the aircraft.

If the aircraft is banking because the pilot is using weight-shift or ailerons to make an intentional roll control input, then the nose will tend to initially yaw in the "wrong" direction due to adverse yaw, and again this will create a sideways airflow over the aircraft.

The main purpose of a rudder is to prevent this sideslip due to adverse yaw and yaw rotational inertia when the pilot is intentionally banking the aircraft. Most rudderless aircraft (unless they are using spoilerons for roll control) will experience some sideslip whenever the pilot is intentionally entering a turn, as well as when the aircraft is tipped into a bank by turbulence. The dynamics that we have been discussing up to this point take place mainly while the aircraft's bank angle is changing, or immediately after the aircraft's bank angle has changed. But even after quite a few seconds have passed with no further change in bank angle, and the aircraft's yaw stability mechanisms have had plenty of time to act, there will still typically be a very slight sideslip when a rudderless aircraft is banked, because a bank always creates a curvature in the flight path (i.e. the aircraft is turning), and when the flight path is curving, the outboard, faster-moving wingtip tends to experience more drag than the inboard, slower-moving wingtip. This yaws the nose toward the outside or high side of the turn, at which point the drag torques from the left and right wings, plus any "weathervane" yaw torque from the vertical tail (if present), again come into balance.

In future articles we'll use the concept of "airflow curvature" to explore this balance of yaw torques in more detail, and we'll examine how the position and size of the vertical fin (if present) affects the slight amount of sideslip that we typically see in a stabilized, constant-bank turn in a rudderless aircraft.

This is a rather complex subject Therefore if a pilot wishes to keep the nose of the aircraft pointing directly into the airflow during a stabilized, constant-bank turn, he'll typically need to apply just a touch of inside rudder, especially at low airspeeds where the turn radius will be small and the difference in airspeed between the two wingtips will be the most pronounced (**Steve CORAM**, the State CFI, made mention of this in an article he wrote some years ago for the WINDSOCK magazine when he was describing how a high wing trainer with dihedral rolls when the rudder is applied).

If there is no rudder, or if the pilot does not apply inside rudder, this continued, slight sideslip means that dihedral will continue to create a rolling-out (stabilizing) roll torque even when the bank angle is no longer increasing. Also, this continued, slight sideslip means that anhedral will continue to create a rolling-in (destabilizing) roll torque even when the bank angle is no longer increasing.

But we are jumping the gun here: the reason a roll torque arises when a sideways airflow is present is given below. Anhedral or dihedral create a roll torque whenever an aircraft moves sideways through the air mass, regardless of whether the sideways motion is due to the fact that the aircraft has gained a velocity component toward one wingtip and the aircraft's yaw stability mechanisms have not yet yawed the nose into alignment of the new direction of travel, or the direction of the flight path has not changed but the nose of the aircraft has yawed to point to the left or the right of the direction that the aircraft is actually moving through the air mass.

Both cases have the same end result--the aircraft moves sideways through the air mass, so there will be a sideways component in the airflow over the aircraft (relative wind). In both cases, anhedral or dihedral will generate a roll torque. And in both cases the aircraft's yaw stability mechanisms will be attempting to yaw the nose to point directly into the relative wind, which would end the sideslip or skid. The roll torque created by dihedral or anhedral during a sideslip or skid is caused by the fact that the left wing is experiencing a higher or lower angle-of-attack than the right wing, due to the sideways component in the airflow (relative wind). This is the central point of this entire article.

SAFE FLYING

Should you cross an airplane with a magician you would have a flying sorcerer.