

Angels 1-5

‘Enemy aircraft at 15,000 feet’

**Air combat
over
Britain,
1940.**

Ian Hopping
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Setting up

Note on terminology.

To avoid confusion between ‘turn’ as into change direction, and the division of a game into ‘turns’, the phrase ‘Bound’ is used to refer to game turns. Each Bound is sub-divided into three Phases. A Phase is further divided into Impulses. The number of impulses per phase varies from plane to plane in relation to its speed- see the Impulse Chart.

Play Sheets

Each aircraft has 1 play sheet. These are used to track the speed, damage and ammo for each individual aircraft, as well as having a place for its planned movement order. Showing the call sign of each aircraft on the sheet, along with marking the model with this helps stop confusion about which aircraft goes with each sheet. It is one sheet per model, NOT per type.

Each aircraft has an area for orders, an example of two completed lines are shown below

Orders

1 st phase	2 nd phase	3 rd phase	Man	Eng	Speed
S	S	S			7
L	C	C	- 5	+3	5

Starting with the top most row the player writes the orders for the next phase at the start of each phase (i.e. 2nd phase is written after all firing for the 1st phase). After the 3rd phase speed adjustment due to manoeuvring is calculated, and placed in the ‘Man’ Column. The player then adjusts the engine speed, and writes that in the ‘Eng’ column. The new speed, which is used the next turn is calculated from the previous speed +/- the Man and Eng columns. This is explained in the ‘End of Phase’ Section.

Players should agree on how the planes will be initially placed on the board. This could be a pre-designed scenario, placing models on opposite table edges and secretly noting height/speed before every one announces simultaneously, or having the RAF at random heights to denote a ‘scramble’.

Aircraft

Models or counters of the aircraft should be approx. 5 cm across and 5 cm long for fighters, 8cm wide and 10 cm long for bombers (or at least in proportion to the fighters). If the models are not these sizes (e.g.1:200 scale aircraft, which are about 8 cm across), they need a base of the correct size on the bottom of the stand. It is it width of the base which is used for targeting in combat.

If you want to use the models as they are, with no base increase the distances- i.e. 1:200 double all distances etc, 1:72, multiply by 4- You will need a BIG table if using Airfix kits- a bf109 would move 200 cm per turn at top speed.

The base will be referred to as the **targeting area**.

Heights.

There are 6 heights: Deck, Very Low, Low, Medium, High and Very High. An aircraft's current height should be shown by the model. Dice work well, or you can make some way to vary the height of the model.

Any aircraft trying to go below 1 (Deck) crashes¹, any aircraft trying to go above Very High, stays at Very High, but still loses the speed it would have if the climb had been successful.

Pilot Skill

If desired pilots can be given individual skill ratings, from -2 (Green recruit) to +2 (veteran)

Random assignment for 'pickup' or one off games

2d6	2-3	4-5	6-9	10-11	12
Skill	-2	-1	0	+1	+2

Campaign games

Assign skill randomly for each pilot. German pilots receive +1 on the above roll if the campaign starts near the start of the Battle of Britain.

After each battle there is a chance to improve

To qualify for a check the pilot must have both shot at something, with a chance of causing damage (i.e. a combat roll of 6, modified, would have scored more than 1) and been shot at, which again had a chance of causing damage.

Roll a d6- a modified result of 0 results in gaining 1 point of skill.

Modifiers +/- pilots current skill

-1 for each and every hit on enemy fighters.

-1 for each 3 hits on enemy bombers

Terrain

Obviously not much! Land based objects don't usually extend high enough to trouble even height '1' planes². However after a few games you may wish to experiment with combat away from south east England- for instance Norway, and place some Level 1 hills or mountains on the table that can be crashed into. Alternatively if playing over the English Channel you may wish to call all land masses Level one, so nothing can fly at this height over them.

If using models on tall enough poles you may wish to place some very small scale (2mm) terrain to give the illusion of height. Also such models could provide targets for bombers- the real reason for the Blitz! If bombing is being used then each target should be given a damage value- the larger it is, the more damage it takes. Targets should have a well defined area of 5cm x 5cm- groups of buildings should be mounted on a base to make them one target. Larger targets are made up of multiple 5 x 5 targets.

¹ Alternatively, you may consider this 'Dived out of combat'. If so the plane counts as exiting the table. If it is important it is best for the players to come to agreement when it is a crash, and when it is an escape BEFORE the game.

² Even though I have called '1' the 'deck' very few flew low enough to encounter any objects in combat. Very low flying was used by bombers trying to sneak under Radar later in the War.

Movement

Each aircraft has a maximum speed. It does not have to move it's maximum every bound, and it's speed will change through the game. Diving and applying throttle increases speed. Turning, climbing and slowing decreases speed. At the start of the game players should note their speeds and heights. At the end of each bound speed adjustments are applied, and the new speed noted in the final column of the line for that bound.

Orders

At the start of every phase each player writes on the play sheet under Orders what the plane is to do

S- Straight
 D- Dive
 L- turn left
 SL- Slide Left
 C- Climb
 R- Turn right
 SR- Slide Right

Example

1 st Phase	2 nd Phase	3 rd Phase
L	C	S

During the 1st phase a pilot intends to turn left. In the second phase he climbs. Finally he goes straight.

If he had chosen to climb at the same time as he turned left the order in the 1st phase would have been CL. Only changing height and turning may be combined in one phase. They may not be combined if the plane has only one impulse that phase. All other orders may not be combined.

Moving

Each plane moves simultaneously, in accordance with the order. Move is one phase at a time, with a pause to allow firing after each phase.

The players must move as they have written, even if it's not what the meant- i.e. written L instead of R. If an order is illegal then an S order is carried out instead.

IMPULSE TABLE			
Speed	P1	P2	P3
3	1	1	1
4	1	2	1
5	2	1	2
6	2	2	2
7	2	3	2
8	3	2	3
9	3	3	3
10	3	4	3

Distance moved depends on the plane's speed, and is modified by which phase currently being moved. Cross reference phase with the plane's current speed on the table below for total number of impulses this phase.

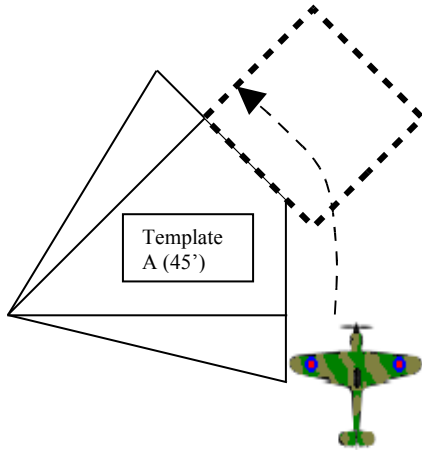
So for a plane speed of 7 in the second phase it gets three impulses

Interpreting orders.

Straight. The plane moves 5 cm straight forward per impulse it has.

Slip. For each impulse, the plane moves forward 4cm, and to the chosen side 3 cm

Climb/Dive. The plane changes height by one height step. It moves straight forward 2cm for the first impulse, and straight for any remaining impulses.³



Example of a Hurricane turning

Turn. Using the template of the appropriate type the plane turns. The template is placed by the side of the aircraft, the line running from the point next to the front of the plane. The plane is moved to the second line, placed so the line would continue straight across it's nose.

Turns are always the second thing done in a phase, unless the plane only has 1 impulse. All other impulses are treated as straight. If this is combined with a change height order then no movement is made in the 1st impulse.

Exceptions

A +2 skill Bf109 pilot may use the B template.

A Bf109 at speed 5 or less may use the B template.

Special Manoeuvres

Planes may perform 2 special manoeuvres, the Immelman, and the Split S. These are half loops, at the end of which the aircraft may face any direction. The Immelman is a climbing loop, while the Split S is a dive.

Immelman

No other order is given for the turn, just Immelman written across that turns line. It must be given the first phase

1st phase- the plane moves 7cm and climbs 1 level.

2nd phase- the plane stays stationary, and climbs 1 level.

3rd phase- the plane may, at the pilot's discretion, climb a third level. This must be announced at the start of the 3rd phase, before any plane moves. It is then turned to face any direction, and then moves 7 cm.

Split S

No other order is given for the turn, just Split S written across that turns line. It must be given the first phase

Movement is the same as for an Immelman, but the plane dives instead of climbs.

Immelmans lose 5 speed for a 2 level climb, and 7 for a 3 level climb. Likewise the Split S gains 5 and 7 respectively. This is the only speed adjustment done in the End of Turn calculation- the direction change happens as a roll during the vertical (2nd phase)

³ Note- this may look like a fast plane climbs shallower than a slow one (as it moves horizontally further per height). Remember each height band is pretty wide- approximately 4- 5,000 feet, so fast planes can be thought of as being higher in the band they are in. A fast plane will be able to climb more bands per bound, as it will be able to afford to lose more speed when new speeds are calculated at the end of the bound.

Shooting during Immelman/Split S.

The manoeuvring pilot may not fire. The plane counts as normal target during the 1st and 3rd phases. During the 2nd phase it counts as side aspect (-3) for ALL attacks on it (see Firing rules).

End of Bound.

Calculating new speeds

At the end of the 3rd phase the players adjust the speeds of their aircraft. This is done in the following way.

Speed change due to manoeuvre.

-1 for each turn, -2 for each climb, +2 for each dive. Write the total in the 'Man.' Column.

Throttle

In the Engine column you write down the speed change for next turn you wish to make through the engine. This can be + (for more) the maximum of your throttle rating. E.g. a Me109 may add up to 4 speed points.

Alternatively, you may decrease speed by up to 4 (i.e. -4).

Your new speed is your current speed, plus/minus the change due to manoeuvre (Man. Column) and plus/minus the engine speed change (Eng). The total is written in the speed column. This is your speed next turn.

As mentioned above, Immelmans lose 5 speed for a 2 level climb, and 7 for a 3 level climb. Likewise the Split S gains 5 and 7 respectively. This is the only speed adjustment done in the End of Turn calculation- the direction change happens as a roll during the vertical (2nd phase) so costs no speed.

Excess Speed

If an aeroplane has a final speed higher than its engine rating then the following applies.

Due to Engine damage

- The planes speed for the next turn is reduced to the maximum for the current engine value.

Due to excess throttle

- The planes speed for the next turn is reduced to the maximum for the current engine value.
- Any fuel used is still lost, even if there was no speed gain.

Due to gaining speed from a dive

- The plane immediately moves 5 cm per excess speed over its CURRENT engine speed.
- From the final speed subtract the ORIGINAL engine rating, then subtract a further d6 roll, then add 1 for each point of damage taken. If the result is one or more then the aircraft takes this many points of damage. This represents the stress to the airframe for exceeding the aircraft's designed speed, while adding the damage taken is representative of damaged yet functioning components being pushed too far.
- The planes speed for the next turn is reduced to the maximum for the current engine value

Fuel

Each throttle point you use to speed up costs 1 fuel point. These should be crossed off the play sheet as you apply the throttle.

Optional Rule

In addition, lose one fuel per phase with 3 or more impulses during that bound.

'Bingo' Fuel

When an aircraft runs out of fuel it must attempt to leave the table via its base line(s). The pilot may manoeuvre, and fire, but its general attitude should be one of retreat, only turning back to avoid immediate danger.

Such an aircraft may still use fuel points. It also continues to lose fuel from critical hits. These must be recorded, and when the plane finally leaves the table a d6 is thrown for each extra fuel point used. Any result of 1 on any die (even only one die) means the aircraft ran out of fuel before managing to land, and did not get home. The more 1s rolled the further from base it was!

The RAF have more fuel than the Luftwaffe as they were closer to home to start with, and needed less fuel to get them there. London is at the extreme of a Me109s range, while some RAF airbases are on the outskirts of London.

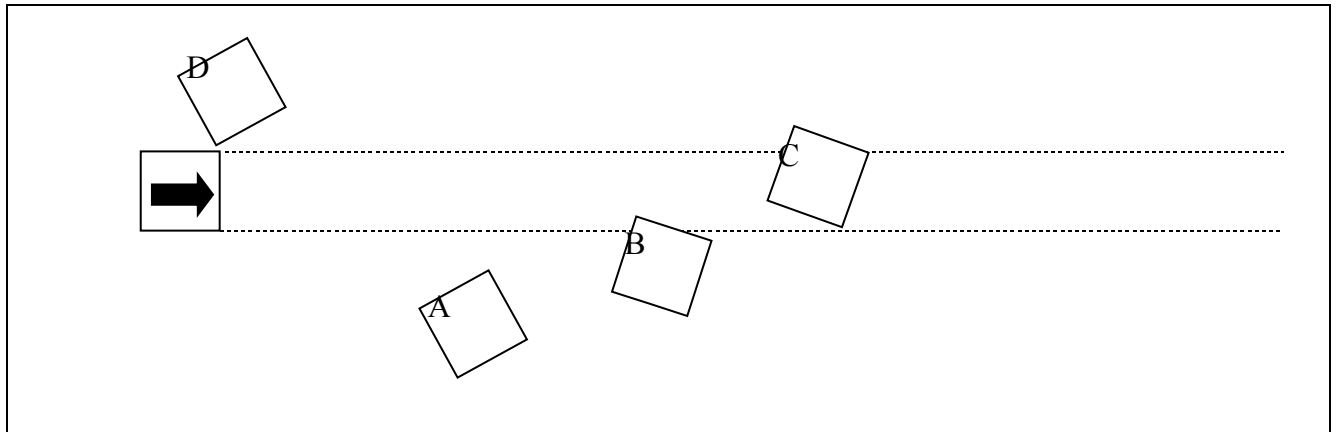
If a plane exits the table with fuel, it is assumed to get home, even if losing fuel every turn from critical hits

Combat.

At the end of each Phase an aircraft may fire.

Fighters firing.

The left and right sides of the targeting area for the aircraft (e.g. the counter, or the base for larger models) mark the boundaries of where the pilot can fire, when extended forwards. If part of any enemy targeting area fall between these then it can be fired at- See below



B and C are valid targets, A and D are not.

If using models without bases, the target area extends from the wingtips.

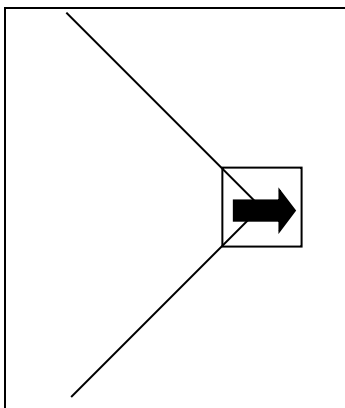
The target area is always the full width, no matter where the guns are really mounted. This allows for adjustments by the pilot not possible in the game, shooting passing targets etc. Note that shooting always takes place at the phase end, with planes where they are at that point- no 'opportunity fire' is allowed half way through. This is the pilot being too slow as the target flashed by at 250mph- remember all aiming is manual, no radar and computer to help.

Optional Rule.

A pilot may not fire at a plane below if he climbed that turn, and conversely may not fire at a plane above if he dove.

Rear gunners- e.g. Ju88, Me110.

A triangle is drawn from the centre point of the counter through the rear corners. This gives the arc the rear gunner may fire. It may only fire at targets on the same height, or higher.



Turrets firing

Forward turrets may hit anything in front of the bomber, rear turrets any thing behind. Side gunners may hit anything on their side. Basically draw a line along the appropriate edge- any thing that is at least partially across this is a target.

Dorsal turrets may hit *anything* above/below, depending on location. They may not shoot at aircraft on the same level.

Ammo

Each aircraft has ammo boxes with a modifier in. Each time an aircraft fires it crosses these off, left to right, using the modifier in that box to add to its combat die roll. When all boxes are crossed out the guns are out of ammo.

Spitfire ammo example.

Spitfires carried 8 .303 cal machineguns, with 14 seconds worth of ammo (300 rounds). This was usually fired as 4 3-second bursts, with a final 2 second burst, hence the last box- the 5th shot- having only +2

+3	+3	+3	+3	+2
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Me109 ammo example.

The 109 carried more powerful 20mm cannons, hence the +5. However, there was less ammo, so only three bursts are available. Many 109s had twin machine guns directly in front of the pilot. These fired by interrupter, as they fired through the propeller arc. This slower rate of fire means the ammo lasted longer, so there are still loaded guns even when the cannons are empty. However, it also means, when coupled with the fact that there were 2 compared to the Spit's 8, they did less damage- hence the -2.

+5	+5	+5	-2	-2	-2
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Firing

Throw a d6

Add/subtract the ammo value.

Add/subtract the pilots skill.

Add/subtract deflection modifier- This is the edge through which the shot passes, as certain angles are harder to hit from. Draw a line from centre to centre to see which side it passes through. If it passes through the corner add each pilots speed, skill, height and a d6 throw. Highest total chooses which of the two it is.

Front +0 Rear +2 Side -3

-1 per difference in height

-1 per full 10 cm of range

+3 if target only flew straight/slipped last impulse

+1 if fired at but missed same target last impulse

+2 if hit same target last impulse

Combat Result Tables

Result	Hits	Criticals	Chance of getting a Critical hit
1 or less	Miss	D6 - on a roll of 6	
2-3	D6-3	D6 - on a roll of 5-6	
4-5	D6-2	D6 - on a roll of 4-6	
6-7	D6-1	1 Critical	
8-9	D6	2 Criticals	
More than 9	+1 per point over 9	+1 per 2 points over 9	

Any plane that loses all its damage boxes crashes.

For each Critical hit table roll 2d6, and check against deflection column

	Front	Side	Rear
2	Pilot Killed	Pilot Killed	Pilot Killed
3	Pilot Killed	Pilot Killed	Extra Damage d6
4	Pilot Killed	Engine damage	Control surface damage
5	Engine damage	Engine damage	Control surface damage
6	Engine damage	Extra Damage d6	Fuel tank- lose d6 fuel
7	Extra Damage d6	Extra Damage d6	Extra Damage d6
8	Engine damage	Throttle damage	Fuel tank- lose d6 fuel
9	Engine damage	Control surface damage	Fuel tank- lose 1 fuel per turn
10	Throttle damage	Fuel tank- lose d6 fuel	Fuel tank- lose 1 fuel per turn
11	Throttle damage	Fuel tank- lose 1 fuel per turn	Fuel tank- lose 2 fuel per turn
12	Extra Damage d6+1	Fuel tank- lose 2 fuel per turn	Fuel tank- lose 2 fuel per turn

- All effects are cumulative through the game- so you can lose fuel at more than 2 per turn if the right criticals are scored.
- Any hit on fuel tank- plane explodes on a 6 on a d6
- If fuel loss takes plane below 0 fuel then Bingo Fuel rules apply.
- Engine damage- cross out the current max speed, and replace with 1 lower. Planes with a maximum of less than 3, crash.
- Throttle Damage- lose 1 throttle

Control surface damage

D6	Result
1	No left next turn
2	No right next turn
3	No climb next turn
4	No dive next turn
5-6	Roll again, effects last 1 extra turn

Note – rolls of 5-6 are cumulative, if you roll 5,6,1 then that is no left turn for three turns.

Bailing out.

Throw a d6. Subtract 1 for each extra point of damage past 0 taken by the plane. Any positive (1 or more) result and the pilot lives and can be reused in the campaign. E.g. a Spitfire with 3 damage points left take 5 points of damage. It crashes, having reached 0. The pilot tries to bail. The 3 minus 5 is -2. Roll a D6-2. If the result is 0 or -1, the pilot didn't make it.

Bombing.

Any plane noted as having a bomb load may bomb ground targets. To be qualify the plane must have flown straight and level for the entire previous bound, and also up to the point in this bound it drops the bombs. The player states in the firing part of the phase that he wishes to drop the bomb load. Bomb dropping takes place after all other firing. The entire load must be dropped in one go.

If the plane did not fly straight and level for the required period then the bombs are automatically considered to have missed the intended target.

After all firing, before the drop is marked (see below) the British (or defending) player rolls 1 die per bomber dropping. If the score is equal or more than the height of the bomber then ground defences have caused the pilot to have jinked or manoeuvred at the last moment, and the bombs miss the intended target. The bombs are still considered released, just no effects are recorded.

If the ground defences cause this then roll again. On a '6' the bomber has been hit. Roll a further die. This counts on the Combat Results Table as the 'Result'. If a critical is scored then roll on the 'Side' column.

A bomber that has dropped its bombs is raises its max speed by 1, and gains one speed the turn it drops.

Mark the point the bombs were dropped, along with height, direction and speed of the bomber. The speed is it's speed for the entire bound, not just the number of impulses in this phase.

During the next 'End of Bound' section of the *following* Bound the location of bomb hits is calculated. Roll 1die for each point of speed the bomber was moving at the release point, plus 1 for each point of height. The total is the distance the bombs move forward along the marked direction of travel. Mark this point.

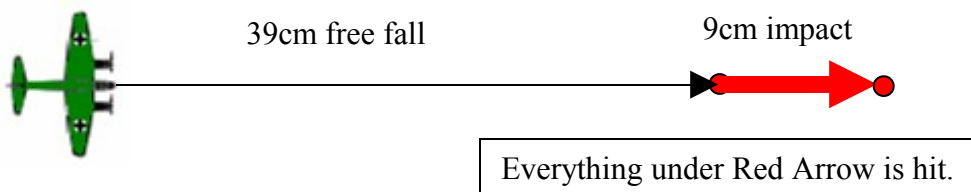
Example.

A bomber drops its bombs at height 5, while travelling speed 6. 11 dice are thrown, giving a possible range of 11cm to 66cm that the bombs will travel before hitting the ground. Dice actually thrown are 1, 2, 2, 3, 3, 3, 3, 5, 5, 6, and 6. The marker is placed 39cm from the point of release, along the direction of travel the plane was moving at the point of release.

For each bombing point the bomber has then roll a die. Measure along the direction of travel by the total scored . Mark this second point. Anything under this has been hit. Each target that has been hit is marked. The bomb loads of heavier bombers may be shown as more than one hit. Give the target that many hits.

Example

The bomber in the previous example has 2 bomb points. 2 dice are thrown- a 4 and a 5. The bomb impacts extend for a further 9 cm from the original impact point.



If the plane is shown as No Bombing Points only the point of impact counts for working out Hits. At the end of the game roll 1 die per hit. If the total is more than the number of damage points then the target is destroyed. It is done at the end so the bombing player does not know what the outcome is until after the raid. Players may wish to make an exception for ships.

Dive Bombers

Planes defined as Dive Bombers may make dive-bombing attacks instead.

Dive Bombers may descend by 2 height levels per phase- just mark 2 dives. Each takes 1 impulse in a phase. All dives count towards gaining speed.

Dive-bombers do not have to fly straight and level as per normal bombers. The only requirement is in the phase they drop their bombs they have only Straight and Dive orders. They must have 2 Dive orders in the phase they drop. If the plane only has 1 impulse in the phase, then the last order of the immediately preceding phase MUST be dive.

Dive Bombers may gain 1 extra height during the 'End of Bound' to bleed off extra speed. There is no forward movement with this. This may only be done in a bound where the bomber descended two levels in one phase.

Ground defence rolls are at -3 to see if the pilot was forced to manoeuvre. The 'To hit' roll if he was is not affected by this, nor is the damage roll.

The drop point for dive bombers is noted as per normal bombing, but resolved in the 'End of Bound' of the bound the bombs were dropped.

For location of bomb hits throw one die per height (as normal) plus one more if it had a 'Straight' order in the phase it dropped. (This can only happen if the plane had 3 impulses to move, as 2 must be used in diving.). This means a dive-bomber will never throw more than 5 dice for hit location, and possible only 1.

Work out hits as for a normal bomber.

Dive Bombers with excess speed.

Where a dive bomber has excess speed from diving subtract a further 3 points from the excess after subtracting the die roll.

Extra Rules.

The following rules are optional.

Pilot delay.

The biggest difference between an experienced pilot and a new one, even for civilian pilots, is the perception of the surrounding airspace, and reaction to it. To simulate this player may agree to hamper the reaction of 'green' pilots in the following way.

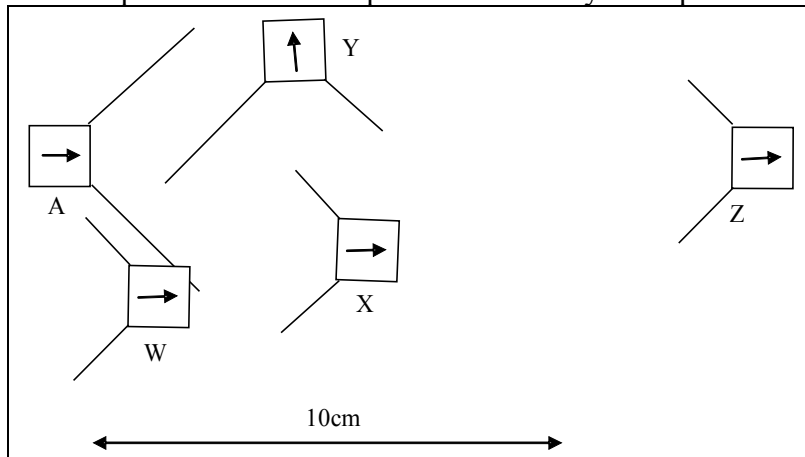
Pilots with a skill of -2 must write two phases in advance. The first two phases of the game are both Straight. When the orders for phase 1 are written, the pilot writes for phase 3. On the next he writes for phase 1 of the following bound. On the last phase he writes for phase 2 of the next bound. This continues through the game.

Pilots with a skill of -1 write orders one phase in advance.

Speed calculation and throttle are applied before the player writes for phase 1.

Tailing

If a pilot is within 10cm of another aircraft and that aircraft is in his front quarter AND he is in the rear quarter of the other plane then he may attempt to tail. (see diagram).



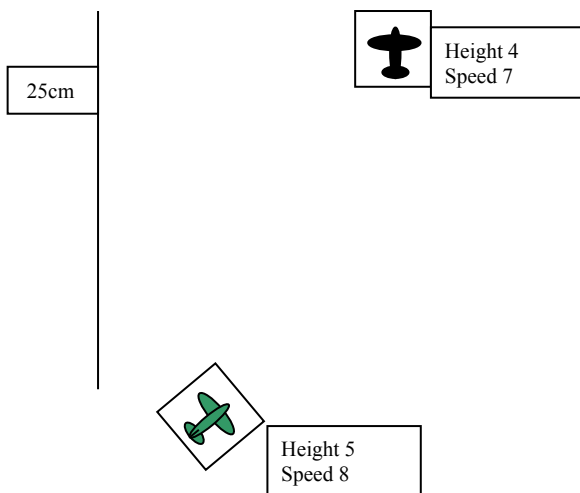
'A' is tailing X- X in front arc, A in rear arc. He is not tailing Y- Not in Y's rear arc, W- not in A's front arc, or Z- more than 10cm.

A pilot may only attempt to tail one plane. This must be the closest, unless he was tailing another eligible plane last phase, when he may continue to try to tail.

Tailing attempts are made before the tailing player writes any orders, but after other players have written orders. Both pilots roll 1 die, and add/subtract pilot skills. If the tailing player scores equal or more than the front pilot then the tailed player must show the player following what orders he has written before the following player has written.

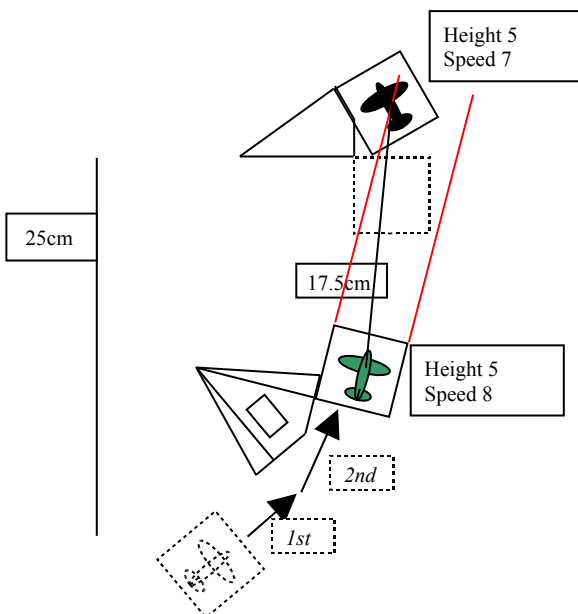
If there is a line of tailing, then resolve each separately e.g. A is followed by B is followed by C. A writes orders. Roll to see if B manages to tail. B writes orders. B and C throw to see if C follows B. C writes orders.

Example Play.



Having been 'Bounced' by the Spit (green) the 109 (black) writes orders CL / L / L for Climb and Bank Left, Left and Left

The Spitfire pilot, guessing the 109 will turn into him (as per standard practice in a dog-fight) writes L / L / L

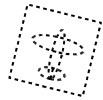


1st Phase- At speed 7 the 109 has 2 impulses this phase, the Spit has 3 for speed 8. The 109 spends its first impulse climbing. As it is combining with a turn there is no movement on this climb. The second impulse is the turn, using template C.

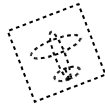
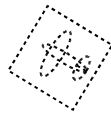
The spitfire moves forward 5, then turns using template B, then moves another 5cm.

He has caught the German pilot in his sights- the red lines! The range is 17.5 cm.

The first ammo box on a Spit fire is +3, the is -1 for a full 10cm of range (the remaining 7 ½ doesn't count), +2 for a rear shot, total modifier of +4 (+3-1+2). He rolls a 3, for a total of 7. On the damage table this is d6-1 damage, plus a critical hit. He rolls 4, minus 1 is 3 points of damage to the 109. The Crit is 3 and 6 = 9. For a rear shot this is Fuel tank, lose 1 extra fuel a turn. The 109 pilot makes a note of this, and crosses off 3 damage boxes- half his boxes. The Spitfire pilot crosses off the first of the ammo boxes.



Phase 2. The 109 moves 3 impulses- Straight, turn straight. The Spit only 2- Straight then turn. This time he shoots at +6 as there is an extra +2 for hitting the target last turn. 1! Plus 6 = 7 again d6-1. This time he rolls a 1 but minus 1 = No damage. There is another Crit for the shot of 7. 10- Again the fuel tank. The German is now losing 2 fuel a turn.



On the Third phase the 109 had 2 impulses again- Straight then Turn. The Spitfire goes Straight, Left, Straight. Again he shoots, but as he now firing through the side it is a maximum deflection shot so -3, still +3 for ammo (the 3rd shot of 4 at +3), -1 for range over 10cm, +2 as hit last turn: Only +1

Again the Spitfire rolls poor dice- only a 1, +1 gives 2, a d6-3. He rolls a 2, so no damage. The damage table shows that to get a critical he needs a 5 or a 6- he rolls 4, just failing.

The 109 has Climbed once, and done three turns. This means it changes speed of -2 for the climb and 3 x -1 for the turns. A total of -5 on the speed. The pilot opens the throttles to full- 4 on a 109, so the over all speed change is just -1. He is doing speed 6 the next turn. This has cost him 6 fuel- 4 for the throttle, and a further 2 for the 2 fuel tank hits. Even if he uses no more throttle, he will still lose 2 fuel a turn because of this leak!

The Spitfire loses 3 speed- for 3 turns. He compensates for this by also opening the throttle to full. As this is 3 on a Spitfire, his speed stays the same. After writing the new speeds, both pilots write orders.

	P1	P2	P3
3	1	1	1
4	1	2	1
5	2	1	2
6	2	2	2
7	2	3	2
8	3	2	3

Further Examples of moves and end of turn calculations

Start speed 7

1 st phase	2 nd phase	3 rd phase	Man	Eng	Speed
<i>S</i>	<i>L</i>	<i>D/L</i>	<i>+0</i>	<i>+1</i>	<i>8</i>

The plane has 2 impulses the first phase, so goes straight twice (10cm)

It has 3 impulses in the 2nd phase, so goes straight 5cm, uses the turn template, then further 5cm straight

The final phase has 2 impulses. It dives (No movement because combined with turn) then uses the turn template.

Each turn loses 1 speed- a total of -2, but the dive adds 2, so no loss of speed due to manoeuvres.

The pilot adds 1 throttle, to the speed increases to 8. Next turn the plane will receive 3 impulses in the 1st and 3rd phases, and 2 in the second.

Start speed 6

1 st phase	2 nd phase	3 rd phase	Man	Eng	Speed
<i>D</i>	<i>D</i>	<i>D</i>	<i>+6</i>	<i>-3</i>	<i>9</i>

The plane has 2 impulses in each phase. As the orders are the same in each, every phase it will go 2cm forwards, and drop a height, then 5cm in the second phase- no second order means it goes straight. Speed gain is 3 dives x +2 – a total of 6. The pilot eases off the throttle to lose three speed, so the final speed is 9 depending on the plane there was a chance of damage if he kept at 12.

Start speed 8

1 st phase	2 nd phase	3 rd phase	Man	Eng	Speed
<i>SR</i>	<i>R</i>	<i>SR</i>	<i>-1</i>	<i>0</i>	<i>7</i>

Phase 1- 3 impulses: Slide right - each impulse 4 forward, and 3 to the right- a total of 12 forward and 9 right- however the plane has only moved 15cm total (check with Pythagoras!)

Phase 2- 2 impulses- straight 5cm then turn

Phase 3- Again 3 impulses: Again slide right each impulse 4 forward, and 3 to the right- a total of 12 forward and 9 right.

1 speed loss for the turn

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