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Weapon Training: Gunsights - Luftwaffe Revi Series

This page is offering the interested reader a rather free translation of a small booklet issued by the German Airforce to the fighterpilots. It is called "Horrido ! - des Jägers Schiessfibel. D.(Luft)5001

Shoot - and score hits!

Well - why did you not manage to down your opponent in your last attack? Do not blow it off (budge it) - this would be too easy! You think, this could not be assessed afterwards? Wrong, at least with a little reflection on the matter.

It is well known - from gun camera footage and combat reports - that a number of errors with regard to aiming and shooting are made on a regular basis. It is likely, you have the same issues:

1. You shoot from too far away.
2. Your lead is wrong.
3. You shoot from unfavorable positions
4. Your coordination of the aircraft controls is not smooth enough
5. You are not using the weapons control systems properly
6. You rely on tracers for aiming
7. Your aircraft and guns need proper adjustments.
8. You are using inefficient ammunition load outs.

Of course - there are probably some more reasons for your lack of success - but these eight well known issues will be discussed here in practical terms.

It is important for you to consider for each of the issues presented here, what went wrong in the past with you shooting.

Rule number one: Get close to your prey!

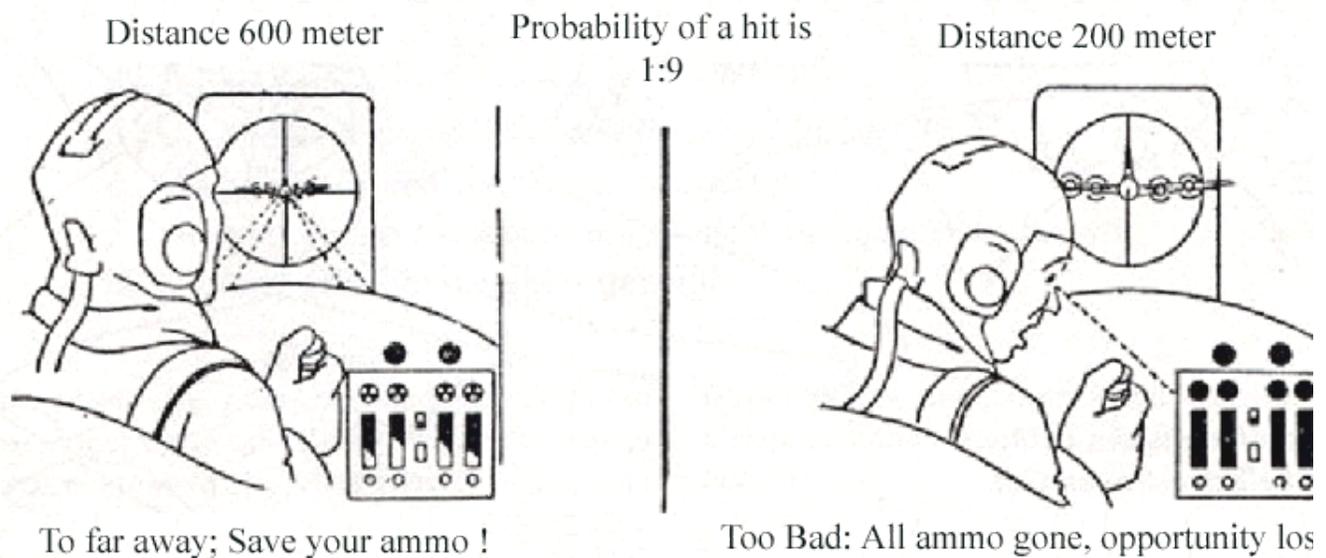
Hit probability:

Assuming you could - with a single burst of your armament - score a single hit frm 600 meters, than for all practical reasons - you would score with the

same amount of ammunition about four hits from 300 meters, nine hits from 200 meters and 36 hits from 100 meters.

Your probability to score hits grows exponentially (tremendously), the closer you get to the target. At half the distance of this example you do not get twice the number of hits but four times as much. And at one third the distance you score nine times as many hits! SO: GET CLOSE !

Of course, out of larger distance flying and shooting seems easier - but the result will be clear: holes in the air - not your prey. And of course, do not waste your ammunition from a distance. You will need it later - after getting close - to score decisive hits. Many pilots regretted to have wasted their ammo - when the opportunity to score really showed up.



And of course you will have to shoot and hit, till your opponent is defeated. The larger aircraft can take a lot of hits before you destroy them.

Estimating distances:

In combat it is only natural to misjudge distances. Like your dead reckoning tells you, you are 100 meters away - where using good judgment or actual measurement would set the distance at 200 meters. You should not go by dead reckoning. This is why you got a Revi in front of your nose. The outer ring of your Revi is so designed as to indicate 1/10 of the target distance at all time. Easy.

If you know about the size of your opponent - like the wingspan of a fighter being about 10 meters - and the wingspan fits just once into the outer ring, than you know you are 100 meters away. (since 10 meters (wingspan) is 1/10th of 100 meter). Would the same opponent fit twice into the ring, he is of course twice the distance away - i.e... 200 meters.

Memorize the golden rule:

Wingspan in meters x number of times the target would fit in the ring = distance to target in meters.

With a large bomber - having a wingspan of about 30 meters - fitting twice into the ring the distance would be

$$30 \times 2 \times 10 = 600 \text{ meters}$$

If you repeat the mental exercise of this type of calculation often enough, it will become second nature.

Now sit down, take pencil and paper and draw a couple of rings and enemy aircraft at various distances. Memorize the "pictures" as best you can - since if you do the following issues will be immediately apparent to you.

1. Whether you start shooting from too far away
2. Whether it is time to break off the attack
3. How fast the target is (how long did it take you to get closer by 500 meters ?)

These target pictures must become ingrained in your memory, for you to assess a situation without thinking or calculation: you will need to know, when you are 400 meters away instantly, since in a combat situation it is not likely your opponent will spare you the time to do any calculations. Just because of lack of mental practicing, the distances are misjudged so very often with mediocre shooting as a result.

For repetition:

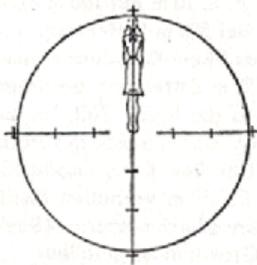
All four engine Bombers have a wingspan of around 30 meters, all fighters have approximately 10 meters of wingspan.

four engine bomber filling the ring once = 300 meters

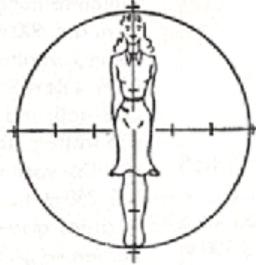
a fighter type filling the ring once = 100 meters.

Two engine aircraft vary from 16 to 28 meters of wingspan. You need to learn about this - else you will miss.

Examples



Agirl: 1.60 m tall
fits twice into the ring
 $1.60 \times 2 \times 10 = 32$ meter distance
Better get closer.



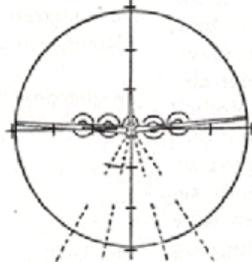
And now ?
fits once into the ring
 $1.60 \times 1 \times 10 = 16$ meter distance
Get a little closer.



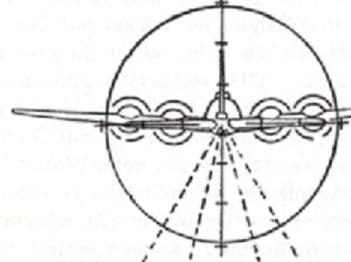
Oh oh ?
fits once into the ring
 $1.60 \times .5 \times 10 = 8$ meter distance
Oops better get outa here.



A Fortress with 30 m wingspan
fits twice into the ring
 $30 \times 2 \times 10 = 600$ meter distance



Go get her !
fits once into the ring
 $30 \times 1 \times 10 = 300$ meter distance



Keep shooting
fits 1/2 times into the ring
 $30 \times .5 \times 10 = 150$ meter distance

Calculating Lead

Estimating the right amount of lead is fairly easy. Have a look: A projectile will travel 500 meters in about one second. In this second your target does travel 100 meter. In case you are about 500 meters away from your target, you need to "lead" it by about 100 meters to make sure your rounds and the target meet - and this is of course what you want. You can see this lead of 100 meters best when you fly to your target at a 90 degree angle relative to his flight path (90 degree deflection).

If the target flying towards you at an angle smaller than 90 degrees, the 100 meters lead will appear to be reduced and your lead distance will need to be reduced accordingly. If the angle is zero (target flying directly towards or away from you) your lead distance will be zero.

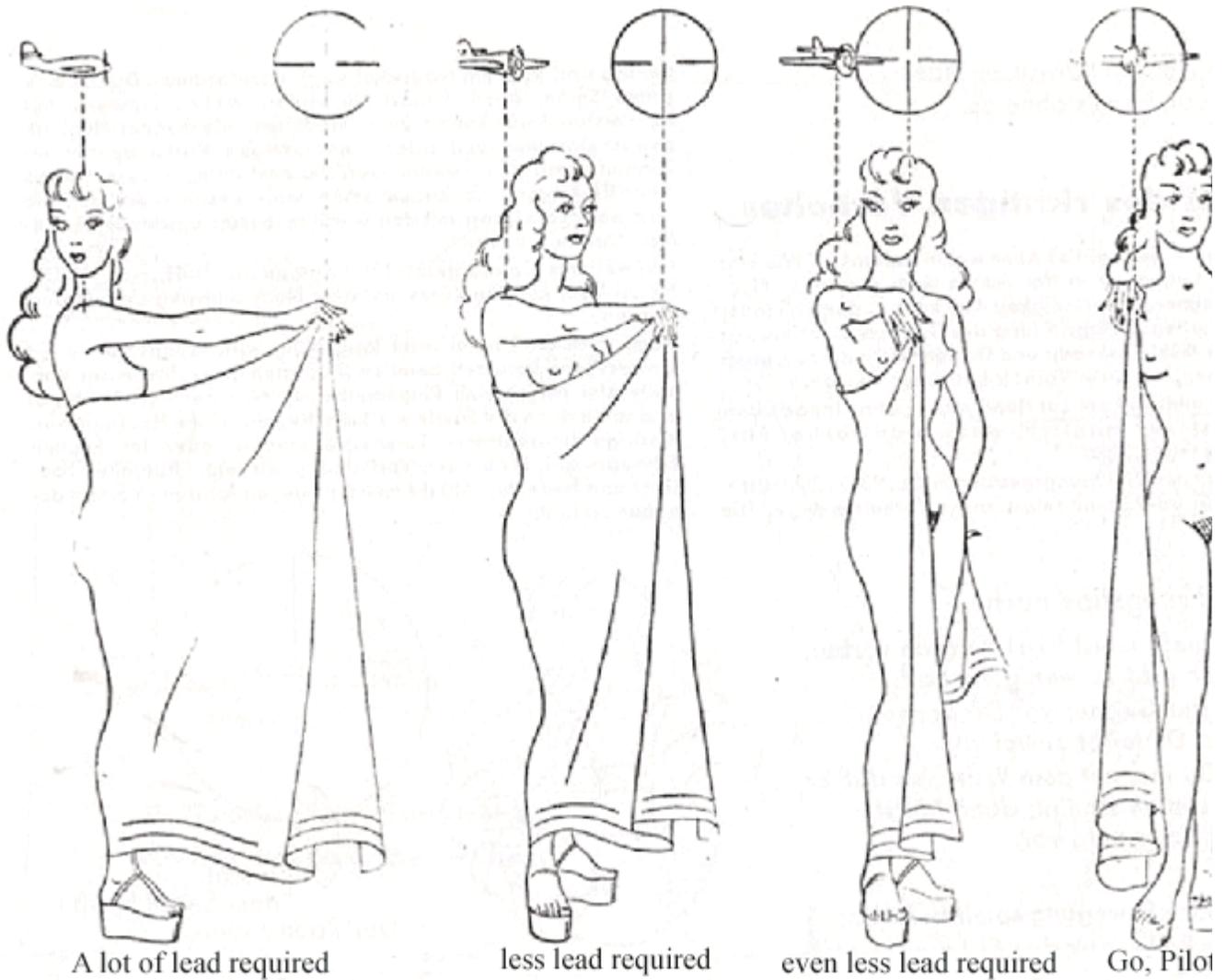
To estimate the amount of lead required use your Revi again. Remember: the full circle gives you always 1/10th of the distance to target. That means 10 meters at 100 meters or 50 meters at 500 meters.

Since you have to "lead" your target at 500 meter distance with 100 meters of lead, this means you need two times the full ring or four times the radius. At 250 meters your ammo and the target will take about half the time to meet in the same spot. Your target travels about 50 meters in this time - and this is your amount of lead. At 250 meters the circle encloses just 25 meters, since you have to "lead" by 50 meters it will take two full circles of the revi or four time the radius of this circle. Interesting - isn't it ?

Keep in mind: To calculate lead using the Revi the distance to target is not important - it is your line of sight to the target that matters.

T deflection angles smaller than 90 degrees, the required amount of lead is getting smaller. Assuming a target speed of 450 to 600 km/h it looks like this:

Deflection angle in degrees	Deflection in Revi radii
5	1/2
10	1
20	1 1/2
30	2
50	3



Coming to terms with "Lead"

Well, you are in combat, you are approaching your target - horrido! But where to aim? Wait a minute ! We have learned about it in the gunnery classes - let us see: Deflection 30 degrees, target speed at 400 km/h - that makes it 1,5 to 2 radii - now the flight path of the target ... Most likely you have been hit by now by someone with quicker wits, but the good thing is, you have now ample time to cope with your mathematical problem since you are most likely dangling from your parachute by now

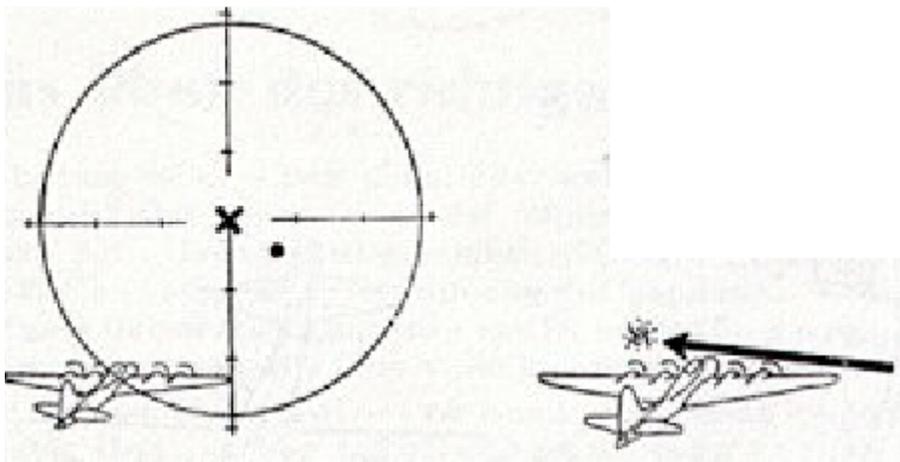
You need to know your aiming point directly in a combat situation - without any calculations. To achieve this you need to train, train and once again train!

A few hints from experience:

1. If your ammo misses the target aft, you have too little lead.
2. If the target buzzes past, you have too much lead
3. If you hold your target in your sight to the point where it appears to be stationary, your lead is slightly too small

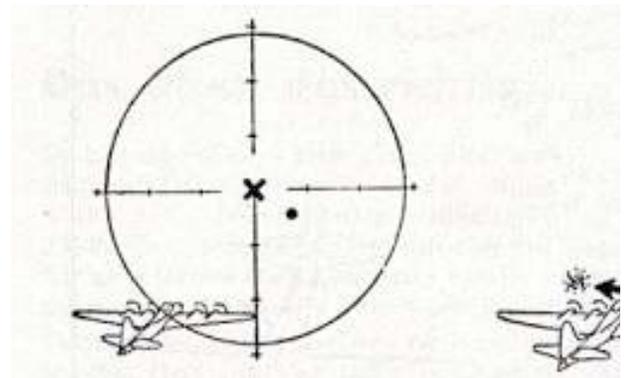
Remember:

It is not the apparent relative movement of the target that is important, just the angle of the relative flight path indicated by the aspect ratio of the target that it takes to calculate lead accurately.



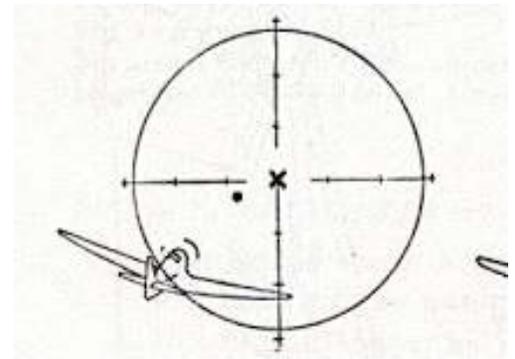
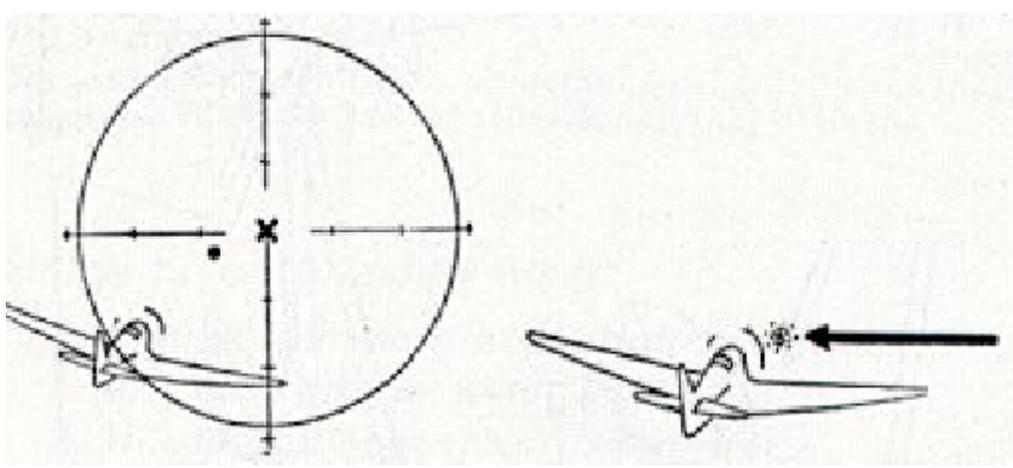
Accuracy:

How accurate does your estimate of lead need to be ? Let us have a look:



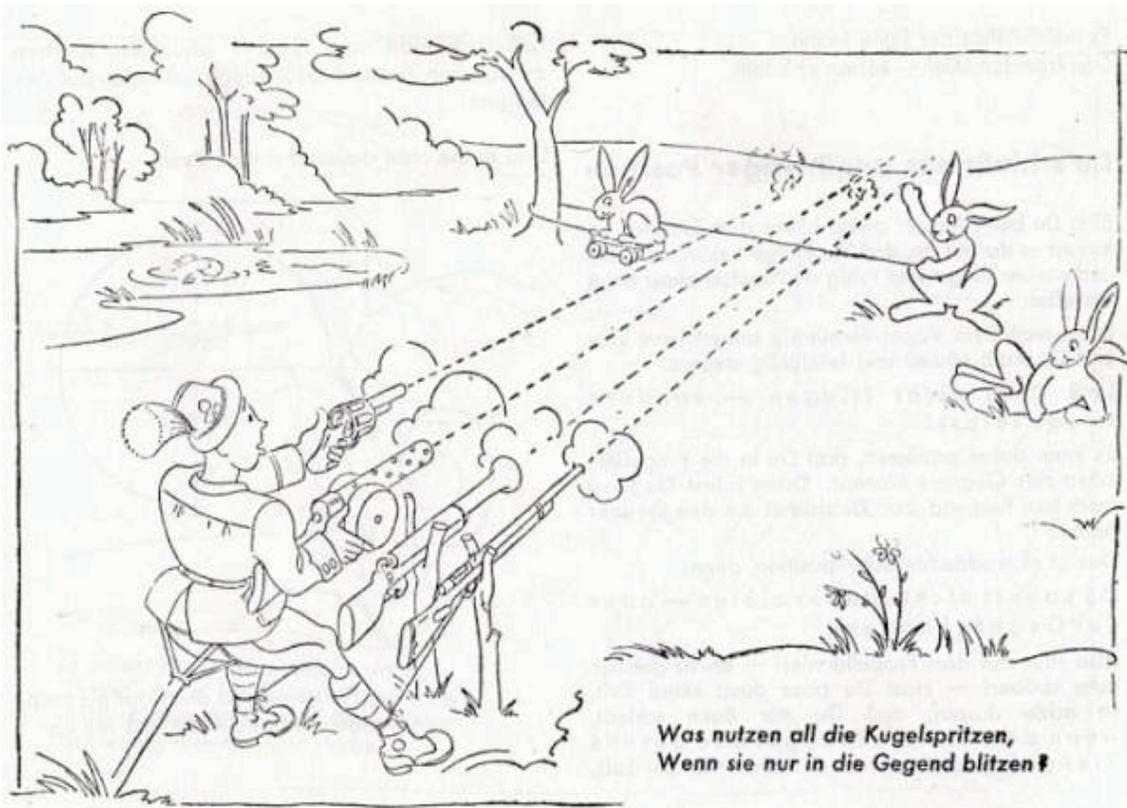
Example one (a Fortress at 300 - 400 meters) The dot indicates where you should have aimed - the x shows where your actual aim point was.

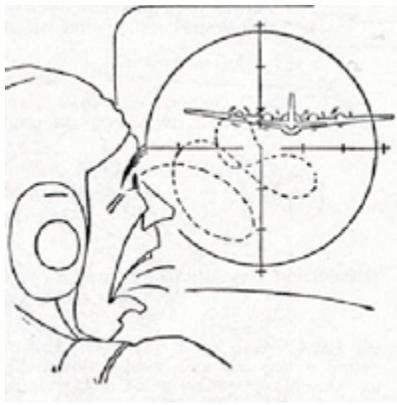
Would you have hit anything because of the dispersal of the projectiles on their way to target? The answer is a clear cut NO! As you can see in the picture.



Example two (a Spitfire at 100 meters). The dot indicates where you should have aimed - the x shows where your actual aim point was. And again - no hits.

Do not rely on ammo dispersal - this will not help you if you aimed badly. From the examples you can tell, how accurate your estimate of lead needs to be in order to score hits. If you still think it helps to harmonize your guns at a larger distance (larger cone of fire), well you are wrong my friend, as you can tell from the example of our huntsman below.





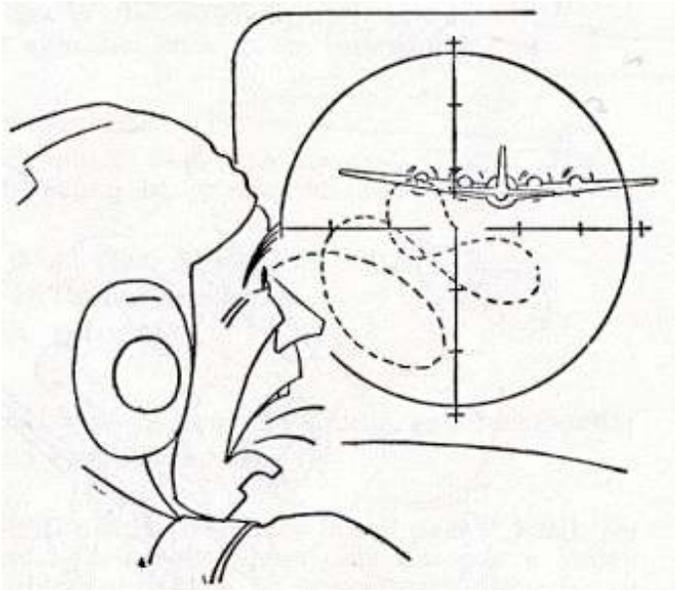
Shooting from inferior positions.

If you are directly behind a target in an attack it is paramount for good results to fly very smooth and to aim with high precision.

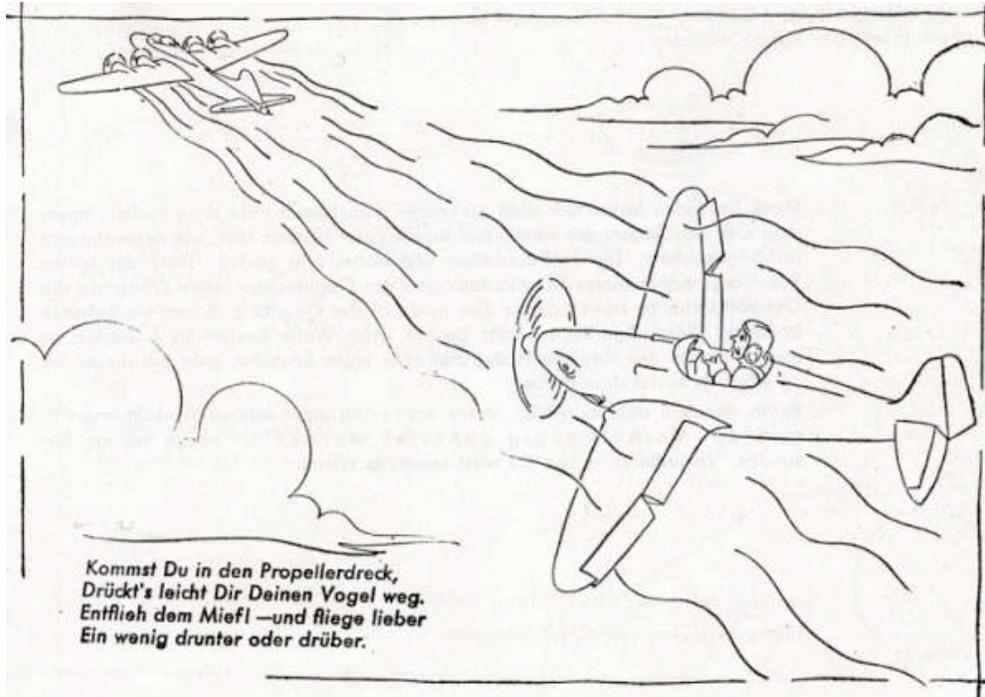
To achieve that, your bird needs to be trimmed accurately and your corrections have to be fast and precise.

Fly the bird - do not let the crate fly you ! Take charge. Be precise.

If you are getting very close, it is likely to get yourself into the wake or slip-stream of your opponent. In this case you will have a hard time keeping your pipper on the target.

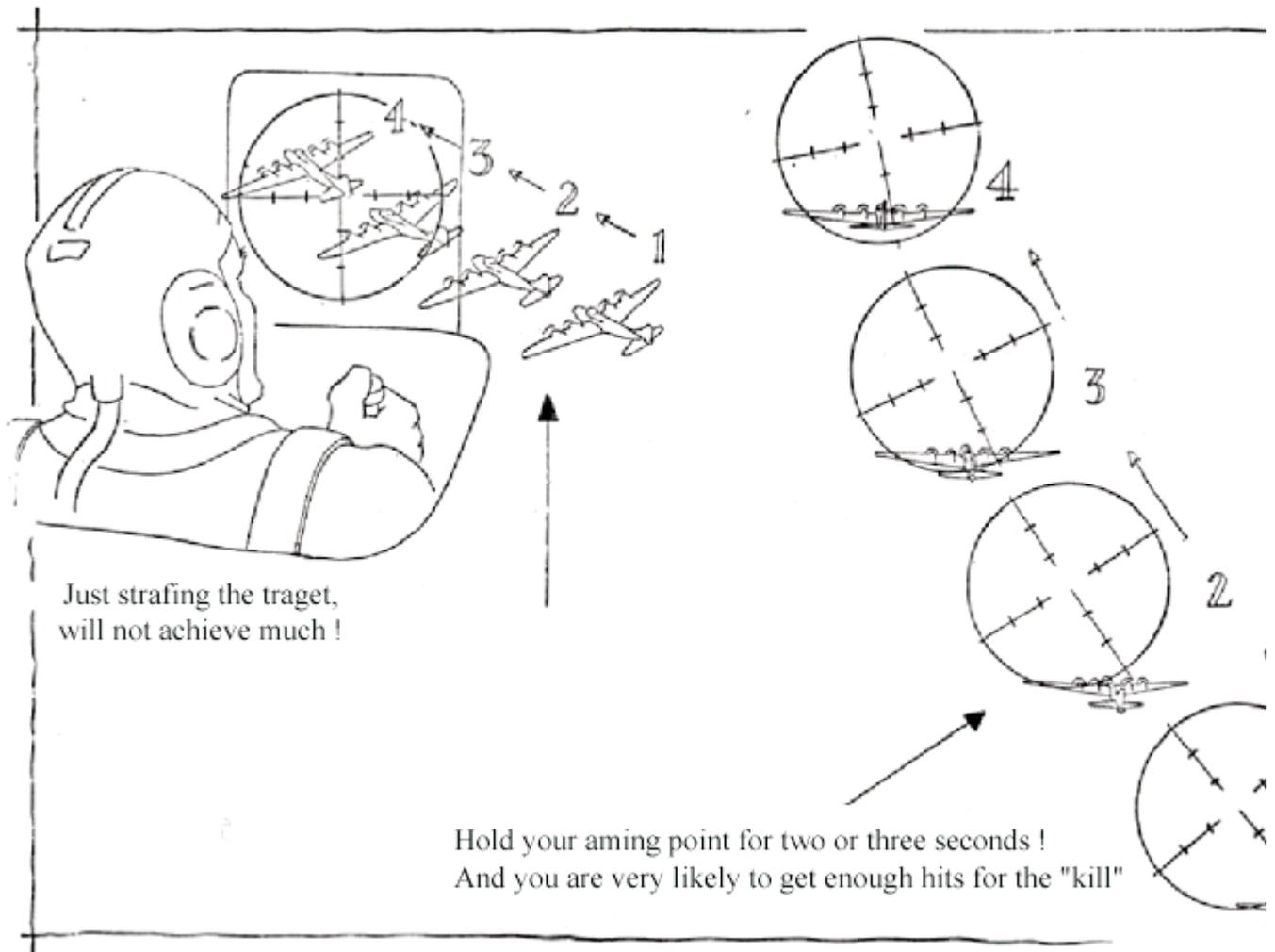


Get out of the turbulent wake of the aircraft in front of you - either by going slightly higher or lower. If you do not have the time to do so, make sure you only pull the trigger, when the pipper is dead on the target.



Remember: To make sure of your getting the "kill" it takes a sufficient number of hits on the target. Besides a very lucky shot, it is a question of hit probability. Distance is one component, but the time you keep your target in the sights with the right amount of lead is another factor. And these crucial seconds cannot be shortened. It does not help much to have the target just buzz through your aim point for split seconds. Your probability to score a critical hit is marginal. Even if your aircraft has a lot of firepower. If your target remains in the critical spot for just 1/10 of a second consider yourselves lucky if you manage to score a single hit with each weapon.

If you decide to shoot from poor angles, you need to hold your aim point relative to the target as long as possible. Try it, you will see it works.



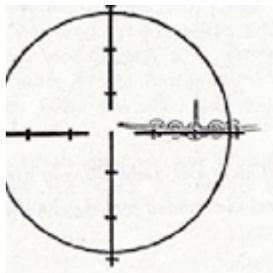
Coordinated Controls.

There are circumstances where your aiming point does not match with your expectations. You may have experienced this without taking specific notice. You are flying towards your target from say behind and left and you want to get into a chase turn. To get your piper on the target in a hurry you are using too much rudder besides the ailerons - more than it takes to fly a coordinated turn - you push the trigger and you miss, even though your aim appears to be correct.

The reason for this is simple - your aircraft is skidding, and the projectiles go off in the direction of the skid. The same is true when slipping in a turn.

If you need to shoot in a turn, the only solution is to keep the aircraft in a coordinated turn, else your mark will be off.

Of course, you can make small corrections of your aim with the rudder, since in this case skidding will be hardly noticeable.

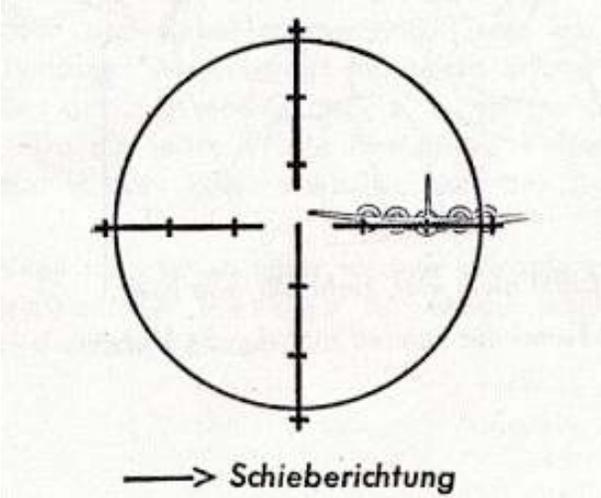


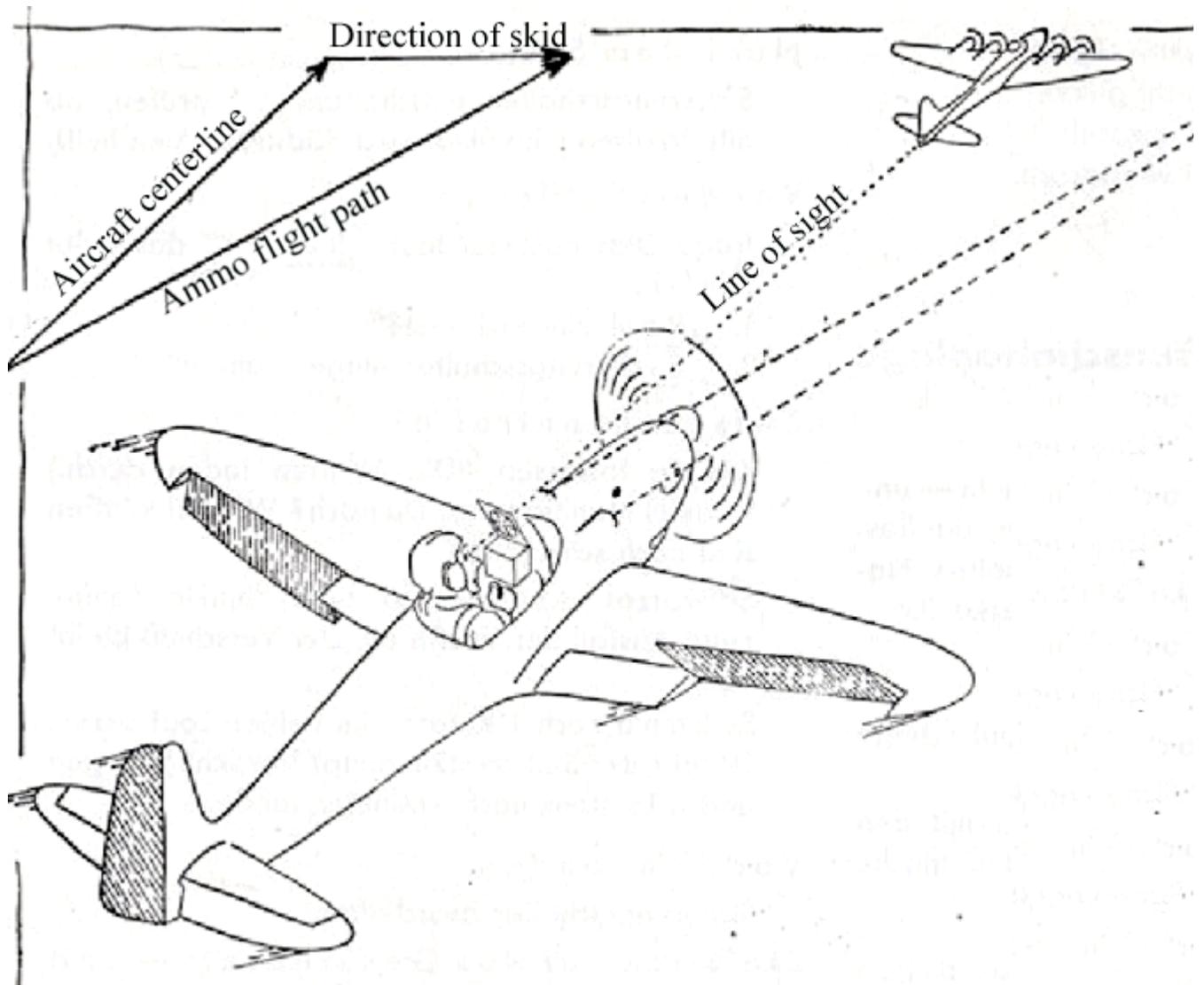
However, if you happen to get into a skid while turning and have to shoot, then the tracers may be of help to you in way or follow these hint:

When you skid from left to right: Aim to the left.

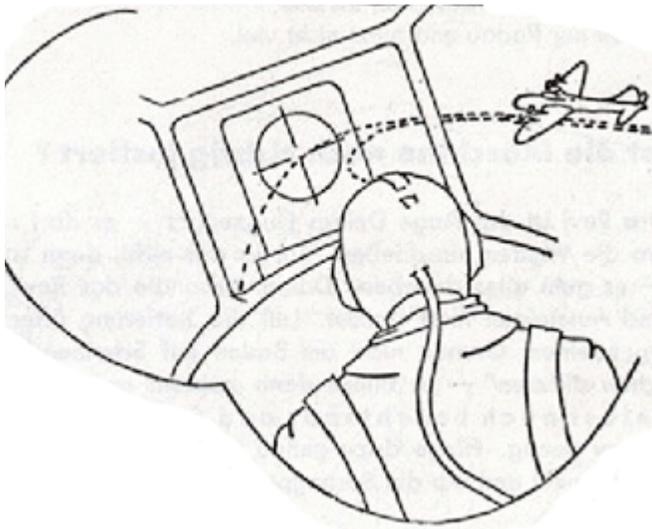
When you skid from right to left: Aim to the right.

In your gunsight it would look like this: Skidding form left to right.





Tracers are misleading:



Tracers will deceive you - especially when shooting in a turn. This is well known - and some do like the tracers mixed into their ammo load out at all. It is true for fighters, that almost all shooting will be done with gunsight alone. Any correction or your aim you may make guided by watching your tracers, will take place after assessing the error, which means after the projected time and place of impact. At larger distances between you and your target, any corrections made like this will be to late, this the situation may have changed in the meantime.

Tracers can aid you however, when:

1. You train your eyes to follow the tracers only in close proximity with the target and to ignore the rest of the misguiding flight path. This way, you may learn to ignore the indicated trajectory information.
2. You have developed a good feel for when the projectile is supposed to impact.
3. you keep your Revi at the aiming point and use the tracers only as additional information,

For sure: It is very tricky business to learn to use the tracers as a way to correct your aim. It takes a lot of practice, and the results may be mixed anyway.

Weapon Systems

FW 190 A6

