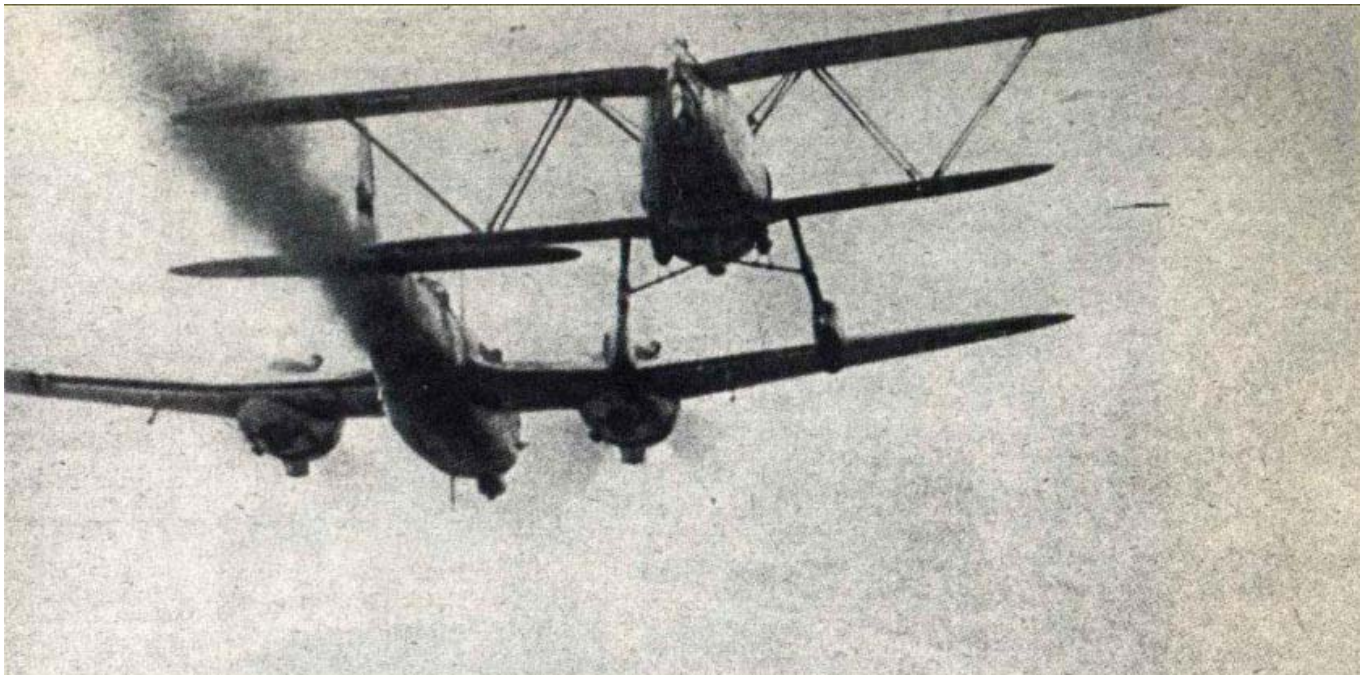
Sniper's Corner

v. 2.0



by Bruno & Abraxa

Forward

The aiming skill through the gunsight is one of the recurring problems met by all the combat flightsim pilots. It's a kind of skill mostly developed through the practice: hours and hours of flights&fights, essentially based on direct experiences. Nevertheless, the art of the perfect shot, especially with an high degree of deflection, is something obeying to the well defined rules of the ballistics science. The Sniper' s Corner (SC), developed having in mind the virtual pilots of Il2 Forgotten Battles in the first place, is an attempt to represent, with graphical immediacy, the essential elements of the gunsight and shooting scene as they appear to the pilot. The use of an electronic sheet easily allows the "what if" approach we need, since there is a considerable number of parameters affecting the relationship between the position of the target and the theoretically perfect moment to press the trigger.

For an easier understanding of how to use the SC, we suggest to repeatedly try to change each parameter at once and observe the corresponding visual effect. It's better to get used to each single separated parameter in order to understand the global effect obtained by adding one parameter on another and varying them all. The yellow cells in the sheet are associated with "input" parameters that can be modified. In order to set up the parameters the user has to select the proper cell and insert the desired value.

A note fit for all parameters adjustable through cursors. Clicking on the arrows on right/ left of the cursor, the value increases/decreases. Te user can even left click on the cursor and move it to select the right value. It is also possible to set up a value directly, that is, by selecting the yellow cell to the right of the cursor, and modifying the digits directly up in the bar.

Parameters of the target aircraft

- The first menu allows to select the type and the model of the target aircraft.
- The cursor *TR* (Target Range) sets the distance of the target. By changing this parameter you will observe the target getting smaller or larger, according to the distance.
- The cursor *TS* (Target Speed) sets the speed of the target aircraft.
- The cursor *Ao'T* (Angle off the Tail) sets the angle between the target flight direction (a nose-tail theoretical arrow) and the flight direction of the attacking aircraft. An angle of 90°, places the target on a trajectory perfectly perpendicular to the direction of the attacking aircraft. An angle of 180° determines instead the classic position of the "head on" to "hours 12". The angle of 270° corresponds to the perpendicular position of 90°, but in the opposite direction. Obviously, 0° corresponds to an attack from the tail ("hours 6").
- The *Ao' C* (Angle of Clock) determines the position of the target as regards the "quadrant" around the center of the gunsight. The values are indicated according to the order of the hours on the quadrant of the clock. In order to easily understand how this parameter works, set up the parameter *Ao' T* with the value of 90° at first, then try to vary the parameter *Ao'C*. Observe how the target moves around the center of the gunsight, just like a clock pointer. Therefore, *Ao'C* determines the direction of the motion of the target, in the plan of the gunsight.
- The cursor *Ao'BT* (Target Bank Angle) determines the angle of rolling (or banking) of the target. The positive values indicate the degrees of the banking on the right side. Those preceeded by a negative sign indicate the banking angle on the left side.

Parameters of the attacker aircraft

- Attacker Speed (*AS*), Altitude (*A*), Angle of Attack (*Ao'A*), Angle of Banking (Ao'BA). These parameters of the attacker aircraft work by selecting the yellow cell and setting up the value in the bar. The variations of the height, speed, angle of attack (*AoA*) and of the angle of banking affect in different ways the ballistic calculation. Try to change these parameters and observe the movement of the target inside the scene to see how much each of these parameters affects the scenario. Actually their practical relevance can be considered minor if compared to other parameters, but for the sake of completeness, *Sniper' s Corner* offers the opportunity to set them all up. The only exception to this general consideration is represented by the *AS*, only if it

assumes high values (600-700 km/h) and, at the same time, a low velocity muzzle shell weapon is employed.

- Guns. The importance of such parameter is paramount: according to the type of guns, the speed of the shells varies considerably togheter with its weight and dimensions. As we can easily see, the scenario changes a lot if one is using a low rather than a high muzzle shell velocity gun. Clicking on *DB guns*, left low, you can see the specifications for each kind of gun, from the caliber, to the muzzle shell velocity, weight and so on. For some guns, a label is used for marking the cartdrige type. *T* stands for tracer, *AP* for armour piercing, I means incendiary, *HE* high explosive and *MG* Minen Geschoss. Back to the console, observe how much the position of the target varies if you are using the deadly but "slow" 30mm mk108 rather than the equally devasting but much "faster" 37mm NS37 mounted on the Yak 9T [*].

  The new version of the SC allows you to select two different weapons and to switch quickly from one to the other through the cursor *Selected gun*, located under the "scenario" options.

  The *SC* allows now to create a personal customized guns database. Clicking on *DB Personal* you can access to a blank database that can be implemented by the user. The total number of "customized" guns is up to ten.
- The parameter *GD* (Gun Axis Distance) states the distance between the guns. Such position, specially for wing mounted guns, varies remarkablly from aircraft to aircraft. To represent the single arm in axis arrangement, like a cannon firing from the hub, it is proper to set GD=0.
- *SCD* sets the Static Convergence Distance, the distance (from the gunsight) of the ideal point on which the bullets, simmetrically fired by a couple of guns, will converge. It's set according to the individual preferences. We speak of *static* convergence because we imagine to be in the shoes of a ground crew working on an airplane standing on the ground. The convergence point during the flight is a little bit ahead than the one set on the ground. Such a forward shift is as higher as higher is the speed and the altitude of the fighter.
- The *Dispersion Angle* (Ao'D) concurs to set up the so-called "cone of dispersion" typical of each type of arm. Ideally, an angle of dispersion of the value equal to zero, should mean that each bullet of the same burst hits exactly the same point. Actually, each guns has its degree of accuracy and, of course, the gun mounting has its role in the resulting fire dispersion. The weapon is as much accurate as smaller the dispersion is. The default value of 0,4° seems quite coherent with the average angle of dispersion used in Il2FB. The definition of the Ao'D is of statistical nature. Conventionally, an angle of 0,4° means that the 75-80% of the bullets hits a point within a cone of 0,4°.

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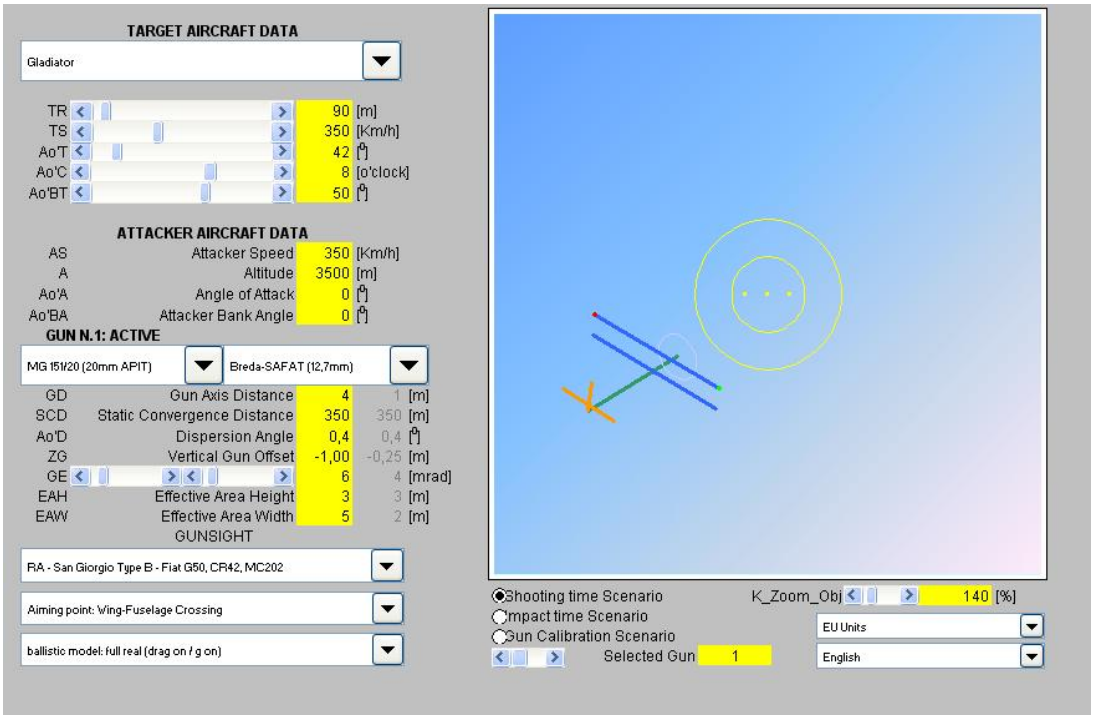
[*] *We would like to thank Emmanuel Gustin for allowing us to adopt, as a basis for the weapon DB, the ballistic data published in "the wwII fighter gun debate" website (see the links section). Some datas have been uptadet and corrected according to the values used in* Il2FB.

- The *Vertical Gun Offset* (*ZG*) indicates the distance between the line that ideally passes through the center of the gunsight and the line ideally traced for extension from of the position of the gun. A negative offset represents the most typical situation (-1 meter is the adopted as default value). However, for high winged planes mounting their guns on the wings (the Polish P11) ZG can be set to positive values. Anyway, for the great majority of the cases, it is suggested to leave this parameter as it is. Finally, for guns firing through the hub, –0,5 can be considered as a reasonable approx. value.
- GE. The *Gun Elevation* value was set by the ground crew in order to compensate the vertical offset, but above all to compensate the parabolic trajectory traced by the bullets. The actual parabolic form is obviously due to many physical factors such as gravity, the decay of the speed of the bullets due to air drag which,in turn, is related to the air density changes according to the altitude. The trajectory will therefore cross the aiming line (the ideal horizontal line steaming from the gunsight) in two points: the near zero pioint and the far zero point. Depending on the desired *DCS*, the convergence point (point blank) could result to be the near zero or the far zero. An observation on *GE* units. Mrad means "milliradiant" and it's used to define very small angles. Practically, an object 1mt tall at the distance of 1km implies an angle of 1 milliradiant. To have a clearer view about how to modify the parameters described in the points above, it's suggested to set the scenario on the option Gun Setup Scenario. That way you can visually grasp the variation of the offset, convergence and dispersion. In some texts, as an alternative to [mrad], the term [mils] is used as well.
- The *Effective Area Height* (*EAH*) and the *Effective Area Width* (*EAW*) delimitate the transversal section of the "corridor" through which the gunshots have to be concentrated to be effective.
- *Gunsight*. This menu allows you to choose the gunsight type you are aiming through.
- The *Aiming Point* menu allows to decide the point of impact of the bullets: nose, wing/fuselage crossing, center of the left wing, center of the right wing, tail, engines (up to four).
- *Ballistic Model*. It has four ballistic options. Ideal (drag and gravity forces aren't taken into account). Intermediate 1 (drag is calculated, gravity isn't). Intermediate 2 (gravity is calculated, drag isn't). Full Real (both drag and gravity affect the calculations).

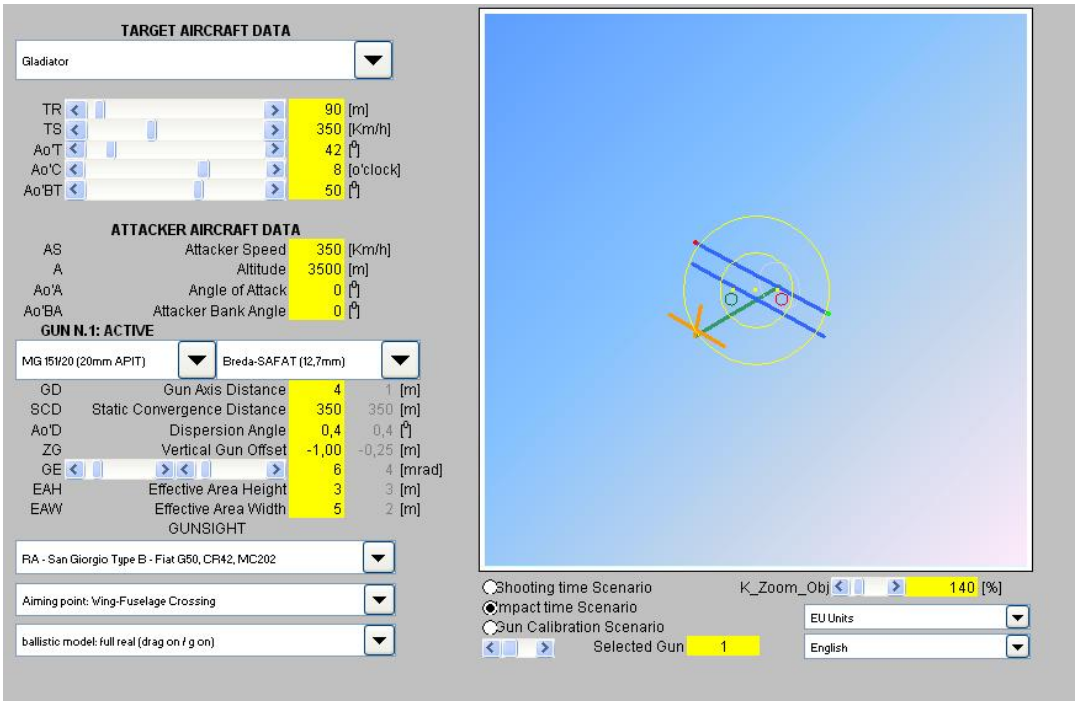
Other menus

- The menu *Scenario* offers three options.

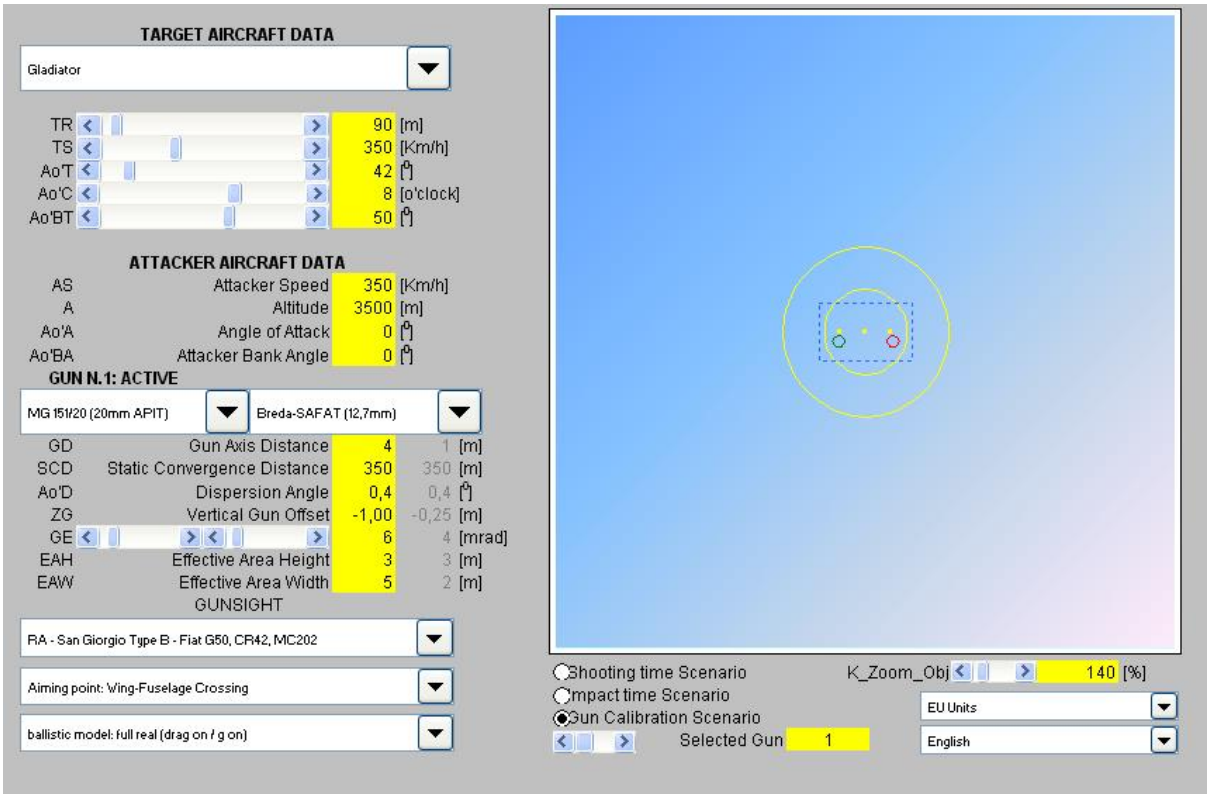
1. The first one (shooting time scenario) shows the right position of the target at the right moment to push the trigger.



2. The second one (*impact time scenario*) corresponds to the position of the target at the moment of the impact of the bullets, provided the two planes didn't change their respective speeds and directions.



3. The third option (gun calibration scenario), without any target, is used to set up the gun calibration parameters at "zero" aircraft altitude and speed. The dotted rectangle delimitates the area of effectiveness coherent with the value selected in the *DB* cell. The interval of distances within which the dispersion cones are internal to the area of effectiveness, represents the "window" that delimitates the area where the gunshots appear to be sufficiently concentrated to be effective.



In both the impact time scenario and gun calibration scenario a green and a red circle can be observed. These circles represent the weapons dispersion area. The green circle is associated with the left mounted arm whereas the red one is the right mounted arm dispersion cone. In order to figure out the bullets trajectories when calibrating *GE* to get a desired *DCS*, we suggest to select the gun calibration scenario and change the *TR* parameter by moving the slider.

- The *K_Zoom_Obj* allows to zoom in and out the scenario and helps to see the whole scene in case of highly deflected shootings.
- The measure units menu allows to select the European metric system (*EU*) or the Anglo-Saxon system using iardes, feets and mph (*UK*).
- With the last menu, you can select the interface language of the *SC*, Italian or English.

Further readings and links

Andy Bush on fighter combat:
http://www.simhq.com/_air/air.html

Gunsights:
http://paparomeo.freeyellow.com/sighttable.html

The Galland's manual and guide to aim, for the Luftwaffe pilots
http://rafiger.de/Homepage/Pages/Schiessfibel.html

1943 RAF Gunnery School Manual:
http://www.greatergreen.com/il2/

History and analysis of the weapons of WWII aircrafts:
http://users.skynet.be/Emmanuel.Gustin/fgun/fgun-in.html
http://mitglied.lycos.de/jaytdee/fbg/rof.html
http://free-st.hinet.hr/dvd/Weapons.html
http://www.axishq.wwiionline.com/~ring/info/ammo/ww2ol-weapons.htm

Website by Edoardo Mori on ballistics, in Italian:
http://www.earmi.it/default.htm

Site on the flight physics of bullets:
http://www.nennstiel-ruprecht.de/bullfly/intro.htm#header_introduction

Statistic analysis of bullet dispersion:
http://www.concentric.net/~reaper/gunnery/gunnery.html