Ground Attacker

Handbook

1st Edition



StG77_HvB

ABOUT THIS HANDBOOK

The focus of this handbook is effective utilization of the German and Russian Ground Attack aircraft available within the online multiplayer servers of the *IL-2: Great Battles Series*.

This handbook presupposes proficiency in basic operation of the Ground Attack aircraft described herein, to include taxi, takeoff, landing, engine operation, bombing, gunnery, and navigation. As such, it does not cover basic operational procedures. While the topics covered are applicable to any multiplayer server, the handbook does maintain a predilection toward the challenges faced in expert server environments.

Ground Attack is a rather broad topic, and there are as many possible methodologies and approaches as there are players. This handbook is not intended to be the final word on the matter, but rather one player's perspective gained through a great deal of online play. Readers may adopt or disregard the many recommendations contained in this manual through comparison with their personal experiences.

This handbook is very detailed in both situational analysis and recommended approaches. Some players may find the page-after-page of minutiae a bit overwhelming, or feel that such a detailed approach is unrealistic or overkill for online play. The amount of effort one is willing to put forth in pursuit of a reward, and naturally the perception of that reward's value will vary from one person to another. That is to say, the line between what is perceived to be "fun" versus "work" will shift depending on the individual. I can only communicate that writing out explanations of the concepts contained herein was exponentially more difficult than knowing the concepts and implementing them during online play. Once these concepts are internalized and become intuitive, they can be executed effortlessly. To repeat the point of the preceding paragraph: Take out of this what works for you and leave behind what does not. Sometimes a player just wants to "play" without the mental exertion of conjuring and briefing an Attack Plan, and that is understandable.

A prime, underlying theme of this handbook is mission survival. There is a wide spectrum of player behavior regarding this aspect of play. On one end is a risk-adverse mindset bordering on neurosis. On the other is mission after mission of thoughtless, careless, reckless absurdity. Between those two extremes lies a profusion of approaches leaning toward either end at varying degrees, often influenced by server penalties for death, capture, and loss of aircraft. While elevating the value of mission survival, this manual does not advocate a specific position concerning *how much risk is too much* for a potential sortie. Rather, it imparts the benefits of identifying and analyzing all risk factors associated with Ground Attack missions and describes systematic and coherent steps to minimize them.

Update 3.008 occurred at the completion stage of this handbook. The sweeping changes to vehicle damage modeling that accompanied 3.008 have consequently changed both the mechanics and the definition of tank destruction in ways that are undergoing player evaluation and analysis as of 12/2018. While a vehicle exploding is still an indicator of its destruction, the program will now list a tank as "destroyed" after incurring a certain amount of track and roadwheel damage. The level of track/roadwheel damage necessary to classify the tank as destroyed is currently not clear, as often a tank with a broken track or roadwheel is not listed as destroyed. My personal impression is that while the amount of ordnance required to destroy a tank does not appear to have changed significantly, visual determination of whether a tank is destroyed (explosion) in a multiplayer environment is now only partially valid, as an unexploded tank exhibiting roadwheel and/or track damage *may* or *may not* be destroyed.

I would like to extend sincere thanks to the TAW players who took time to communicate their thoughts on Fighter vs. Ground Attacker interactions. I found much of their input very illuminating and sometimes surprising. Overall, the spectrum of responses provided some significant insight into the concerns, thought processes, and approaches of some of the best players defending against Ground Attacks.

StG77_Kondor has been leading StG77 since the days of IL-2 1946 and has been my main flying buddy since January 2017. I have learned a great deal from him throughout hundreds of hours of online play. He is the most talented Ground Attacker I know, and I am convinced if he didn't love Ground Attack he would be one of the top fighter pilots in the game. No matter the aircraft he's in, if you give him the opportunity, he will shoot you down. Without his insights and helpful review of this entire document, the quality of the final product would have been much lower.

*Finally, a big "Thank You" to JimTM, who came out of the blue within hours of this handbook being posted online and saw room for formatting improvements. He spent his Saturday afternoon singlehandedly synchronizing page numbers, optimizing the PDF file, and reducing the file download to less than half of its original size with no quality loss. The IL-2 community is fortunate to have people like Jim, and I am truly grateful.

GLOSSARY OF TERMINOLOGY

Attack Altitude – the altitude from which an attack against an enemy Target Area will commence.

Attack Azimuth – the compass direction of an attack against an enemy Target Area.

Attack Dive – a dive from any angle from the Attack Point to the Target Area.

Attack Plan – a comprehensive and detailed plan to attack an enemy Target Area.

Attack Point – a pre-planned location near the Target Area from which an attack toward the Target Area will start.

Egress Altitude – the altitude maintained when moving toward friendly lines and destination airfield after completion of an attack on an enemy Target Area.

Egress Azimuth – the compass direction of a route from the Target Area back to friendly lines and a destination airfield.

Immediate Action Plan (IAP) – a pre-planned series of actions an individual or Flight Group will take upon chance contact with enemy fighters.

Immediate Action Decision (IAD) – an on-the-spot decision made by an individual or Flight Leader concerning what actions to take upon chance contact with enemy fighters.

Initial Egress – the initial movement away from a Target Area after releasing bombs, until out of AAA range.

Point of No Return – a designated point on the ingress flight route where the individual or Flight Group will continue movement to the Attack Point and execute an attack on the Target Area regardless of local enemy activity.

Target – a single enemy structure, vehicle, or gun within a Target Area.

Target Area – an enemy position comprised of several individual targets. Target Area examples include Defensive Positions, Vehicular Columns, Airfields, and Factories/Depots.

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1. KNOWLEDGE BEGETS SUCCESS

A Ground Attacker aware of the mission-relevant factors identified in this section will have enough information to:

- **Make sound decisions regarding Target Selection**
- **Formulate an Attack Plan maximizing mission success and survival**

Absence of knowledge about the factors presented in this section can potentially start an avalanche of negative events leading to a disastrous conclusion.

There are two primary goals of any Ground Attack mission:

- **Hit the Target Successfully**
- **Avoid Being Killed or Captured**

Players who do not place much importance on the second goal should read no further, because this handbook places equal importance on both.

1.1 COMMUNICATION

Communication is the single-most indispensable tool to mitigate risk. At a minimum, all members of a Flight Group should be in voice contact via TeamSpeak, Discord, or a similar voice communications program. Ideally, the Flight Leader should also be in contact via TeamSpeak Whisper or similar function with other players operating in and around the intended Target Area. Server team chat text can be utilized if voice communications are not possible, but the problem with team chat is that it is both ahistorical and often impractical. WWII pilots did not type text messages to each other from the cockpit. More importantly, a pilot in a dogfight, on a bomb run, or evading flak cannot type messages in a timely manner, causing delays or outright omissions of critical information. Ultimately, team chat is still better than no communication at all.

On the other hand, too many players on the same TeamSpeak or Discord channel can make communications chaotic. This issue can be mitigated by Flight Groups occupying separate channels and Flight Leaders utilizing multiple communication methods, such as the TeamSpeak Whisper function, for inter-team communications.

1.2 KNOW THE SERVER



Every server presents unique operational environments, aircraft availability and bomb payload limitations, penalties for failure, and victory conditions. When available, it is highly advised to read a server's player manual prior to flying missions there. These manuals are normally available on the server website.

1.2.1 SERVER EXAMPLES



Tactical Air War has a feature where hidden AI ground troops will fire on enemy aircraft behind their lines and broadcast the location of those enemy aircraft on team chat. *Coconut Expert* has AI fighters patrolling certain areas. Flak guns, not shown on the server map, also guard specific bridge locations. *Wings of Liberty* has the GPS function enabled, which makes navigation easier for you *and the enemy*. Enemy fighter pilots with no navigation concerns will reach a ground Target Area effortlessly and have much more free time to look for you instead of staying oriented. Awareness of each server's mission environment will prevent nasty surprises.





1.2.2 TARGET AREA/TARGET RELEVANCE

It is important to know how server-specific Target Areas are relevant to the mission scenario in terms of their function, importance, and how destruction of certain Target Areas and specific targets within Target Areas affects both sides in both the short and long term.

1.2.3 PILOT/AIRCRAFT LOSS

The penalties for getting killed or captured in some servers are negligible, while in others, particularly expert servers, they can be quite severe, resulting in a mandatory "time out" period lasting minutes to hours, loss of accrued Combat Missions, termination of kill streaks, a significant loss of player points, and no credit for any ground targets destroyed on that mission. Likewise, the loss of an an aircraft due to a ditch, bail out, or crash may limit future availability of that aircraft type along with a point loss. Loss of aircraft or virtual pilot lives (through kill or capture) may also be detrimental to your team's chances of victory in certain expert servers. Depending on the server flown, this juxtaposition of a Target Area's tactical importance versus the costs of aircraft/pilot loss while attacking that Target Area is a primary consideration for the Ground Attacker.

1.2.3.1 Suicide Jockeys. Servers with minimal penalties for aircraft/pilot loss encourage reckless behavior. In these servers an enemy fighter pilot may press an attack against you regardless of friendly escort presence, the amount of damage inflicted on his own aircraft, or the certainty of mutual destruction. While servers with heavy penalties for aircraft/pilot loss largely prevent this

type of behavior among most pilots, there will nevertheless always be a small but significant number of enemy fighter pilots who do not value their virtual life or aircraft as much as you value your own.

1.3 KNOW THE TARGET AREAS



It is beneficial to know as much as possible about each server-specific Target Area type. While the layout and of bridge and railway station Target Areas is roughly similar across different servers, there are significant differences in other types concerning size, layout, and AAA numbers/effectiveness. These differences will exert significant influence on Target Area Selection and the multiple parameters of the Attack Plan.

1.3.1 TARGET AREA TYPE/LAYOUT/AAA CONFIGURATION

- ✓ ***Vehicle Columns** – stationary or moving?*
- ✓ ***Defensive Positions** – enclosed or spread out?*
- ✓ ***Factory/Depot Positions** – single or multiple location layout?*
- ✓ ***Airfields/ Depots** - recon photo available on server website?*
- ✓ ***Flak** – number of guns/location/type/accuracy/activation range*
- ✓ ***Damage** - Has the Target Area been attacked already? How much remains?*

Aggregate Target Area knowledge can be obtained through flying experience within the server. Immediate targeting information can often be obtained from fellow team members in the server who have recently surveyed the Target Area and can answer immediate questions about AAA and condition of targets. Target Areas in some servers such as *TAW* contain individual tanks and artillery pieces in defensive positions that contribute a significant numerical strength value to the position in proportions much greater than their diminutive appearance from the air. Knowing in advance where these equipment types are located within the Target Area makes for more efficient and effective Ground Attack results.

1.4 KNOW THE WEATHER



Cloud density/altitude and wind speed/direction are two factors that can influence target selection. Heavy and even medium clouds can hinder level bombing missions by obscuring the Target Area. When the cloud base is low, target acquisition and identification will be difficult at higher altitudes, as will any attack requiring a high-altitude dive. A strong crosswind blowing 90 degrees across an attack heading can make accurate target lineup and pinpoint bombing accuracy problematic. High ambient temperatures mean slower aircraft speeds, and increases the time needed to climb to altitude. At extremely low ambient temperatures aircraft performance is much improved, picking up speed faster in a dive and lowering the required Attack Altitude to

reach a desired Low Angle diving attack speed. Low visibility conditions due to falling snow or rain make navigation and Target Area identification more difficult, while improving chances of not being detected by enemy fighters. Snow conceals terrain features and makes navigation more difficult.

1.5 KNOW YOUR FELLOW PILOTS

- ✓ **How large is the Flight Group?**
- ✓ **How competent and experienced are the pilots in the Group?**
- ✓ **How competent and experienced are the fighter pilots escorting the Group?**
- ✓ **Are there pilots in the Group you've never flown with?**



The answers to these questions acutely affect the Target Area Selection process. Navigation skills are mandatory in no-GPS servers. Engine management skills are critical to maintaining a cohesive flight formation. Bombing, strafing, and communication skills are critical for multiple-pass attacks. When time is a crucial factor, a mission can be jeopardized or even ruined by Flight Group members failing to spawn, taxi, and takeoff in a timely manner. Effective fighter escort can often greatly facilitate mission success, and intersects with considerations concerning the enemy situation described in **Subsection 1.7**.

This is the bottom line – when you have inexperienced or unfamiliar pilots in your Flight Group, a complicated and intricate Attack Plan is a bad idea. The same applies to fighter escort: When unsure of escort effectiveness, formulate an Attack Plan that minimizes the possibility of enemy contact – whenever possible.

1.6 KNOW YOUR AIRCRAFT

- ✓ **Speed (Cruise. Emergency Power)**
- ✓ **Dive Characteristics**
- ✓ **Climb Characteristics**
- ✓ **Maneuverability**
- ✓ **Ordnance Loadouts**
- ✓ **Durability/ Damage Sustainment**
- ✓ **Gunner Position Effectiveness**



The A20B is extremely fast and can even dogfight to an appreciable degree but cannot endure high-G maneuvers or sustain damage as well as a Pe-2. The Pe-2 is the toughest aircraft of all and holds a well-earned reputation for rear gunner lethality. But it cannot destroy tanks with its forward-firing armament like the IL-2. The He 111 carries an impressive bomb load but is slow and will fall apart in a high-speed dive. The Ju 88 has superior dive performance but no effective forward-firing armament like the Bf 110. The Ground Attacker should be familiar with the ordnance packages, flight capabilities, and engine limits of each aircraft type to determine

suitability for a given mission. Attack Plan specifics will vary significantly depending on the aircraft utilized.

1.7 KNOW THE ENEMY

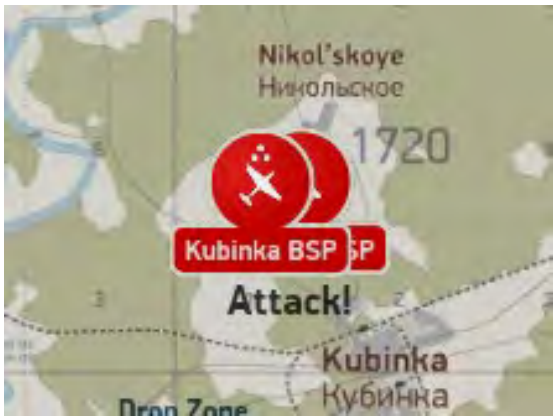
Consideration of the five variables in this subsection will determine the degree of urgency for fighter escort when planning attacks on potential Target Areas, and the number of fighters required. If escort is not available, analysis will at a minimum provide a picture of probable enemy presence at each Target Area location.

1.7.1 ENEMY NUMBERS



The higher the number of enemies in the air, the greater the possibility of being intercepted. Even when friendly player numbers are at parity with or greater than enemy numbers, *unless they are all flying with you, total friendly player numbers are absolutely no guarantee of protection.*

1.7.2 ENEMY LOCATION



The dots on enemy airfields as shown on the server map provide a very approximate idea of enemy player distribution. Some airfield map markers show two icons labeled **FSP** (Fighter Spawn Point) and **BSP** (Bomber Spawn Point), showing separate dots for each icon. This is a helpful indicator of the rough percentage of enemy players flying fighters. The airfield icon dots only show where the enemy is spawning, not their intentions. While most enemy fighter pilots will head toward either enemy or friendly positions closest to the airfield where they spawn, crafty enemy fighter pilots will often intentionally spawn at an airfield far away from the position they intend to cover, as a deception measure to fool opposing Ground Attackers.

1.7.3 ENEMY GROUPINGS



It is often helpful to ask for information concerning concentrations of enemy activity through voice communications or team chat, both prior to takeoff and during the flight to the Target Area. Experienced pilots in the Target Area, once they are aware of your movement toward that area, may provide a running commentary on enemy activity as you close the distance. Hit the TAB button and/or look at the server website to see the list of enemy pilots. There is a

reasonable possibility that pilots belonging to the same squadron will be flying in one location together.

1.7.4 INDIVIDUAL ENEMY PILOT HABITS

If the number of enemy players is low and time permits, scanning individual enemy pilot stats on the server's website can often provide some degree of insight concerning their *modus operandi* and probable intent. At a minimum, the stats will show whether an enemy pilot primarily flies ground attack or fighter aircraft.

1.7.5 STELLAR ENEMY FIGHTER PILOTS

There is a small but significant number of fighter pilots who have achieved an extremely high level of Aerial Combat Maneuvering skill and gunnery proficiency. They are also very experienced at anticipating the intent and location of Ground Attackers. When server player numbers are low, their presence can exert a profound impact on operations and outcomes for both sides. Ground Attacker losses may be exceptionally high should these exceptional fighter pilots choose to defend objectives. It is critical to identify and become familiar with the habits of these players, and plan accordingly when they are flying on the opposing team.



When player numbers are low, stellar enemy fighter pilots can rack up a high number of kills by defending a position and picking off Ground Attackers as they approach the Target Area in piecemeal, individual attacks. By keeping an eye on stellar enemy pilot real-time stats and maintaining communication with other Ground Attackers, you can ascertain the situation and come up with a plan to avoid, deceive, or defeat them.

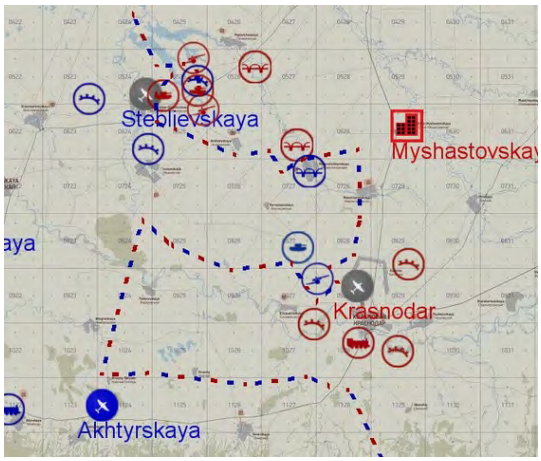
2. FORMULATING AN ATTACK PLAN

Armed with an awareness of the factors presented in **Section 1**, we scan the map looking at potential Target Areas. As our eyes move across the map, Attack Plan rough drafts rapidly flit across our brains, accompanied by our best estimates of each plan's chances of success in the current server environment. If flying with other players, we debate the merits of each proposed plan. In this section we will examine those decision-making processes in detail.

Target Area Selection and Attack Plans go together – you must be knowledgeable of the latter to perform the former. In **Section 2** we will first examine the considerations related to **Target Area Selection**, then explore the components of an **Attack Plan**.

2.1 TARGET AREA SELECTION

2.1.1 RISK ACCEPTANCE



The two primary Ground Attacker goals stated at the beginning of this handbook – hitting targets successfully and staying alive and uncaptured - are potentially conflicting, as attempting the first goal necessarily puts one in a position to fail the second. After identifying the myriad threats and threat mitigators associated with a given Target Area, you must decide how much risk you are willing to stomach. There are two potential loss possibilities inherent to any Ground Attack sortie:

- ✓ **TOTAL LOSS: Pilot + Aircraft loss (Killed or Captured)**
- ✓ **PARTIAL LOSS: Aircraft loss only (Shot Down but not Killed or Captured)**

For every potential Target Area considered, you must quickly make a series of evaluations and decisions:

- ✓ **Identify the threats**
- ✓ **Identify the measures available to mitigate those threats**
- ✓ **Estimate the post-mitigation, net risk level for both TOTAL and PARTIAL loss possibilities**
- ✓ **Decide whether you are willing to accept the net risk**

There is a wide spectrum of player preferences and attitudes concerning risk-taking. A discussion concerning the dichotomy of routinely "taking one for the team" versus playing for personal prestige on the stat pages is outside the scope of this handbook. Often the most important Target Area on the map in terms of victory conditions is, not coincidentally, the most dangerous – and vice-versa. The only advice offered here is this: If you're playing in an expert server, do your best to play like an expert. If you're losing pilots and planes in numbers disproportionate to the amount of damage inflicted on the enemy - reevaluate your risk acceptance philosophy.

2.1.2 THREATS AND THREAT MITIGATORS

2.1.2.1 Enemy Fighters. (Described in **Subsection 1.7**).

- ✓ **Assess total enemy numbers**
- ✓ **Assess the enemy fighter/bomber distribution**
- ✓ **Estimate enemy locations**
- ✓ **Estimate enemy intent**
- ✓ **Estimate enemy player ability/proficiency**

These assessment steps will assist you in making an overall evaluation of the threat they present around your intended flight route and Target Area.

2.1.2.2 Enemy Fighter Threat Mitigators

Escort. The single-most effective asset available to minimize the threat of enemy fighter interception is a proficient and preferably numerous fighter escort. Even if escort pilot proficiency and numbers are less than ideal, your escort may sometimes distract enemy fighters just long enough for you to execute an unobstructed attack and egress.

Numbers. The higher the number of aircraft in a Ground Attack Flight Group, the better everyone's chances of not getting shot down – on a statistical, individual basis. This is not to say there won't be some unlucky "sacrificial lambs," and the aircraft that normally suffer the brunt of pursuing enemy fighter attacks are the ones in the rear of the formation during egress. Immediate Action Decisions are discussed in **Subsection 4.2.**

The Pe-2. In terms of self-defense, the Pe-2 stands high above all other Ground Attack aircraft in the *IL-2 Great Battles* inventory. Its ability to sustain damage and stay in the air is unparalleled. Its rear-facing, crew-controlled gun package is infamous for dispatching enemy fighters. The aircraft's reputation alone makes many a German fighter pilot think twice before chewing away at it from the 6:00 position, lest they become the main course. For these reasons, you will find that you can take a Pe-2 into high-threat environments you would never even consider entering with any other aircraft. The Pe-2 is discussed in detail in **Subsections 5.2.4 and 5.2.5.**

Airfield Selection. Discussed in **Subsection 2.4.1.**

Route Selection. Discussed in **Subsection 2.4.2.**

Attack Azimuth. Discussed in **Subsection 2.4.3.2.**

Egress Azimuth. Discussed in **Subsection 2.4.4.**

Egress Altitude. Discussed in **Subsection 2.4.5.**

2.1.2.3 The Importance of Target Area Location as an Enemy Fighter Threat Mitigator.



The higher the probability of enemy interception, the more important a Target Area's proximity to friendly lines becomes. The negative consequences of enemy interception above or near the Target Area can be partially mitigated by retreating into friendly territory and initiating a ditch or bailout if shot down, thus avoiding capture. When flying alone or at a

significant numerical disadvantage, close-proximity Target Areas often may be the only option that offers any appreciable prospect of avoiding capture, although the risks of being pilot sniped or fatally crashing remain. Methods to reduce these dangers are discussed in **Subsection 7.1**.

2.1.2.4 Enemy Flak. As AAA weapons are AI-controlled, they are more predictable than a human opponent. Although AAA layout and density can vary greatly from server to server, most of the time they consistently appear in the same location within specific Target Areas. And once they have been destroyed, they won't be back – at least not until the next map frame. Just be sure the guns themselves are destroyed, because if all you did was make the crew abandon the emplacement, they have a nasty habit of coming back and re-manning the gun within a matter of minutes.

2.1.2.5 Enemy Flak Threat Mitigators.

Flak Dragging. This is by far the most efficient method to take the heat off the many by dangling the few as bait. This method of flak threat mitigation is not without its pitfalls, however. Flak Dragging techniques are discussed in detail in **Subsection 4.3.2.**

Attack Direction (Low Angle Dive Attacks). Make a practice of recording and reviewing your Ground Attack missions. Notice the overall AAA layouts across specific Target Areas. Make a note of each flak gun's position and default facing before it is activated by an approaching enemy aircraft. Does the Target Area have equal 360° AAA coverage, or is there a side of the Target Area not well-protected by default AAA facings? If a weak point exists, that is the point through which you should attack whenever possible.

Speed (Low Angle Dive Attacks). By coming in at the fastest Low Angle attack dive speed possible, you may be on egress before the AAA manages to open up on your aircraft. At a minimum, you will give the AAA weapons the shortest possible time window to acquire, track, and fire at you on the way in. Flak weapon activation distances differ between servers, and often between Target Area types within the same server. Experience and mission video review will give you some familiarity with the differences in activation times across the servers and Target Area types, which will be of great value when constructing your Attack Plan.

Evasion (Low Angle and Dive-Bombing Attacks). Whether Low Angle Bombing or Dive Bombing, as a strict rule of thumb, you should *always* be performing evasive maneuvers as you come off the Target Area after dropping bombs – until you are safely out of light/medium AAA range. But you can also be executing similar maneuvers on the attack dive - but attenuated and less extreme. To pull this off you must be thinking three or four moves in advance to ensure you are in the right place and pointing at the correct angle at drop time. The goal is to not spend more than a few seconds going in the same direction on the way in – especially on the final dive angle just prior to drop – which is where they usually get you. This is easier said than done and takes a bit of practice, but it's not impossible. This technique is discussed in **Subsection 5.1.1.1**.

Numbers. By distributing the risk on a proportional basis, higher numbers of aircraft in a Ground Attack Flight Group lessen the risk of any one aircraft being shot down by enemy AAA. This mitigator is extremely helpful when the Flight Group's goal is to eliminate all AAA in the Target Area in a single mission. Strafing techniques are discussed in **Subsection 4.3.2.3.**

Target Area Location. Similar to a Target Area's location near friendly lines mitigating the potentially negative effects of the enemy fighter threat as discussed in **Subsection 2.1.2.3**, an aircraft taking catastrophic damage from flak fire over a Target Area near friendly lines can likely be steered into friendly territory prior to ditching it.

2.1.2.6 Other Mitigators. This handbook is filled with tips in later subsections that can help mitigate enemy fighter and flak threats. Some are more effective than others, but the more threat mitigators in your repertoire, the better your chances of coming home.

2.2 ATTACK METHODOLOGY

Prior to movement planning, the type of attack must be determined. This decision should balance the goals of maximum damage to the Target Area and mission survival.

2.2.1 LEVEL BOMBING



In most cases, Level Bombing from high altitude is the attack method most likely to ensure mission survival. Of all attack method options, it also presents the highest possibility of an inaccurate bomb drop.

At altitudes of 3500m or higher, light and medium flak weapon threats are completely avoided. The threat from heavy flak weapons remains, however, and the general rule is *the higher the better*. In expert servers, 6000m is the altitude where the heavy flak threat ceases to be significant. Depending on Target Area location and dive capability of the aircraft, the Ground Attacker also has a better chance of reaching friendly lines if enemy fighter interception occurs at high altitude. This situation discussed in **Subsection 7.1.3.3**.

The tradeoff for increased safety at higher altitudes is decreased bombing accuracy. Small or narrow Target Areas such as bridges and vehicle columns are extremely difficult to bomb accurately from high altitude. Additionally, in servers such as TAW where light and medium AAA guns do not appear unless an attacking aircraft comes within their specified range, only heavy AAA guns will be present within the Target Area and susceptible to damage or destruction from high altitude bombing.

Another disadvantage of Level Bombing is the time required to climb to high altitude, which reduces the number of potential sorties against a Target Area within a map frame time limit.

Level Bombing at lower altitudes falling within the range of light and medium AAA guns is strongly discouraged unless there are other friendly aircraft at low level over the Target Area to distract flak.

2.2.2 DIVE BOMBING

Dive Bombing in this handbook is defined as attacks made from a dive angle of 60 to 90 degrees. An experienced pilot utilizing this attack method can achieve pinpoint accuracy, particularly in the Junkers 87.

The drawback to this attack method is prolonged exposure to flak, necessitated by the need to fly near or directly over the Target Area at cruise speed and execute a dive directly above all active AAA weapons in the Target Area. Methods to reduce this risk are covered in **Subsection 5.1.1.1**.

Like Level Bombing, a fair amount of time is required to climb to higher dive altitudes, reducing the number of potential sorties against a Target Area within a given map frame time limit.

2.2.3 LOW ANGLE HIGH-SPEED BOMBING

Low Angle High-Speed Bombing is defined in this manual as attacks made from dive angles less than 60 degrees. This attack can be executed from many possible altitudes, with a higher Attack Dive altitude generating a correspondingly higher dive speed. Low Angle Bombing is a popular and effective attack method. While not as accurate as dive bombing, with practice one can acquire the ability to gauge the correct moment to drop bombs based on dive angle and speed across a diverse array of aircraft types.

When AAA is present in the Target Area, it is recommended to dive from 1500m or higher to generate enough speed to get as close to the Target Area as possible before the AAA weapons activate, followed by a quick and evasive egress out of light/medium AAA range. As dive acceleration, handling capability, and speed tolerance rates differ between aircraft, it is important to be familiar with your selected aircraft's capabilities in the dive. Low Angle High-Speed Bombing tips are provided for several aircraft in **Section 5**.

2.2.3.1 Low Angle Low-Speed Attacks. Conversely, another Low Angle Bombing method is to enter the Target Area as low to the ground as possible to avoid AAA fire until the last possible second. This entails entering the Target Area at cruise speeds considerably lower than dive speeds, but the element of surprise may make up for the lower speed. You may also escape enemy fighter detection at this extremely low altitude. This approach can be less effective against smaller targets due to trees and other visual obstacles on the ground, allowing minimal time to identify and accurately line up on the intended target.

2.2.4 SINGLE PASS vs. MULTIPLE PASSES (LOW ANGLE BOMBING)

A determination for single or multiple passes should be based on the factors listed in **Section 1.** Careful analysis of these factors will help the Ground Attacker make an informed decision.

2.2.4.1 Single Pass. The inherent advantages of single pass attacks are:

- **Minimal time over the Target Area**
- **Minimal exposure to AAA fire**
- **Reduces possibility of enemy fighter interception**

The primary disadvantage is the necessity of dumping all ordnance in one pass, which can limit the amount of damage to targets. The "Drop All" option will put all bombs accurately in one

place but will limit target damage to a single blast area. While multiple bomb releases in a single pass will extend the spread of potential destruction, the problem is that the first bomb release can be lined up accurately while remaining bombs can often only be released haphazardly. There is also no opportunity to thoroughly strafe the Target Area.

2.2.4.2 Multiple Passes. The advantage of multiple pass attacks is potential to inflict maximum damage on targets through several single, well-aimed bomb passes and strafing runs. The disadvantages of lingering over a Target Area for long periods are prolonged exposure to AAA fire and the increased risk of eventually encountering enemy fighters over the Target Area.

2.3 AIRCRAFT AND LOADOUT SELECTION

Pick the right plane for the job:

- ✓ **How quickly do you need to get to the Target Area?**
- ✓ **Do you have escort, or are you responsible for your own defense?**
- ✓ **Are flak weapons present in the Target Area or have they already been eliminated?**
- ✓ **What attack speed is necessary to elude the flak?**
- ✓ **Do you need forward-firing armament for strafing/engaging AAA weapons?**
- ✓ **Is the Target Area a vehicle column/defensive position with several small targets?**
- ✓ **Is the Target Area an airfield or depot with large buildings?**

The advantages and limitations of all ground attack aircraft types, their available ordnances, and ground attack tips for each type are covered in **Section 5**.

2.4 MOVEMENT TO/FROM the TARGET AREA

2.4.1 AIRFIELD SELECTION

There are a few factors to consider when selecting an airfield to begin the mission. Choosing the airfield nearest to the Target Area often makes for the shortest movement route but may not provide enough horizontal space to climb to the required altitude, thus forcing the Flight Group to climb while circling the airfield. When player numbers are low, airfield dots tip off the enemy about your takeoff location. *Sometimes the closest airfield is not the best choice*. Unless you have strong escort, or it is the beginning of the map and you are sure you can make it to the Target Area before any enemy fighters, it may be wise to spawn at an airfield that does not immediately give away your intent. However, high player numbers inevitably mean someone will spawn at the nearest airfield regardless, so deception measures about takeoff location are rendered moot in that case. Even when player numbers are low, friendly players may spawn at the closest airfield to the Target Area when you are already in the air - and ruin the ruse.

2.4.2 ROUTE SELECTION

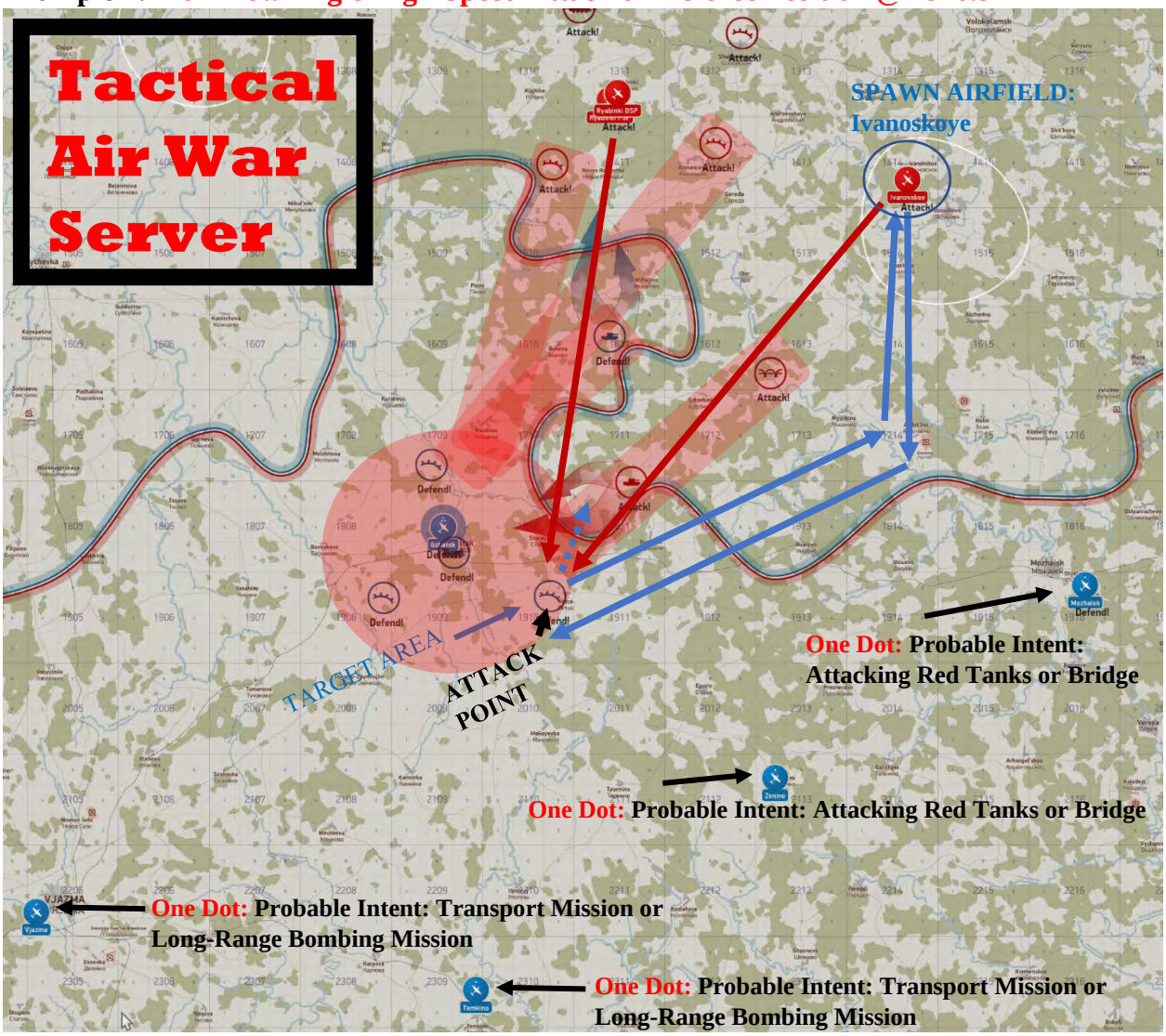
If your Flight Group is escorted by a large and proficient group of fighters, you generally may take the shortest and easiest flight route to the Target Area. In all other cases, a good flight route:

- **Provides a pathway to the Target Area with the least possibility of encountering the enemy**
- **Avoids other Target Areas (both friendly and enemy)**

Often the best flight route is circuitous and requires significantly more time to cover than a straight-line route. This approach can be tedious, but the convenience of a shorter trip through hazardous airspace is meaningless if it ends in death or capture. Other Target Areas can often be magnets for enemy fighters, and the rounds and airbursts fired in your direction from flak guns located at nearby enemy Target Areas may reveal your location before you arrive in the intended Target Area.

Once you have determined the required Attack Point Altitude **(Subsection 2.4.3.1.1)**, make sure the intended flight route provides enough time and space to achieve that altitude. When practicable, plan the climb portion of the route within friendly territory as much as possible to minimize the amount of time traversing enemy territory. It is very helpful to use a mission-planning utility program such as the **IL-2 Mission Planner** to obtain exact azimuths for each leg of the route. Let's examine two examples of flight route planning for both Red and Blue hypothetical missions in the TAW Server:

Example 1: Pe-2 Low Angle High-Speed Attack on Defense Position @ 1910.9



Click Here to see the IL-2 Mission Planner

In this example, the primary goal of the flight route (blue arrows) is arrive at the defensive position Target Area and execute a Low Angle High-Speed diving attack. Therefore, the chosen route specifically avoids anticipated areas of enemy activity (shaded in red) around friendly positions and enemy Target Areas, while also taking into consideration enemy player distribution across the map as indicated by the enemy airfield dots.

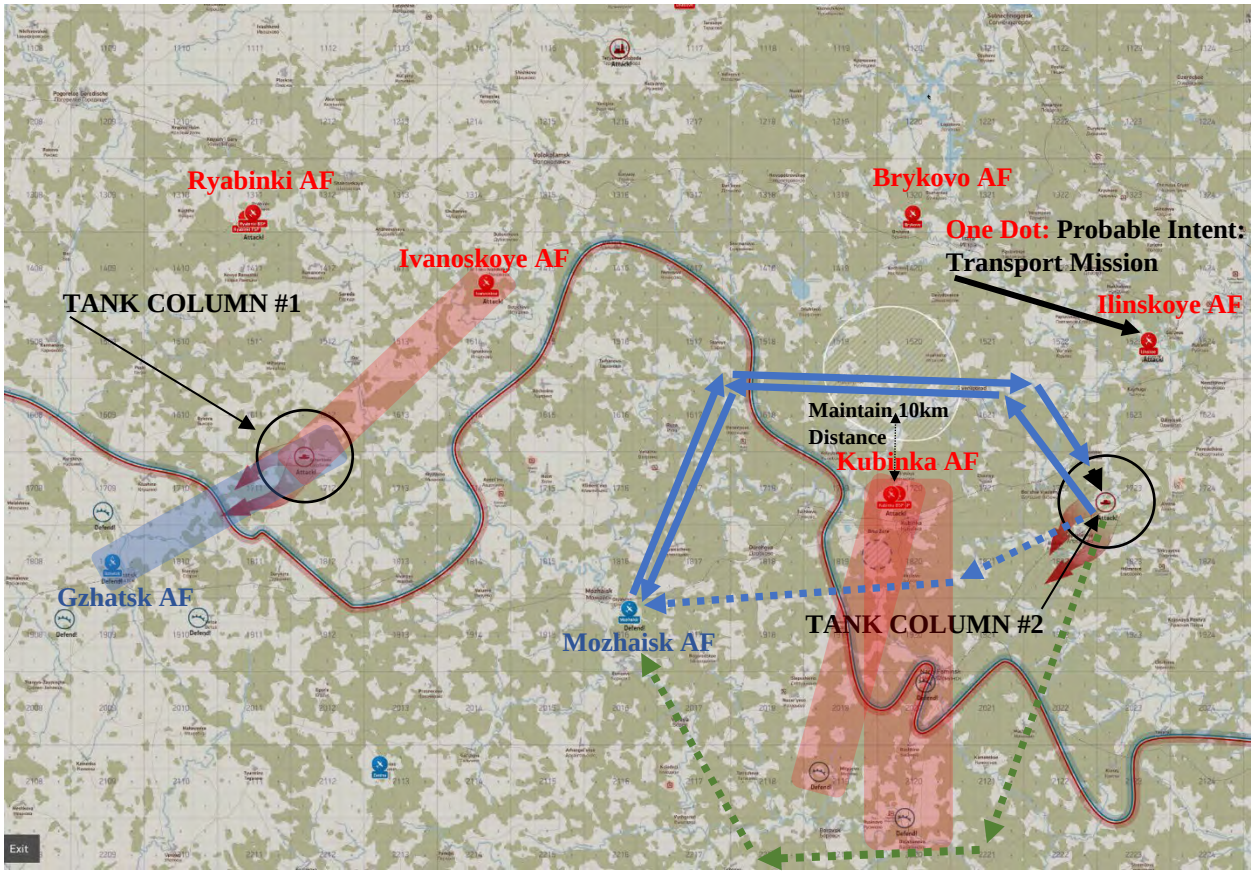
We can see that most enemy players are spawning at Gzhatsk Airfield, immediately NW of the intended Target Area. Gzhatsk does not have separate fighter and bomber spawn points, so we cannot ascertain the distribution of enemy fighters and bombers. Nevertheless, they will likely be dispersed across the many enemy and friendly positions in the area. There are low numbers of enemy players on nearby airfields. While their intentions are not easily discernible, our best guess is that those players are either flying transport missions or ground attack missions against Red Target Areas NE of Ghatsk airfield. There is indeed the possibility that an enemy fighter pilot is taking off from one of these rear airfields because the Gzhatsk spawn area is full, or he is masking his intent to defend the Gzhatsk defensive positions. The latter possibility is typical of the routine risks inherent to most Ground Attack missions.

The red arrows identify two possible flight routes that cross over both friendly positions and enemy Target Areas, thus posing a high probability of encountering enemy fighters. The blue arrows indicate a flight route with a lower possibility of encountering the enemy – at least until arrival in the Target Area. By taking off at Ivanoskoye, an airfield without separate Fighter and Bomber spawn points, our intent is ambiguous. The route provides sufficient time and space to climb to the desired 3500m Attack Altitude while still inside friendly territory. While this route, coming over enemy lines NE of the Target Area and coming around to strike it from the south, does put the Ground Attacker(s) inside enemy territory for a longer time than merely crossing enemy lines directly NE of the Target Area, the calculated risk is that no enemy will be encountered in that section of enemy airspace.

The Attack Point (black arrow) - where we would start our Attack Dive, is slightly south of the Target Area. This provides the benefit of being generally headed toward friendly lines at the start of egress. In case of catastrophic aircraft damage or pursuit by enemy fighters, the dotted blue arrow indicates the quickest path from the Target Area back (approximately 15°) to friendly territory to avoid capture, although the chances of making a safe return to base after crossing friendly lines is far from guaranteed. The solid blue return arrow indicates an egress (approximately 50°) that stays inside enemy territory initially but keeps us outside of the danger zone. If engaged on this return route prior to arriving across friendly lines, there is the option of turning north and seeking help from the red tank column AAA.



2.4.2.2 Example 2: BLUE TEAM - JU 88 Low Angle Attack on Tank Column @ 1723.4



In this example, the goal of the flight route (blue arrows) is to arrive at the eastern Red tank column (Tank Column #2) undetected, execute a Low Angle High-Speed diving attack against the column, and return to Mozhaisk airfield. Let's examine the factors at play that would cause us to choose this particular Target Area and flight route.

There are 15 Blue players and 13 Red players currently active. Most Blue players are spawning at Gzhatsk airfield and attacking the Red tank column (#1) at 1712.7. Most Red players are spawning at Kubinka airfield and are presumably focused on attacking the Blue defensive positions to the south. By viewing the respective aircraft spawn point dots at Kubinka, we can see that all Red players spawning from there are flying bombers. There is one dot at Ilinskoye airfield, which may indicate an intent to cover the Red tanks at 1723.4, but more likely signals a transport mission(s) to Kubinka or Brykovo.

While the easier Target Area would be Red Tank Column #1 at 1712.7, where Blue players are operating in the face of minimal opposition as indicated by the single dot on the Red airfield of Ivanoskoye, that tank column is facing imminent annihilation for the very same reason. There will likely be little to nothing remaining by the time we arrive. The only remaining Target Area is the tank column at 1723.4, and judging from Red player disposition, they are not anticipating an attack there – for the moment. That will change as soon as the other column is destroyed, so we must move quickly.

The location of Red Tank Column #2, deep in enemy territory, makes this a high-risk mission. If we have strong escort we could fly directly from Mozhaisk airfield to the Target Area, but with no escort available, we must be a little craftier in our approach. The blue arrows show an approximate heading of 20° after takeoff, before turning east around the junction of 1517-1617. This initial heading provides the

time and space to climb to a 2500m Attack Altitude prior to crossing enemy lines. It also ensures the 90° leg of our route will take place more than 10 km north of Kubinka airfield, thereby not setting off the airfield warning indicator and alerting the enemy to our presence.

The hidden enemy resupply column (indicated by the large white circle around 1519/20 and 1619/20) does not have heavy flak weapons. If we happen to fly over it at 2500m altitude we will hopefully not be engaged, but the enemy players may be alerted to our presence there via a team chat warning. That is fine. The impression will be that our activity is focused on locating the resupply column, when we are in fact quickly moving out of that area.

When we arrive at 1622.7, we will turn onto an approximate heading of 160° and start looking far ahead to identify and line up on the rear of the Red tank column. Our Attack Point is 1722.9, and from there we will execute a Low Angle dive attack on the column, followed by a sharp, treetop-level turn west, accompanied by plenty of evasive maneuvers to avoid flak fire.

Prior to carrying out our attack, we must decide on our egress route - either back the same way we came, or west to Mozhaisk, crossing the area of high enemy activity. A reassessment of current enemy numbers and disposition will provide the information to make a competent decision. If there is no increased fighter presence, it would be acceptable to make a westward egress across the danger zone, although it would be wise to stay 10 km south of Kubinka airfield and not give away our presence.

If you are wondering, based on that logic, why we didn't just cross the danger zone to get to the Target Area instead of a long and time-consuming northern approach, the answer is simple. If we were to be engaged or merely spotted by enemy Ground Attackers somewhere south of Kubinka during our approach route, the attack is spoiled. A Ju 88 can generally compete with the Pe-2 in speed, but not when carrying a bombload. Even if the Pe-2s do not engage, they will report our presence to the Red team, who have plenty of time to land at Kubinka or Ilinskoye, respawn in a fighter, and catch us near the Target Area or during egress. After the attack, the proverbial cat is out of the bag and the attack will be automatically reported by "ground troops" on the Red team chat within a crucial few minutes. By evaluating the Red team player numbers and estimating their locations and dispositions just before the attack, we can make an informed estimation of their probable reaction and plan accordingly. Is it still "business as usual" with no fighters spawning at Kubinka? If yes, we have a good chance of throttling across the danger area at treetop level, bomb-free, and out-running any twin-engine pursuers. Have fighters spawned at Kubinka and will likely soon be racing toward the tank column from the airfield, defensive positions, or somewhere in between, with the intention of intercepting you along the most predictable western egress route? Then we would be better off turning north and following in our footsteps back home. If, by chance, Ilinskoye is also indicating three dots at that time, we should bite the bullet and egress south (green dotted arrow), cross under the danger zone, and return to Mozhaisk from the south. If someone loses an engine or has a fuel leak due to enemy flak fire, they can take the southern egress and hopefully ditch in friendly territory, or take the western egress and risk it all to try to reach Mozhaisk airfield.

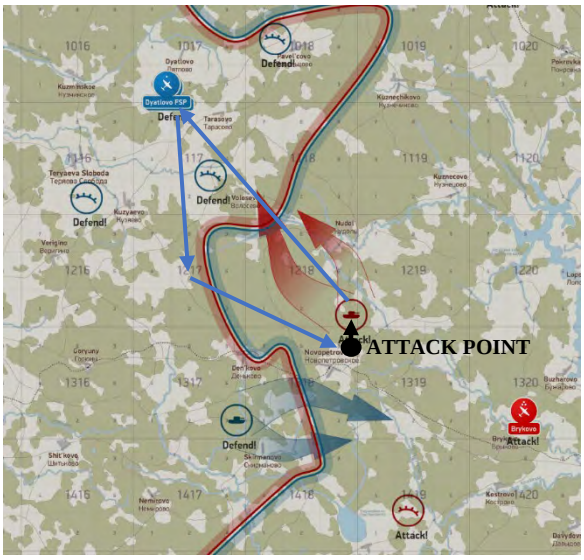
Regardless, once out of flak range, we proceed back on our selected egress route. If we retake the northern route home and the enemy threat is minimal, we can try to locate the resupply column north of Kubinka if fuel permits.

2.4.3 ATTACK POINT: Definition and Specifications

The Attack Point is the final waypoint on the movement from which you will point your aircraft toward the Target Area and initiate an Attack Dive.

When Level Bombing, fixed Attack Point locations are not necessary because Level Bombers do not dive into the Target Area. They are thus free to line up on their intended Target Area from any location several kilometers away. Dive bombers begin their Attack Dive practically above the Target Area, making the Target Area itself the Attack Point.

Low Angle bombing, however, necessitates that an attack dive commences from a fixed location, altitude, and distance from the Target Area.



The importance of the Attack Point considerations outlined below is predicated on two variables:

- **The density and accuracy of AAA within the intended Target Area**
- **The enemy fighter threat around the Target Area**

In expert servers such as TAW, which features particularly vicious flak, and in any mission scenario where contact with enemy fighters over the Target Area is probable, executing the Attack Dive and egressing out of the Target Area at the highest possible speed – in the direction of friendly lines - is crucial. Proper Attack Point planning can achieve those goals.

The Attack Point is not so much a fixed point as it is a general location in the vicinity of the Target Area. As you navigate toward the Attack Point, use terrain feature to identify it and the Target Area from as far away as possible. The goal is to approach the Attack Point while eyeing the spot where the Target Area is located, *even if has not yet rendered*. Spotting the Target Area as soon as it appears will maximize the time available to get an accurate line up on the targets you want to destroy within the Target Area.

2.4.3.1 Attack Point Altitude and Distance to Target. When executing Low Angle High-Speed attacks, the Attack Point distance from the Target Area should be determined in conjunction with the Attack Point Altitude needed to achieve the desired attack speed at the time bombs are released. There are several factors to take into consideration when determining Attack Point distance and the altitude.

To begin with, you must be thoroughly knowledgeable of your aircraft's dive characteristics; specifically, the different speeds it will attain on dives from multiple altitudes and horizontal distances to the Target Area. Second, you must determine the approximate altitude from which you will release bombs. Finally, you must decide the speed you wish to reach at bomb release altitude.

The general rules of thumb are as follows:

- **The closer the Attack Point to the Target Area, the steeper the dive.**
- **The steeper the dive, the quicker the acceleration.**
- **The higher the altitude at dive start, the longer the aircraft will continue to accelerate.**
- **The higher the level speed at dive start, the less altitude required to attain the desired dive speed.**

And exact inverse implications for these four rules apply as well. If the Attack Point is too far away and altitude too low, you arrive over the Target Area at a speed less than sufficient to get the jump on the AAA. If too close and too high, you find yourself diving toward the Target Area at an angle too steep, requiring throttle control to avoid exceeding the aircraft's dive speed limit. If high speed is the goal, you must determine the proper altitude and distance from the Target Area to achieve a speed just under the dive speed limit at bomb drop altitude.

2.4.3.1.1 Determining Attack Point Altitude and Distance. So where to start in determining Attack Point distance and altitude? Placing the Attack Point 3-4 km from the Target Area is a good generic starting point, but to determine the required dive altitude, there is simply no substitute for knowing your aircraft's dive characteristics and speed.

Experiment with the aircraft in Quick Mission if you are unfamiliar with its behavior in the dive. Pick a target and dive on it from different altitudes, distances, *and ambient temperature conditions*. There are distinct differences in aircraft level speed and dive speed performance between ambient temperature extremes. Be aware that the aircraft's level speed at the start of the dive will significantly influence the altitude required to attain the desired dive speed. If you are struggling to climb that last 2-300m prior to diving, you will probably be starting your dive at 200-250 kph, which is fine if you planned your dive altitude for that situation. If you plan your climb in accordance with **Subsection 2.4.3.1.4**, you will start your dive at cruise speed and a correspondingly lower altitude.

2.4.3.1.2 Controlling Dive Speed. One trick to lower the attack dive altitude is to close radiators and push ATA/RPM settings to full emergency power just before diving. The fast dive speed should keep the engines cool enough to get the aircraft through the attack dive and initial egress. Once out of light/medium AAA range you must open the radiators/outer cowlings and reset the engine to climb or cruise settings. If you choose to dive from a higher altitude at climb/cruise engine settings, you should nevertheless go to full emergency power just after releasing bombs, and reset to climb/cruise settings after exiting AAA range.

If you anticipate exceeding the dive speed limit of your aircraft prior to bomb drop, you can reduce or chop the throttle. The key is to not reduce your dive speed any more than necessary, but just enough to keep the aircraft within its limits. Getting this right takes practice and experience.

If you can see that you will not achieve the required speed at the time of bomb drop, go to full emergency power and close radiators. Otherwise, abort the pass or continue into the Target Area and accept what may come.

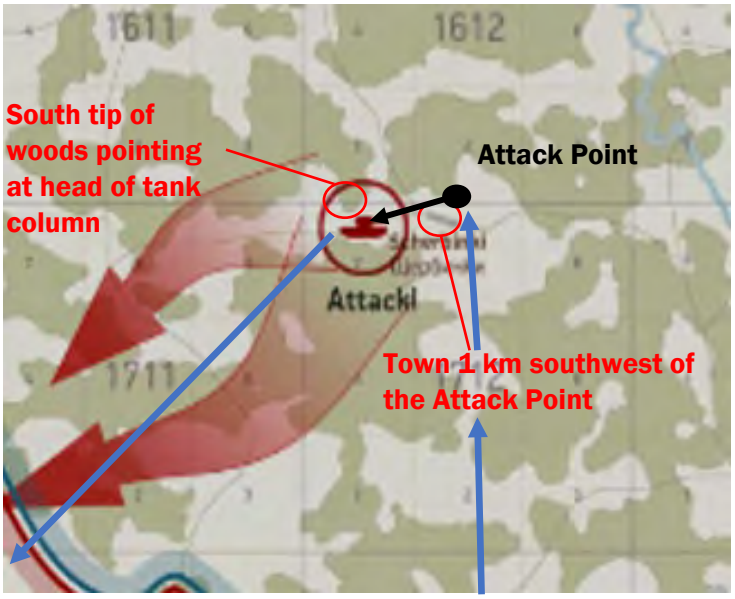
2.4.3.1.3 Potential Perils of Diving Too Close. If you are approaching the planned Attack Point at a lower altitude than expected, you will have to move the Attack Point closer to the Target Area to achieve the required dive speed. In addition to a consequentially steeper dive, a closer Attack Point presents another problem. The AAA detection range (**Subsection 4.3.2.1**) can extend out to 2000m, although it usually does not.

2.4.3.1.4 Considerations When Climbing to Attack Altitude. Make sure there is enough distance between the embarkation airfield and the Attack Point to achieve the required altitude. Otherwise you must plan to execute a climbing spiral – over the airfield or elsewhere along the flight route. It is often beneficial to reach the desired Attack Point altitude while still over friendly territory, or at least over a section of enemy territory where the possibility of enemy fighter interception is low. Climbing at slow speeds over enemy territory means prolonged exposure to a hostile airspace, and slow climbing speeds impact effective maneuver options if intercepted.

2.4.3.1.5 Life is Easier with a Flak Dragger. When attacking with a dedicated Flak Dragger, the need for speed becomes much less critical. The Attack Point Altitude can be much lower, and Attack Point distance to the Target Area can be closer. The benefits and pitfalls of flak dragging are addressed in **Subsection 4.3.2**.

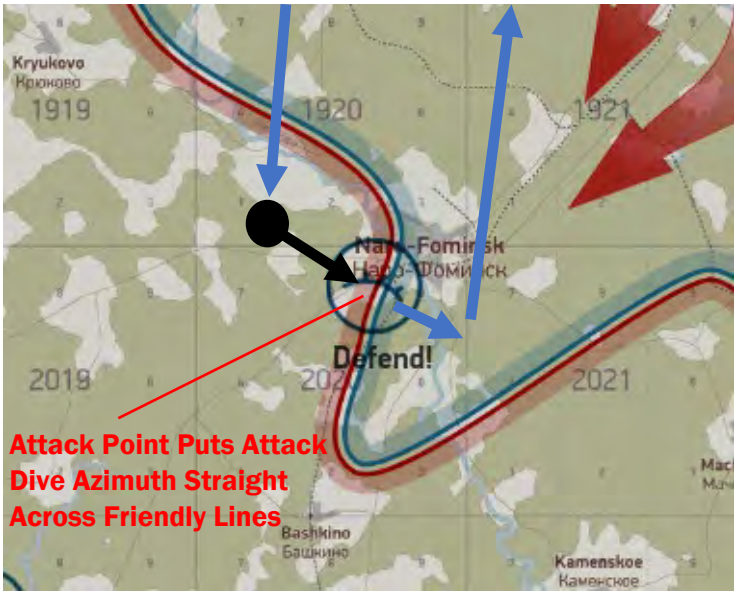
2.4.3.2 Attack Point Location and Attack Azimuth.

2.4.3.2.1 Attack Point Identification. During Attack Plan formulation make sure to identify on the map a key terrain feature at or near the Attack Point that will be easily recognizable from the air. Some good terrain feature examples include a town, road intersection, unusually-shaped river segment, lake, a clearing or group of clearings within an otherwise heavily-wooded area, or an unusually-shaped forest edge. Note the terrain feature's direction and distance from the Attack Point. If possible, identify two key terrain features near the Attack Point for reinforced identification potential.





2.4.3.2.2 Attack Point Placement.
Whenever possible, select an Attack Point location that will line up your aircraft with the planned egress azimuth as soon as bombs are out, as covered in **Section 2.4.4**.



The advantage to attacking on the Egress Azimuth is that if your aircraft is damaged from AAA fire, you will not need to maneuver a damaged aircraft onto a new heading. Additionally, if you are engaged by enemy fighters, provided the Target Area is near friendly lines, you have an improved chance of getting over friendly territory before having to ditch or bail out.

The disadvantage to this approach is that you may need to fly a little deeper into enemy territory to put the Target Area between your aircraft and friendly lines. In the case of targets laid out along a long, rectangular area, you may want to attack the Target Area length-wise to maximize the damage from multiple bombs along the path of attack, which may not coincide with an Egress Azimuth toward friendly lines.

2.4.4 EGRESS AZIMUTH

Egress azimuths are generally directed at the nearest friendly airfield or nearest friendly lines, but these two destinations are not always in the same direction. Sometimes the nearest friendly lines can be in nearly the opposite direction of the nearest friendly airfield.

The determination for an egress azimuth direction should be based on analysis of the situational variables outlined in **Section 1.2**. The more potentially dangerous the mission, the more appealing the fastest egress out of enemy territory becomes.

The best approach is to know the azimuths of *both* the nearest friendly airfield and nearest friendly lines from the enemy Target Area. If your aircraft is damaged or intercepted by enemy fighters, take the azimuth toward the nearest friendly lines. If neither danger is encountered, and contact with enemy fighters during egress is not anticipated, take the azimuth toward the nearest friendly airfield.

Generally, you should avoid both friendly positions and enemy Target Areas on the movement to the intended Target Area and egress home. If you are engaged during your attack dive or egress, however, all bets are off and you may be able to use the AAA guns around friendly positions to shake off or destroy pursuing enemy fighters.

2.4.5 EGRESS ALTITUDE

Egress altitude is both a subjective preference and influenced by situational factors in and around the Target Area. The altitude choice, unless Level Bombing at very high altitudes, generally boils down to an egress either at treetop level or at an altitude somewhere above treetop level.

2.4.5.1 Treetop Level Egress. If you come off an attack dive already at treetop level, it makes sense to stay low and retain as much speed as possible as you exit the Target Area and return to friendly territory. If you exit the attack dive higher than treetop level, diving down to treetop level will increase your aircraft's speed out of the Target Area. This minimizes exposure time to AAA fire during initial egress and reduces the ability of heavy flak weapons to fire at your aircraft. If enemy fighters are around the Target Area at higher altitudes, your aircraft may be harder to spot, although any AAA tracers fired in the direction of your egressing aircraft will nullify that potential advantage.



A good fighter pilot concerned with preservation of his virtual aircraft and life will think twice about pursuing any Ground Attack aircraft at treetop level – particularly into enemy territory. His decision to pursue your aircraft will depend primarily on 1) whether he has a wingman, and 2) the potential presence of opposing fighters in the immediate area. Once he is behind you he must choose between slowing down to match your speed, or making a pass at high speed, climbing and/or turning several hundred meters, and diving back down onto you. In either case, these approaches make him vulnerable to opposing fighters, and he is too low to dive away. The enemy fighter also cannot maneuver below your aircraft and is exposed to fire from your AI gunner(s) while you conduct evasive maneuvers.



Most importantly, egressing at treetop level affords you the opportunity to ditch the aircraft if it becomes untenable in the air. For this reason, it is critical to stay as near to the ground as possible.

The disadvantage of a treetop level egress is that it affords minimal downward movement options when evading enemy flak or fighters. If your evasive maneuvers happen to take you 100m or higher, and enemy fire destroys your aircraft's control functions when the nose is

pointing downward, you will likely not survive the crash impact. Bailout is a possible option at low altitude only if the aircraft's nose continues to point upward while ejecting.

If your twin-engine aircraft loses one engine due to enemy fire or tree impact and you're at ground level, it may be difficult or impossible, depending on the aircraft type, to gain any additional altitude for a successful airfield landing.

Due to limited navigation visibility at low altitudes, it is important to use the radio compass, when available, to maintain an accurate azimuth to the nearest friendly airfield.

2.4.5.2 Higher Altitude Egress. Starting egress at higher altitudes occurs when dropping bombs from higher altitudes or climbing away from the Target Area. This option provides more three-dimensional maneuverability at the price of reduced initial egress speed potential. It also provides the ability to bailout (generally 400m or higher) if shot down.

Navigation and friendly airfield spotting are easier at higher altitudes, and landing a damaged aircraft is much easier when already at sufficient altitude to begin a runway approach.

2.4.5.3 The Bottom Line. *The worst altitude in any situation is one that is too high to ditch and too low to bail*. In servers with harsh penalties for death, capture, and aircraft loss, you will likely find that a 5-10m egress altitude will achieve the following:

- **Discourage many expert enemy fighter pilots from pursuing you at low level into (your) friendly territory**
- **Give your AI rear gunner(s) a potentially better chance of inflicting catastrophic damage on pursuing enemy fighters**
- **Ditching instead of crashing will reduce the frequency of pilot deaths**

2.4.6 IMMEDIATE ACTION PLAN (IAP)

An Immediate Action Plan is the planned action the Flight Leader intends to take upon chance contact with enemy fighters during the movement to the Target Area. The normal course of action when flying solo is to immediately turn onto a pre-planned "escape azimuth" toward the nearest friendly lines, but the presence of friendly escort fighters and/or flying as a member of a Flight Group provides additional options for action. These options are discussed in **Subsection 4.2.** When leading a Flight Group, depending on the mission environment, the Flight Leader may either outline a definitive IAP in the Attack Plan Briefing, or make an Immediate Action Decision inflight based on the encountered enemy fighter threat.

The IAP may also include a "**Point of No Return**," normally at or near the Attack Point, where the Attack Plan will be followed regardless of enemy fighter presence. Point of No Return specifics are discussed in **Subsections 4.2.1-4.2.2.**

As the direction and distance to the nearest friendly lines may change multiple times during the movement to the Target Area, it is important to always be aware of your current location while moving along the flight route.

3. BRIEFING THE ATTACK PLAN

3.1 FLIGHT LEADER SELECTION



If you're flying a mission alone, you simply create an Attack Plan loosely based on the Mission Briefing Content in **Subsection 3.2** and go unleash it on the enemy. When groups of people fly together, the situation becomes much more complicated.

In most national military organizations there are chains of command and well-defined distinctions of authority between superiors and subordinates up and down the ranks. This structure obviously does not exist in an online gaming environment simulating a military conflict. Ironically, but not surprisingly, this important difference often makes for a very "un-military" (and hilarious to players with a military background) virtual experience. When no one is in charge and everyone does pretty much whatever they want, the aggregate result is usually disorganized chaos. It is no surprise that no one on the IL-2 forums can definitively prove why a team is winning or losing in a multiplayer server, because the absence of authority and oversight makes it is impossible to know what every player is doing.

This highly unrealistic phenomenon can be mitigated at the lower echelon unit level by designating a Flight Leader with authority and responsibility for a mission.

In cases where members of a Flight Group possess extensive experience flying together as a group, this appointment and the associated duties that come with it can be a largely informal affair.

For Flight Groups where mutual familiarity is not well-established and individual skill levels may be unknown, the authority and decisions of the Flight Leader can be crucial for mission success.

It is helpful to elect a Flight Leader prior to spawn, preferably one of the Flight Group Members experienced in the server being flown. Once that is done, a timely formulation of the Attack Plan can begin.

3.2 ATTACK PLAN BRIEFING CONTENT

When leading a Flight Group, it is critical for each Group member to be cognizant of all relevant mission parameters and assignments prior to takeoff. These details are best communicated by the Flight Leader through a detailed Mission Briefing as shown below. Prior to spawn, the Flight Leader must formulate an Attack Plan encompassing consideration of the variables outlined in **Sections 1** and **2.** This plan may include input from the members of the Flight Group at the Flight Leader's discretion. Once a plan has been decided, even if all flight members have been involved in constructing the Attack Plan, it is the Flight Leader's responsibility to summarize the plan verbally to ensure everyone is aware of all relevant details and nothing is left to assumption. The Flight Leader should communicate the following Mission Briefing information to the Flight Group prior to spawn:

- **Intended Target Area**
- **Target Area Location**
- **Type of Attack/Attack Altitude**
- **Aircraft Type(s),**
- **Loadout(s) and Settings**
  - **Spawn Airfield**
  - **Fuel**
  - **Ordnance Package**
  - **Bomb Timer Delay**
  - **Aircraft Skin**



The Flight Leader can cover the remaining items of the Attack Plan in pre-spawn or while starting engines in the spawn area:

- **Remaining Map time**
- **Weather/Cloud Density/Winds**
- **Enemy Situation/Player Numbers**
- **Friendly Situation/Player Numbers**
- **Target Area Condition**
- **Target Area AAA**
- **Nearby Enemy Target Area AAA**
- **Escort Availability**
- **Flight Order/Formation**
- **Designate Alternate Flight Leader**
- **Flight Plan (engine settings)**
  - **Movement to Target Area Azimuth(s) and Waypoints**
  - **Attack Altitude**
  - **Attack Point Location**
  - **Attack Azimuth**
  - **Target Assignments / Actions Over Target Area**
  - **Egress Azimuth(s)**
  - **Point of No Return / Immediate Action Plan**



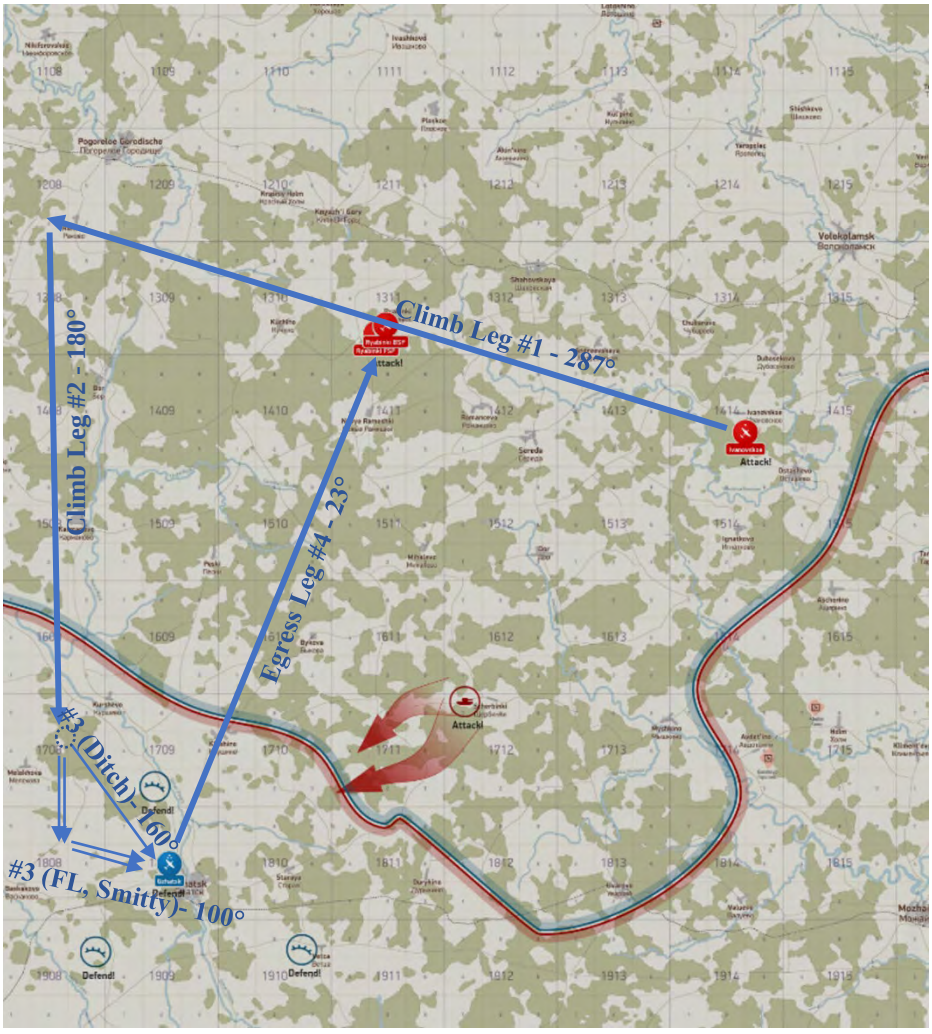
This is quite a bit of information to cover, and at first glance may appear a bit daunting. The thing to remember is that many of these information items are discussed between Flight Group members in one form or another before any mission begins; otherwise no mission could take place at all. The checklist on the preceding page merely assembles the relevant mission items in a coherent order.

Many of the mission items need not be briefed in certain situations. For example, if your Flight Group has already flown one or more missions within a certain map frame, the items in blue font should already be known, and can be omitted from the briefing. Or, for example, if your Flight Group will be level bombing or dive bombing, an Attack Point is not required.

Depending on the familiarity and skill level of the pilots in your Flight Group, available time, and everyone's awareness of current map and Target Area conditions, the Mission Briefing can be altered or abbreviated per mission conditions and personal preferences.

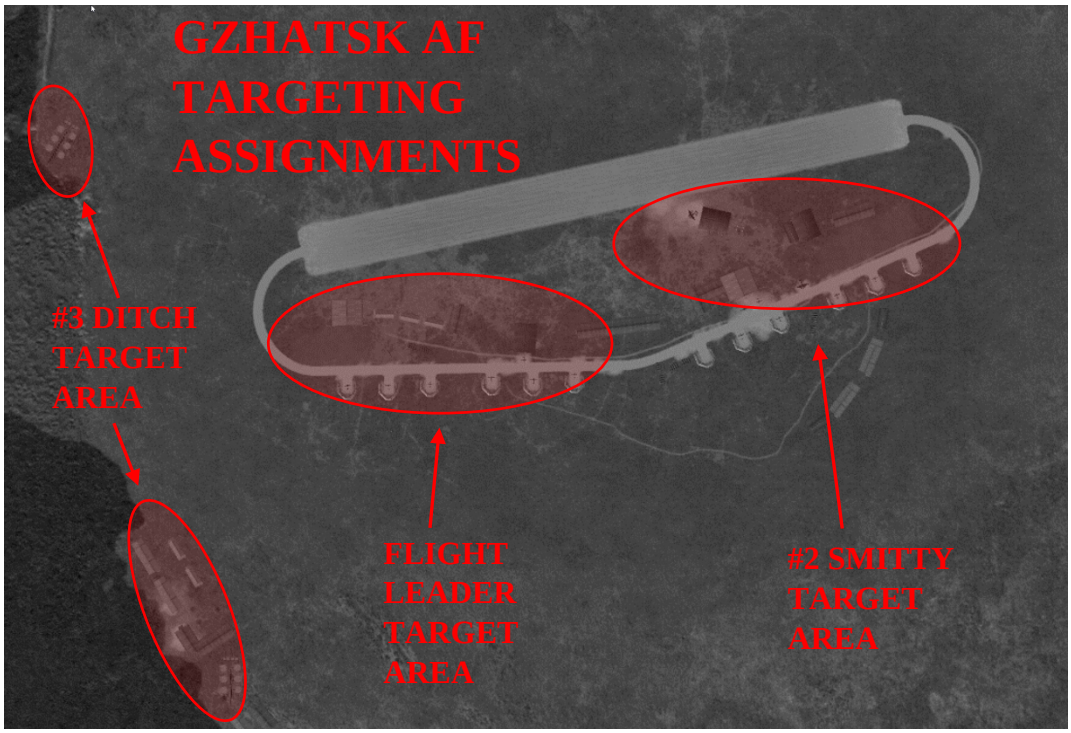
3.3 EXAMPLES OF ATTACK PLAN BRIEFINGS

3.3.1 *Attack Plan Briefing Example #1* (Three Pilots – Red Team – TAW Server)



(Pre-spawn)

"Ok guys, our intended Target Areat is Gzhatsk AF located at 1809.5, and we're going to level bomb it from 5k. Let's take Pe-2 Series 87s out of Ivanovskoe AF, with 50% fuel, ten FAB-100 bombs with a one-second delay, Blister Turret, and your choice of aircraft skin."



(Post-spawn)

"Please pull up the map and follow along while we're starting engines. There's 1 hour 30 minutes remaining map time. Clouds are light, the ambient temperature is 15 degrees. The ground wind speed is 4mps from 185 degrees, but we'll make the appropriate adjustments based on bombsight wind data when we get into our bombsights in a second….. I was informed through team chat that the light cloud base is 2000m.

There are currently 18 enemy players in the air, and I estimate 12-15 of them are operating out of the targeted airfield. There are 15 friendly players, including us, but only 2-3 fighters capping our tanks @ 1712.7, and everyone else is busy elsewhere. It's not possible to know the enemy fighter/bomber distribution at Gzhatsk AF because it does not have separate runways for fighters and bombers, but I estimate the majority are involved in attacks against our tank column with possibly a few fighters capping the defensive positions. Since there are no dots on our friendly airfield at Ryabinki, and because our point of origin, Ivanovskoe AF, does not indicate whether fighters or bombers are spawning there, I believe they won't be expecting an airfield attack. That stated, there is always the possibility of encountering one or two enemy fighters in the vicinity of the targeedt airfield. If they're capping the defensive positions, I don't expect them to be higher than 4k, so hopefully we can drop on the airfield at 5k and start our egress out of there before they become a problem.

The airfield is currently 18% damaged, so there are still plenty of targets. The AAA is 100% intact as far as we know, but we will only be engaged by the heavy 88mm Flak 36 guns. The enemy defensive position

at 1809.2 has already been heavily attacked during the previous map frame, so Flak 36 fire from that location is unlikely. We have no escort for this mission.

We'll fly in a loose Vic formation with 200-300m horizontal separation between aircraft. I'll be lead, Smitty take #2 position, and Ditch take #3. If I am eliminated from the mission, Smitty will take over flight lead.

After takeoff we will assume a 287° heading and begin to climb. Our engine settings for the climb up will be 980 mm Hg (90%) and 2700 RPM (92%). We'll start with radiators set at 70% and adjust them down as we gain altitude. Once we get to that hook-looking section of woods at 1208.2, we will turn on a 180° heading. This route should give us enough space to climb to 5k within friendly territory, and I anticipate hitting 5k just before crossing enemy lines. When we get to the large wooded area with the big hole in the middle at 1708.5, we should be able to visually identify the runway at Gzhatsk. At that point this is what we'll do - please pull up the airfield recon photo on the TAW website:

- *Smitty and I will continue on a 180° heading while keeping the runway in sight. At the southern edge of 1808.8 we will turn onto a roughly 100° heading toward Gzhatsk airfield. From there we will line up individually on our respective targets. Smitty will pick out and hit the buildings and aircraft between the runway and taxiway on the eastern half. I will hit the buildings and aircraft on the western half of the same area.* ***The runway will be visible from a considerable distance****, and we can use it as a reference point to get lined up correctly long before the actual targets become visible.*
- *Ditch – you hit the that line of targets west of the runway on the eastern edge of the wood line. Since you're lining up on a different azimuth from Smitty and I, do a quick but full 360° turn over 1708.5 – to give us time to get down to 1808.8 and ensure we all arrive over the airfield more-or-less at the same time. After your full turn, head toward the airfield on a heading of approximately 160°.* ***With the runway and western wood line edge in full view from far away****, you shouldn't have any problems getting lined up well in advance.*

Here are a couple of things to remember: we're all going toward the airfield on slightly different azimuths. Make sure you make the correct adjustments on your bombsight wind angle instrument and double-check your speed and altitude settings prior to bomb drop. Also, as the airfield is 18% damaged, try to get a good line up on undamaged targets.

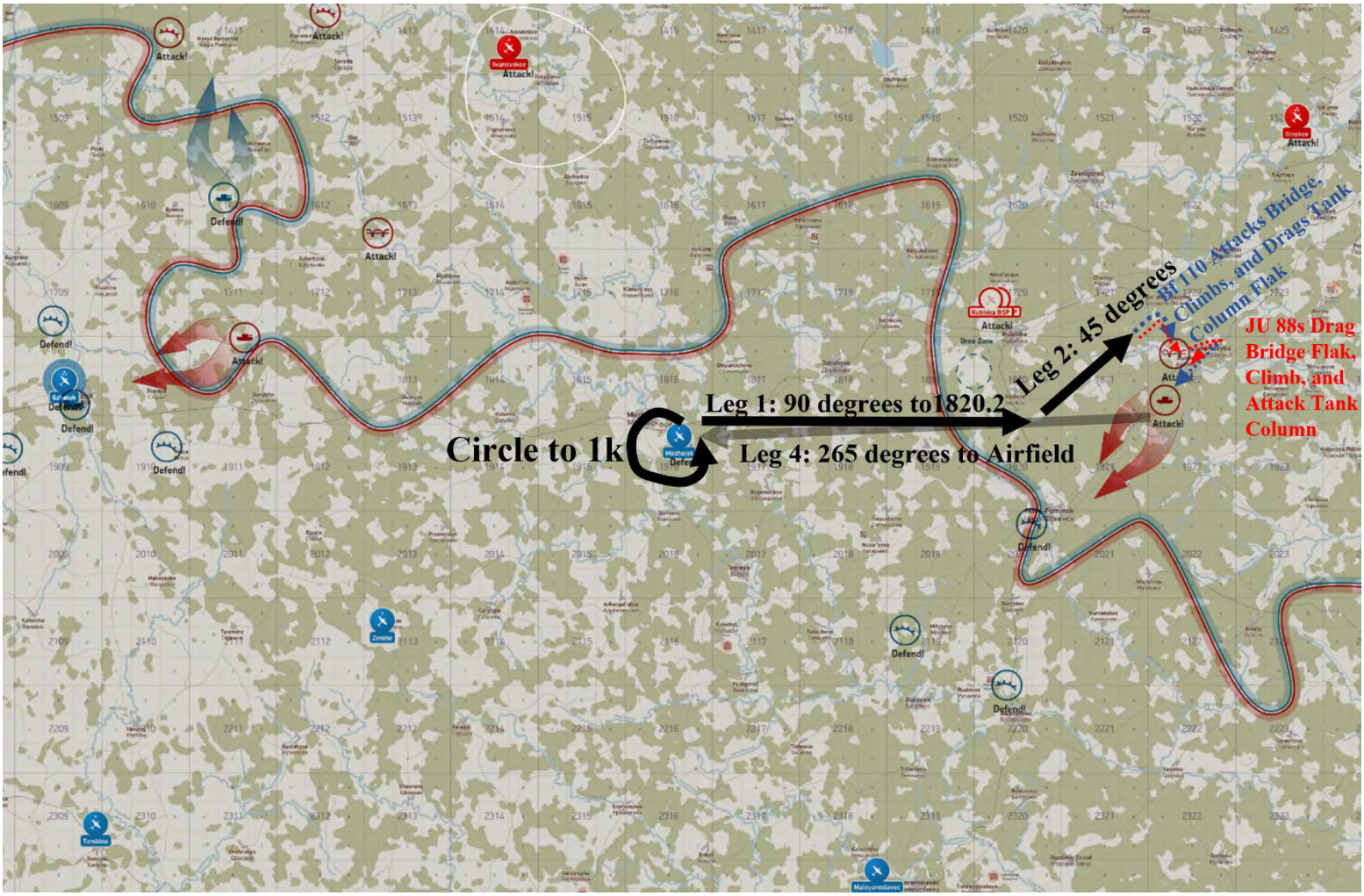
After bomb release we will turn left onto a 23° heading toward Ryabinki AF. If we become separated on egress due to our different bomb run azimuths, it's not a big deal. Just get on a 23° heading, jink around a little to avoid the flak, and get out of there. You can adjust your egress heading onto the radio compass heading once it becomes active. You can start your landing descent around the southern edge of 1413.

The Point of No Return (PONR) for Smitty and I is our final turn-in point at 1808.5. Ditch, since you're on your own after we split up at 1708.5, if you get engaged after we separate you will have to make your own determination - based on your current location - whether to continue your bomb run or run north to friendly territory.

If we are engaged between friendly lines and the PONR we will ditch bombs and do an egress dive on a 20° azimuth in the general direction of friendly lines and Ryabinki airfield. Once over friendly lines, if it's only one fighter, we will dogfight him. If it's two or more, we will continue to run toward Ryabinki.

Ok, make sure your bombsights are set, and let's taxi out."

3.3.2 *Attack Plan Briefing Example #2* (Five Pilots – Blue Team – TAW Server)



This second example is a Mission Briefing to conduct a double attack on a tank column and the bridge supplying it. It is a more complex and ambitious plan than the first example and would be a bad idea to attempt with an inexperienced group of players, or players who have not flown together before. But when flying with people who possess extensive experience flying Ground Attack missions together as a group, it stands a good chance of successful execution.

(Pre-spawn)

"Ok guys, we're hitting two Target Areas; the bridge at 1822.8 and the tank column at 1822.1. Both will be Low Angle diving attacks from 2.5k. Smitty and I will take JU88s and Ditch will take a Bf 110. Departure AF is Mozhaisk. Ju 88 loadout is 28 SC50s, 1-second delay, with 40% fuel. Bf 110 loadout is two SC 500s, 3-second delay, and 40% fuel. It's a snow map, make sure you take a white skin."

(Post-spawn)

"Please look at the map while we're starting engines. There's 55 minutes remaining map time. Skies are clear, ambient temperature -5 degrees. The general wind speed is 2mps from 65 degrees.

There are currently 13 enemy players operating, and only a few are up in the NW sector, even though we have 20 friendly players and most of them are pounding the enemy tanks and defensive positions up there. That indicates to me that the enemy players are focused on hitting our defensive positions 30-40 km SE of Mozhaisk, and probably aren't expecting a hit on our intended Target Areas. But since enemy presence is heavy in that sector between the nearest enemy airfield, Ilinskoe, and our defensive positions, we're going in with escort fighters.

Both Target Areas are fresh. There are a couple of heavy and a couple of light flak weapons at the bridge. The tank column will have 5 to 6 GAZ M4s and ZIS 5-72s.We have two fighter escorts, Ray and Jay, also on this TeamSpeak channel.

We'll fly in a loose Vic formation with 200-300m horizontal separation between aircraft. I'll be lead, Smitty take #2 position on the right, and Ditch take #3 on the left. If I am eliminated from the mission, Smitty will take over flight lead.

There are lots of moving parts to this mission, but everyone here is experienced enough to pull it off. We will takeoff and turn left to circle the airfield until we get to 1k altitude. This is to ensure we reach the Attack Altitude of 2.5k prior to reaching enemy lines. The Ju 88s will climb at 1.25 ATA, 2450 RPM, with radiators at 40%. Once we reach 1k, we will get on a 90° heading and continue to climb to 2.5k. Once we cross enemy lines, we will make sure to stay more than 10 km south of the enemy AF at Kubinka so as not to tip off the enemy to our presence. Our escorts Ray and Jay will be above us at 3.5k.

Once we get to the open area in the woods at 1820.2, which should be easy to identify, we will shift to a 45° heading and start looking outside our right-side windows for the first Target Area – the bridge at 1822.8. Once we identify the bridge we'll stay on the 45° azimuth until we reach our Attack Point at 1722.1. From there, our escorts will stay at 3500m and provide top cover while Smitty and I will dive at the bridge in our JU 88s to drag the AAA. Ditch will hang back and follow our dive about 600m behind us in his 110. Smitty and I will time our dive to level out at 1250m above the bridge – low enough to distract the AAA fire away from Ditch. As we pass over the bridge we will zoom climb on a 70° heading back up to 2500m over the town of Aprelevka at 1822.8, which is our Attack Point for the tank column attack.

As Smitty and I are climbing NE away from the bridge and still distracting the AAA, Ditch will swoop in and drop his two SC 500 bombs on the bridge, hopefully eliminating the bridge and flak guns. After dropping bombs, Ditch will also execute a zoom climb on a 70° heading and level out over Aprelevka at 1500-2000m altitude. By then Smitty and I will be back up at our 2500m Attack Altitude. All three of us will then turn onto a 225° heading toward the tanks and identify the road section where the tank column is located. The front of the column will be in the NE corner of 1822.1. Ditch will now be in front of Smitty and I, and about 500-1000m below.

On my order, we will line up and make our attack dive on the tank column. Ditch will level out at 500m over the tank column and zig-zag to avoid being hit while dragging the flak. I will drop bombs between the middle and front of the column, Smitty will hit the rear to middle section.

After dropping bombs, we will execute a low-level egress on an approximate 265° heading, making sure to jink around until we are out of light/medium AAA range. We will stay low and on this heading until we acquire the beacon signal leading back to Mozhaisk airfield. If any of us sustain catastrophic damage that prevents a return to Mozhaisk, a 190° heading is the shortest route back to friendly lines to ditch.

Since we have escort, our Point of No Return and Immediate Action Plan are flexible. My determination to abort or continue the mission will be based on how Ray and Jay handle any enemy fighters. Based on our flight route to the first Target Area, our general escape heading in 270 degrees."

- *NOTES:*
  1) *While it would be advantageous to use the escorting fighters to drag the flak over both Target Areas, the likelihood of encountering the enemy is sufficiently high to keep the escorts as protective top cover.*
  2) *When a dedicated flak dragger is available, as in the case of Ditch dragging the flak over the tank column for Smitty and the Flight Leader, it is not normally necessary for the Flight Group to climb to a high altitude to attain maximum dive speed for the attack. In this case there is a significant chance of the escorts being overwhelmed over the Target Area, or Ditch being eliminated during his bridge attack. Therefore, the JU 88s must be prepared to attack the tank column in a rapid dive to beat the AAA and exit the Target Area as quickly as possible.*

4. EXECUTING THE ATTACK PLAN

4.1 FROM TAKEOFF TO THE ATTACK POINT



4.1.1 FLYING SOLO

Lone Wulf missions are fairly simple affairs. You're responsible only for yourself, and don't have to divert brain cells to lead a Flight Group or maintain a place in formation. Nevertheless, even when flying alone, it is a good idea to communicate with friendly players to obtain current information on your intended Target Area, and possibly secure ad hoc fighter escort or support over the Target Area.

In GPS-enabled servers, navigation is a no-brainer. In expert servers, it is important to always know your location, *especially over enemy territory* – which is the worst possible place to get lost.

Stick to your Attack Plan after takeoff unless changes in mission conditions force you to make changes. Arbitrarily changing your mind in the middle of a mission may put you in a situation where all relevant variables surrounding your new plan have not been analyzed sufficiently.

4.1.2 FLIGHT LEADER RESPONSIBILITIES

4.1.2.1 Formation Cohesion. After takeoff keep your aircraft speed sufficiently slow to allow the Group to form up, then increase to climb speed. Make sure the Group knows to notify you if someone is having difficulty staying with the formation, so you can decrease speed to allow them to catch up.

4.1.2.2 Navigation. In no-GPS expert servers, the Flight Leader must be a skilled navigator. But even the best navigators occasionally get lost, especially on snow maps. If you're lost, don't pretend otherwise and make the situation worse. Solicit the help of the entire Flight Group to figure out your location.

4.1.2.3 Communication. The Flight Leader has two communications responsibilities – communication with Flight Group members, and communications with friendly players outside the Flight Group concerning the Target/AAA/Enemy situations.

4.1.2.3.1 Intra-Group Communications. There are many information items that need to be communicated to the Flight Group during the mission. As pilot of the lead aircraft, the Flight Leader should notify the Flight Group when:

- **Making changes to Engine Settings**
- **Engaging/disengaging the Autolevel function**

The Flight Leader should also keep the Flight Group apprised of his current azimuth heading, and the following navigation-related information:

- **Call out terrain features along the flight path and their location on the map to keep the individual members of the Flight Group oriented to the Flight Group's current location.**
- **Notify the Flight Group 10-15 seconds prior to changing flight azimuth headings to give them time to prepare to turn.**
- **Notify the Flight Group when crossing the lines into enemy territory.**
- **Notify the Flight Group when approaching the Attack Point.**
- **Point out the Target Area when it comes into view.**
- **If making a Single Pass attack, call out the egress azimuth as a reminder just prior to the attack.**

4.1.2.3.2 Inter-Team Communications. Communications with players outside the Flight Group may be done through Whisper or similar voice function, or team chat. If the Flight Leader has his hands full with navigation or other responsibilities inflight, he can delegate inter-team team chat communications to a Flight Group member.

4.1.2.4 Maintain Awareness of the Mission Environment. Conditions can and will often change on the way to the Target Area. Keep an eye on enemy airfield dots, particularly the Fighter Spawn Points near your intended Target Area. If your flight route falls within 10 km of friendly positions, keep an eye on those positions for enemy presence indicated by heavy flak bursts and light/medium flak tracers, and broadcast that information on team chat. Particularly adept Flight Leaders will anticipate potential changes concerning enemy dispositions and already have a "Plan B" ready, which he will issue in a Fragmentary Order.

4.1.2.5 Fragmentary Orders. Mission conditions may change at any time. Fragmentary Orders (FRAGOs) are on-the-spot changes to the Attack Plan verbally communicated by the Flight Leader in response to any changes in the mission environment requiring alterations to the Attack Plan.



When formulating the Attack Plan, experienced Flight Leaders can identify and anticipate mission factors potentially subject to change, and have a "Plan B" mentally prepared for such situations. For example, if there are multiple potential Target Areas near an intended Target Area that cannot be attacked due to a heavy enemy presence over the Target Area, the Flight Leader may elect to change over to one of the

other Target Areas. The Flight Leader should quickly issue a FRAGO outlining the new plan, including any changes to the Flight Plan portion of the Attack Plan.

Examples of situational changes and the Flight Leader's subsequent FRAGO

Situational Change	**Defensive Position Destroyed by other friendly Ground Attackers prior to Group's arrival.**
FRAGO	**Change to Secondary Target Area.**
Situational Change	**Friendly Element reports Defensive Position AAA entirely eliminated.**
FRAGO	**Make multiple bomb/strafing runs instead of the original plan for one bomb pass and egress.**
Situational Change	**Friendly Element reports strong enemy fighter presence in intended Target Area.**
FRAGO	**Change to Secondary Target Area.**
Situational Change	**Friendly Element reports all Tank Column AAA destroyed.**
FRAGO	**(JU 88 Group) Reduce Attack Altitude from 2500m to 1500m to increase bomb drop accuracy in the absence of a flak threat.**
Situational Change	**Visual inspection of Target Area from the Attack Point reveals Targets have sustained more damage than expected.**
FRAGO	**Issue new Target Assignments based on remaining undamaged targets.**

These are just a few of many possible changes than can occur in the middle of a mission. In these circumstances a Flight Leader possessing sufficient server experience will not be perplexed by unfolding events. Rather, he can make a *rapid* and effective decision, issue a FRAGO outlining a new Flight Plan with all relevant bases covered, and continue to lead the mission. A fast decision is critical so as not to potentially prolong the Flight Group's exposure time over enemy airspace.

4.1.3 FLIGHT GROUP MEMBER RESPONSIBILITIES

First and foremost, be an asset to the Flight Group and not a liability. Be proficient on the aircraft you're flying. If you possess limited experience with the aircraft selected for the mission, say so up front, and give the Flight Leader the opportunity to discuss other aircraft options with you.

Understand the risks before you participate in the mission. Your input is most likely welcome during the formulation of the Attack Plan, and that is the time to voice your opinions and ideas. If the plan is not to your liking, you have the option to opt out. But once you opt in, you're in for the duration, and *you're not in charge*. Don't second-guess or countermand the Flight Leader's decisions while inflight. If you are more experienced than the Flight Leader and would like to interject some advice, propose it politely and explain your reasoning with tact, brevity and precision.

Mistakes are very easy to make in multiplayer servers. Try to not be the guy who flubs his takeoff and forces the Group to circle the airfield while he respawns.

Know the mission specifics based on the Attack Plan briefing. Write it down if necessary, to avoid asking questions in-flight about information already conveyed in the Attack Plan briefing.

Refrain from excessive, unnecessary chatter on the voice communications channel. Keep your end of the conversation mission-related.

Maintain your proper position in the Group formation. If you are having difficulty keeping up with the Flight Leader, say so before you fall out of the formation. If the aircraft ahead of you is falling back from the Flight Leader, do not pass him and take his place in the formation unless the Flight Leader directs you to do so. Let him and the Flight Leader know so the Flight Leader can make speed adjustments to maintain formation cohesion.

In non-GPS expert servers, *it is your responsibility as a Flight Member to stay oriented at all times during the flight*, instead of merely focusing solely on the aircraft to the front. This means you should possess sufficient skill to maintain your position in the formation while also paying attention to the flight azimuth and watching for relevant terrain features and enemy fighters.

4.1.4 FLIGHT GROUP FORMATIONS

The information outlined in this section significantly overlaps with **Section 4.2.3** as Flight Group spacing is directly relevant to potential Immediate Action Decisions.

4.1.4.1 Compact Formations. Compact Formations are defined in this section as formations that maintain an approximate horizontal separation of five to fifty meters between aircraft. The primary advantage of a compact grouping is strong formation cohesion. The disadvantages are numerous. Compact Formation problems when engaged by enemy fighters are discussed in **Subsection 4.2.3.**



It takes considerable collective concentration to maintain a tight formation. In fact, it often requires so much focus that it is difficult for anyone besides the Flight Leader in the lead aircraft to pay attention to other important details such as navigation and scanning the sky for enemy aircraft. Staying oriented requires accessing the flight map from time to time; a task made that much more onerous when collision avoidance is a greater priority.

While some experienced players can maintain a tight interval and stay oriented, less experienced Flight Group Members are forced to keep their eyes glued on the aircraft to their front the entire flight and rely on the Flight Leader to get them to the Attack Point. They are unaware of their current position until they follow the Flight Leader into a turn toward the Target Area from the Attack Point or enter the bombsight for level bombing. This problem is not necessarily detrimental to mission success, but it does put the onus for mission success entirely on the Flight Leader.

4.1.4.2 Open Formations. Open Formations are defined in this section as formations where aircraft maintain an approximate horizontal separation greater than 50 meters; normally 100 to 700 meters' separation. The less rigid positional requirements provide Flight Group Members the freedom to focus more attention on the other individual responsibilities stated in **Subsection 4.1.3** while maintaining a looser position in the formation. From long distance, Open Formations are also



generally harder for enemy fighters to spot than Compact Formations. When engaged by enemy fighters, Open Formations offer many Immediate Action options as covered in **Subsection 4.2.**

If the Attack Plan calls for maintaining a Compact Formation diving attack on the Target Area, the Attack Point is the place to tighten up aircraft intervals.

4.1.5 INTERACTION WITH ESCORTING FIGHTERS

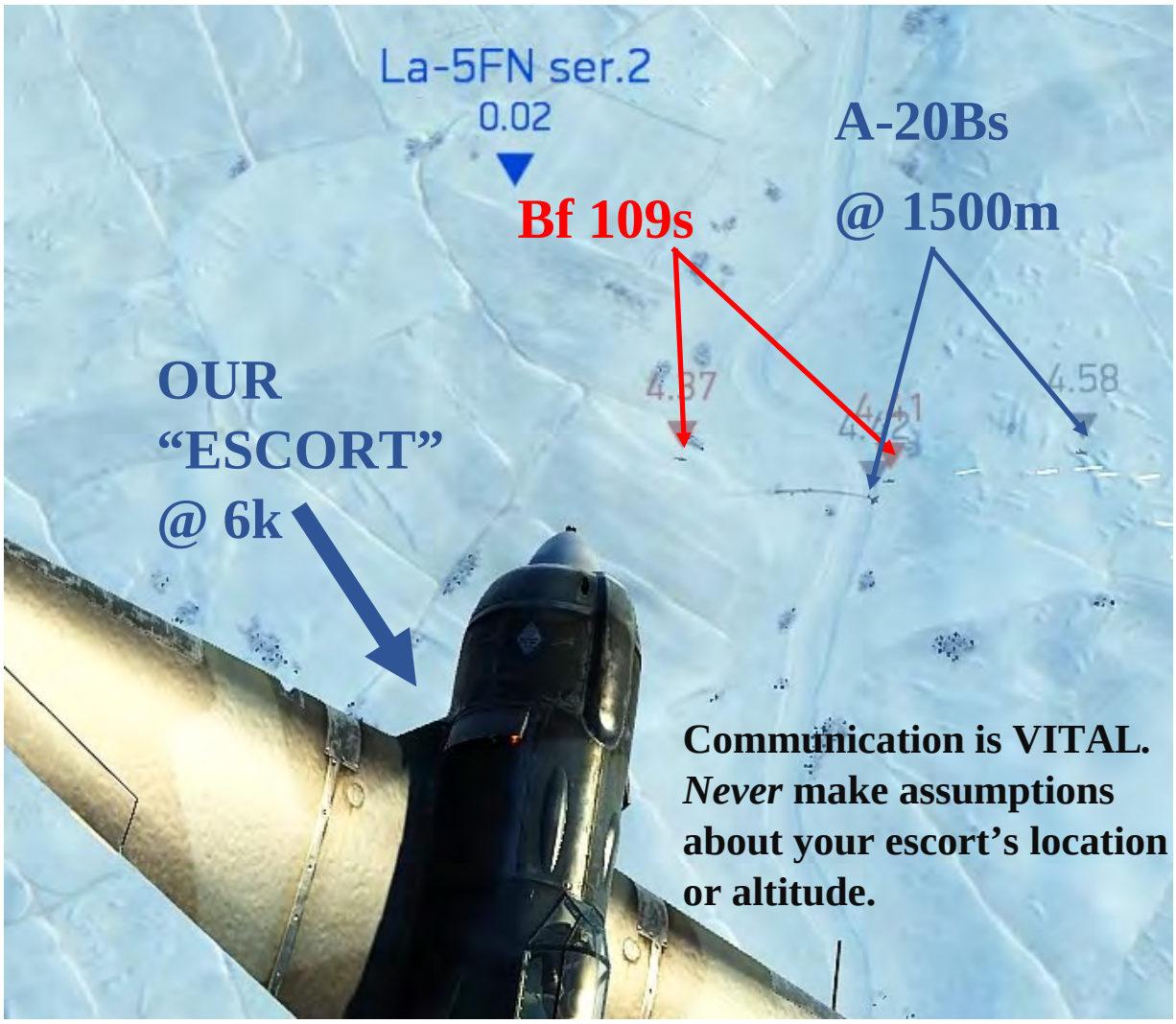
Flying with escorts can be tricky business, and the less you know about the people escorting you, the trickier it can get. Ideally, the escorts are members of your squadron. You've flown together a long time and know each other's capabilities perfectly. They're immediately accessible on your TeamSpeak channel. You're in frequent communication concerning your respective locations and altitudes. If they encounter enemy aircraft, they tell you all relevant details in real time while they dogfight, enabling you to make timely decisions regarding your mission. That is the ideal situation, and often not the case.

Another scenario, perhaps more reflective of reality for many of us, goes something like this: A couple of guys answered your call for escort protection to the Target Area while your Flight Group is starting engines. You may have flown with them once or twice in the past, and don't know much about them. Or maybe you don't know them at all. Maybe they're not using a voice channel, so the communication is conducted entirely via team chat. Maybe (probably) you and they speak different languages and have limited proficiency in each other's respective language.

So, all that close coordination and communication described two paragraphs above is nonexistent. They are going to provide escort the way *they* see fit. You can make requests, but they're under no obligation to do things your way. Maybe they know what they're doing, maybe they don't. If you are flying toward the Target Area at 1500m altitude, don't expect them to fly top cover for you at 2500m, especially if they're in German fighters. They don't want to get shot down any more than you do.

In these situations, there are a few things you should do. The first is to keep them apprised of your altitude and location – frequently. The second is to stay apprised of their altitude and location as much as possible without coming off as a nag. If you're at 1500m and they let you know they're at 5000m, there's not much you can do about that, but at least you can proceed accordingly. If they get into a dogfight, don't expect them to necessarily notice your team chat messages, and don't expect much from them in the way of typed messages until the fight is finished – keep that in mind and proceed accordingly. If you are engaged and are forced to execute your Immediate Action procedures (**Subsection 4.2**), you need to let them know what is happening – ASAP. Hopefully they will see the tracers and be along shortly.

Of course, there are many, many potential scenarios falling between these two extremes. But regardless of the situation, communication is critical. Never substitute assumptions for communication – even if you know your escort is a good fighter pilot. Have a look at the photo on the next page of a Tactical Air War Top 20 fighter pilot providing "escort" in the latter stages of Campaign 13.



4.2 IMMEDIATE ACTION DECISIONS (IAD)

The choice of which Immediate Action to take when engaged by enemy fighters is dependent on six primary factors:

- **Number and current location/altitude/skill level of fighter escort (if available)**
- **Flight Group location (proximity to friendly lines, the Attack Point, and Target Area)**
- **Number of enemy fighters engaging**
- **Size of the Flight Group**
- **Type of Ground Attack aircraft being flown**
- **Dogfighting capabilities of the Flight Group members**

The circumstances of every enemy fighter encounter are unique, and present differing conditions based on the variables listed above. At the simplest level, the choices are: *Run, Fight,* or *Continue the Mission*. A list of common, chance engagement scenarios and suggested Immediate Action Decisions are contained in the table on the following page. The most relevant variables to each scenario are in red font.

Examples of IAD Scenarios

	Engagement Conditions		Recommended Action
#1	Escort?	None	Run
	Flight Group Location	Over/Near Friendly Lines	
	# Enemy Fighters	1 or more	
	Flight Group Size	1	
	Ground Attack Aircraft Type	ALL TYPES	
As a Lone Wulf, unless you have an advantage over an enemy fighter such as surprise, energy, or stellar dogfighting skills in an IL-2 or Bf-110, you're better off trying to get away or at least get back over friendly lines. If you are near a friendly airfield or defensive position you can drag the fighter into their AAA range.			
#2	Escort?	None	Continue Mission
	Flight Group Location	At Point of No Return	
	# Enemy Fighters	1 or more	
	Flight Group Size	1 or more	
	Ground Attack Aircraft Type	ALL TYPES	
Whether alone or with a Flight Group, if you are engaged at or near the Attack Point, which is where the Flight Leader will normally determine the Point of No Return, you really have nothing to lose by going for the target. After the attack, you must egress out of enemy AAA range and then attempt to get back over friendly lines to further escape or fight.			
#3	Escort?	None	Run
	Flight Group Location	Over/Near Friendly Lines	
	# Enemy Fighters	1 or more	
	Flight Group Size	2 or more	
	Ground Attack Aircraft Type	Ju 88/He-111	
When flying aircraft with no pilot-controlled, forward-firing armament, fighting is not a viable option. If your Flight Group is over friendly lines, head for an airfield or defensive position with active AAA weapons. If near friendly lines, head for the nearest friendly territory.			
#4	Escort?	None	Fight
	Flight Group Location	Anywhere	
	# Enemy Fighters	1 or more	
	Flight Group Size	≥ Enemy Fighter Numbers	
	Ground Attack Aircraft Type	IL-2/Pe-2/Bf-110/Hs-129B-2/Ju 87/A20B	
When flying aircraft *with* pilot-controlled, forward-firing armament, fighting is an option, particularly if your Flight Group maintains a numerical advantage over the enemy. If you're at the Attack Point, you may be able to attack the target first, egress out of enemy AAA range, and then dogfight with any pursuing enemy fighters. The heavily-armed and maneuverable IL-2 and Bf 110 can be very effective in these scenarios. Less effective but still capable of putting up some degree of fight are the Pe-2, Hs 129, A20B, and Ju 87. Ultimately, it is the Flight Leader's decision to fight or run when the Flight Group is comprised of these aircraft.			
#5	Escort?	≥ Enemy Fighter Numbers	Continue Mission
	Flight Group Location	Anywhere	
	# Enemy Fighters	1 or more	
	Flight Group Size	1 or more	
	Ground Attack Aircraft Type	ALL TYPES	
Provided the escorting fighters at least hold parity in numbers to the engaging enemy fighters and are in position to quickly confront them, there is a good chance to continue the mission with minimal hindrance. Even when the escort is outnumbered, they may divert sufficient attention away from your Flight Group. If the escorts are getting overwhelmed and your Flight Group is comprised of aircraft with dogfighting capability, you have the option to assist them.			

There are just five examples of many, many possible scenarios. The Flight Leader may brief a tentative Immediate Action Plan preflight and be prepared to issue a FRAGO inflight if necessary.

4.2.1 POINT OF NO RETURN (PONR)

The Point of No Return (**PONR**) is the location along the flight path where the Flight Leader determines the Flight Group will continue the mission regardless of enemy activity in the air. The PONR is usually at or near enemy lines or the Attack Point.

4.2.2 IMMEDIATE ACTION DECISIONS PRIOR TO THE PONR

The Flight Leader must be prepared to make an Immediate Action Decision if engaged prior to reaching the PONR. If flying over/near friendly lines and far from the PONR, the decision to abort and run or fight is an easy one. If flying with dedicated escort, the decision to continue the mission is also easier to make. Closer to the Attack Point with no escort, the decision becomes trickier. The questions in this situation are:

- **How many aircraft will the formation possibly lose between our current location and the Target Area, based on the estimated number of attacking enemy fighters?**
- **Is the attack worth these potential losses?**
- **How close are we to friendly lines?**

Ultimately, the Flight Leader must weigh the potential benefits of continuing the mission against the potential loss of aircraft and pilots.

4.2.3 STAY TIGHT, GET SMOKED: The Advantages of Dispersed Formations When Engaged by Enemy Fighters

There is a prevalent opinion among proponents of Compact Formations that a tight aircraft grouping should enable interlocking fields of AI gunner fire that will effectively defend against enemy fighter attacks. In my experience, that notion falls apart 90% of the time in the multiplayer environment.

Apart from the Pe-2 (particularly with the Blister Turret), the crew-controlled armament of Ground Attack aircraft is woefully inadequate to the task when compared to the arsenal of weaponry installed in the fighter aircraft they contend with. When AI gunners are pitted against experienced human fighter pilots who utilize smart and specialized attack methods to avoid AI gunner defensive fire, it's not much of a contest. When less-experienced fighter pilots simply park on the Ground Attacker aircraft's *six* and spray bullets from 100m, dangerously exposing their engine and cockpit, the odds of scoring some critical hits does tilt in the AI gunner's favor. But as noted above, even in this situation, perhaps excepting the Pe-2 with Blister Turret, the AI gunner is waving a twig and the fighter is swinging a bat.

AI crew gunnery skill level settings vary from server to server. On some servers they may all be set to *Normal* as a default. On others the assigned AI gunner setting may be randomly assigned on each individual sortie, whereupon spawning Ground Attackers receive a *Normal* gunner 60-80% of the time, with a 10-20% chance of getting either a *Low* or *High* skill gunner. The

important thing to remember regarding these random skill level distributions is there is no way of knowing your gunner's skill level, and the probability is they are average, which certainly does not work in your favor if you're intercepted.

Under these circumstances the worst thing a Flight Group can do is continue flying in a tight and unwavering formation when attacked, expecting the AI gunners to take care of the problem. Trying this approach will lead to severe disappointment with the outcome in most encounters.

When one aircraft in a Compact formation is shot down, the attacking enemy fighter has no problem tracking and engaging the rest, because they're all together and going in the same direction as the last one he just sent down. Even if the AI gunners do manage to finally dispatch the enemy fighter(s), in 90% of those encounters the Flight Group will come away from it in very poor shape - if any aircraft survive at all.

No one is flying in formations of 100+ B-17s bristling with .50 caliber machine guns in any *IL-2 Great Battles* multiplayer servers – yet. Until that day arrives, staying in compact formations when engaged is a bad idea. Whether the Flight Leader decides to run, fight, or continue the mission, if you start the engagement encounter with at least 300m separation between aircraft, the Flight Group will have a better chance of successfully executing the Flight Leader's Immediate Action Decision.

4.2.4 RUNNING

Whether a Ground Attack Flight Group with no fighter escort is engaged or the escort is completely overwhelmed, and the Flight Leader's decision is to run, the individual aircraft in the Flight Group should *disperse*. This does not mean scattering to the four cardinal directions; rather, everyone moves onto the approximate Immediate Action Egress Azimuth specified by the Flight Leader, without trying to stay in a formation. This will automatically create significant separation between aircraft.

The least complicated course of action is for the Flight Leader to direct the entire Flight Group to dive to 5-10m altitude and continue to egress at low level. The benefits of a low-level egress are discussed in **Subsection 2.4.5.1**. The Flight Leader should also *post the enemy fighter's location, altitude, and heading in team chat*. The primary goal when running is to make it over friendly lines. Once that is achieved, the next goal is to make it back to a friendly airfield.

When the enemy fighter engages an aircraft in the Flight Group, the pilot of that aircraft should make maximum effort to evade the enemy fighter's fire. Individual evasive maneuvers are discussed in **Subsection 7.1**. The longer the engaged Ground Attacker can keep his aircraft in the air, the more time is provided to the others to escape, and for friendly fighters to enter the area.

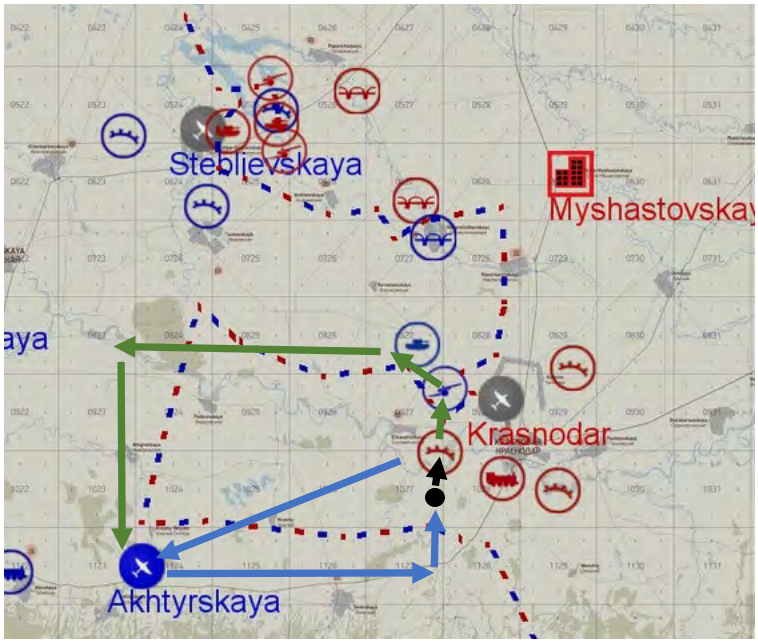


From an emotional perspective this technique may appear a mercenary, “every man for himself” approach. From a rational perspective, however, it is more a “sacrifice the one for the safe return of the many” approach, and a very effective method to minimize total losses.

4.2.4.1 Using Friendly Position AAA. As alluded to in **Subsection 2.4.4,** when putting together an Attack Plan, you should take friendly positions into account when making determinations for an Immediate Action Egress route. Those friendly positions you plan to avoid on the way to the Target Area may be very helpful if you are running from enemy fighters.

If there are friendly positions in the vicinity of your intended Target Area, you may want to put your IAD route over them to aid your escape if you must run. Make sure you stay aware of the direction and distance to them during the movement to Target Area, and be prepared to call out an azimuth to them in the event your IAD is to run.

Experienced fighter pilots coming upon an enemy position will often execute a steep climb or sharp turn to avoid light and medium AAA fire from them. This gives you the opportunity to gain some separation away from the enemy fighter. Often, they will abandon pursuing you because the flak fire in their direction has given away their location, forcing them to quickly get to a higher altitude to reclaim some potential dogfight energy.



If a Flight Group attacks the Red defensive position in the NE corner of 1027, they can plan for a normal egress of 245° (blue arrow) if no enemy fighters are encountered. If the Flight Group is intercepted over the Target Area, they can do an Immediate Action low-level egress (green arrows) of 0° – which will take them quickly across friendly lines and over the friendly artillery position AAA, followed by a 345° egress azimuth to the friendly tank column AAA. After that it’s a 270° heading to the edge of the forest in 0823.6, and a 180° heading back to Akhtyrskaya airfield.

Less experienced pilots may follow you right over the friendly position at low level, exposing themselves to fire from every active flak gun within the Target Area. There is no guarantee the AAA will destroy their aircraft, or even hit them at all, but it is worth the attempt. If multiple enemy fighters are chasing you across the position, their numbers will obviously divide the quantity of fire; the fighter nearest you may inadvertently drag the flak for the rest.

Friendly airfields are the best protection in terms of flak density. In expert servers such as TAW, you will find yourself frequently attacking enemy Target Areas very close to friendly airfields that are disabled but still maintain fully-functioning flak capabilities – use them to your advantage when pursued. Airfields are much larger positions than defensive positions or vehicular columns. You can stay within the boundaries of an airfield and execute evasive maneuvers until your attacker is destroyed or exits the area. Lingering around smaller positions

carries much more risk, as the AAA emplacements are fewer and it is easy stray out of their effective range; which is exactly what the enemy fighter pilot is waiting for you to do.

It is important to be aware that friendly positions can be a curse and not a blessing if there are enemy fighters there making attacks or covering enemy Ground Attackers, and/or the friendly position flak weapons have already been eliminated by enemy attacks.

4.2.5 FIGHTING



Some Ground Attack aircraft are more amenable to dogfighting than others. The IL-2, Pe-2, Bf 110 (particularly the G-2 model), and A-20B can all put up a fight under the right circumstances. Even the Hs 129 and Ju 87 can bite back when in capable hands. How things turn out will depend on the dogfighting skills of your Flight Group members and those of the enemy, and the level of numerical superiority your Fight Group maintains.

It should be noted that a few players have become adept at jumping into the front gunner position of a Ju 88 or He-111 and flying the aircraft while firing the front armament. While this technique is of dubious historicity, players excelling at that capability may also choose to stay and fight.

Clearly, you're at a significant maneuverability and speed disadvantage in these encounters. Don't get suckered into a head-on confrontation unless your gunnery skills are superb and you're in an aircraft with some serious front-firing clout, such as the Bf 110 or IL-2. If you made the decision to abort the attack and assist your escort fighters, the combination of friendly fighters suddenly augmented by your Flight Group changing into a fighter role can be a tremendous advantage in a dogfight.

Ideally the fight is occurring over friendly territory, preventing a capture if you must ditch or bail. One habit to avoid is dogfighting over the enemy Target Area within range of enemy flak. When fighting over enemy territory, use the dogfight sequence of events to your advantage when possible. If a solo enemy fighter attacking your Flight Group is climbing out of range for the moment – in the direction of *his* friendly territory, instead of pointlessly trying to climb up to him and moving deeper into enemy territory, get back on your escape azimuth toward *your* friendly lines, and use that time to move a kilometer or two in the right direction before the scuffle resumes.

4.2.6 CONTINUING THE MISSION PAST THE PONR

When engaged at or past the Point of No Return, the chief priority of each Flight Group member is to make it to the Target Area and accurately drop bombs without getting shot down. The second priority is to egress off the Target Area on the prescribed heading and altitude.

Accomplishing these two tasks is often difficult when the target area is swarming with enemy fighters,, and the chances of pulling this off depends on the Flight Group size, number of enemy fighters, and presence/number of friendly escort fighters.

The Flight Group formation integrity may very well become disrupted with pilots losing sight of each other. Indeed, the Flight Leader may even order the formation to spread out, to make it harder for the enemy fighter(s) to engage multiple aircraft in one pass. and it then becomes the individual responsibility of each Flight Group member to evade enemy fighters if necessary, reach the target, and get away in the right direction. This is yet another reason why it is crucial for each Flight Group member to be aware of his current location in relation to the target. A Flight Group member that has been merely following the Flight Leader and not paying attention to navigation responsibilities will be in trouble when things get crazy and the Flight Leader is no longer in view.

4.3 ACTIONS ON THE TARGET AREA

4.3.1 TARGET ASSIGNMENTS

Target Assignments for each Flight Group member may either be assigned in advance during the Attack Plan briefing, particularly if recon photos of the Target Area are available, or after a quick visual appraisal of the Target Area at the Attack Point just prior to commencing the Attack Dive.

When verbally assigning targets at the Attack Point following a visual appraisal, the Flight Leader should use the most unambiguous language possible. You can use the four cardinal directions to specify locations within the Target Area, but it is easier to simply specify locations based on the Attack Direction, i.e. (Far or Near) Left, (Far or Near) Middle, and (Far or Near) Right , or any other similar identification system that works for the Target Area layout.

If the Target Area has already incurred damage, the Flight Leader should quickly assess what has *not* been destroyed, and issue target assignments accordingly.

Example #1: Targeting Assignments based on Attack Plan Briefing

5x Pe-2

4x 250 kg Bomb Loadout

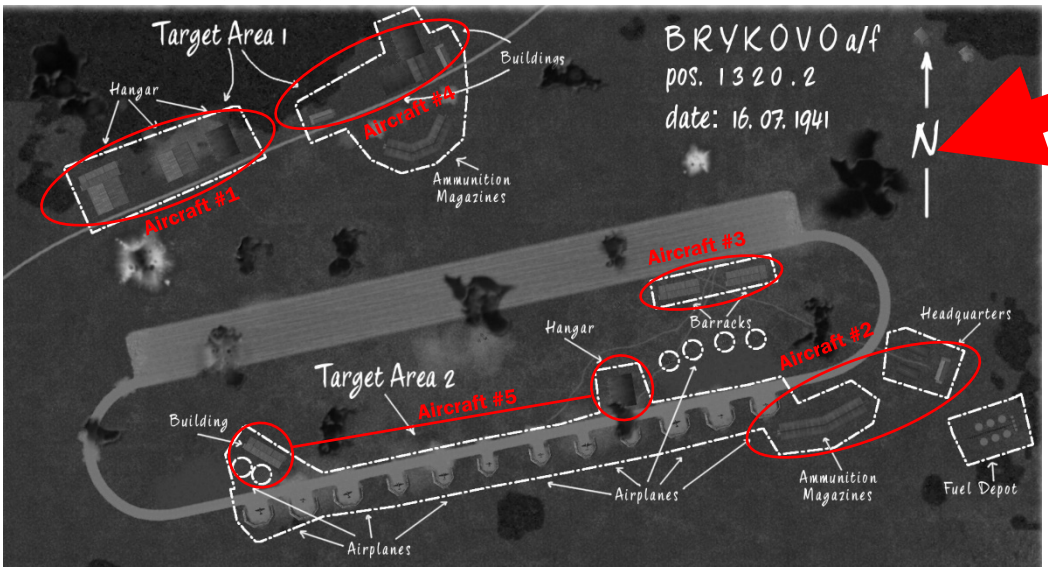
LOW ANGLE DIVE ATTACK FROM 2500m

ONE PASS @700+ kph

240-260° ATTACK DIVES

180° EGRESS Out of AAA RANGE

90° EGRESS TO FRIENDLY LINES



GENERAL ATTACK DIRECTION

Example #2: Targeting Assignments based on Visual Appraisal



4x Ju 88

28x 50 kg
Bomb Loadout

LOW ANGLE
DIVE ATTACK
FROM 2500m

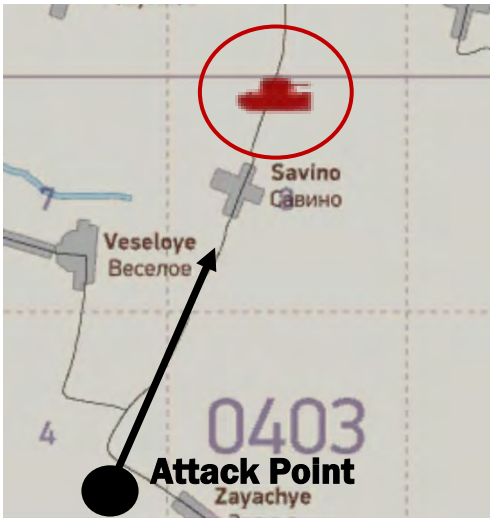
ONE PASS
@700+ kph

13-18°
ATTACK DIVES

0° EGRESS
Out of AAA RANGE

270° EGRESS
TO FRIENDLY LINES

When formulating the Attack Plan, the Flight Leader already can identify the front of the tank column and direction as indicated by the map icon and its intended objective to the north. Since column is new, and the Flight Leader knows that fresh tank columns in this server are comprised of 30 to 45 vehicles, he is confident the column will stretch southward through the town of Savino. But roads often reveal minor twists and turns that do not show on the mission map, and multiple bombs dropped along a linear path require the targets to be in a straight line. Therefore, the Flight Leader acquires a visual appraisal of the road at the Attack Point, and issues target assignments based on the straightest road segments and estimated path length of 28 SC50 bombs dropped at a delayed release of .1 seconds.



4.3.2 FLAK DRAGGING



When done correctly, the benefits of flak dragging are substantial. It is not necessary for the Ground Attacker(s) to achieve the crucial high speeds to minimize AAA exposure on the attack dive. It is therefore possible to attack from lower altitudes, which mean a shorter climb time and more accurate bomb placement. When done incorrectly, however, flak dragging can be disastrous to mission success. In this subsection we will explore the mechanics of AAA activation and the benefits and pitfalls of flak dragging.

4.3.2.1 Light/Medium AAA Detection Range. Flak weapons activate when an enemy aircraft comes into their programmed detection range. Once an enemy aircraft is detected, they begin a short activation process followed by traverse and elevation actions toward the enemy aircraft. Detection ranges are set by server administrators and are outside the control of players. Some servers use the same detection range for every flak weapon at every Target Area on every map frame. Most servers vary the detection range for AAA at each Target Area. Detection ranges normally fall between 800 to 2000 meters. The farther out the detection range, the more advance

time the flak gun has to activate, rotate, and fire at the incoming aircraft. It is important to be aware of this because the aggregate AAA response to your designated Flak Dragger and the incoming aircraft behind him are based entirely on their programmed detection ranges. Why is this important? Let's look at some scenarios:

Scenario #1: Your Flight Group of two Ju 88s are executing a Low Angle diving attack on a defensive position with an aggregate Light/Medium AAA *detection range of 800m*. Your Flight Group, attaining a dive speed of 670 kph, 800m from the Target Area, accelerating to 700 kph at bomb drop altitude above the Target Area, are so fast that 4 out of 6 of the flak emplacements could not activate and rotate quickly enough to track either aircraft until they were on an evading egress heading. Of the two flak guns that did manage to accurately track your aircraft in time for a split-second snap shot before you were zooming away, both missed.

Scenario #2: Your Flight Group consists of three A-20B aircraft executing the same Low Angle diving attack on a defensive position, with a designated La-5 Flak Dragger 700m in front of the diving formation. Once again, the aggregate Light/Medium AAA *detection range is 800m*. The AAA weapons around the position are activated by the La-5 but are unable to rotate quickly enough to track the it because of the aircraft's high speed, so they abruptly cease their attempts to track the La-5 as it flies past the position, and immediately track and fire on the lead A-20B, with devastating results.

Scenario #3: Your Flight Group of two Ju 88s are again making a Low Angle dive on a defensive position – this time with an aggregate Light/Medium AAA *detection range of 2000m*. Your Flight Group lead aircraft, attaining a dive speed of 670 kph at 800m from the Target Area, is engaged by two AAA emplacements at a range of 500m, with two more AAA emplacements - further away, engaging at a range of 300m from the position. The second aircraft, flying 250m behind the lead, is engaged by two AAA emplacements when 200m from the position. The lead aircraft sustains multiple hits and loses all control function, crashing into the Target Area. The second aircraft manages to egress with a damaged engine and limps home.

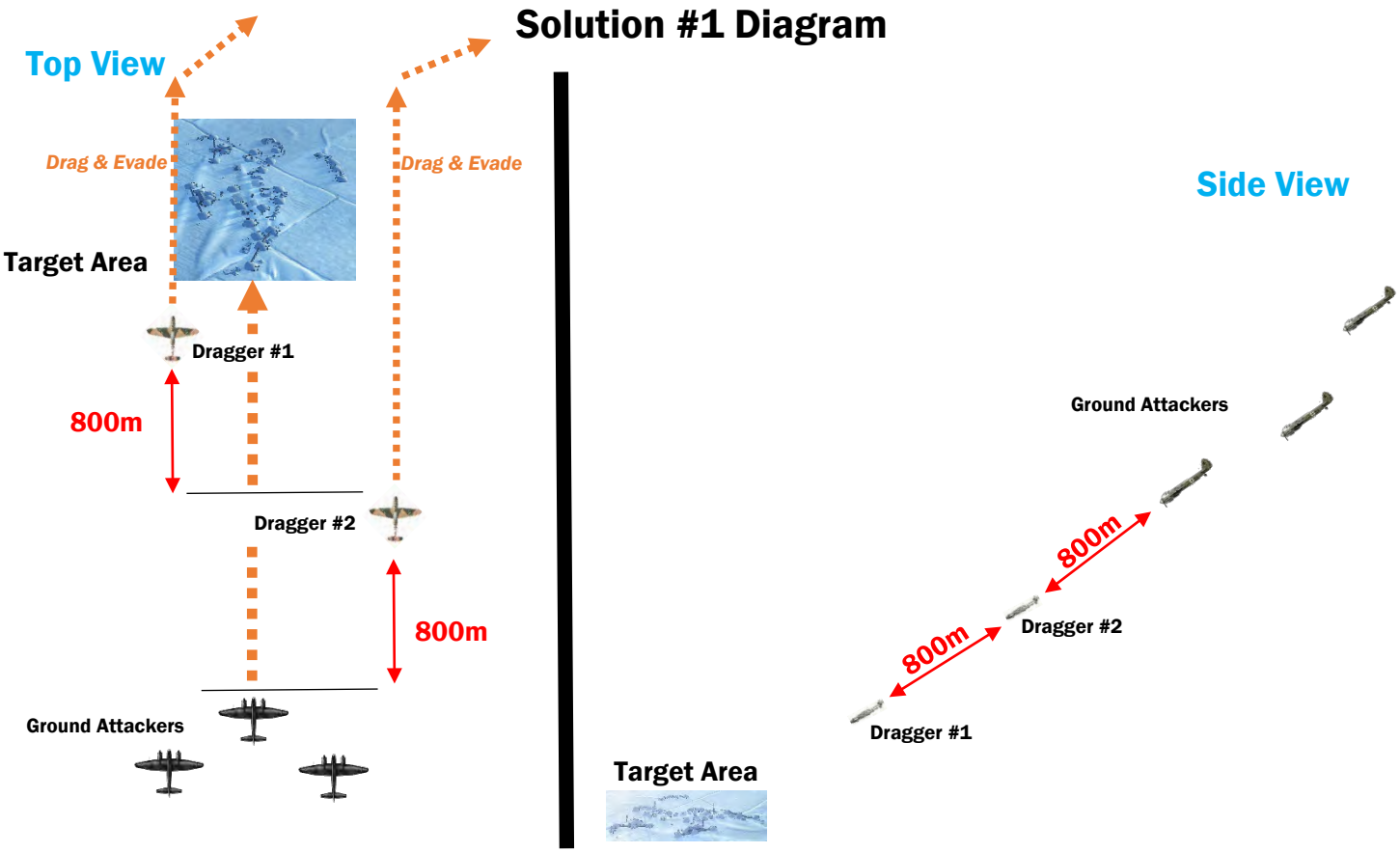
Scenario #4: Identical to Scenario #2, your Flight Group consists of three A-20B aircraft executing a Low Angle diving attack on a defensive position, with a designated La-5 Flak Dragger 700m in front of the diving formation. This time, the aggregate Light/Medium AAA *detection range is 2000m*. All Target Area AAA emplacements lock onto the La-5 and the first AAA emplacements begin to fire when the La-5 is 500m from the position, the rest joining in as the La-5 zigzags at high speed above the position. The AAA emplacements continue to track and fire at the La-5 as it evades outwardly in the opposite direction of the incoming A-20Bs. The A-20Bs arrive at the edge of the position untouched, drop all ordnance, and are only engaged after starting an evading egress – the first AAA emplacements firing at them when they are 400m away.

What is the common differentiator in these four scenarios? *Flak detection range*. The takeaway from these examples is that when the aggregate AAA detection range within a Target Area is short, *a Flak Dragger may activate the AAA against incoming Ground Attackers more effectively than having no Flak Dragger at all*. When the aggregate AAA detection range within a Target Area is long, *a designated Flak Dragger will, in most cases, effectively drag most or all AAA*

attention away from the incoming Ground Attackers. When the detection range falls in between the extremes (approximately 1200-1600m), results will vary depending on the actual detection range, incoming aircraft speed, and the distance between the Dragger and the lead Ground Attack aircraft.

But how can we know the AAA detection range prior to the attack? The simple answer is – most of the time we can't, but there are a few possible approaches to mitigate the effects of not knowing.

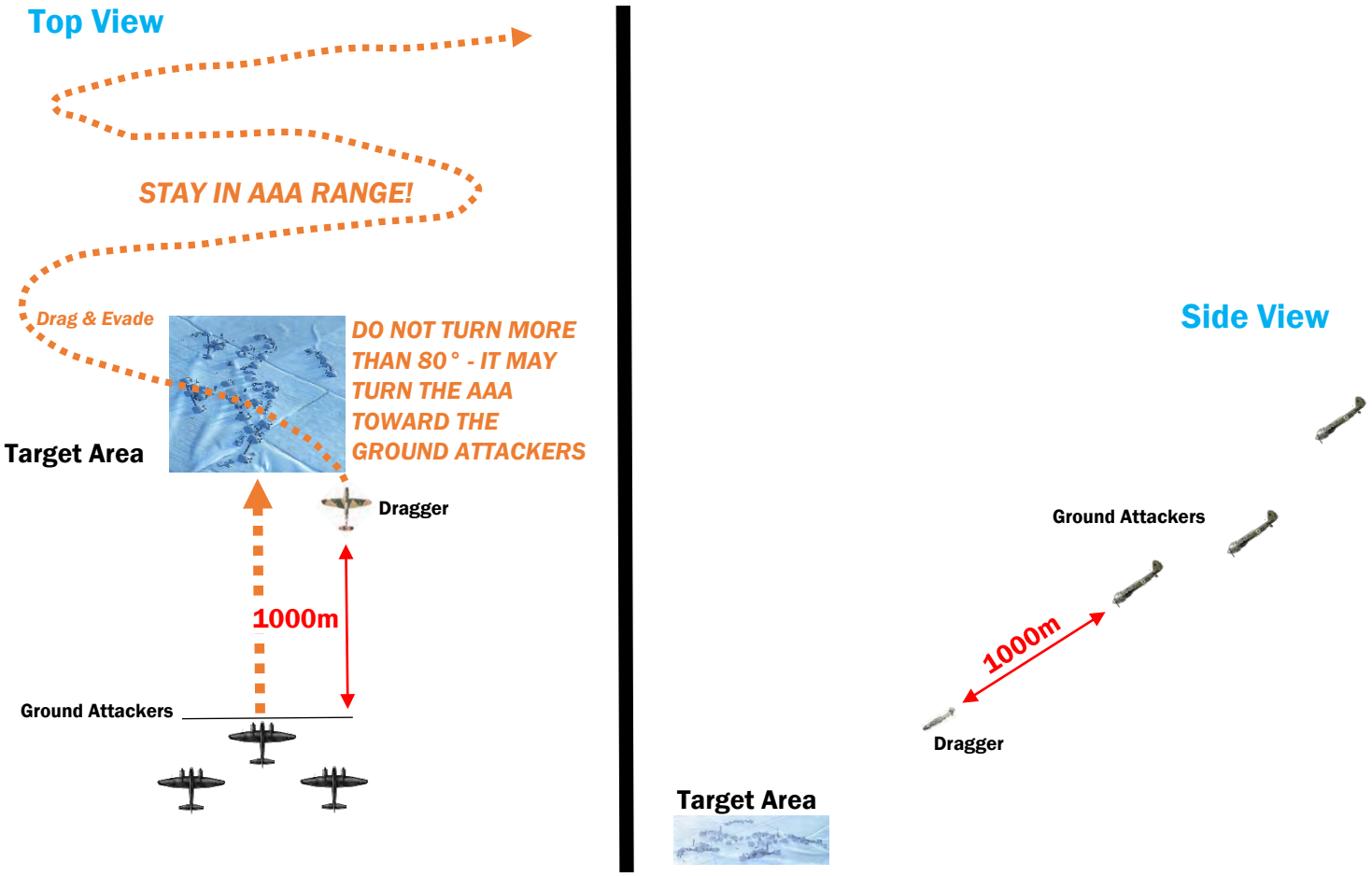
Solution #1 If your Flight Group and escorts are sufficiently numerous, you can designate *two* aircraft as Flak Draggers. At the Attack Point, the Draggers dive ahead of the Ground Attackers with an 800m separation between the first and second Dragger, and an 800m separation between the second Dragger and the lead Ground Attacker. The Draggers should be offset to the left and right edges of the Target Area to ensure that they get the attention of all AAA emplacements. It is not necessary for the Draggers to arrive at the near edge of the Target Area at low level, but they should be lower than 600m altitude. If the aggregate AAA detection range is *long*, the lead Dragger will pick up most of the AAA fire and the second Dragger will soak up the attention of any AAA flak weapons that may be prone to shifting away from the first Dragger. If the aggregate AAA detection range is *short*, the lead Dragger may not receive any fire until he is past the Target Area. But since his presence nevertheless activated all the AAA emplacements even though he was too close and fast to track, most of their attention and fire will be absorbed by the second Dragger – clearing the way for a clean and accurate bombing opportunity by the incoming Ground Attackers. In either case, all aircraft should do an evading egress off the Target Area to avoid fire from any AAA emplacements that survived the attack.



Solution #2 If your Flight Group has only one aircraft available for flak dragging it is still possible to grab the attention of all AAA emplacements, but this solution will put the flak Dragger in more peril than usual. The Dragger should dive from the Attack Point approximately 1000m ahead of the lead Ground Attacker aircraft, and be lined up on the left or right side of the Target Area. He should be at or lower than 600m altitude when he completes his dive at the near edge of the Target Area. From the near edge of the Target Area he should make a sharp turn right or left across the Target Area, then another sharp turn in the opposite direction, and continue this pattern across the Target Area. The most important responsibility of the Flak Dragger is to deliberately *stay within the range of the Target Area AAA emplacements until the Ground Attack element releases bombs.*

Naturally this dragging method puts the Dragger in a dangerous position. In addition to making successive left and right turns, he must vary his vertical position during the turns by climbing and diving to avoid the inevitable deflection lead shots from the many AAA weapons. He may have to begin evasive maneuvers prior to arrival at the edge of the Target Area if the flak opens up on him from long range. The one thing he must make sure *not* to do is turn more than 80°, as that may cause the AAA guns to turn in the direction of the incoming Ground Attackers. In most cases, a Dragger flying this pattern will keep the flak fire off the incoming Ground Attackers.

Solution #2 Diagram

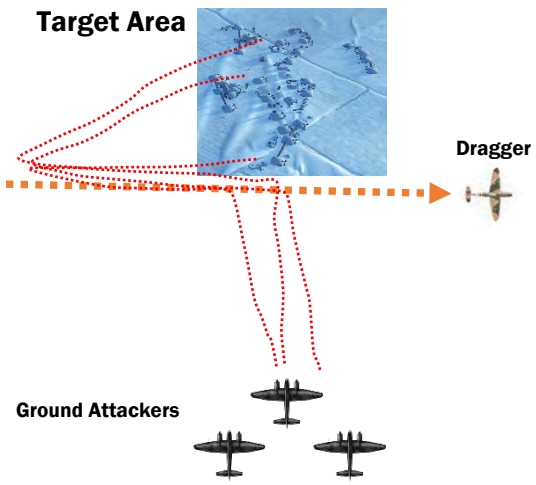


4.3.2.2 Position and Timing. The preceding solutions are only two possible methods to drag flak. In multiplayer environments Flak Draggers tend to approach Target Areas from all directions and altitudes in relation to the Ground Attack element – with mixed results.

Aircraft positioning (of both elements) and timing are interrelated, and you cannot discuss one without the other. If the Dragger is too far ahead of the Ground Attacker, he may move out of light/medium AAA range before the Ground Attacker can get to his bomb release point over the Target Area. The AAA will thus shift their tracking toward the Ground Attacker. If the Ground Attacker is too close to the Dragger, the activated AAA may simply bypass tracking the Dragger and focus on the trailing Ground Attacker. Additionally, if the Dragger is not approaching the Target Area from the same direction as the Ground Attack element, myriad problems can arise.

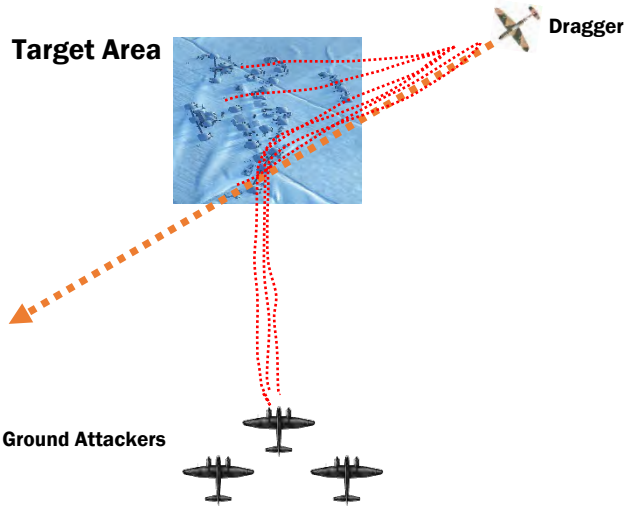
The same basic problems discussed concerning escort fighters in **Subsection 4.1.5** are also applicable to Flak Draggers. Ideally, you are familiar with the Draggers, are in voice communication with them, and they are willing to get in position and start their drag dive on your order. Just as important, they are willing to dive ahead of and in the same direction as you from the Attack Point. When one or more of these requirements is not met, there is a significant likelihood of nasty surprises. Let's look at some diagrams of less than optimal flak dragging methods:

Bad Dragging Example #1



The Dragger is dragging in a direction perpendicular to the Ground Attacker element. Unfortunately, his path takes him between the Target Area and the incoming Ground Attackers. As he moves from left to right across the leading edge of the Target Area, the AAA is activated by the Dragger and they begin to track him. At the point where the Dragger pulls the AAA toward the direction of the Ground Attackers, many AAA guns stop tracking the Dragger and lock onto the lead Ground Attacker (red dotted lines .....).

Bad Dragging Example #2



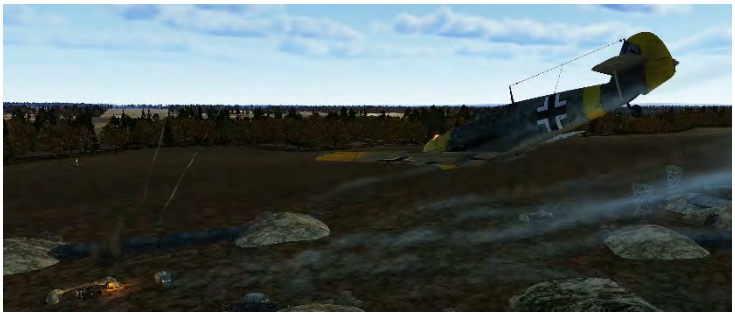
The Dragger is dragging in a direction that will ultimately pull the AAA in the direction of the Ground Attacker element. The AAA is activated by the Dragger as he moves toward the Target Area, but as he flies over the Target Area he pulls the AAA toward the direction of the Ground Attackers. Similar to Bad Dragging Example #1, many AAA guns stop tracking the Dragger and lock onto the lead Ground Attacker (red dotted lines .....).

If the Dragger can't or won't dive in the same direction ahead of you from the Attack Point, you should, at a minimum, be able to visually confirm his location and altitude - which will allow you to estimate his distance from you and the direction he is taking toward the Target Area. This information will help you assess whether he will effectively drag the flak or turn them in your direction. Hopefully he will let you know when he begins his drag dive, and hopefully you will be at the Attack Point and in position to begin your attack dive.

4.3.2.3 Dragging and Eliminating AAA on Multiple Pass Attacks. If you intend to make multiple passes on the Target Area with your Flight Group, the Flight Leader or (depending on the size of the Flight Group) the two aircraft in the lead can simply drag the flak without bombing or strafing on the first pass, employing the techniques discussed in the preceding subsections. On subsequent passes, eliminating (with bombs or strafing) the AAA emplacements that survived the first pass will normally be the priority.

During multiple pass attacks on Target Areas with active flak, make sure to move *completely* out of light/medium AAA range before turning back toward the Target Area for another pass.

If the flak gun(s) firing at the aircraft to your front stops firing at him, and you are alone, or the rest of the Flight Group is behind you, the AAA is turning to track you.

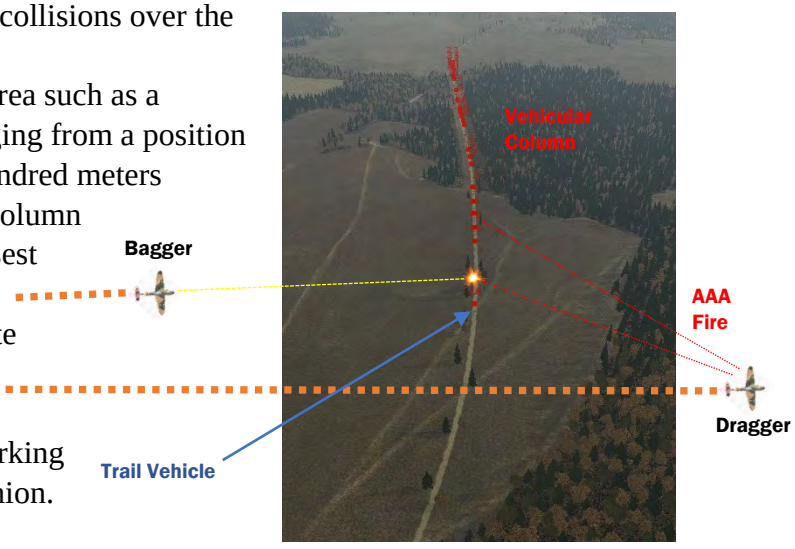


When selecting a flak gun to strafe or bomb, *shoot the gun that is not shooting at you*. Unless your long-range gunnery skills are superb, avoid duels with the flak. If you see two or more AAA guns firing at you while you're lining up on another, abort your pass and continue to drag those AAA guns so someone else can identify and destroy them.

When leading a Flight Group comprised of several aircraft, during the Attack Plan briefing specify a Flight Group turn-around direction for the attack passes, either to the left or right. This will help reduce the possibility of accidental collisions over the Target Area.

When eliminating AAA on a linear Target Area such as a vehicular column, you may want to try dragging from a position 90°/perpendicular to the column, and few hundred meters distant from the column front or rear. If the column AAA's detection range is short, only the closest two or three flak guns will fire at the dragger, allowing the trail aircraft to eliminate them without (hopefully) activating every flak gun in the column simultaneously.

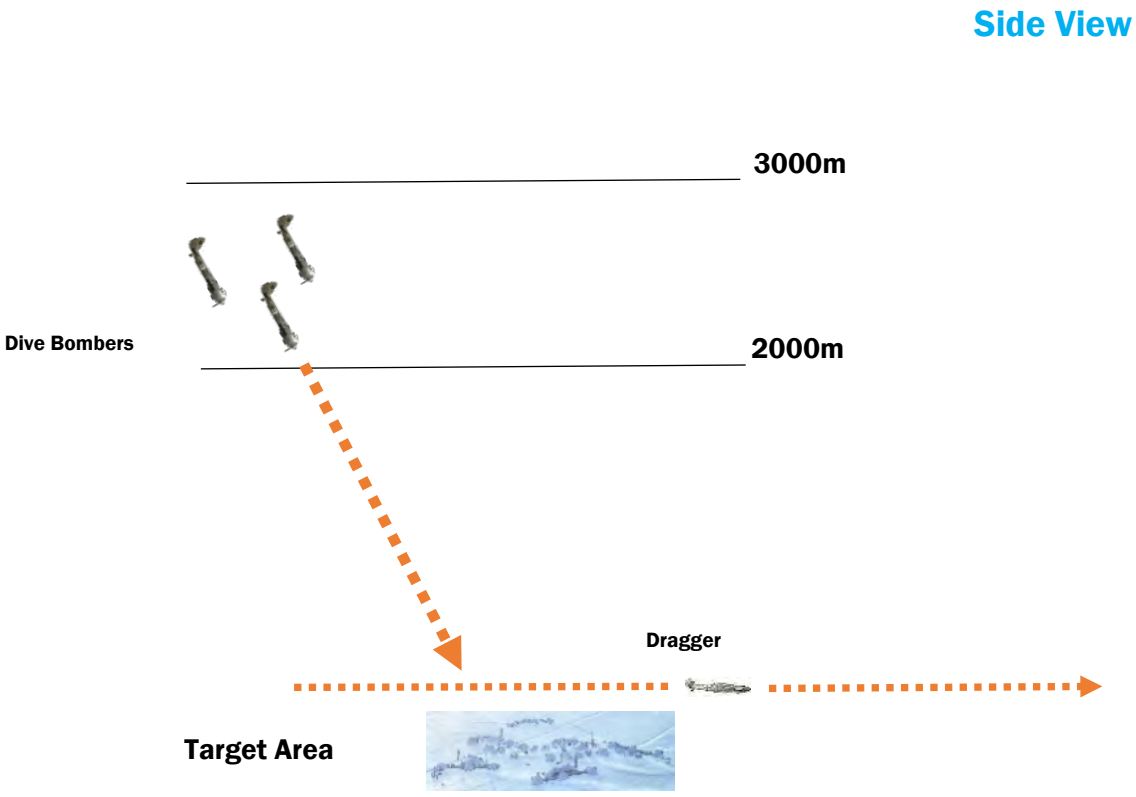
You can make multiple passes, gradually working your way up or down the column, in this fashion.



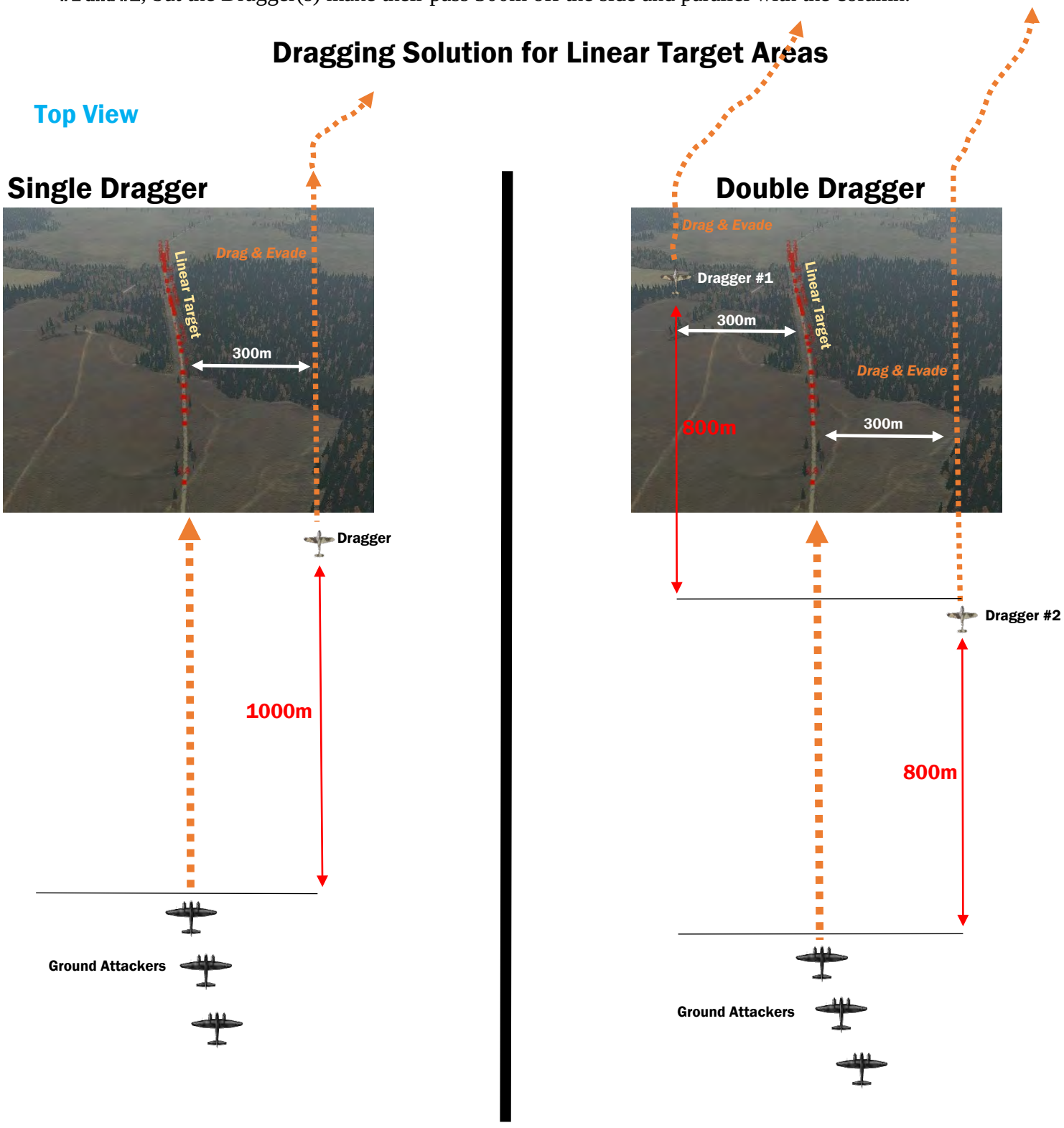
4.3.2.4 Dragging for Dive Bombers. Dive Bombers are particularly vulnerable to AAA fire, and a dedicated Flak Dragging element will improve their chances of a successful attack and egress. The dragging techniques presented in **Subsection 4.3.2.1, Solutions #1 and #2** can be utilized, albeit from a steeper diving angle. If the Dragger(s) are flying aircraft without dive brakes, particularly in the case of fighters, they must be proficient with engine management and/or flaps to control their acceleration on the dive due to the steeper dive angle.

Another dragging solution is for the Dragger to distract the flak via a low-level dragging pass. The Dragger should be passing above the Target Area before the lead Dive Bomber breaks below 2000m during the attack dive. The Dragger should approach the Target Area from roughly the same direction as the Dive Bombers, which will pull the flak fire in the opposite direction of the Dive Bombers as the Dragger egresses away from the Target Area. If the Dive Bombers are below 2000m before the Dragger is over the Target Area, there is a significant possibility that at least a portion of the AAA weapons will track and fire at the Dive Bombers.

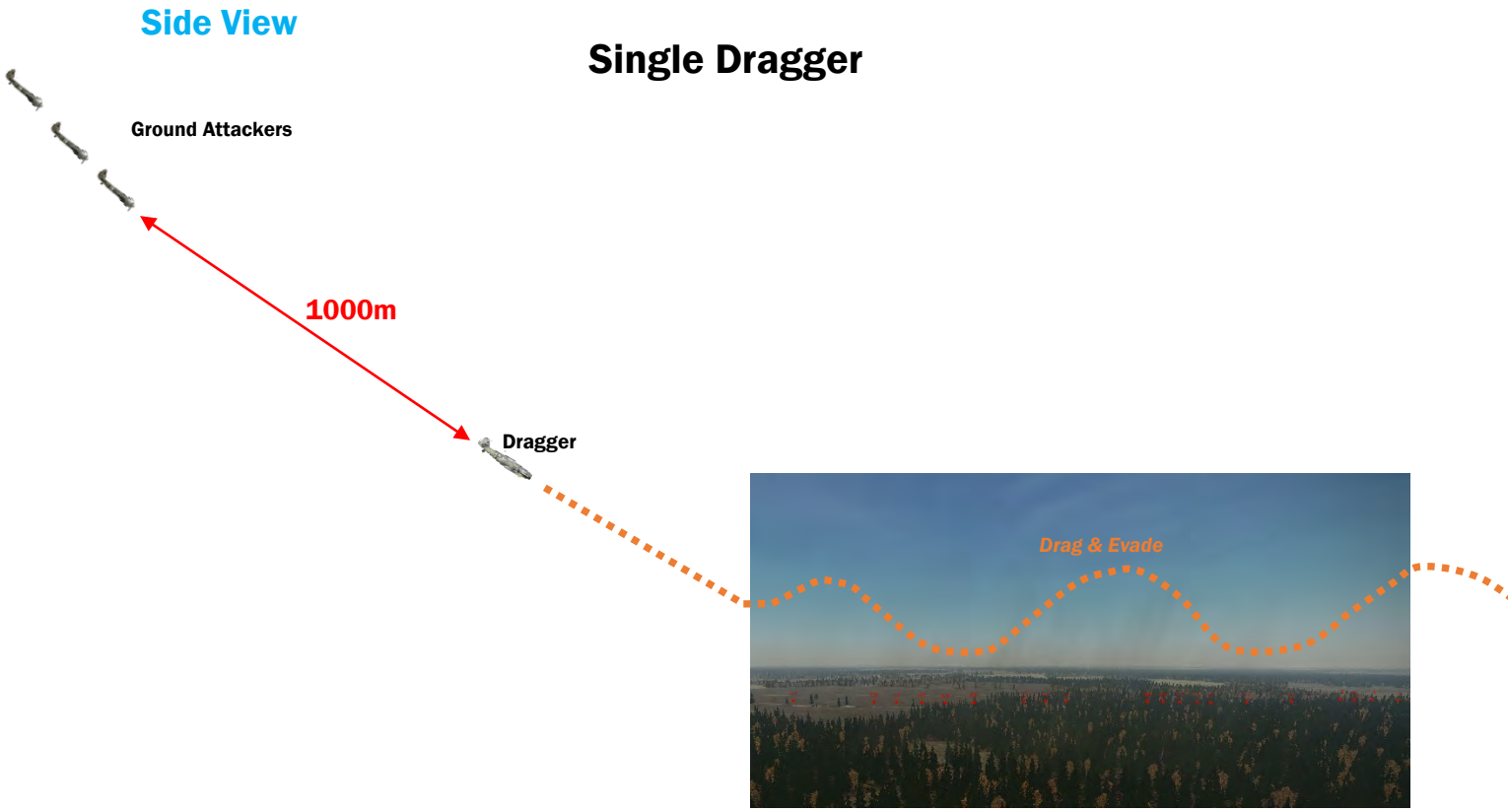
Low Level Dragging Solution for Dive Bombers



4.3.2.5 Linear Target Area Dragging. In contrast to the multiple-pass AAA elimination technique described at the end of **Subsection 4.3.2.3**, there is another effective approach available when making a single, Low Angle attack dive pass against a linear, vehicular column target with one or two Flak Draggers. This technique is similar to those described in **Subsection 4.3.2.1, Solutions #1 and #2**, but the Dragger(s) make their pass 300m off the side and parallel with the column.



Dragging Solution for Linear Target Areas



Once the AAA begin firing, the Dragger(s) must do climb & dive evasive maneuvers (pictured in the above diagram) until out of light/medium AAA range. Lateral movements will not effectively evade column AAA fire coming from the left or right side.

4.3.2.6 Final Tips. When there is a Flak Dragger to your front during the attack dive, depending on his position when the first AAA emplacement opens fire, he may not see the tracers from the first AAA gun(s) that fire at him. If you are in voice communication with the Dragger, be sure to instantly inform him the moment you see tracers, so that he can evade accordingly.

When possible, have the Flak Dragger start his dive in front of you at the Attack Point, in your same direction. Any other arrangement is fraught with disastrous possibilities.

Being too close or too far from your Dragger is dangerous. But it can be difficult in the beginning to know your true distance from the Dragger. Flight Recordings of previous missions are not much help because for some odd reason the aircraft in playbacks appear closer than they actually were during the mission. Only experience gained through trial and error will teach you how to visually apprise where you should be in relation to the Dragger.

When you observe, during your attack dive, friendly Ground Attackers (not in your Flight Group) flying willy-nilly around your intended Target Area being fired at by the AAA, be aware that they may pull the AAA tracking onto you, *especially if any of them are flying toward you*.

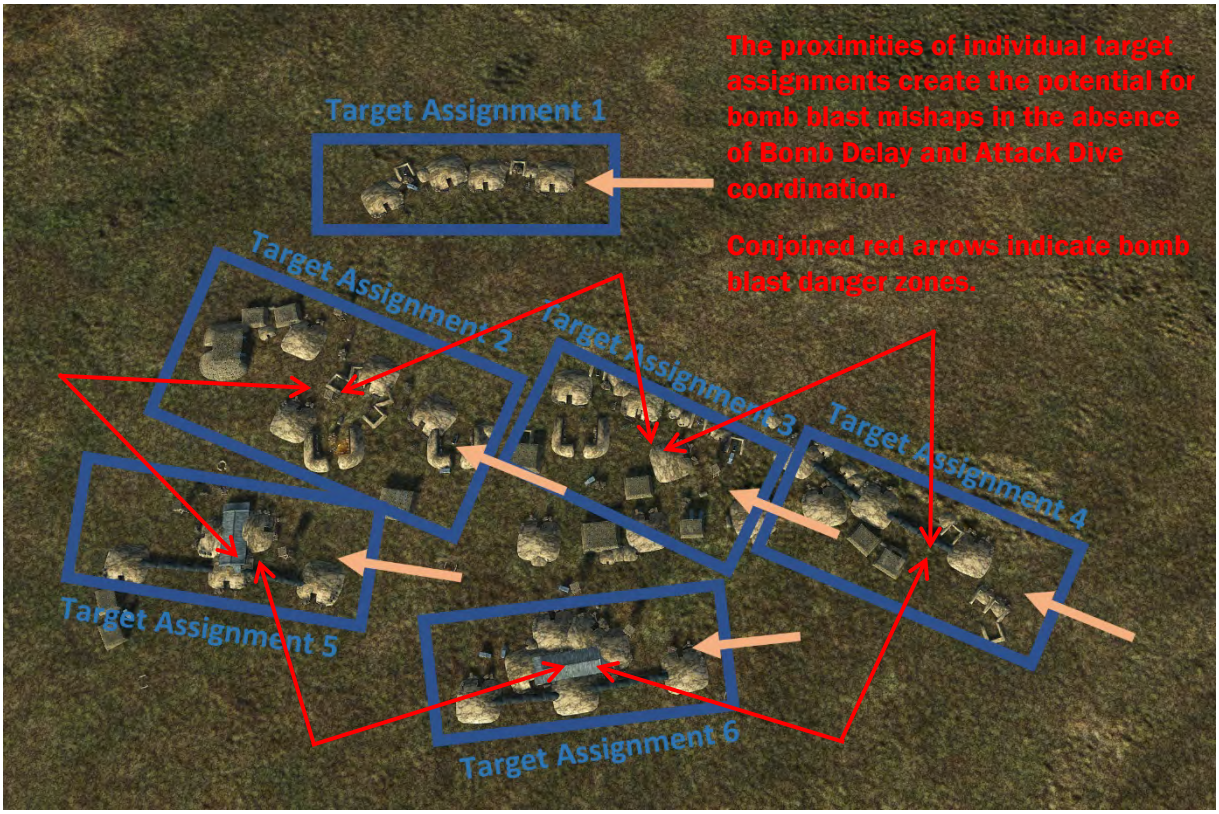
4.3.3 BOMB TIMER DELAY SETTINGS

4.3.3.1 Lone Wulf Attacks. When Low Angle or Dive bombing a target alone, a 1-second bomb timer delay is preferable for bombs up to 500 kg. The reasoning behind this being, when AAA is firing at you on the way out, the longer the time before detonation, the more time is given to any soon-to-be-dead AAA emplacements within your bomb blast radius to fire at your aircraft. Provided your speed at bomb drop is 550 kph or faster, your aircraft will not be affected by the bomb blast of even 500 kg bombs, though your aircraft may shake a little. For 1000 kg bombs or heavier, a three to five second delay is necessary. The choice between the two is dependent on your planned drop altitude and speed.

4.3.3.2 Flight Group Attacks. With a Flight Group, bomb timer delay should be predicated primarily upon the proximity of target assignments within the Target Area and number of aircraft in the Flight Group, as well as bomb size.

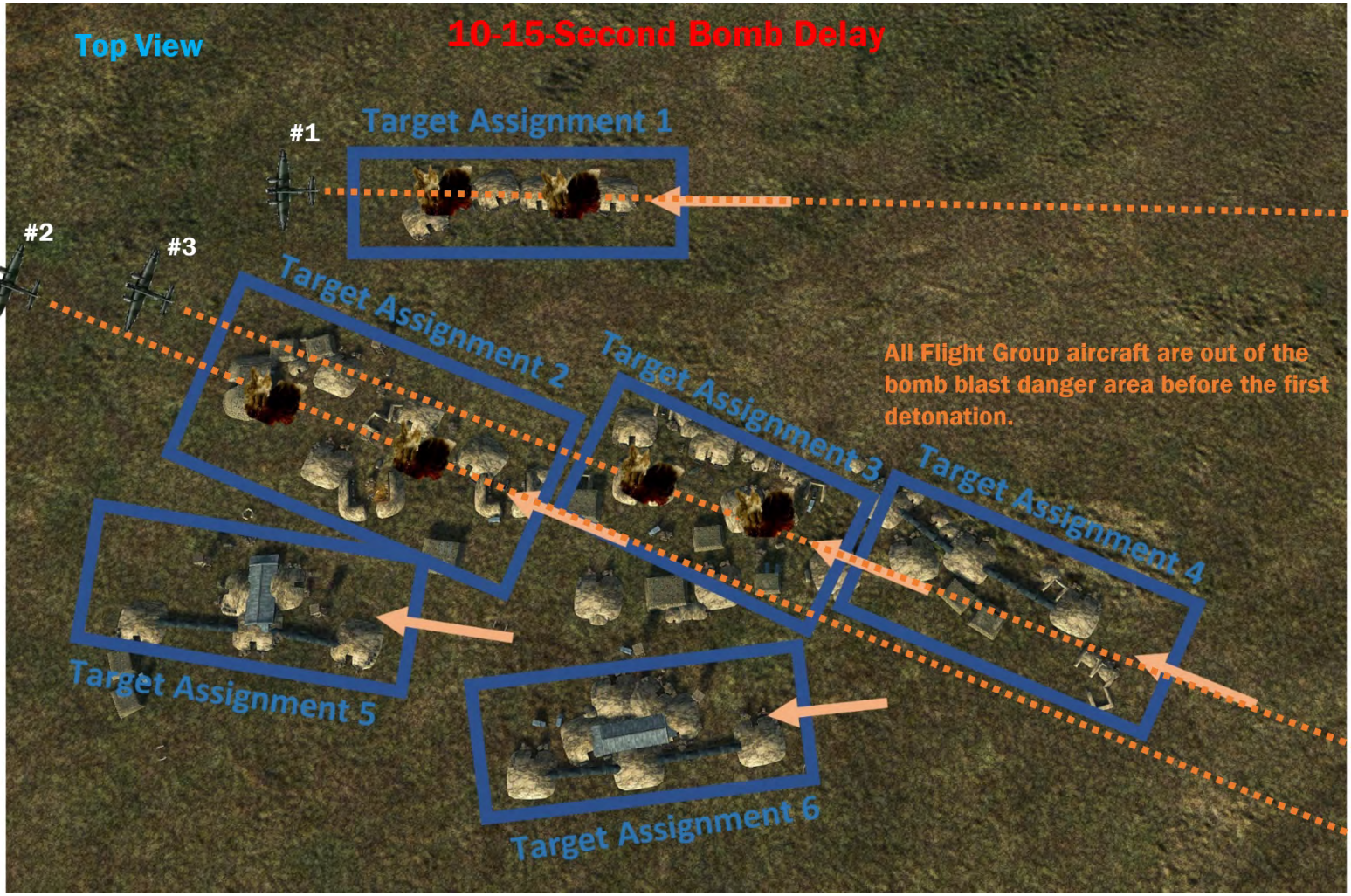
It can be difficult to maintain a coherent Flight Group formation during the Attack Dive, particularly when there are minor or major differences in dive trajectory when multiple aircraft are lining up on multiple targets within the Target Area. This creates situations where aircraft are mutually closer or farther apart than anticipated. The more aircraft in the Flight Group, the more the problem is compounded. The less experienced the pilots in the Flight Group, the more the problem is additionally exacerbated.

Another risk consideration is the mutual proximity of individual target assignments within the Target Area, particularly ones along the same flight path of two or more aircraft:



A basic solution to this problem is to simply assign a 10 or 15-second bomb timer delay to Flight Groups comprised of five or less aircraft diving simultaneously, which will normally allow all aircraft to release bombs and clear the Target Area prior to the first detonation (**Example 1**). When using a 10-second bomb timer delay, it is important start the Attack Dive with no more than 1 km separation between the lead and trail aircraft.

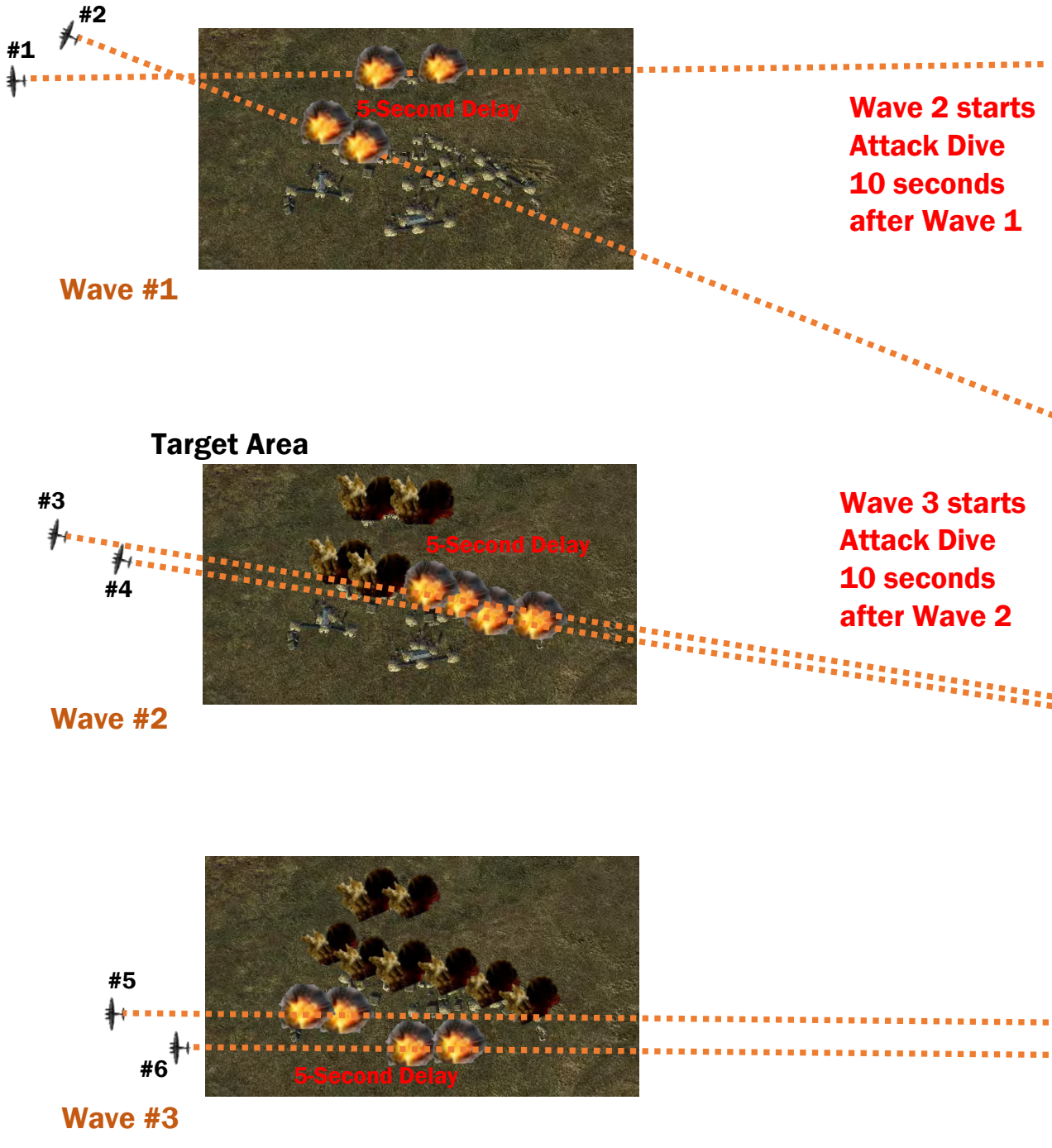
Example 1:



For larger Flight Groups there is the option of executing the Attack Dive in waves of two aircraft each, with a 5-seond bomb delay and 10-second spacing between the Attack Dives of each consecutive wave (**Example 2**).

Example 2:

Top View



When attacking larger Target Areas such as airfields, bomb timer delay decisions should be based upon individual target assignments, the mutual proximity of assigned targets, and the planned linear spacing between Flight Group aircraft during the attack dive. (See **Subsection 4.3.1 Example #1**).

4.3.3.3 Tips. Whether the Flight Group formation is tight or loose during the attack dive, aircraft spacings errors can easily happen. If you find yourself out of position – too close or too far from the aircraft to your front, you must take action to avoid entering the blast zone, based on the bomb timer delay setting of the aircraft to your front. You may have to drop from a higher altitude or even abort the pass if you cannot get into the correct position through throttle management or dive brake adjustments.

If you find yourself on the way to a Target Area in an ad hoc, hastily-assembled Ground Attack Flight Group with a vague outline of an Attack Plan, be sure to know the bomb timer delay settings and intended targets of the aircraft in front of you prior to the attack dive. Knowing this information will help you plan your run and position your aircraft accordingly.

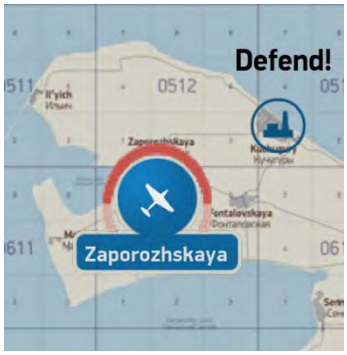
4.4 EGRESS TO LANDING

4.4.1 AVOID COMPLACENCY



When protecting a friendly Target Area, many, if not most fighter pilots use the Target Area flak tracer fire to alert them to the presence of enemy Ground Attackers. Even if you aren't engaged over the Target Area, there is always a significant possibility that an enemy fighter is closing on you as you make your egress away from the Target Area. Depending on your relative speeds, it could take several minutes before the enemy fighter is close enough to activate a warning from your AI rear gunner(s).

Check your six frequently, even if you have a rear gunner. You can autolevel and do a thorough check from the rear gunner position(s). Your egress speed should be the highest possible for the aircraft type without blowing the engines. A high level of familiarity with your aircraft type will enable you to adjust the ATA, RPM, and radiator/outer cowling settings to achieve this. Don't forget the advantages of a low-level, ground-hugging egress as outlined in **Subsection 2.4.5.**



If you suspect an enemy fighter is following you from your long *six* when you are near your destination airfield, check the map to see if the airfield icon is red. If the icon is red there is an enemy located within 10 km of the airfield. Whether that airfield warning is indicative of an enemy fighter trailing you or some other type of enemy activity around the airfield (or both), this is not the situation



to make a business-as-usual landing. Attempt to get a clarification of enemy activity in the airfield vicinity through voice communication or team chat. Find out if the airfield's heavy flak guns are firing, and the location and altitude of their shell bursts. If no enemy activity is observed by friendly players at or around the airfield, you should fly over the airfield at low level and check your *six*. If you are informed that the airfield is under attack, you should usually avoid the airfield until the red icon disappears – but stay aware of the direction of the airfield relative to your location in case your gunners call out an enemy fighter. In that case you must run to the protective cover of the airfield AAA regardless of the current situation there.

4.4.2 LANDING ETIQUETTE

When your Flight Group arrives at the destination airfield, damaged aircraft should be given landing priority. Aircraft with damaged engines should enjoy top landing priority, particularly twin-engine aircraft with only one working engine. The Flight Leader should use team chat to inform players around the airfield spawn area, taxiway, and runway that damaged aircraft are inbound for landing in *X* minutes. If you are alone, that communication is your responsibility.

Inbound aircraft should land in the direction of takeoff. On most server maps at full zoom, the airfield icon will be located at the *approach edge* of the runway. When heavily damaged aircraft must make a landing in the opposite direction, that intent should also be communicated in advance via team chat.



5. GROUND ATTACK AIRCRAFT

5.1 AXIS GROUND ATTACK AIRCRAFT

5.1.1 Ju 87 D-3



This Stuka model serves two primary roles of Dive Bomber, and a tank-busting precursor to the later Ju 87 G.

When utilized in the traditional Dive Bomber role, the Stuka is the most accurate bomber aircraft in the *IL-2 Great Battles* series to date. Unfortunately, it is also one of the slowest Ground Attack aircraft in the *IL-2* inventory but retains a respectable climb rate. It can also carry an impressive bomb payload for a single-engine aircraft, and its ordnance package choices are many, allowing the pilot to balance attack punch and desired speed.

The pilot-controlled, forward-firing twin 7.92 machine guns are anemic in comparison to the forward-firing cannons of the Bf 110 or IL-2. The rear gunner twin 7.92 machine guns, in contrast, provide markedly superior rear protection to the single machine guns in the back of the Bf 110 E-2 and IL-2 mod 1942.

The 12x 7.92 MG option will likely be effective should someday ground troop concentrations become present in the game and can be strafed. Until that day comes, this option is largely useless.

The BK 37 cannon option is a different story. In capable hands, this aircraft can execute 1-shot kills on Soviet light tanks (T-70, BT-7), and 2-shot kills on the T-34 medium tank. It can also defeat the KV-1 heavy tank, but may take several shots to do so, and highlights the primary drawback of this tank hunter – limited ammunition.

With a total 24 rounds distributed equally between two wing cannon and a compulsory two rounds fired per single trigger pull, it is effectively a 12-shot weapon. While each BK 37 appears to be more

Maximum Speed	367 kph (0m) 389 kph (2000m)
Dive Speed Limit	650 kph
Maximum G Load	9G
Climb Rate (0m) Climb Rate (3000m)	8 mps 7 mps
Dropped Ordnance Options	01 SC250 (+4 SD 70) 03 SC250 01 SC500 (+4 SD 70) 01 SC500 (+2 SC 250) 01 SC 1000 01 SC 1800
Forward-Firing Armament	2x 7.92mm MG 17 1000 rounds 1200 RPM
Forward-Firing Armament Options	OPTION 1: 12 x 7.92mm MG 81 250 rounds 1600 RPM
	OPTION 2: 2 x 37mm gun BK37 24 rounds 160 RPM
Rearward-Firing Crew Armament	2x 7.92mm MG 81 500 rounds 1600 RPM

effective at armor penetration in comparison to the Soviet Sh-37 and NS-37 cannon, the limited ammunition severely curtails its effectiveness. For example, when a BK 37-armed Ju 87 engages a damaged and smoking BT-7 that could be eliminated by one of the 80 MK 103 30mm rounds carried on the Hs 129 B-2, the Ju 87 will fire *two rounds*, or 8.5% of its total ammunition load.

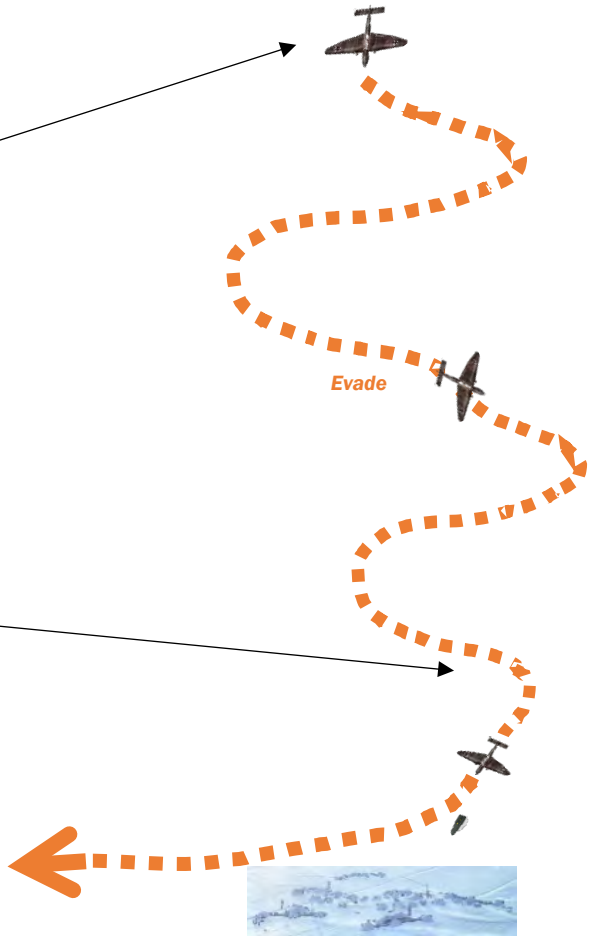
In less-than-capable hands, the BK 37-armed Stuka can be an exercise in frustration. Firing at the programmed convergence setting is critical to placing both rounds in the same location, and turret shots are usually necessary to quickly destroy any tank type. Even though the BK 37 is more powerful than the 30mm MK 103, its meagre ammunition capacity requires the pilot to fire one or two, 2-round shots per pass. There is no possibility of walking the rounds onto the target.

In terms of damage sustainment capability, the Ju 87 D-3 is rather modest. The engine is easily damaged when struck and the non-retractable landing gear are cannon round magnets. While the wings appear to be slightly tougher than those on the Bf 110 and Hs 129 B-2, like all Axis Ground Attack aircraft, the Stuka's control system functions evaporate rapidly under sustained hits.

The Ju 87 D-3 is very easy to take off, land, and is very forgiving in flight. While slow, it is fairly maneuverable, has a turn rate almost comparable to a fighter, and its stall speed is one of the lowest of any aircraft.

5.1.1.1 Dive Bombing Tip. The problem with dive bombing in the Ju 87 D-3 is that while the slow dive speed greatly facilitates accurate target lineup and bomb drop accuracy, it makes the aircraft an easy target for Target Area AAA. You can improve your chances of survival if you:

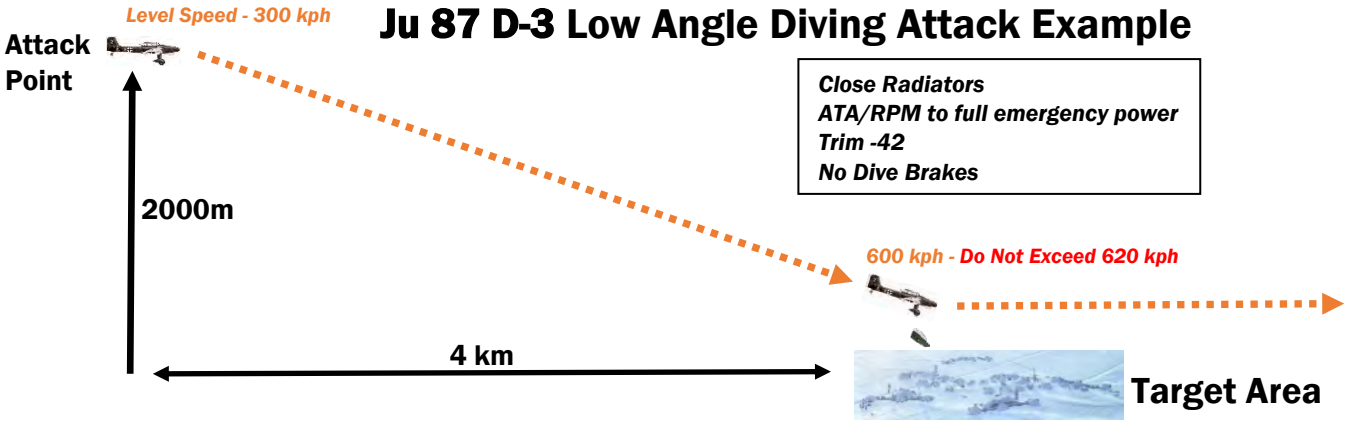
- Do a subtle zigzag pattern prior to diving if Heavy AAA is firing at you. You can still keep an eye on the target area by tipping a wing.
- Just before diving, completely close radiators, reduce ATA to zero, *increase RPM to 100%*, and engage the dive brakes.
- *EVADE* throughout the dive, right up until bomb drop. This means you must be aware of your target prior to diving, keep an eye on it during the dive, and be thinking three maneuvers in advance to be in the right place at drop altitude. The trick is not to point in one direction for more than a few seconds.
- 2-3 seconds before bomb drop, disengage the air brakes and push the ATA to maximum power. This will increase your egress speed out of light/medium AAA range. Once out of AAA range, open radiators and adjust ATA and RPMs to maximum continuous power.



5.1.1.2 Low Angle High-Speed Bombing Tip. The Ju 87 D-3 is a very capable Low Angle High-Speed bomber, provided you don't exceed its dive speed limit. In situations where clouds or strong AAA in the Target Area make dive bombing too dangerous, Low Angle bombing is certainly an option with the Stuka.

The optimal attack altitude is approximately 2000m* at a pre-dive level speed of 300 kph. Your attack point should be approximately 4 km from the Target Area. Just prior to dive, close the radiators and push the ATA and RPMs to maximum. *Do not engage the dive brakes*. Adjust the trim to a nose heavy -42%. The goal is to achieve a 600 kph attack dive speed at a bomb drop altitude of approximately 400m without exceeding 600 kph by much, otherwise pieces begin to fall off the aircraft. Once the attack is successful and you are out of light/medium AAA range, open the radiators and reset the ATA and RPMs to maximum continuous power.

It is important to stay aware of your speed during the attack dive. If you begin to exceed 600 kph - reduce the ATA. If it is tactically advantageous to start the attack from higher altitude, you can both adjust engine power and use dive brakes *judiciously* to keep your speed as close to 600 kph as possible.





** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 252 liters (30%), no siren, and a bomb load of 1x SC500 and 2x SC250.*

5.1.2 Bf 110 E-2



Although not possessing the capability to dive bomb or level bomb, the Bf 110 E-2 is an efficient Low Angle bombing platform capable of high-speed bombing passes.

While its 2x SC500 bomb payload makes for effective single-pass attacks, the aircraft really shines in the multiple-pass attack mode. This is due to its powerful forward-firing armament and multiple bomb-carrying capacity. The 12x SC50 and 2x SC500 + 4x SC50 options bring substantial destructive potential when dropped separately across multiple passes. The Bf 110 E-2 also possesses powerful strafing power in the form of twin nose-mounted 20mm cannon and four machine guns.

Maximum Speed	456 kph (0m) 494 kph (2000m)
Dive Speed Limit	740 kph
Maximum G Load	11G
Climb Rate (0m) Climb Rate (3000m)	10.3 mps 9.6 mps
Dropped Ordnance Options	12 SC50 02 SC250 (+04 SC50) 02 SC500 (+04 SC50) 01 SC1000
Forward-Firing Armament	2 x 20mm MG FF 180 rounds 540 RPM 4 x 7.92mm MG 17 1000 rounds 1200 RPM
Forward-Firing Armament Options	N/A
Rearward-Firing Crew Armament	1x 7.92mm MG 15 500 rounds 1600 RPM

The aircraft is significantly lacking in rear protection, however. The single 7.92mm MG 15 is one of the weakest crew armament configurations in the skies, matched in inadequacy only by the IL-2 mod 1942.

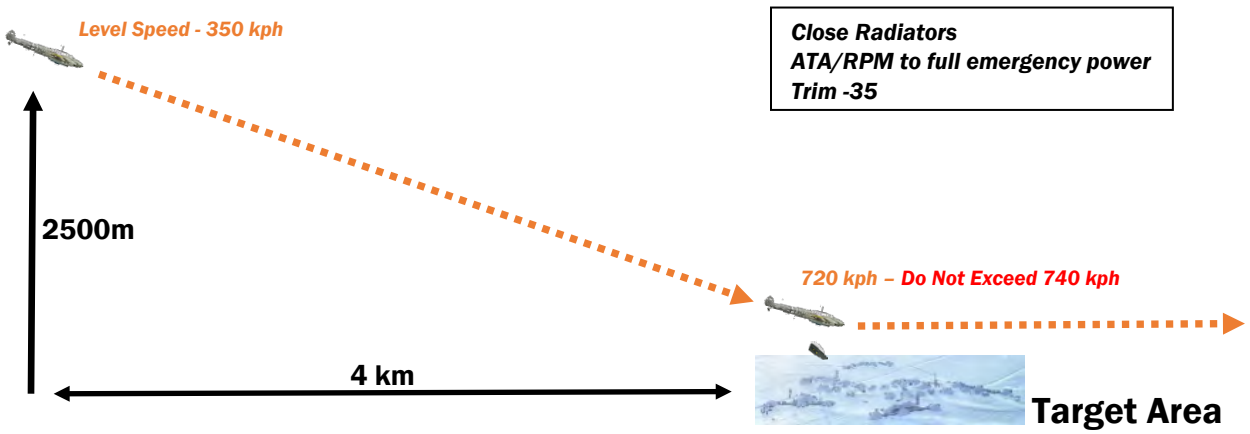
The E-2 is capable of appreciable speed for an early-conflict, twin engine aircraft, capable of outrunning and out-diving the Russian I-16. While its turn rate is not impressive, a team of E-2s operating with a numerical advantage against enemy fighters can hold their own quite well, particularly so when augmenting Bf 109s in a dogfight.

The tail section and wings are not particularly sturdy in terms of damage sustainment resilience, but the twin engine configuration makes the aircraft more likely than the Stuka to successfully return to base and land after being damaged. The engines are strong enough that the E-2 can remain airborne and reasonably controllable on the power of one engine.

5.1.2.1 Low Angle High Speed Bombing Tip. To achieve a dive attack speed of 720 kph at a bomb drop altitude of approximately 400m, the Attack Point altitude should be 2400m* with a pre-dive level speed of 350 kph and the Attack Point located 4 km from the Target Area. Set vertical trim to nose-heavy -35 to enable a controlled dive and recovery after bomb drop. Close radiators and push the throttles to full power just prior to diving and keep them there until out of AAA range.

**** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 381 liters (30%), armored windscreen and pilot headrest, and a bomb load of 2x SC500.***

Bf 110 E-2 Low Angle Diving Attack Example



5.1.3 Bf 110 G-2

The G-2 model offers several improvements over the E-2. In addition to a bomb payload and options identical to the E-2, it can also carry 1x SC 1000 bomb. The G-2 is considerably faster than its predecessor and has a much-improved turn radius. Regrettably, Russian fighter performance had also improved greatly by the time the G-2 became operational, and it is still outmatched by Russian single-engine fighters of its era.

For Ground Attack purposes, however, the aircraft is a delight in many ways. It enjoys a dramatically higher climb rate that the E-2, which, combined with the faster speed, gets the aircraft to the Target Area much quicker. The increased power makes for a faster dive speed and lower Attack Altitude required to achieve 720 kph. It also improves the already superb one-engine performance. The SC 1000 bomb option is a massive punch for an aircraft this fast. The quad 20mm setup (OPTION 1) is a deadly strafing configuration and is quite effective at destroying light tanks. This configuration can also be accompanied by a modest 4x SC50 bomb payload.

Historically, the gondola-mounted BK 37 cannon was an operational failure, causing myriad stability and accuracy issues in-flight. The virtual version of this weapon system carries none of those burdens and makes the Bf 110 G-2 a potentially more



Maximum Speed	489 kph (0m) 533 kph (2000m)
Dive Speed Limit	740 kph
Maximum G Load	11G
Climb Rate (0m) Climb Rate (3000m)	15.6 mps 14.1 mps
Dropped Ordnance Options	12 SC50 02 SC250 (+04 SC50) 02 SC500 (+04 SC50) 01 SC1000
Forward-Firing Armament	2 x 20mm MG 151/20 400 rounds (L) 350 rounds (R) 700 RPM 4 x 7.92mm MG 17 1000 rounds 1200 RPM
Forward-Firing Armament Options	OPTION 1: 2 x 20mm MG 151/20 200 rounds
	OPTION 2: 1x 37mm BK 37 66 rounds 160 RPM
Rearward-Firing Crew Armament	2x 7.92mm MG 15 500 rounds 1600 RPM

effective tank killing platform than the Ju 87 D-3 armed with twin BK 37s. With a single, centrally-mounted cannon with almost triple the ammunition of the Ju 87, the advantages are obvious. But there are a few drawbacks.

First, while the aircraft itself is a stable gun platform, the G-2's inherent faster speed makes for comparatively less time to accurately aim, fire, and avoid ground obstacles. Second, the BK 37 must be reloaded after firing six rounds, and it cannot be reloaded prior to firing all six rounds. This can be problematic and lead to situations where there are one or two rounds still loaded after an attack pass and will probably be insufficient to destroy a tank on the next pass. When this situation occurs every two to three passes, it can greatly increase the length of time spent over a tank column Target Area before all rounds are expended. Of course, it is possible to fire off the remaining round(s) and reload while preparing for the next pass when prolonged exposure over an enemy Target Area is a bad idea.

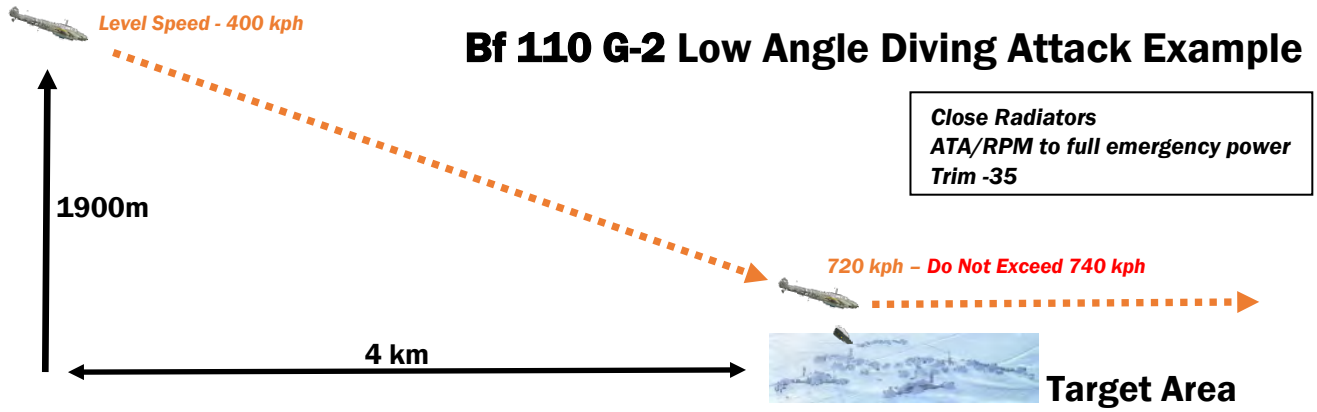
5.1.3.1 Tank Killing Tip. When attacking tanks with the BK 37, take the four SC 50 bombs. You can drop them singly to "soften up" T-34s and KV1s for your cannon attacks, or even destroy them with a direct hit. Because the bombs are mounted on the wings, you need to offset your aim to the left or right depending on which side the bomb is coming from.







5.1.3.2 Low Angle High-Speed Bombing Tip. The G-2 can achieve 720 kph at a bomb drop altitude of approximately 400m from an attack altitude of 1900m* when the Attack Point is approximately 4 km from the Target Area with a pre-dive level speed of 400 kph. Set vertical trim to nose-heavy -35. Close radiators and push the throttles to full power just prior to diving and keep them there until out of light/medium AAA range.



** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 381 liters (30%), removed headrest, and a bomb load of 2x SC500.*

5.1.4 Hs 129 B-2



The Hs 129 B-2 is the slowest Ground Attack aircraft of those currently available on either side. Its bomb payload is anemic, essentially making the aircraft a *one trick pony,* but it performs that trick – *strafing* - pretty well.

Although the aircraft's slow speed allows for a long and stable target lineup, it is not quite as maneuverable as the Stuka in the turn and climb. Stall speed is slightly higher than that of the Stuka, but the aircraft responds very well to low-speed rudder corrections. Rear visibility is abysmal, although the rear-view mirror option does mitigate this problem somewhat. To compound matters, the Henschel does not have a rear gunner, which is a significant disadvantage for enemy fighter spotting and rear defense. The armored cockpit is very effective at protecting the pilot from direct hits, but the wings are no sturdier than those of the Bf 110 and the tail is prone to completely disintegrating when struck. The engines are also not well protected and tend to suffer substantial damage when struck.

Maximum Speed	349 kph (0m) 396 kph (3000m)
Dive Speed Limit	650 kph
Maximum G Load	9G
Climb Rate (0m) Climb Rate (3000m)	9.0 mps 7.0 mps
Dropped Ordnance Options	01 SC250(+2x SC50) 06 SC50 04 SC50
Forward-Firing Armament	2 x 20mm gun MG 151/20 250 rounds 700 RPM 2 x 7.92mm MG 1000 rounds 1200 RPM
Forward-Firing Armament Options	OPTION 1: 4 x 7.92mm MG 1000 rounds 1200 RPM
	OPTION 2: 30mm gun MK 101 30 rounds 250 RPM
	OPTION 3: 30mm gun MK 103 80 rounds 400 RPM

The automatic engine and radiator management feature make this aircraft extremely easy to manage in-flight. It is extremely difficult to keep the aircraft in the air on the power of a single engine, but it can be possible under certain conditions (**Subsection 5.1.4.1**).

The 30mm MK 101 cannon can destroy any Soviet tank but does not quite pack the punch of the BK 37. The low ammunition capacity severely limits the number of tank kills per sortie.

The 30mm MK 103 cannon is a dramatic improvement over the MK 101. With a higher rate of fire and almost triple the ammunition, in expert hands it can rival the BK 37-armed Stuka in tank kills per sortie. It also has none of the BK 37 ammunition and reloading issues described in **Subsections 5.1.1 and 5.1.3**. Pilots who are not yet tank-strafing experts and have trouble consistently achieving accurate turret shots with the Stuka will find the Hs 129 B-2's fast rate of fire and large ammunition load more forgiving, allowing one to walk fire onto the target and kill

light tanks in a single pass. It can be difficult to destroy a T-34 in a single pass, but not impossible. Expert Ground Attackers can take out a KV-1 in two or three passes, but if the strafing pilot does not put all rounds perfectly into the turret, it may take half the ammunition load to destroy a single KV-1.

In addition to the MK 101/103, the Hs 129 B-2 also carries a large load of ammunition for the MG 151/20. This is advantageous for eliminating flak prior to focusing on tanks, and continued strafing of light-skinned targets after the 30mm has been depleted.

5.1.4.1 Single-Engine Operation Tip. When ambient temperatures are warm, if you lose an engine in this aircraft you will soon be ditching. The best course of action is to get on a heading toward the nearest friendly lines and climb as high as possible immediately after the engine is damaged. Once it gives out, engage the auto-level function, feather the bad prop, make sure the other engine is at 100% power, shoot off all remaining ammunition if you can do so without drawing attention to your aircraft, and see how far you can go before your speed goes under 200 kph and you must take over the controls to ditch. *When ambient temperatures are very cold, however, the Hs 129 B2 will stay airborne much, much longer*. It may even get you all the way back to your destination airfield. The trick is to keep it on auto-level and not try to turn. The second the auto-level is disengaged, the aircraft will immediately begin to lose altitude. Get it as close to the runway as possible before you take the controls. Hopefully you can get it lined up before you run out of air.

5.1.4.2 Tank Killing Tips. The concentrated fire of the gondola-mounted BK 103 and nose-mounted twin MG 151/20 cannons dispatch light tanks very efficiently. I am also convinced this concentrated fire even hastens the destruction of medium and heavy tanks not susceptible to damage from the MG 151/20 cannons by themselves (but I cannot prove that statement). However, even after your 30mm ammunition is finished, you can continue dispatching light tanks with the MG 151/20s.

There is an option to take 2x SC50 bombs along with the MK 101/103. You should take them and be able to drop them accurately. The extra weight is moot considering the Henschel's sluggishness. At best the SC 50s will increase your total kills for the sortie by one or two tanks. At worst they will soften up T-34s or KV1s for your attack pass with cannons. The bomb on the left wing drops first, so use the bomb drop offset technique described in **Subsection 5.1.3.1.**



5.1.5 JU 88 A-4



The Ju 88 A-4 is a true jack-of-all-trades and is the one aircraft in the Luftwaffe inventory that can do it all – Dive Bombing, Level Bombing, and Low Angle Bombing – and do it perfectly.

Although slightly slower than either Pe-2 Series and appreciably slower than the Bf 110 E-2, its lethal bomb payload capacity is almost triple the capacity of the Pe-2, more than double the capacity of the Bf 110 E-2 and G-2, and is 45% greater than that of the A-20B. The He 111 H-6 and H-16 have significantly higher payload capacities, but the Ju 88 A-4 speed and climb rate is vastly better than either He 111 model, getting it to level bombing altitudes much quicker.

Maximum Speed	424 kph (0m) 462 kph (2000m) 486 kph (5000m)
Dive Speed Limit	670 kph
Maximum G Load	8G
Climb Rate (0m) Climb Rate (3000m) Climb Rate (6000m)	7.0 mps 5.1 mps 3.4 mps
Dropped Ordnance Options	28 SC50 44 SC50 04 SC250 (+28 SC50) 06 SC250 (+28 SC50) 04 SC500 (+02 SC250) 04 SC500 (+18 SC50) 02 SC1000 01 SC1800 (+01 SC1000)
Crew Armament	**Nose** 1x 7.92mm MG 81 750 rounds 1600 RPM **Top Rear** 2x 7.92mm MG 81 1000 rounds 1600 RPM **Rear Belly** 2 x 7.92mm MG 81 950 rounds 1600 RPM

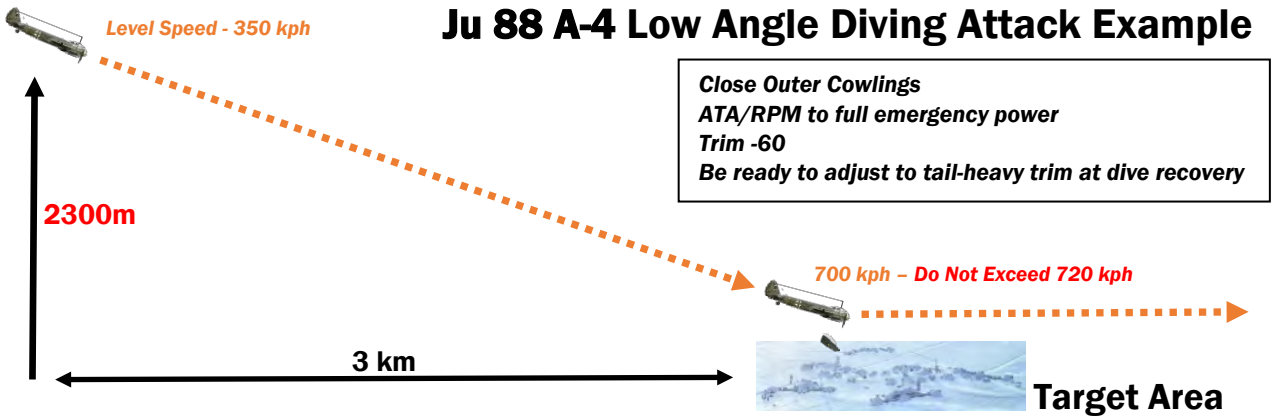
The Ju 88 A-4 is a very accurate Dive Bomber but is easier to control at dive angles of 50° degrees. When dive brakes are not used, it picks up speed quickly in the dive, making it a very effective platform for Low Angle High-Speed diving attacks. It is also a very effective tank column killer (**Subsection 7.2**). While the listed dive speed limit is 670 kph, in practice it is closer to 720 kph. When level bombing, it is a stable, accurate and quick platform with a 300 to 350 kph speed on bomb runs over the Target Area.

The crew armament is barely adequate, but better than many of the Ground Attack aircraft on both sides. The single MG 81 in the front is not so much of an issue as the two MG 81s in the top rear cupula. These MG 81s are not mounted together in a dual-firing mode, but are mounted on separate windows and fired separately by a single gunner, making the arrangement effectively a single MG 81 defending the most likely angle of attack. Although the dual MG 81s in the rear belly offer more effective protection, the lack of more powerful MGs overall means that in most cases, even if the AI gunners manage to down an enemy fighter, the Ju 88 comes out of the encounter so badly damaged it rarely makes a safe return. Even when the AI gunner is top level, tough Russian fighters like the LaGG-3 and P-40 simply shrug off the light MG round impacts and press the attack.

The Ju 88 A-4 is arguably the toughest Luftwaffe Ground Attack aircraft but has nowhere near the damage sustainment capacity of the Pe-2. Its wings are tougher than those of the Bf 110 and

Hs 129 B-2, and its engines can take a fair amount of punishment before giving out. It has very impressive single-engine performance and can easily return to the destination airfield on one engine. Taxiing and taking off in the Ju 88 A-4 make take some getting used to for some pilots, as the rudder is useless at speeds under 100 kph and its wheel brakes feel strangely like the aileron controls when diving at speeds over 600 kph. Its stiffness during high-speed dives requires enough experience on the part of the pilot to be thinking three maneuvers in advance to line up on the target properly.

5.1.5.1 Low Angle High-Speed Bombing Tip. The Ju 88 A-4 can achieve 700 kph at a bomb drop altitude of approximately 400m from an attack altitude of 2300m* and pre-dive level speed of 350 kph when the Attack Point is 3 km from the Target Area. Set vertical trim to nose-heavy -60 to prevent the aircraft's tendency to nose up at high speeds. Pay attention to your dive angle and altitude at bomb drop. If you are too low at bomb drop you should crank the vertical trim to tail-heavy trim simultaneously with the pull out of the dive. It is helpful to practice this technique offline until comfortable with it.



5.1.5.2 Cold Weather = Massive Bomb Load. An experienced Ju 88 A-4 pilot can get the aircraft off the runway with its maximum 2900 kg bomb payload, but depending on runway length, it takes good flaps management skill to keep it from stalling after takeoff. When the ambient temperature is below zero, it is easier, and the aircraft climbs more efficiently. That is the time to inflict massive damage on enemy Target Areas with the A-4. Engage one notch of flaps just prior to lifting off and keep the speed at or above 200 kph after takeoff. Retract the flaps at around 250m AGL altitude and be prepared to lose a little altitude when flaps are retracted.



It will take a bit more time to climb to level bombing altitude, but once there you can make two level bombing passes over a factory or airfield or two different Target Areas. When Target Area flak has been suppressed and escorts are present, the Ju 88 A-4 can wipe out entire Target Areas in multiple Low Angle attacks using one of several available 2900 kg ordnance packages.

**** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 504 liters (30%), and a bomb load of 4x SC500.***

5.1.5.3 Putting Out a Wing Fire. If the wing area of the Ju 88 A-4 catches fire, it is possible to dive and extinguish it. First, locate the flaming area on the wing. If the fire is beside the wing root/fuselage or in the engine itself, it is unlikely you will be able to put it out by diving. If it is on the outside area of the wing, you have a chance:



500m is the minimum altitude that provides enough vertical space to get the dive speed fast enough to put out the fire, but *higher is always better*. If the wing catches fire at treetop altitude and your speed is high, you have enough time to climb to 500m or higher and attempt a dive. Go full emergency power ATA and RPM to get to dive altitude as quickly as possible. Once there, initiate a steep dive and input nose-heavy trim to maintain the dive. Be prepared to revert to tail-heavy trim to pull out of the dive if nearing the ground. Keep an eye on the fire and maintain the dive until it goes out or ground impact is imminent, and you must pull out of the dive.

There is a possibility the flaming wing will snap off during the dive, especially if other areas of the wing have been damaged by enemy fire. This is true for the other wing as well, so the decision to attempt a dive should be a calculated risk based on a rapid appraisal of the aircraft's condition.



5.1.6 He 111 H-6



The He 111 H-6 is slow and not as quick a climber as the Ju 88 A-4, but it is endowed with a monstrous bomb payload capacity that dwarfs the bombing power of any other Ground Attack aircraft in the *IL-2 Great Battles* series except the Ju 88 A-4.

The aircraft's severe dive speed limit and low G load capability preclude the possibility of high-speed, Low Angle attack runs. It's lack of air brakes precludes traditional Dive-Bombing methods, although low-speed, limited duration Dive Bombing is possible, as are low-speed, Low Angle dive attacks. The use of the H-6 in those capacities is not common, however, particularly in expert servers.

The He 111 H-6 is easy to take off and land. It is not nearly as maneuverable as the Ju 88 A-4, but its low stall speed makes it very easy to fly. The H-6 cannot indefinitely maintain flight on a single engine, but from level bombing altitudes it can travel a very, very long distance on one engine with some rudimentary altitude management (**Subsection 5.1.4.1**).

The crew armament is even less protective than that of the Ju 88 A-4. While sporting many more gunner positions than the A-4, covering all sides of the aircraft, each position is armed only with a single 7.92mm MG 15. This weak defense, combined with an unimpressive damage sustainment capability and limited maneuverability, usually make for a very

Maximum Speed	369 kph (0m) 398 kph (2000m) 405 kph (5000m)
Dive Speed Limit	560 kph
Maximum G Load	4.5G
Climb Rate (0m) Climb Rate (3000m) Climb Rate (6000m)	4.5 mps 3.6 mps 1.8 mps
Dropped Ordnance Options	16 SC50 04 SC250 01 SC500 (+16 SC50) 01 SC500 (+04 SC250) 01 SC1000 (+16 SC50) 01 SC1000 (+04 SC250) 02 SC1000 01 SC1800 (+16 SC50) 01 SC1800 (+04 SC250) 01 SC 1800 (+01 SC1000) 02 SC1800 01 SC2500
Crew Armament	**Nose** 7.92mm MG 15 600 rounds 1000 RPM **Top Rear** 7.92mm MG 15 1125 rounds 1000 RPM **Rear Belly** 7.92mm MG 15 1200 rounds 1000 RPM **Front Belly** 7.92mm MG 15 675 rounds 1000 RPM **Left Side** 7.92mm MG 15 450 rounds 1000 RPM **Right Side** 7.92mm MG 15 450 rounds 1000 RPM
Crew Armament Options	**Nose** 20mm MG FF 240 rounds 540 RPM **Front Belly** 20mm MG FF 330 rounds 540 RPM

unpleasant experience when encountering enemy fighters. The He 111 H-6 does offer a 20mm MG FF cannon option for the nose and front belly gunner positions, but these positions face the least likely direction for an enemy fighter to appear. If these cannons were available for the rear top and belly positions, this aircraft would have the most infamous reputation of all for defensive armament. The nose-mounted MG FF can be advantageous should a pilot switch to the nose gunner position and strafe ground targets, or in the unlikely event he finds himself on an enemy fighter's *six*.

5.1.6.1 Single-Engine Operation Tip. When you lose an engine in this aircraft you should feather the bad engine. If you are not already heading toward friendly lines/airfield, immediately get on the correct azimuth and engage the autolevel function. Keep the good engine at maximum continuous power and manage the radiators to keep if from overheating. Your speed will continue to slow until it hits the stall speed limit. When it does, go into a shallow dive, staying on azimuth, and when your speed increases back to 250-300 kph, engage the autolevel function again. You should only have to sacrifice about 500m of altitude to get the aircraft back to this speed. Repeat this procedure all the way back to your destination airfield. If you lose an engine at low altitudes you plainly won't get very far, but at altitudes of 3k or higher, the aircraft will travel an impressively long distance.

If the ambient temperature is below freezing, the He 111 H-6 will fly on one engine at higher altitudes, and steadily maintain a level speed of approximately 220 kph.



5.1.7 He 111 H-16



This later model He 111 offers several improvements over the H-6. In addition to a substantially revised cockpit layout and slightly improved speed and climb characteristics, the H-16's second bomb bay is accessible for dropped ordnance. This change provides even broader bomb package options, and offers the choice of taking additional bombs along with the titan SC2500.

While dive speed and G load limitations, maneuverability, and damage sustainment capabilities remain identical to those of the H-6, changes to the crew armament weaponry present significant enhancements to the aircraft's defense capabilities.

The left and right gunner positions are equipped with 7.92mm MG 81s featuring a much-improved rate of fire over the MG 15s in the H-6. While the rather inconsequential Front Belly gunner position is removed, the Rear Belly position is equipped with twin 7.92mm MG 81s, effectively doubling the firepower for that position. More importantly, the Top Rear gunner position, normally the most active position when tangling with enemy fighters, is fitted with a single 13mm MG 131. Instead of being optional as on the H-6, the 20mm MG FF is the standard armament in the nose.

Maximum Speed	370 kph (0m) 399 kph (2000m) 410 kph (5000m)
Dive Speed Limit	560 kph
Maximum G Load	4.5G
Climb Rate (0m) Climb Rate (3000m) Climb Rate (6000m)	5.3 mps 4.1 mps 2.3 mps
Dropped Ordnance Options	16 SC50 32 SC50 04 SC250 (+16 SC50) 08 SC250 01 SC500 (+16 SC50) 01 SC500 (+04 SC250) 02 SC500 01 SC1000 (+16 SC50) 01 SC1000 (+04 SC250) 02 SC1000 01 SC 1800 (+01 SC1000) 01 SC 1800 (+16 SC50) 01 SC1800 (+04 SC250) 02 SC1800 01 SC2500 (+16 SC50) 01 SC2500 (+04 SC250)
Crew Armament	**Nose** 20mm MG FF 240 rounds 540 RPM **Top Rear** 13mm MG 131 1000 rounds 900 RPM **Rear Belly** 2 x 7.92mm MG 81 850 rounds 1600 RPM **Left Side** 7.92mm MG 81 500 rounds 1600 RPM **Right Side** 7.92mm MG 81 500 rounds 1600 RPM

5.2 ALLIED GROUND ATTACK AIRCRAFT

5.2.1 IL-2 mod 1941



The IL-2 across all models is in many ways the most effective and formidable Ground Attack aircraft in the *IL-2 Great Battles* series, but it is not without some major drawbacks. The mod 1941 is much faster than the Stuka and Hs 129 B-2, slower than the Bf 110 E-2, and even slightly slower than the Ju 88 A-4. However, it is quite maneuverable, has a decent climb rate, and has a turn rate nearly equal to that of a fighter aircraft. The mod 1941 is also quite easy to take off and land, and its very low stall speed make it very forgiving in flight. The wing-mounted 20mm ShVAK cannons are potent enough against enemy fighters, but the optional 23mm VYa-23 cannons are lethal.

Maximum Speed	421 kph (0m) (Boosted – 430 kph) 455 kph (2500m)
Dive Speed Limit	570 kph
Maximum G Load	11.5G
Climb Rate (0m) Climb Rate (2500m)	9.4 mps 8.9 mps
Dropped Ordnance and Rocket Options	02 FAB-250tsk 06 FAB-100M 06 FAB-50sv 08 ROS-82 Rockets 08 ROS-132 Rockets
Forward-Firing Armament	2 x 20mm ShVAK 210 rounds 800 RPM 2 x 7.62mm ShKAS 750 rounds 1800 RPM
Forward-Firing Armament Options	2 x 23mm VYa-23 150 rounds 600 RPM
Rearward-Firing Crew Armament	N/A

For Ground Attack purposes, the mod 1941 enjoys the most diverse ordnance menu of cannon, rockets, and bombs of any aircraft in the series. The ordnance options listed in the table on this page do not reflect the myriad combination options for different listed ordnance types, which are simply too numerous to list. Suffice to say, the IL-2 pilot can select an ordnance package specific to any target type.

Although the mod 1941's maximum bomb capacity is comparatively light at either 2x FAB-250tsk bombs or 6x FAB-100M bombs, there several options to add rockets in addition to carrying a max load of 4x FAB-100s. The FAB-100s also drop from the belly, greatly increasing drop accuracy. More importantly, when attacking tank columns, the VYa-23 cannon option turns the IL-2 into a tank-killer extraordinaire.

Though never known as a tank-killing weapon historically, the virtual version of this cannon can destroy the Pz 38t, Pz III and IV, and Stg III with ease. When armed with bombs, rockets, and the VYa-23, there is simply no Axis tank-killer equivalent. This is because the afore-mentioned Axis tanks are not as heavily armored as the Soviet T-34 and KV-1, and specialized Axis tank-killing aircraft such as the BK 37-armed Ju 87 D-3 and Bf 110 G-2, along with the Hs 129 B-2, possess no rocket capability and very limited bomb capacities when using the heavy cannon option, or in the case of the Stuka, none at all. In expert hands, using the combined power of bombs, rockets, and cannon, the mod 1941 can destroy Axis tanks at double-digit numbers in a single multiplayer-expert server sortie. Against other Target Area types, the mod 1941 also

shines when used against Target Areas containing soft targets such as trucks, AAA and artillery guns, static aircraft, where the aircraft's superior strafing capabilities can be put to full effect.

In contrast to these assets, the aircraft's dive speed limitation is a major liability - at 570 kph, the mod 41 is barely better than the He 111 in that respect. Therefore, Dive Bombing and high-speed, Low Angle diving attacks are off the table for the mod 1941, and that can often limit the aircraft's potential in servers featuring Target Areas with densely concentrated and accurate AAA. It is much less effective than most Ground Attack aircraft when used for single-pass attacks, where the short time over the Target Area prevents accurate deployment of its massive ordnance, and its slow speed makes it an easy target for AAA weapons. To unleash the mod 1941's full potential, it must conduct attacks using multiple passes.

To create the conditions necessary for multiple pass attacks, the skies must be cleared of enemy fighters and the ground must be cleared of AAA. This is very hard to achieve by a Lone Wulf IL-2 pilot unless he selects a Target Area with a low probability of enemy fighter presence and is an expert strafer. To achieve favorable Target Area conditions with an IL-2 Flight Group, escort is required in the form of dedicated fighter aircraft, or a portion of the Flight must act as an anti-fighter element. Multiple pass, AAA elimination techniques are discussed in **Subsection 4.3.2.3.**

Another positive quality of all IL-2 variants is its damage sustainment capability. While arguably tougher against AAA hits than Axis Ground Attack aircraft, the underside of the aircraft is much more vulnerable to round impacts than the wing tops and upper fuselage, which are quite resistant to damage. The engine compartment also holds up well against round impacts. While capable of standing up to multiple gun passes from inexperienced Bf 109 pilots firing a single MG 151/20, an expert pilot can easily down an IL-2 in a single pass by putting several consecutive hits on a wing or the tail section. The firepower of any Fw 190 variant or Bf 109 with cannon pods will quickly down the IL-2.



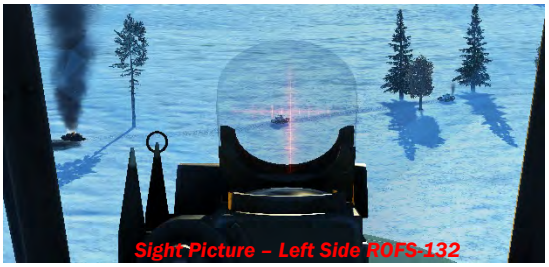
The mod 1941 does not have the option to add a rear gunner position. This makes the mod 1941 the fastest of all available variants (or the least slow) but removes the convenience of a warning from the gunner when an enemy fighter comes into range. When the 20mm ShVAK cannon are selected rear visibility is quite good, but the VYa-23 option comes with a mandatory armor plate behind the pilot that hinders the view considerably.

The cockpit canopy also does not have an automatic discharge mechanism to facilitate a quick bail out and will not open at high speeds. Many IL-2 pilots fly with the cockpit open for much of the mission, closing it only for attack runs on Target Areas with active flak.

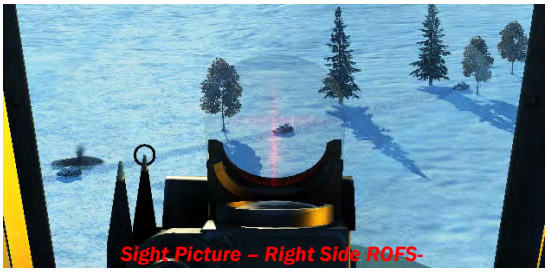
5.2.1.1 Tank Killing Tip. One of the most potent tank column attack options is the VYz-23 cannon with AP ammunition, 8x ROFS-132 rockets, and 6x FAB-50sv bombs. This trifecta of anti-armor ordnance is arguably the most effective in the series.



The 132mm rockets can be fired singly, are easy to aim, and a hit anywhere on an Axis tank will destroy it. The sight pictures presented below are for no-wind conditions.









The FAB-50sv bombs can be dropped singly or in pairs, and there are two delivery methods. When there are no obstacles around the targeted tank, you can come in low from the side at high speed and skip a single bomb into the side of the tank.

Cockpit Sight Picture Sequence of Low Angle, Flat Skip Bombing Approach













When trees prevent a low angle flat approach, you can use the same drop technique from a higher altitude and earlier release, but this approach takes some practice because it is harder to accurately time the bomb release. The bomb often will stick in the ground at the impact point instead of skipping, making it necessary to place the bomb as close to the tank as possible. Make sure to set the bomb timer to 5 seconds to ensure they will arm for detonation.

5.2.2 IL-2 mod 1942



The mod 1942 is considerably slower and less maneuverable than the mod 1941 but offers some new options to IL-2 pilots. A rear gunner position can be added to the aircraft, providing an early warning system of enemy aircraft in the vicinity. The armament itself is a fairly ineffectual, single 7.62mm ShKAS machine gun, putting the mod 1942 in the same league with the Bf 110 E-2 as Ground Attack aircraft with the weakest rearward protection in the *IL-2 Great Battles* series.

Maximum Speed	380 kph (0m) (Boosted – 400 kph) 414 kph (2500m)
Dive Speed Limit	570 kph
Maximum G Load	10.5G
Climb Rate (0m) Climb Rate (3000m)	7.1 mps 5.6 mps
Dropped Ordnance and Rocket Options	02 FAB-250tsk 06 FAB-100M 06 FAB-50sv 08 ROS-82 Rockets 08 ROS-132 Rockets
Forward-Firing Armament	2 x 20mm ShVAK 250 rounds 800 RPM 2 x 7.62mm ShKAS 750 rounds 1800 RPM
Forward-Firing Armament Options	OPTION 1: 2x 23mm VYa-23 150 rounds 600 RPM
	OPTION 2: 2x 37mm Sh-37 80 rounds 185 rpm
Rearward-Firing Crew Armament	1x 7.62mm ShKAS 500 rounds 1800 RPM

For tank killing, the 37mm Sh-37 cannon is available on the mod 1942. Much like the stability problems surrounding the gondola-mounted BK 37 on the Bf 110 G-2, the Sh-37s (and NS-37) historically experienced fire synchronization and aircraft pitch issues and were not popular with IL-2 pilots. Those issues are also not featured in the virtual IL-2 using these cannons.



While not quite packing the punch of the German BK 37, the Sh-37 makes up for that deficit with 40 rounds per gun when fitted to the IL-2. It effectively destroys all Axis tanks currently represented in the game. However, the Sh-37 cannon option reduces the number of choices for adding other ordnance when compared to the choices available when selecting the VYa-23 cannon. It also slows the aircraft by approximately 20 kph. As the VYa-23 already efficiently destroys all Axis tanks up to the Pz IV, the Sh-37 is not necessarily the “go-to” cannon for tank killing like the BK 37 and MK 103 are for Axis pilots. That may change if the cannon is effective against the heavier Axis armor types that will soon be added to the series.

5.2.3 IL-2 mod 1943

The mod 1943 brings additional major and minor changes to the IL-2 line. Besides a slightly improved speed and climb rate over the mod 1942, this model features a revised “Visier Vladimirova” gunsight with gradations to assist in aiming ordnance.



The rear gunner position is the default configuration for the mod 1943 and no longer optional. The gunner armament is also upgraded to the 12.7mm UBT machine gun, which makes the mod 1943 a credible threat to enemy fighters hanging out too long behind it.



The 37mm cannon option is the NS-37, which has a faster rate of fire than the Sh-37, and carries 10 more rounds per gun, for a total of 50 rounds each. Adding rockets with the NS-37 is not possible on the mod 1943, and certain ordnance loadout combinations with the ShVAK or VYa-23 cannon are available at reduced capacity in comparison to the mod 1941/2.

An additional ordnance option is the PTAB 1.5 kg HEAT bomblets. These bomblets, dropped by the hundreds, are reasonably effective against soft targets but are of limited effectiveness against tanks.

Maximum Speed	389 kph (0m) (Boosted – 407 kph) 400 kph (1200m)
Dive Speed Limit	570 kph
Maximum G Load	10.5G
Climb Rate (0m) Climb Rate (3000m)	7.5 mps 4.2 mps
Dropped Ordnance and Rocket Options	02 FAB-250tsk 06 FAB-100M 06 FAB-50sv 04 ROS-82 Rockets 04 ROS-132 Rockets 240 1.5 kg PTAB bomblets
Forward-Firing Armament	2 x 20mm ShVAK 250 rounds 800 RPM 2 x 7.62mm ShKAS 750 rounds 1800 RPM
Forward-Firing Armament Options	OPTION 1: 2x 23mm VYa-23 150 rounds 600 RPM
	OPTION 2: 2x 37mm NS-37 100 rounds 250 rpm
Rearward-Firing Crew Armament	1x 12.7mm UBT 150 rounds 1000 RPM

5.2.4 Pe-2 ser.35



The Pe-2 is the Ground Attack superstar of the *IL-2 Great Battles* series in many respects. It does not have the bomb payload capacity of many of its contemporaries, but in terms of sturdiness and defense capability it is in a league of its own. It is the only aircraft in the series besides the Ju 88 A-4 that has the capability to Dive Bomb, Level Bomb, and execute high-speed, Low Angle diving attacks.

The ser. 35 is slightly slower and less maneuverable than the Bf 110 E-2 and has a comparatively poor stall speed. Tight turns can quickly lead to a stall that is difficult to recover. The aircraft is very impressive in the dive, however, and while it doesn't pick up speed in the dive as quickly as the Ju 88 A-4, its maximum dive speed of 790 kph is the fastest of any Ground Attack aircraft on either side, creating the possibility for some extremely quick Low Angle High-Speed bomb passes. The ser. 35 also stays remarkably maneuverable at high dive speeds, but the price paid for that flexibility is a difficult-to-control roll tendency that can make an accurate lineup down a linear Target Area problematic. With dive brakes extended the ser. 35 can make controlled, accurate 600 kph dive bombing passes from a dive angle of 70°.

The ser. 35 is also a very capable level bomber but is completely outclassed in bomb payload capacity by the Ju 88 A-4 and He 111 H-6/16, and is more similar to the Bf 110 E-2 in that respect. It does possess one unique heavy ordnance option, however – 10x FAB-100M bombs. This loadout is effective against linear targets when the aircraft is flown by a pilot who can master its roll tendency.

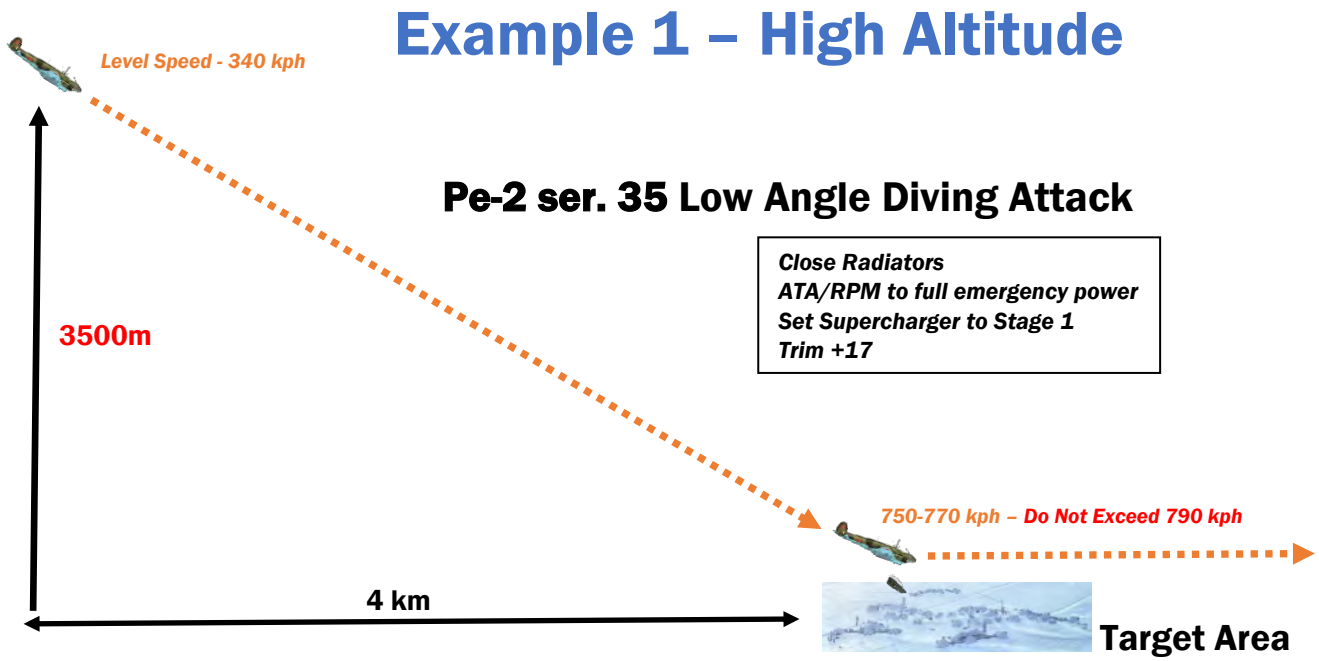
Maximum Speed	434 kph (0m) 476 kph (2000m) 521 kph (6000m)
Dive Speed Limit	790 kph
Maximum G Load	11G
Climb Rate (0m) Climb Rate (3000m) Climb Rate (6000m)	9.3 mps 8.4 mps 5.6 mps
Dropped Ordnance Options	10 FAB-100M 04 FAB-250vs 02 FAB-500M 10 ROS-132 Rockets
Forward-Firing Armament	12.7mm MG 150 rounds 1000 RPM 7.62mm ShKAS 450 rounds 1800 RPM
Crew Armament	**Top Rear** 7.62mm ShKAS 750 rounds 1800 RPM **Rear Belly** 12.7mm UB 200 rounds 1000 RPM **Side** 7.62mm ShKAS 225 rounds 1800 RPM

The front armament of one 7.62mm and one 12.7mm machine gun is one of the weaker configurations among Ground Attack aircraft of both sides with pilot-controlled, forward-firing weapons. The ser. 35's crew armament of 7.62mm machine guns in the top rear and side would be unremarkable save for the rear belly-mounted 12.7mm UB machine gun, which has put many Bf 109s on the ground in short order.



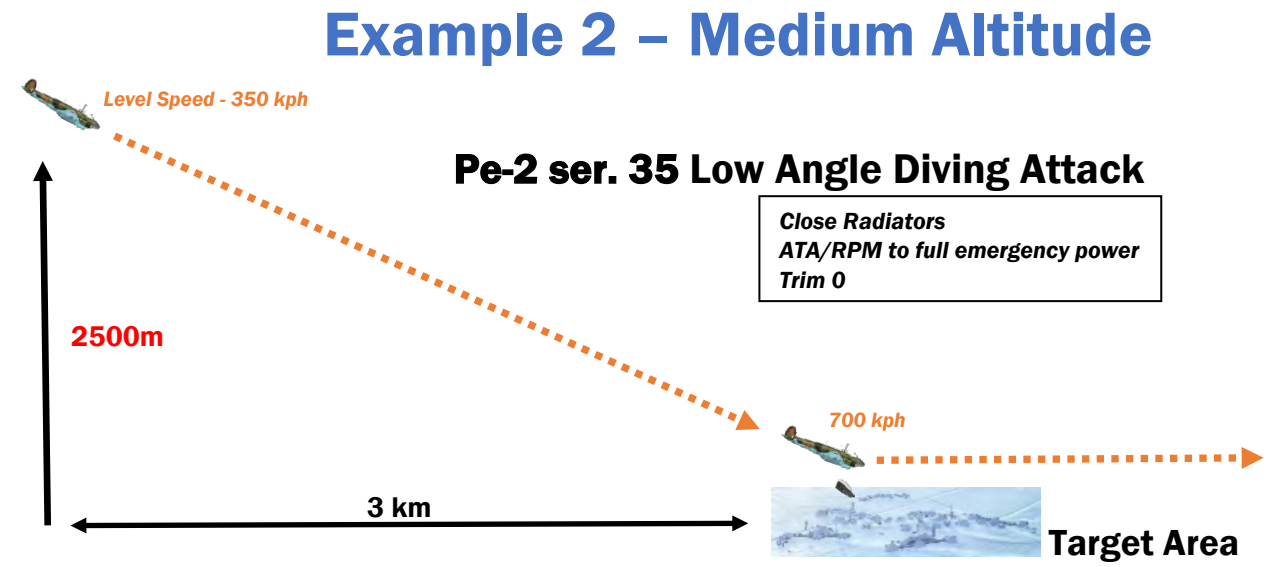
The aircraft's main claim to fame is its damage sustainment capability. The IL-2 was known historically as a "Flying Tank," but in the *IL-2 Great Battles* series, the Pe-2 is the *real* flying tank. The aircraft's ability to stay airborne after sustaining massive damage is simply phenomenal. It can take multiple cannon strikes on the wing and fuselage with no fatal loss of controllability. This toughness contributes to the Pe-2's reputation for downing enemy fighters -since it can remain in the air long after any other Ground Attack aircraft would have gone down, the crew gunners are given more time and opportunities to fire back. Many less-experienced fighter pilots lose patience and press the attack too close to the ser. 35's rear belly 12.7mm UB – with very unfavorable results. It is possible for an expert fighter pilot in a Bf 109 with a single MG 151/20 in the nose to down the Pe-2 in one pass, but that is certainly the exception and not the rule. Against the Bf 109 or MC.202 with extra wing cannon the ser. 35 naturally fares worse, but the outcome of even this matchup is far from predetermined.

5.2.4.1 Low Angle High-Speed Bombing Tip. There are many altitude options to execute high-speed, Low Angle attacks in the Pe-2. The choice of altitude should depend on the Target Area type, location, AAA threat, and the enemy fighter threat. The high-altitude option (Example 1) will put the ser. 35 at a speed of **750-770 kph** at a bomb drop altitude of approximately 400m. This method requires achieving an attack altitude of 3500m* and a 340 kph pre-dive level speed at an Attack Point 4km from the Target Area.



** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 451 liters (30%), and a bomb load of 2x FAB-500M.*

The medium-altitude option (Example 2) will put the ser. 35 on a bombing pass over the Target Area at a speed of **700 kph** at a bomb drop altitude of approximately 400m. This method requires achieving an altitude of 2500m* and a 350 kph pre-dive level speed at an Attack Point 3km from the Target Area.



Attack dives started from altitudes between 3500 and 2500 meters will yield varying dive speeds between 700 and 750-770 kph with a rough ratio of +10 kph per additional 200m of altitude. Either Pe-2 series appears to reliably hold its dive angle and pull out of the dive easily using a balanced (0%) trim setting at maximum dive speeds of 700 kph or less. For maximum speeds in the 750-770 kph range you may need to apply a little tail-heavy trim (17-20%).



**** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 451 liters (30%), and a bomb load of 2x FAB-500M.***

5.2.5 Pe-2 ser.87

The ser. 87 is slightly faster and climbs a little better than the ser. 35 at low altitude, but begins to fall behind its predecessor in both capabilities at 2k and higher. The RPK-10 radio compass, optional in the ser. 35, is standard equipment in the ser. 87. Bomb payload capacity, front-firing ordnance, and damage sustainment capability are identical in both models.

What sets the ser. 87 apart is the Blister Turret option, classified historically as the ser. 110. The Blister Turret adds a 12.7mm UB machine gun to the top rear gunner position while retaining the 7.62mm ShKAS alongside it and keeping the standard 12.7mm UB armament in the rear belly position as well. This option makes the ser. 110 the only Ground Attack aircraft in the series with two heavy machine guns protecting the rear of the aircraft.

Due to this formidable defense capability the ser. 110 has become well-known for turning the tables on many Axis fighter pilots who linger too long on their quarry's *six*. In fact, the aircraft's infamous reputation has caused many would-be assassins to leave the Pe-2 alone entirely. Many players have voiced perceptions that the Pe-2s AI gunners exhibit accuracy capabilities that exceed those of AI gunners on other aircraft, but the more likely explanation is that two 12.7mm UB machine guns covering the rear simply double the possibility of hits on an attacker at the 6:00 position, and the 12.7mm rounds cause much more damage than smaller caliber rounds. Many experienced fighter pilots prefer to attack the Pe-2 from it's 12:00 position, and have developed specialized techniques to attack the aircraft while minimizing exposure time to the rear gunners.



Maximum Speed	446 kph (0m) 476 kph (2000m) 498 kph (6000m)
Dive Speed Limit	790 kph
Maximum G Load	11G
Climb Rate (0m) Climb Rate (3000m) Climb Rate (6000m)	10.4 mps 7.8 mps 3.0 mps
Dropped Ordnance Options	10 FAB-100M 04 FAB-250vs 02 FAB-500M 10 ROS-132 Rockets
Forward-Firing Armament	12.7mm MG 150 rounds 1000 RPM 7.62mm ShKAS 450 rounds 1800 RPM
Crew Armament	**Top Rear** 7.62mm ShKAS 750 rounds 1800 RPM **Rear Belly** 12.7mm MG 200 rounds 1000 RPM **Side** 7.62mm ShKAS 225 rounds 1800 RPM
Crew Armament Options	**Top Rear Blister Turret** 1x 12.7mm UB 200 rounds 1000 RPM 7.62mm ShKAS 750 rounds 1800 RPM

When facing later-model Axis aircraft like the FW 190 and Bf 109 G-6 with the 30mm MK 108, the Blister Turret advantage diminishes considerably. As pointed out in the description of the ser. 35, an important factor behind the aircraft's superior defense capability is its ability to stay airborne with significant damage. The heavy armament of later-era Luftwaffe aircraft simply brings down the Pe-2 quicker.

5.2.5.1 Single Engine Operation Tip. Surprisingly for such a superior aircraft in many ways, both the ser. 35 and 87 have difficulty staying airborne on the power of a single engine, but it performs better than the Hs 129 B-2 in that condition. If your altitude is 1000m or higher, get on an azimuth toward the nearest friendly airfield, don't go lower than 1000m, and engage the autolevel function immediately when the engine gives out. If at low level when the engine is damaged, climb to a minimum altitude of 500m, preferably 1000m if possible, get on your designated egress azimuth, and engage autolevel when the engine dies. Set the good engine to the highest ATA and RPM levels and the lowest radiator levels possible under the current ambient temperature conditions, and keep an eye on the temperature gauges.

The aircraft will quickly begin to lose altitude anytime autolevel is disengaged. Any attempt to maneuver without sacrificing altitude will stall the aircraft into the ground. Any additional damage to ailerons or tail will exacerbate the difficulty of maintaining stability. The recommendation to climb to 500m to 1000m is to have enough altitude to maneuver into a position to land on the runway back at the destination airfield. The only way the aircraft will respond without stalling into a death spin is to keep the speed at 200 kph or better in a shallow dive as you maneuver into a line up with the runway. Even if you are unable to climb to 500m, getting on the correct egress azimuth and engaging autolevel will at least get you back over friendly lines where you can ditch without fear of capture.

When ambient temperatures are below zero, the Pe-2's single engine performance is a little better, but not strong enough to deviate from the recommendations above.

If Part of the Tail is Missing All Bets Are Off. When preparing for flight on a single engine, make sure to check the condition of the tail. If missing a horizontal stabilizer, stay as low to the ground as possible and ditch the aircraft once inside friendly lines. When airborne with one engine and half a tail, the Pe-2 is far too unstable to attempt a landing and will become uncontrollable without warning.



5.2.6 A-20B



Maximum Speed	314 mph [505 kph] (0m) 326 mph [524 kph] (1000m) 338 mph [544] kph (5000m)
Dive Speed Limit	412 mph [665 kph]
Maximum G Load	6.5G
Climb Rate (0m) Climb Rate (3000m) Climb Rate (6000m)	10.0 mps 8.2 mps 5.0 mps
Dropped Ordnance Options	08 FAB-100M 16 FAB-100M 20 FAB-100M 04 FAB-250tsk (+08 FAB-100M)
Forward-Firing Armament	2 x 12.7mm ANM2 .50 200 rounds 850 RPM
Crew Armament	**Top Rear** 12.7mm ANM2 .50 390 rounds 850 RPM **Rear Belly** 7.92mm ANM2 .30 600 rounds 1150 RPM

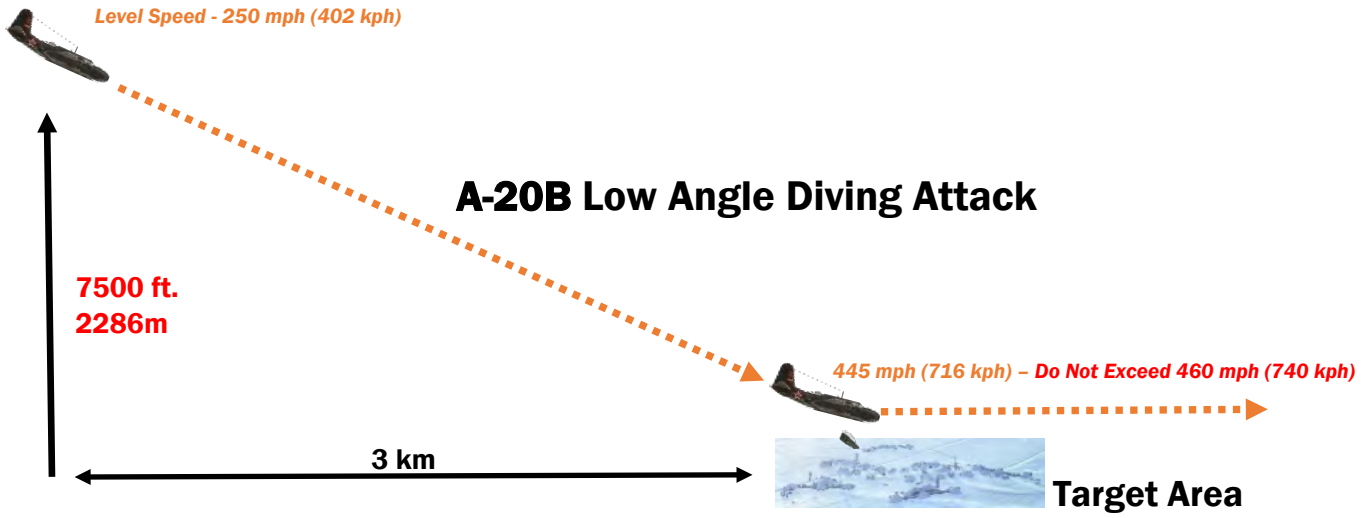
The A-20B is the fastest Ground Attack aircraft in the *IL-2 Great Battles* series; a fact that can often be overlooked because the airspeed indicator is marked in mph. An empty A-20B can outpace a MC. 202 on the deck, and Bf 109s closing with it from 2-3km away may find it takes quite a while to get within firing range. It also enjoys an outstanding climb rate. The aircraft is quite maneuverable and rolls very well for a twin-engine aircraft, but its very low G load tolerance means that too sharp a pull on the stick can lead to the instant loss of a wing. The A-20B features tricycle landing gear and is hands-down the easiest twin-engine aircraft to take off and land in the series.

The A20B is a very capable level bomber but heavy ordnance options are few, and the lack of at least a 2x 500 kg bomb option for an aircraft of its size and power is mildly bewildering. The maximum bomb package of 4x 250 kg + 8x 100 kg bombs is 1100 kg lighter than the maximum capacity of the Ju 88 A-4, the Luftwaffe's most similar Ground Attack aircraft. However, no other aircraft offers a 16 to 20x 100 kg bomb option, and this option makes the A-20B the most potent *one-pass-and-gone* tank column wrecker in the series (**Subsection 7.2**).

The aircraft has two major downsides. The first is poor damage sustainment capability that is much like that of the He 111 H-6. When impacted by rounds from enemy fighters or AAA, the A-20B appears more prone to catch fire than most Ground Attack aircraft in the series. The second downside is disappointing defensive capability. While the forward-firing twin 12.7mm machine guns in the nose are adequate for strafing flak or popping an unsuspecting enemy fighter, the crew armament featuring a 12.7mm machine gun in the top rear gunner position is nowhere near either Pe-2 series aircraft in rear defense effectiveness. This may be due to the aircraft's inability to withstand damage and stay airborne as well as the Pe-2*.

> ****There are some dissenting opinions regarding this observation. See* Subsection 7.1.4.**

5.2.6.1 Low Angle High-Speed Bombing Tip. The A-20B will begin to lose ailerons at a speed of 460 mph (740 kph). It is possible to achieve a dive speed of 445 mph (716 kph) at a bomb drop altitude of 1300 ft. (396m) from an attack altitude of 7500 ft.* (2286m) and pre-dive level speed of 250 mph (402 kph) when the Attack Point is 3 km from the Target Area. The aircraft stays smooth throughout the dive and pulls up easily at -35 nose-heavy trim. Because of the low G load limit, care must be taken not to jerk the stick when pulling out of the dive. The aircraft is very prone to losing a wing when the G load limit is exceeded.



5.2.7 Final Word on Low Angle Diving Attacks

When executing high-speed Low Angle diving attacks in any aircraft it is important to remember that the altitude, dive angle (based on the Attack Point-to-Target Area distance), and level flight speed prior to the dive greatly affect the aircraft's dive speed. Ambient temperatures affect both level speed and dive speed - the colder the weather, the better the performance. Head or tail winds will also affect dive speed. Other influencing factors include fuel and bomb weight.

If the dive is begun at emergency power, once out of light/medium AAA range make sure not to forget to open the radiators/outer cowlings and reduce ATA/RPM. Alternatively, it is possible to begin the dive from higher altitudes under maximum continuous power and standard radiator settings to avoid the additional headache of engine management during the attack procedure. This method can be advantageous engine and radiator settings can be used to increase or decreases the dive speed.

It is strongly recommended to create offline custom missions for all Ground Attack aircraft to allow experimentation with different Attack Altitudes, engine settings, distances between the Attack Point and Target Area, level flight speeds, ordnance packages, wind, and ambient temperature conditions. Possessing an intuitive idea of an aircraft's performance under many possible combinations of conditions will allow you to be in the right place at the right altitude to generate the required dive speed.

**** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example is based on a fuel load of 445 liters (30%), and a bomb load of 4x FAB-250tsk.***

6. FIGHTER AIRCRAFT in the GROUND ATTACK ROLE

Fighter aircraft used in the Ground Attack role bring different dynamics to the mission that the Ground Attack pilot must be able to master and exploit to full advantage. The first dynamic is speed in the form of faster climb and level flight. Faster speeds decrease the movement time to target and enable a much faster egress speed off the Target Area and back to the destination airfield. The second is faster dive speed for *some, but not all* fighter aircraft. While incapable of dive or level bombing, some models can execute high-speed Low Angle diving attacks at speeds surpassing the fastest Ground Attack aircraft. This is important when attacking Target Areas with particularly dense and accurate AAA. When executing multiple pass attacks over a Target Area the heavy forward-firing armament of fighter aircraft make them great strafing platforms and flak eliminators. Finally, in addition to superior speed, fighter aircraft are far more maneuverable and can take on enemy fighters much more effectively than Ground Attack aircraft.

On the other hand, utilizing fighters for Ground Attack missions does present certain risks and limitations. Many models are not much faster in the dive than fast-diving Ground Attack aircraft such as the Pe-2, Ju 88 A-4, and Bf 110. Their bomb payload capacity is considerably less than a dedicated Ground Attack aircraft, and consequentially cause much less damage to the Target Area. Their strafing capability can make up for the light bomb load when attacking Target Areas containing several soft targets, however. Fighter aircraft carry no AI gunner “early warning system” to alert the pilots to the presence of the enemy. Ground Attackers in fighter aircraft must consequently spend an inordinate amount of time checking their *six* in addition to their myriad other responsibilities. Fighter aircraft absorb comparatively less damage from hostile fire before being destroyed, and with no rear gunner “bullet stopper,” the chances of losing a pilot to a direct cockpit hit is greater. Many fighter aircraft do not carry a radio compass, making low-level egress navigation more difficult. In many cases a Ground Attacker with poor dogfighting skills would be safer in a Pe-2, IL-2, or Ju 88 A-4.

There are two fighter aircraft that are *true* Ground Attack aircraft in every sense of the word: The Fw 190 A(F)-8 and the P-47D-28. While retaining the speed and strafing capabilities of a fighter, their bomb payload capacities rival the Bf 110 and Pe-2.





TABLE 6.1 AXIS FIGHTER AIRCRAFT OVERVIEW

Aircraft	Maximum Speed	Dive Speed Limit	Forward-Firing Ordnance	Heavy Ordnance Options	Radio Compass	Additional Armor Options
Bf 109 E-7	477 kph (0m) 520 kph (2000m) 564 kph (5000m)	850 kph	2x 20mm MG FF 2x 7.92 MG 17	1x SC250 4x SC50	NO	Armored Wind Screen Armor Plates
Bf 109 F-2	528 kph (0m) 563 kph (2000m) 606 kph (5000m)	850 kph	1x 15mm MG 151/15 2x 7.92 MG 17 **OPTION:** 1x 20mm MG 151/20	1x SC250 4x SC50	NO	Armored Wind Screen
Bf 109 F-4	522 kph (0m) 570 kph (2000m) 635 kph (6000m)	850 kph	1x 20mm MG 151/20 2x 7.92 MG 17 **+ OPTION 1:** 2x 15mm MG 151/15 **+ OPTION 2:** 2x 20mm MG 151/20	1x SC250 4x SC50	NO	Armored Wind Screen
Bf 109 G-2	525 kph (0m) 569 kph (2000m) 648 kph (7000m)	850 kph	1x 20mm MG 151/20 2x 7.92 MG 17 **+ OPTION:** 2x 20mm MG 151/20	1x SC250 4x SC50	NO	Armored Glass Head Rest
Bf 109 G-4	540 kph (0m) 564 kph (2000m) 640 kph (7000m)	850 kph	1x 20mm MG 151/20 2x 7.92 MG 17 **+ OPTION:** 2x 20mm MG 151/20	1x SC250 4x SC50	NO	Armored Glass Head Rest
Bf 109 G-6	529 kph (0m) 547 kph (2000m) 632 kph (7000m)	850 kph	1x 20mm MG 151/20 2x 13mm MG 131 **OPTION:** 1x 30mm MK 108 **+ OPTION:** 2x 20mm MG 151/20	1x SC250 4x SC50	YES	Armored Glass Head Rest
Bf 109 G-14	576 kph (0m) 668 kph (5500m)	850 kph	1x 20mm MG 151/20 2x 13mm MG 131 **OPTION:** 1x 30mm MK 108 **+ OPTION:** 2x 20mm MG 151/20	1x SC250 4x SD70 2x 21cm BR	YES	
Bf 109 K-4	**DB-605DB engine:** 599 kph (0m) 702 kph (7500m) **DB-605DC engine:** 614 kph (0m) 713 kph (6200m)	850 kph	1x 30mm MK 108 2x 13mm MG 131 **+ OPTION:** 2x 20mm MG 151/20	1x SC500 1x SC250	NO	
Fw 190 A-3	555 kph (0m) 574 kph (3000m) 667 kph (6700m)	850 kph	2x 20mm MG 151/20 2x 7.92mm MG 17 **+ OPTION:** 2x 20mm MG FF	1x SC500 1x SC250 4x SC50	NO	
Fw 190 A-5	558 kph (0m) 578 kph (3000m) 658 kph (6400m)	850 kph	2x 20mm MG 151/20 2x 7.92mm MG 17 **+ OPTION 1:** 2x 20mm MG FF **+ OPTION 2:** 2x 20mm MG 151/20	1x SC500 (+4x SC50) 1x SC250 8x SC50 4x SC50	NO	
Fw 190 A-8	558 kph (0m) 580 kph (3000m) 641 kph (6200m)	850 kph	2x 20mm MG 151/20 2x 13mm MG 131 **+OPTION 1:** 2x 30mm MK 108 **+ OPTION 2:** 2x 20mm MG 151/20	1x SC1000 1x SC500 (+4x SD70) 1x SC250 (+4x SD70) 2x SC250 (+4x SD70) 3x SC250 8x SD70 4x SD70 12x Panzerblitz I Rkts 2x 21cm BR	NO	**F-8 Strike Option:** Additional armor around fuselage bottom and engine compartment. **Sturmjäger Option:** Additional armor plates on cockpit sides and armored glass on windshield sides.
MC. 202	500 kph (0m) 543 kph (2000m) 604 kph (5000m)	850 kph	2x 12.7mm MG **+ OPTION 1:** 2x 7.7mm MG **+ OPTION 2:** 2x 20mm MG 151/20	2x 100-T 2X 50-t	NO	Armored Wind Screen

6.1 AXIS FIGHTER AIRCRAFT

6.1.1 MC. 202

The MC. 202 is rather slight in heavy ordnance options, with 2x 100-T bombs being the maximum bomb payload. However, the aircraft dives as well as any Luftwaffe fighter. Its basic guns loadout is also comparatively light, but the 2x MG 151/20 gun pod option puts it on par with the Bf 109 as a strafing platform.

6.1.2 Bf 109

The Bf 109 bomb payload capacity across all models is moderate until the K-4, which can carry one SC 500.The G-14 is the sole model equipped with the 2x 21cm BR mortar option, and replaces the 4x SC 50 bombs with slightly heavier 4x SD 70. For strafing, the 109's trademark nose-mounted cannon is very accurate, but when outfitted with two extra cannons on wing-mounted gun pods the aircraft's strafing efficiency is lethal. The replacement of the twin 7.92mm MG 17s in the nose with twin 13mm MG 131s greatly enhances the aircraft's basic strafing capability.

The 109's liquid-cooled engine and radiators are particularly vulnerable to hits and typically does not run for long after experiencing damage. The airframe itself is incapable of sustaining much more than light damage from enemy fire without losing flight stability. This makes the 109 unsuitable for Ground Attack missions where there is a high risk of taking flak fire.

6.1.3 Fw 190

In Ground Attack terms the Fw 190 series is simply better in both bombing and strafing ordnance options, and those capabilities improve greatly from model to model. The Fw 190 A-3 debuts with an SC 500 capability, and the A-5 offers the impressive options of 1x SC 500 + 4x SC 50 or 8x SC 50 bombs in a special U-17 option that also features a low-altitude engine boost system. But it is in the A-8 that the airframe's true Ground Attack potential is realized.

6.1.3.1 Fw 190 A-8. The A-8 features an enormously diverse selection of heavy ordnance options, all the way up to 1x SC 1000 bomb. There also options to carry 8x SD 70, 3x SC 250, or 1x SC 500 + 4x SD 70 bombs. In addition to the wing-mounted 2x 21cm BR mortar option, for the first time a Luftwaffe aircraft has a multiple rocket armament option in the form of 12x Panzerblitz I rockets. While the A-3/5 carried limitations for bomb selection and bomb release delay capability, that shortcoming is fixed with the F/G-8 "Strike Package," which allows full manual control of individual bomb drops and offers a 70-millisecond release delay between bombs when using the "drop all" option. There are two Ground Attack configurations; the F-8 *Schlachtflugzeug*, and the *G-8 Jabo Rei*. The latter option removes the nose-mounted 2x MG 131 machine guns and enables the G-8 to carry 1x SC 1000 or 3x Sc 250 bombs.

The Werfer-Granate 21 is a unique addition to the Luftwaffe ordnance inventory. Originally intended for *en masse*, Staffel-scale launches against B-17 formations, it did see use against ground targets. It is difficult to aim accurately and causes considerable drag when mounted. While a historically interesting piece of ordnance, all-in-all, a 100 kg bomb is just as effective.

The 12x Panzerblitz rockets are slightly more effective. The rockets can only be fired in pairs or a volley of 12. These rockets can knock out light tanks quite efficiently, but destroying T-34s and KV-1s usually requires several direct hits. When fired in pairs, it is not impossible to put a pair of rockets into the side of a tank, but it is not easy. The lack of an option to fire a single rocket - a feature endemic to all rocket-armed Allied aircraft, makes the Panzerblitz rockets a less effective option than they could be.

6.1.4 LOW ANGLE HIGH-SPEED BOMBING TIP

Every Luftwaffe fighter aircraft in the current *IL-2 Great Battles* inventory enjoys a dive speed limit of 850 kph, including the MC. 202. This capability is more than 100 kph faster than the dive speed limits of most Allied aircraft in the series. Naturally there is no requirement to make every diving attack as close as possible to 850 kph, but against Target Areas with dense, accurate flak and a high probability of enemy fighter presence, it certainly doesn't hurt to exploit this advantage when possible.

The primary difference between Ground Attack aircraft and fighter aircraft when employing this technique is the importance of maintaining active throttle management in the latter case. The dive speed must be carefully controlled to not exceed the aircraft's dive speed limit.

To compound the challenges to this technique, the Air Speed Indicators in all German-manufactured aircraft stop at 750 kph. The MC. 202 Air Speed Indicator stops at around 725 kph. On the MC. 202, Bf 109 E and F models, and all Fw 190 models. The needle stops moving at the Air Speed Indicator maximum listed speed. On the Bf 109 G and K series the needle moves past the 750 kph limit, and there are gradation marks past that marker that can somewhat indicate actual speed.

Therefore, when exceeding 750 kph during high-speed dives, developing a feel for each aircraft type's approximate speed based on limited or no information from the Air Speed Indicator is a necessary skill for efficient throttle management past the Air Speed Indicator limits.

As a generic reference and starting point, this tip uses an Attack Altitude of 4000m and an Attack Point approximately 7 km from the Target Area. It is possible to achieve the same dive speed results from a lower altitude and closer Attack Point-to-Target area distance – or from higher and farther away – depending on the enemy threat environment. The problem with moving the Attack Point closer and lowering the altitude is the potential risk of not having enough altitude for the aircraft to accelerate to the required speed. Conversely, moving the Attack Point closer without lowering the altitude will make the dive angle steeper, making dive recovery problematic. Every aircraft type will respond differently to these changes in terms of acceleration and handling, and as stated in **Subsection 5.2.6** - altitude, dive angle, pre-dive level flight speed, wind, and ambient temperatures affect dive speed and should be taken into account. Fuel weight and different ordnance loadouts will also exert influence on dive acceleration.

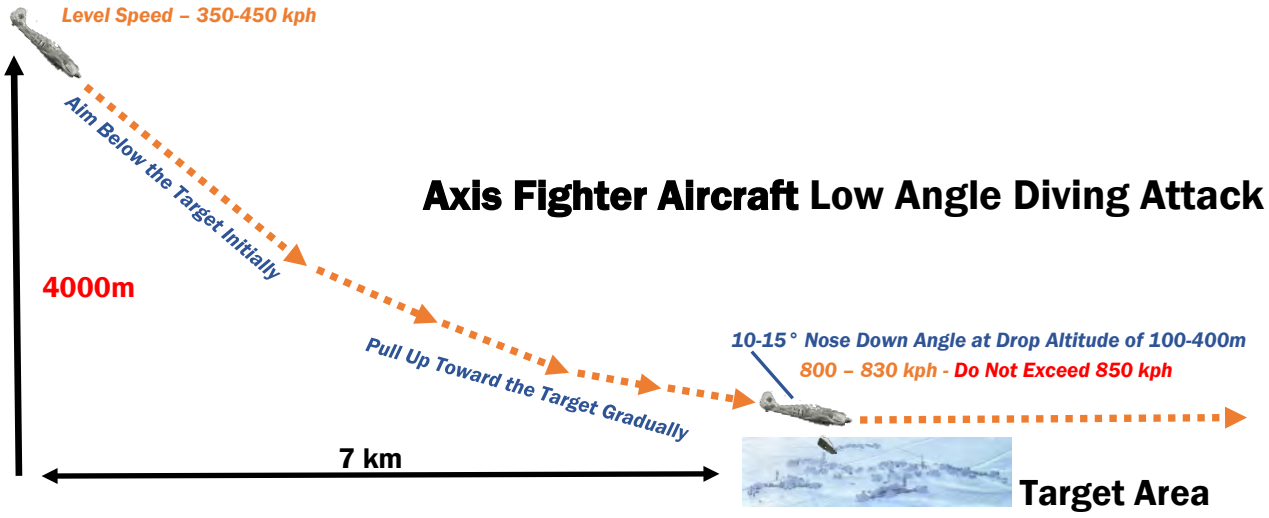
When starting the Attack Dive, point the aircraft nose below the Target Area and hold it there as the aircraft picks up speed. You can start the dive at approximately 1.2 ATA in any Axis fighter aircraft. If controlling radiators or outer cowlings manually, you can close them. This is not so

much to enhance dive speed as it is to facilitate the fastest possible initial egress speed off the Target Area and out of light/medium AAA range.

As aircraft speed increases and target distance decreases, slowly pull the nose up toward the Target Area and line up on your intended target. Keep an eye on the Air Speed Indicator to monitor the relationship between speed and target distance, and increase/decrease the throttle to achieve the following goals: First, get the aircraft speed up to 750 kph prior to arriving over the Target Area and use the throttle to facilitate a *controlled* and gradual increase past 750 kph. Second, release bombs at an altitude of 100-400m at a nose-down angle of 10 to 15°.

Immediately after releasing bombs, level out, push the throttle to 100% emergency power, and perform small left-right evasive maneuvers at treetop level until out of light/medium AAA range. Once out of AAA range, open the radiators/outer cowlings if manually controlled.

The trickiest aspect of this technique is that engine management procedures will differ significantly between aircraft, and very high-performance aircraft such as the Bf 109 K-4 requires very precise throttle control to keep the dive speed under 850 kph. Just as important is the nose angle when releasing bombs, which will be the culmination of dive angle adjustments made throughout the Attack Dive. 10-15° downward is ideal. If the nose angle is any steeper, there is a significant risk of not recovering from the dive. If you misjudge the dive angle and are forced to level out prior to reaching the bomb release point, you will lose critical speed and risk more exposure to AAA.



**** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example for all Axis fighter aircraft is based on a 50% fuel load and a bomb load of 1x SC 250.***

6.1.4.1 Aircraft Model-Specific Information.

Bf 109: The suggested stabilizer trim settings for any 109 model at dive start **is nose-heavy -50** to facilitate a reliable dive recovery from a 10-15° downward nose angle. Immediately after bomb release and pushing the throttle to full power, adjust the stabilizer trim to -60 or the aircraft will creep upward.

When starting the Attack Dive from an altitude of 4000m, it is recommended to use an Attack Point 6 km from the Target Area when flying the Bf 109 E-7.

When diving from 4000m in the Bf 109 K-4, an Attack Point 8 km from the Target Area is recommended. The K-4 is an extremely powerful aircraft and accelerates very quickly in the dive. Active throttle management should be initiated as soon as the aircraft accelerates into the 600 kph range.

The major advantage of the G-K models is the Air Speed Indicator needle, which continues to move and provide an approximate indication of actual speed after moving past the 750 kph marker.

Fw 190: The recommended pre-dive stabilizer trim setting is **neutral 0%** (based on testing using 50% fuel and 1x 250 kg bomb payload). Immediately after bomb release and pushing the throttle to full power, you must adjust the stabilizer trim back to -36. If flying the Fw 190 A-5 with the U-17 package, engage the engine boost when you push the throttle to maximum power after releasing bombs.

MC. 202: The recommended pre-dive stabilizer trim setting is **nose-heavy -40%**. Immediately after bomb release and pushing the throttle to full power, adjust the stabilizer trim back to -50 to maintain a level egress.

6.1.4.2 Final Suggestions.

If performed incorrectly this technique can easily lead to a or exposure to Target Area AAA fire at sub-optimal speeds. Offline practice is required on each aircraft type employed for this technique. Experiment at different altitudes, Attack Point distances, temperature conditions, and fuel/ordnance loadouts. Be able to visually gauge the distance to the Target Area, whether it be 7 km or your own preferred Attack Point distance/altitude for a particular aircraft type.

If you are having difficulty developing a feel for an aircraft's speed past the Air Speed Indicator limit, change the *Quick Mission - Realism* setting to *Custom*, and activate the *Instrument Panel* option. This will show an on-screen, digital speed indicator to indicate speeds past the Air Speed Indicator limit and give you an idea of the aircraft's acceleration past the limit at different dive angles and throttle input.

When the dive speed limit is exceeded, the aircraft will likely first lose an aileron or horizontal stabilizer, and will continue to lose control surfaces as long as the aircraft speed stays above the dive speed limit. It is possible to return to base and land while missing a piece, but the absence of two or more control surfaces, or the rudder, will greatly decrease the likelihood of a safe return. Exceed the dive speed limit offline in *Quick Mission* with different aircraft types and take note of which control surfaces are the first to go.

TABLE 6.2 ALLIED FIGHTER AIRCRAFT OVERVIEW

Aircraft	Maximum Speed	Dive Speed Limit	Forward-Firing Ordnance	Heavy Ordnance Options	Radio Compass
I-16 Type 24	448 kph (0m) 460 kph (1800m) 490 kph (4500m)	620 kph	2x 7.92mm ShKAS 2x 7.92mm ShKAS **OPTION:** 2x 20mm ShVAK	2x FAB-100M 2x FAB-50M 4x ROS-82 Rockets 6x ROS-82 Rockets	NO
Mig-3 ser.24	525 kph (0m) 626 kph (7600m)	750 kph	2x 7.92mm ShKAS 1x 12.7mm UB **+ OPTION 1:** 2x 12.7mm UB **+ OPTION 2:** 2x 20mm ShVAK	2x FAB-100M 2x FAB-50M 6x ROS-82 Rockets	NO
Yak-1 ser.69	514 kph (0m) 549 kph (2000m) 582 kph (4000m)	720 kph	1x 20mm ShVAK 2x 7.92mm ShKAS	2x FAB-100M 2x FAB-50M 2x ROS-82 Rockets 6x ROS-82 Rockets	YES
Yak-1b ser.127	530 kph (0m) 567 kph (2000m) 600 kph (4500m)	720 kph	1x 20mm ShVAK 1x 12.7mm UB	2x FAB-100M 2x FAB-50M	YES
Yak-7B ser.36	526 kph (0m) 565 kph (2700m) 586 kph (4000m)	740 kph	1x 20mm ShVAK 1x 12.7mm UB	2x FAB-100M 2x FAB-50M	YES
LaGG-3 ser. 29	505 kph (0m) 548 kph (2000m) 573 kph (4000m)	750 kph	1x 20mm ShVAK 1x 12.7mm UB **OPTION 1:** 1x 23mm VYa-23 **OPTION 2:** 1x 37mm Sh-37	2x FAB-100M 2x FAB-50M 6x ROS-82 Rockets	NO
La-5 ser. 8(F)	544 kph (0m) 571 kph (3000m) 603 kph (6500m)	720 kph	2x 20mm ShVAK	2x FAB-100M 2x FAB-50M	YES
La-5FN ser.2	583 kph (0m) 605 kph (2500m) 646 kph (6000m)	720 kph	2x 20mm ShVAK	2x FAB-100M 2x FAB-50M	YES
Spitfire MK.VB	515 kph (0m) 604 kph (5000m) 597 kph (7400m)	725 kph	2x 20mm Hispano Mk.II 4x 7.7mm Browning .303	N/A	NO
Spitfire MK.IXe	542 kph (0m) 610 kph (3350m) 664 kph (6850m)	725 kph	2x 20mm Hispano Mk.II 2x 12.7mm Browning .50	1x 500 lb. G.P. (+2x RP-3 Rkts) 1x 500 lb. G.P. (+2x 250 lb. G.P.) 2x 250 lb. G.P. 2x RP-3 Rkts	NO
P-40E-1	494 kph (0m) 601 kph (5000m)	860 kph (534 mph)	6x 12.7mm M2 .50 **OPTION 1:** 4x 12.7mm M2 .50	1x FAB-500M (+4x ROS-82 Rkts) 1x FAB-250sv (+4x ROS-82 Rkts) 4x ROS-82 Rockets	NO
P-39L-1	539 kph (0m) 600 kph (2850m) 596 kph (4600m)	841 kph (523 mph)	1x 37mm M4 2x 12.7mm M2 .50 4x 7.62mm M2 .30	1x FAB-250tsk 1x FAB-100M	YES
P-47D-28	557 kph (0m) 700 kph (7000m)	805 kph (500 mph)	8x 12.7mm M2 .50	2x M65 1000 lb. (+1x M64 500 lb.) 2x M65 1000 lb. (+6x M8 4.5 in. Rkts) 2x M65 1000 lb. (+1x M64 500 lb.) 2x M65 1000 lb. (+6x M8 4.5 in. Rkts) 3x M64 500 lb. (+6x M8 4.5 in. Rkts) 2x M64 500 lb. (+6x M8 4.5 in. Rkts) 1x M64 500 lb. (+6x M8 4.5 in. Rkts) 6x M8 4.5 in. Rockets	YES

6.2 ALLIED FIGHTER AIRCRAFT

With a few notable exceptions, the bomb options for Allied fighter aircraft are even lighter than those for the Bf 109. Many models, however, do possess a capability not available to Axis fighters outside the Bf 109 G-14 and Fw 190 A-8 – 82mm rockets. The problem is the ROS-82 rockets are not very powerful, certainly nowhere near as powerful as the ROS-132 rockets. The ROS-82 rockets *can* destroy Axis tanks, but it may take two or three good hits to finish one off.

Most Allied fighter aircraft dive speed limits are 100-130 kph lower than that of Axis fighters, and 40-70 kph lower than the Pe-2. While this disadvantage certainly does not preclude many Allied fighters from making high-speed Low Angle dive attacks near their dive speed limit from a lower altitude and/or shorter distance (compared to Axis fighters) from the Attack Point to the Target Area, it should be noted the slower dive speeds will make them more vulnerable to flak fire than Axis aircraft capable of 800+ kph attack dives. The P-39L-1, Pe-40-E1, and P-47D28 are all capable of 800+ diving attacks in accordance with the guidance contained in **Subsection 6.1.4**. The American-built engines in these aircraft, especially the P-40E-1, requires more proactive overall engine management in comparison to the highly-automated Luftwaffe fighter aircraft,.

6.2.1 I-16 Type 24

Highly maneuverable but not particularly fast, and possesses the lowest dive speed limit of any Allied aircraft besides the IL-2. When equipped with the 2x 20mm ShVAK option, the I-16 Type 24 is a very capable strafing platform.

6.2.2 Mig-3 ser. 24

The Mig-3 ser. 24 sits at the top end of the Allied aircraft with sub-800 kph dive speed limits. It is a capable strafing platform when using the 2x 20mm ShVAK option.

6.2.3 LaGG-3 ser.29

While limited to the typical Allied fighter heavy ordnance options, the LaGG-3's nose cannon options make it a very effective tank killer. The VYa-23 and Sh-37 options provide a critical, additional option missing from the MK 108 heavy cannon option for Axis fighters - a 100% armor piercing ammunition load. Using all AP ammo, both the VYa-23 and Sh-37 cannons are very efficient at dispatching Axis tanks. When combined with bombs or rockets, in experienced hands the LaGG-3 is a lethal threat to armor columns. The LaGG-3 is also very tough and can sustain much more damage than the typical fighter aircraft.

6.2.4 Yak-1 ser. 69/129 and Yak-7B

The nose-mounted 20mm ShVAK cannon coupled with either 2x 7.92mm ShKAS or 1x 12.7mm UB machine guns are accurate strafing ordnance. The Yak-1b and 7B are not equipped with ROS-82 rockets.

6.2.5 La-5/La-5F ser. 8 and La-5FN ser.2

Typical light bomb payload and no rocket capability. The La-5 series are the only Russian-built aircraft in the series with 2x 20mm nose-mounted ShVAK cannon as default armament.

6.2.6 Spitfire MK VB / MK IXe

The MK VB is the only Allied fighter aircraft with no bomb or rocket capability at all. The MK IXe is a different story. It is not only capable of carrying a larger 500 lb. (227 kg) bomb, it can also carry that plus 2x 250 lb. (113 kg) bombs or 2x RP-3 armor-piercing or high explosive rockets. The 2x 20mm Hispano cannon and 4x 7.7mm (MK VB) or 2x 12.7mm (MK IXe) machine guns give these Spitfire models more strafing power than the average Allied fighter.

6.2.7 P-40E-1

At 860 kph (534 mph), the P-40E-1's dive speed limit is the highest of any aircraft in the series, slightly edging out Axis fighter aircraft. It can also carry the heavier FAB-500M bomb and 4x ROS-82 rockets along with it. While not armed with a cannon, its 6x 12.7mm M2 machine guns can cut a considerable swath of destruction through soft targets. Like the LaGG-3, the P-40 E-1 can sustain considerable damage and remain airborne. Although surpassed in bomb payload capacity to a large degree by the P-47 D-28, for an early-to-mid era aircraft the P-40 is very impressive in the Ground Attack role.

6.2.7.1 Low Angle High-Speed Bombing Tip. When executing an Attack Dive from an Attack Point 7 km from the Target Area at a 4000m Attack Altitude, start the dive at 42" manifold pressure, 3000 RPM, 66% fuel mixture, tail-heavy 20% trim, and close the outer cowlings. Unlike the P-39L-1, the P-40E-1 has no manifold pressure governor. To avoid shattering the crankshaft, it is important to keep an eye on the manifold pressure and proactively manage the throttle to keep it under 45" throughout the dive. You will have to quickly adjust trim to 5% after bomb release to make a level egress.

The additional task of consistently keeping the manifold pressure under 45" while watching the Air Speed Indicator and maintaining proper dive angle in relation to target distance makes the P-40E-1 a challenging aircraft to use in this type of attack.

6.2.8 P-39L-1

The stock 37mm M4 cannon with the armor-piercing ammunition option is not an effective tank killing weapon, and has a very small ammunition capacity. The single 250sv or FAB-100M heavy ordnance options are modest compared to those available to the P-40E-1 and P-47D-28. But the array of 7.62mm and 12.7mm machine guns combined with the 37mm M4 cannon firing HE ammunition is an extremely effective strafing platform. The P-39L-1 is almost as fast a diver as the P-40E-1, with a dive speed limit of 841 kph (523 mph).

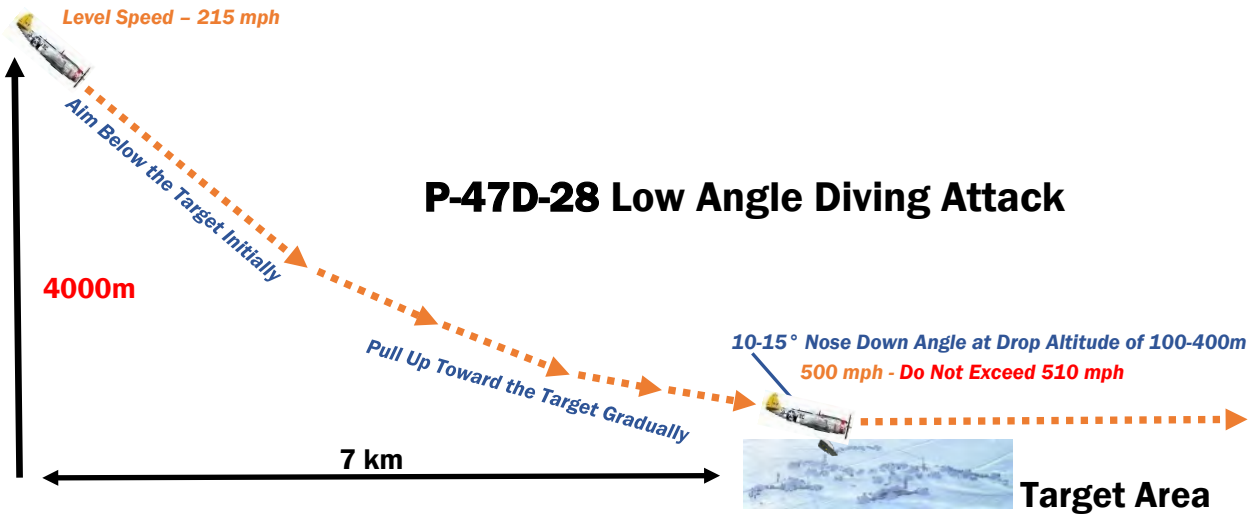
6.2.8.1 Low Angle High-Speed Bombing Tip. Start the dive at 42" manifold pressure, 3000 RPM, 65% water radiator and 40% oil radiator, 90% fuel mixture, nose-heavy -40 trim. You can increase manifold pressure up to 60" during the dive if needed, but don't exceed the two-minute emergency power limit. From 4000m altitude and 7 km distance, it shouldn't be necessary to raise it past 50." The Air Speed Indicator shows speed as measured in mph upward to 700 mph –

well past the dive speed limit, making it possible to maintain the needle just under the 520 mph marker. Additional nose-heavy trim input to the -50-55% range will be necessary immediately after bomb release to keep the aircraft from climbing on egress.

6.2.9 P-47D-28

The P-47D-28's ordnance payload capacity exceeds that of any single-engine aircraft in the series, although it cannot carry a 1000 kg bomb like the Ju 87 D-3, Bf 110 E-2/G-2, and Fw 190 A-8. It can, however, carry 2x M65 1000 lb. bombs, 1x M64 500 lb. bomb, and 6x M8 4.5 in. rockets. The rockets are extremely effective against Axis tanks, and can take out any Axis tank except the Tiger I with a single rocket. This puts the M8 rockets at an efficiency level far above the ROFS-82 rockets, but slightly below the ROFS-132. The 8x 12.7mm M2 .50 machine guns are the most deadly non-cannon, forward-firing armament package in the series, and highly effective at strafing flak and soft targets. With a 805 kph (500 mph) dive speed limit, the D-28 is also superb at Low Angle high-speed dive attacks, though slightly slower in the dive than the P-40E-1 and P-39L-1.

6.2.9.1 Low Angle High-Speed Bombing Tip. From 4k altitude and an Attack Point 7 km from the Target Area, close the outer cowling and oil radiator, keep the inlet cowling at 50%. Adjust trim to nose-heavy -35%. Put fuel mixture at 100%. Make sure the turbosupercharger and throttle are linked, move throttle and RPM to full power, and dive. The D-28 accelerates quickly in the dive; keep an eye on the Air Speed Indicator and reduce throttle when nearing the 500 mph dive speed limit. In the unlikely event you are slower than 500 mph when approaching the Target Area, engage the engine boost system. Regardless, engage engine boost and go full-throttle and RPM once bombs have been released. The aircraft should both dive and recover well with a trim setting of -35%. Once out of AAA range, open the oil radiator, set manifold pressure to 52" and RPM to 2700 until over friendly territory. Do not exceed 15 minutes at this setting.



** Level speed at dive start greatly influences dive acceleration and can increase or decrease Attack Point distance to target. The stated altitude and Attack Point distance in this example is for warm weather conditions when the ambient temperature is 20° or higher. Subzero ambient temperatures normally improve aircraft speed, particularly when diving. Example for the P-47D-28 is based on a 50% fuel load and a bomb load of 2x M64 500 lb. bombs.*

7. GROUND ATTACK TIPS

7.1 INDIVIDUAL ACTIONS UPON ENGAGEMENT

Sections 2 and **3** covered the specifics of Immediate Action Plans and Decisions, and the pros and cons of Running and Fighting. This Subsection focuses on what you as an individual can do when an enemy fighter is moving in on you for the kill.

7.1.1 LOCATE THE THREAT

The AI gunner says, "*He's Engaging*," but that is not always the case. Sometimes it's an enemy Ground Attacker on the way to a target, and sometimes it's an enemy fighter pilot who hasn't even spotted you. It is extremely advantageous to know the number and location of nearby enemy fighters and verify their immediate intent. Trying to make decisions while in the dark about what you're up against makes a bad situation worse, but locating the threat is easier said than done for two reasons: 1) Visibility, particularly to the rear, is generally poor in Ground Attack aircraft. 2) If it *is* an enemy fighter preparing to engage you, you may only have a few seconds to locate the threat before tracers are headed your way. If he's attacking from the high 12:00, the time window is squeezed even smaller.

7.1.1.1 Rapid Visual Scan. Immediately look to the high 12:00 position. If he is coming down toward you – *dive immediately*, dive straight ahead, and dive steeply if you have the altitude. You need to make his attack angle as steep and difficult as possible. Otherwise, look around and do a fast visual scan to the rear across the high 4:00 to 8:00 position, then the low 8:00 to 4:00 position. If your gunner is firing, follow the tracers visually. If the gunner is not firing and you have not located the enemy aircraft, look to the right and left sides, and immediately above you. If you're flying in a Flight Group, everyone should be scanning the sky and communicating.



The most effective method to obtain a clear visual perspective of the rear area is to engage autolevel and switch to the gunner position(s), but this method comes with considerable risk. If the enemy fighter fires at the gunner position while you are occupying it, your pilot could be killed or wounded.

If you still have not located the enemy, repeat the scanning procedure. If the AI gunner gives the "*Out of Range*" message, the enemy aircraft is either moving away from you, or is just out of AI gunner detection range, and you will soon be getting the "*He's Engaging*" message again. If the

AI gunner has not given the "*Out of Range*" message, the fighter is close, you're not seeing him, and it is time to start evasive action. If you spot him and he is coming toward you, it is definitely time to start evasive action.

7.1.2 EVASIVE ACTION IMMEDIATE GOALS

The primary goals are to not get killed, and not get captured. To achieve these ends, you should 1) not put your aircraft in such a position that you will be unable to ditch or bail out. 2) Evade to reducing the possibility of a direct hit to the cockpit. 3) Be pointed in the direction of the nearest friendly lines, or 4) be using the radio compass to head toward the nearest friendly airfield.

7.1.3 EVASION TIPS



If you belong to the .5% of *IL-2* players who can successfully *out-maneuver* and shoot down enemy fighters while flying a Ground Attack aircraft, go right ahead, and good luck. If you cannot pull that off:

When possible, and this is extremely important, get down to treetop level and get across friendly lines as fast as possible. If you lose control of the aircraft from there, you will ditch instead of ending the mission in a fireball of death. Once on the deck, do not climb higher than 200m when evading.

If the aircraft is not at maximum continuous power, put it there. If you're less than one minute away from friendly lines or airfield with an enemy fighter chewing away on your *six*, don't be afraid to go to maximum ATA and RPMs for 45-50 seconds – you really don't have much to lose by doing so. Count the seconds, then reset to maximum continuous power at the end of the count.

It is very difficult to evade at low-level while keeping an eye on the enemy fighter's position, but do make a point to make quick looks at your six when possible. If you cannot see your attacker and are doing unnecessary evasive maneuvers while the enemy fighter is climbing for his next pass, you're wasting speed and time.



When evading, keep your maneuvers quick, short, and continuing in random succession. Keep your evasive turns in the horizontal plane under 30°. Long and sharp turns expose your entire aircraft for a murderous deflection shot, and temporarily prevent your AI gunners from firing. Whether using a compass or radio compass as a directional aid, also use it to keep your evasive turns with 30° of the Egress or Escape Azimuth.

If you see tracers shooting past your cockpit, he will be walking the rounds toward you. Jerk the stick in the other direction immediately, no more than 30°, and vary your altitude slightly to throw off the enemy pilot's sight picture.

Never fly straight for more than a couple of seconds when the enemy is on your near *six*. Do not give him an easy target. Force him to constantly adjust his sight picture. Use a narrow maneuver window that keeps your movements unpredictable but gives your AI gunners maximum opportunity to fire back.

If you are on a voice communication channel with a friendly Ground Attacker in view of the confrontation, ask him to tell you when the enemy fighter is climbing, diving, and firing at you. This information will greatly improve your chances of survival.

Fly over friendly positions whenever possible to pull your pursuer into a flak barrage.

7.1.3.1 Taking Over the Gunner Position. Should you decide to engage autolevel and move to a gunner position with the intent to defend the aircraft yourself, be aware of the risks. In this state, your aircraft presents an easy, non-evading target. While it is true that the enemy fighter's engine and cockpit are vulnerable when he is on your *six*, your gunner position is also exposed – more than the pilot position, and his armament is considerably more powerful than yours. This course of action is recommended only for players who are very experienced at targeting and dispatching fighters from a gunner position.

7.1.3.2 AI Gunner Range. The choice of *Long, Medium, or Short* engagement range settings should depend on the Attack Plan goals. There are advantages and disadvantages to each setting.

An AI gunner engaging from long range might discourage an enemy fighter pilot from closing too close to your six, but unless the gunner is very accurate (and most are not), it probably won't make any difference. One significant downside is that if an enemy fighter pilot has not noticed your aircraft, he certainly will when he sees the very inaccurate tracers coming from long distance. An AI gunner set to long range will also go through his ammunition much faster than when set to medium or short ranges.

A short range setting will prevent drawing attention to your aircraft and conserve ammunition for use only against an enemy fighter coming in close. If your rear gunner fires and you cannot see the enemy fighter, you can be certain your aircraft is within his engagement range and you should be evading. The drawbacks to this setting are: 1) If your AI gunner is highly accurate, he could be putting rounds on the enemy aircraft at medium range, and 2) If your attacker is a highly-skilled marksman he will be hitting your aircraft from medium range while your AI gunner does nothing.

A medium range setting is the default configuration and contains all of the good and bad points of long and short range settings, but to a lesser degree on each point. Unless you have specific reasons based on Attack Plan goals to choose long or short range settings, a medium engagement range setting will suffice.

The sad truth is that if your AI gunner is set to Normal or Low accuracy, the range setting is probably not going to make much difference. AI gunners at those settings generally only land hits on an attacker from 10 to 30-meter distances. The problem is that it is impossible to know what you have in the back seat until you and the enemy fighter finish the confrontation.



7.1.3.3 Bombs Defense. Should you be engaged while still carrying bombs, there is the option not to ditch the bombs immediately but retain them for low-altitude "Bombs Defense." This technique provides the opportunity to destroy the enemy fighter with bombs. Although the chances of succeeding are slim, it may damage the fighter aircraft or make the pilot think twice about getting too close. The goal is to drop a bomb from treetop level while an enemy fighter is behind you, timing the drop so that the bomb will explode when the fighter aircraft is directly above it.



This technique is much easier to employ with Axis Ground Attack aircraft. The Allied bombs take longer to arm, and if dropped too close to the ground on a short delay they will not detonate. This means the Allied Ground Attacker must climb to approximately 300m, put the nose down in a dive and immediately begin dropping bombs in the dive, pulling up at treetop level. Hopefully this will draw an enemy fighter into diving directly behind your aircraft and into the bomb blast zone. This technique is dangerous for Allied aircraft because of the necessity to climb higher than 200m to ensure bomb activation.



To not destroy your own aircraft in the process, you must be sure your own aircraft will be safely out of the blast zone at the time of detonation. Therefore, knowing your aircraft's speed, the bomb size, and bomb timer delay will help you determine whether this technique is feasible under current conditions. If your aircraft speed is moving 550 kph or faster, you need a 3-second delay for 1000 kg bombs and 1-second for 500 kg and lighter bombs. If your speed is in the 250-300 kph range, dropping a 1000 kg bomb is not recommended. A 3-second delay is required for 500 kg bombs, and a minimum 1-second delay for 250 kg and smaller bombs.



The trick is to match the enemy fighter's distance behind you with the timer delay setting of your bombs. Naturally, the longer the bomb timer delay the more difficult the task of accurate timing, and of course it is difficult to keep track of the enemy fighter's location while evading. Often this technique must be executed *blindly*, without knowing the fighter's location. The best *blind* scenario is when carrying *50 to 100 kg bombs with a 1-second delay*. When you see tracers going past your aircraft - drop bombs. There is a fair chance the enemy fighter is close enough to take some damage.



The question of how many bombs to drop is an individual decision. If your aircraft is being severely damaged, you should drop them all to lose the weight immediately. Otherwise, a good approach is to drop half, see what happens, and drop the remainder if the fighter comes back for another pass. It is recommended to drop bombs singly, 1-second apart.

Retaining bombs for this defensive technique will make your escape speed slower than it would be without the bombs. You must weigh the benefits of speed against your chances of pulling off this technique successfully, which, admittedly, is a long-shot.

One way to improve your chances is to regularly practice this technique offline in Q*uick Mission* against a single enemy fighter.

7.1.3.4 High Altitude Dive Defense. If intercepted at 4 km or higher altitude while flying a Ju 88A-4, Pe-2 (either series), or A-20B, a high-speed dive toward friendly lines will buy some time for your escape out of enemy territory, and hopefully discourage enemy fighters from continuing pursuit.

If your AI gunner calls out an enemy aircraft, attempt to locate him using the steps described in **Subsection 7.1.1.1**. If you determine the aircraft is a threat, turn onto your escape azimuth. If the enemy fighter is below you and not in guns range, continue level flight and observe him. Do not begin your dive until he begins firing or climbs level with you. The reason for this is because if the enemy is below and behind you when you start to dive, you are merely making his job easier by descending to his altitude. By staying on the escape azimuth and delaying your dive, you are increasing the distance you will eventually cover before running out of altitude.

Once the enemy fires or pulls level with you - point the nose down in a steep dive. The next steps to take depend on the aircraft you are flying. Please read the entire procedure in the **Ju 88 A-4** section and take note of the procedural variations per aircraft in the follow-on sections covering the **A-20B** and **Pe-2 ser. 35/87**.

Ju 88 A-4: Keep engines at maximum continuous power and close outer cowlings. Set trim to nose-heavy -60. Continue the dive until your speed nears 700 kph. Adjust your dive angle to keep the Air Speed Indicator needle at 700 kph. Do not exceed 720 kph. If your AI gunner reports that the enemy aircraft is out of range, pull up slightly until your dive speed is 600 kph, and maintain that speed. If the AI gunner reports the enemy coming back into range, point the nose down again and resume the dive at 700 kph. But if you continue to dive at 600 kph for approximately 30



seconds with no notification of the enemy fighter's return, raise the nose angle to continue the dive at 500 kph. If after a further 30 seconds the AI gunner is still silent, resume level flight on azimuth. If at any time the AI gunner notifies you of an enemy aircraft, resume the dive at 700 kph.

There are a few reasons for proceeding in this way; the enemy fighter will have difficulty acquiring a guns angle on you at 700 kph. All Allied aircraft excepting the P-40E-1, P-39L-1, and P-47D-28 have dive speed limits near that of the Ju 88 A-4. Your AI gunners, on the other hand, will have no problem firing at him throughout the dive if he is within range. If the enemy aircraft goes out of range, by raising your dive angle and slightly slowing your speed to 600 kph/500 kph you are extending the horizontal distance potential of your dive. If the enemy decides to re-engage, return to 700 kph and he will be right back in the same situation he was in previously – diving at 700 kph while being fired at.

In a continuous dive at 700 kph, the Ju 88 A-4 will travel the following approximate distances from the following altitudes before descending to treetop level:

6k - 23 km *5k - 19 km* *4k – 15 km*

The goals of escape, as always, are to get back over friendly lines and then to a friendly airfield. If you dive down to treetop level and are still being pursued, use the evasion techniques highlighted in **Subsection 7.1.3**.

A-20B: Dive defense procedures for the A-20B are very similar to those of the Ju 88 A-4, and with the same dive speed of 700 kph. Close the outer cowlings and set trim to nose-heavy -35. Unlike the Ju 88 A-4, you cannot jerk the stick around at high speeds in an A-20B. Make dive angle adjustments slowly and smoothly.

The biggest difference when applying this technique in an A-20B is the opposition. The dive speed limit of all Axis fighters is 850 kph. Not all Axis fighter pilots know this, however, and Bf 109 aircraft can be difficult to handle at 700+ kph speeds. The Fw 190 handles better at high speeds, on the other hand, and may be able to close and get some accurate shots at your aircraft. Even so, a 700 kph dive is the fastest way to get back over friendly lines.

Pe-2 ser. 35/87: The dive speed goal for the Pe-2 is 770 kph, not to exceed 790 kph. Close the radiators and set trim to nose-heavy -20. Even though Axis fighter aircraft possess a higher dive speed limit, their Air Speed Indicators terminate at 750 kph. Forcing the fighter pilot to exceed that marker will be an uncomfortable experience for many, if not most – especially if they are also facing fire from the Blister turret.



In a continuous dive at 770 kph, the Pe-2 ser. 35/87 will travel the following approximate distances from the following altitudes:

6k - 21 km *5k - 15 km* *4k – 13 km*

7.1.4 From the Fighter Pilots Themselves



To gain a greater insight into the thought processes of the people dedicated to shooting me down, I contacted several top fighter pilots in the highly-competitive and extremely punishing Tactical Air War (TAW) server. These are players who not only achieve many air kills, but also keep their own deaths and captures to a minimum. Many are also superb Ground Attackers. They routinely finish near the top of the pack, campaign after campaign. I have played with or against all of them in TAW, and have tangled directly with many. I was interested to know their individual opinions on Ground Attack aircraft toughness and defense capabilities, and their personal attack techniques against Ground Attack aircraft. I also wanted to know their thoughts on attacking Ground Attack aircraft formations, and their impressions of the most common mistakes made by both sides in Fighter vs. Ground Attacker confrontations.

I sent a questionnaire containing nine questions to 20 players and received replies from 14. Some answers were short, others were lengthy with extremely well-thought-out explanations, and provide some very interesting perspectives.

Much like we all experience life, we formulate our perceptions and opinions of the myriad aspects of the multiplayer environment through the limited perspective of personal experience. It comes as no surprise, therefore, that while there was consensus on many answers, there were many contrasting points of view on the resilience of the different Ground Attack aircraft models and the effectiveness of their defense capabilities.

The most surprising answer to me was that many found the A-20B to have a strong damage sustainment capability, while my own experience flying the aircraft in multiplayer environments has been that it crumples fairly quickly under enemy guns and tends to catch fire easily. But many did opine that the A-20B's defensive armament was quite ineffective.
Many of the participating fighter pilots do not speak English as a first language and spelling and grammar have been repaired in places, taking care not to alter or detract from the point or idea communicated.

All answers are posted without revealing individual pilot identities. The participating pilots were:

1st CL/Hien	*=FSB=HandyNasty*	*MeoW.Scharfi*	*SCG_Polo*
Der Sheriff	*=FSB=Man-Yac*	*No.64 Drifter*	*SCG_Sinerox*
F/JG300_Faucon	*=LG=Leutnant_Artur*	*=PHX=-Geo-*	
=FEW=N3croo	*=LG=Mad_Mikhael*	*=PHX=SuperEtendard*	

#1. What do you think are the top three IL-2 bomber/attacker aircraft in terms of damage sustainment capability?

1.**Pe-2** 2.**IL-2** 3.**A-20B** (sort of… tough engines, fragile tail…)
#1: **Pe2** (both Variants) #2: **IL-2** (all three variants) #3: **Ju88**
1. Pe-**2** 2. **IL-2** Number 1 is, of course, **Pe-2**. To my thinking, Pe-2 has a very strong fuselage AND it is multiplied by other attributes: speed and agility, resulting in very good ability to soak up damage. Then nothing, nothing, nothing, and in a (distant) "second" place I would put the **IL-2**, but if you are unlucky (as an IL-2 pilot), you will get hit in tail on the first pass, causing loss of control over the elevator and since IL-2 is nose heavy, you are diving straight into a ground with a big boom at the end. But other than that, IL-2 can take a lot of punch. That's why my advice is: fly low & slow - like two meters above the ground. Even if you lose the elevator you will survive. Besides, you are harder to hit flying that low. Can't point out next one, nothing stands out more than the others.
Pe-2 (both variants). 2) **He 111** (both variants). 3) hard one, between **Ju 88** and A-20. I guess Ju 88 because A-20 has a weak spot at the tail controls.
1.**Pe-2** 2.**Il-2** 3.**Ju88**
1.**IL-2** 2.**Pe2** 3.**Ju88** (note that it is easier to put a sustained burst into a IL2, hence it's it easier to shoot them down than a Pe2, but in sheer amount of punishment, IMO the IL2 takes more punishment
1.**IL2** 2.**Pe-2** 3.**A20**
Pe-2; **IL-2** and **Hs-129**. If you consider about the fighter/attacker, then the Lag-3 and P-40 can also in the list.
1.**A20** 2.**Pe2** 3.**Ju88**
The il-2, **The Pe-2** (very fast, sturdy, good defensive armament). **The ju-88**
1.**Il2** 2.**Pe2** 3.**Ju 88**
Overall the **Pe-2** is “top dog.” The **IL-2** certainly take a crapton of spread-out hits but is ultimately very vulnerable once people target one spot, using much faster fighters. The **A-20** is very rugged in many places, with very good engine nacelle design, but the tail is very minimal.

#2. What do you think are the bottom three IL-2 bomber/attacker aircraft in terms of damage sustainment capability?

1.**Hs 129** – no gunner, much of the time a clear shot, slow, one engine not enough to carry the plane, you often get an easy approach. I know it’s about ‘damage sustainment,’ but the Duck has problems in avoiding damage in the first place. 2.**He 111** – slow and easy to catch, bad cockpit armor, the Russian armament can clear the entire cockpit easily, one engine basically not enough to carry the plane. 3.**Bf 110E** – the pilot sits horribly elevated and gets sniped easily. And (it) likes to burn and snap wings.
#Worst: **He111** (both variants) #2nd Worst: **Ju87** #3rd Worst: **Bf 110**
1. **Stuka** 2. **Bf 110E** 3. **He 111**
Hard to say.. I think, **Ju-87** and **BF-110 E-2**.
1) Fw 190 jabo (F-3, since the F-8 is quite strong). 2) **IL-2** (all variants) 3) **Hs 129**
1.**A20** 2.Bf **110** 2.**Henschel 129**
1.**Hs129** 2.**He-111** 3.**Stuka** (note that I consider his from the point of view of a fighter pilot : the duck might be really good at tanking ground fire, but I feel it's terrible at tanking shots from an interceptor)
1.**Stuka** 2.**Bf 110** 3.**Hs 129**
3 bottom are **Hs 129**, **Stuka**, and fighters which are ground attack capable - 109s for instance.
Ju52, **Ju-87** and **He-111**.
1.**Stuka** 2.**Hs129** 3.**IL2**
The Ju-87 (not sturdy) **The Hs129** And for the third one I find it hard, between the **110e2 and the 111h6,** however going in to details here isn't so relevant since they are decent compare to the other two.
1.**Ju-87** 2.**Bf-110** 3.**He-111**
Hs 129

#3. Which IL-2 bomber/attacker aircrafts have the most effective defensive armament?

Pe-2 by a long shot, due to (weapons) caliber and arc of fire. I generally don't like to attack any planes with defensive armament from behind since the gunners are all equally good (or sometimes bad). The caliber and the firing arc are the difference – the areas where the Pe-2 ser. 87 excels. The .50s of the Pe-2 are scary. Other than that I don't like to attack **Stukas** or **110s**. The firing arcs are kind of weird sometimes and the gunner AI can hit (you) in a split second. Often the results aren't that devastating, and they don't stop me from shooting the target down, but they end the sortie; with (plus) the occasional engine kill or pilot snipe.
The answer as most answers will be - the **Pe-2**(both variants) but I usually fear all planes with gunners since they often hit from dead zones or at least inhuman reactions #1 **Pe2** #2 **IL-2M 1943** #3 **Ju87**
1. **Pe-2** 2. **IL-2** 3. **Bf 110G**
First place is again **Pe-2 s.87**. Mostly for the same reasons as above. On paper maybe it is not the top defensive firepower in Great Battles, but overall is a very good aircraft: fast, nimble, small target, good and easy to operate, armament with good fields of fire. I would never pay attention to that, but after flying A20 and those terrible defensive guns with a long time to deploy, I'm appreciating weapons that are immediately ready to fire.
1) **Pe-2 series 87** 2) **He 111 H-16** 3) **Bf 110 G-2**
Pe-2/He 111/Ju88
Pe-2 with blister turret, **Ju88**, **He111-H16** : - **Pe2** for obvious reasons (good gun, good covering arc) - **JU88** actually has decent defensive armament (and I am convinced there would be a lot of whine if it had a 13mm in the top turret), - **He11-H16's** top 13mm really hits like a truck. if only it was faster / more durable
Pe-2
For me its **Ju88**. It is the only plane that always damages me while attacking it. Moreover, **Ju87** and its rear gunner do the work as well. Finally later version of **He111** is deadly too because of its better defensive armament.
Pe-2, **IL-2** and **A-20**.
Pe2 for sure
The Pe2 especially with the blister turrets, they are no question about it, the 12,7mm they carry and their ballistic is just too much for German fighters. **The He 111h16** also has very good defensive armament with the 13mm, however I barely ever went against them, I heard that from other pilots. **the 88** is up there as well however 7mm usually not as effective against Russian planes.
Easy: **Pe2**
1.**Pe-2** 2.**Ju88** 3.**Bf110G2**

#4. Which three IL-2 bomber/attacker aircrafts have the least effective defensive armament?

1. **IL-2** – they rarely hit anything (I think it's the difference and I think the firing arc is bad). 2. **A-20** has the worst defensive armament in the game. I was never hit by the gunners. 3. **He 111** are easy to take out because you are usually much faster, and you can attack at favorable angles. - You may wonder why there is no Stuka – the gunner can be nasty for some reason. I think the firing arc is good.
(all tailgunners are dangerous especially flying straight) #Worst: **Bf 110 E** #2nd Worst: **He 111 H6** #3rd Worst: **IL-2 1942** with tail gunner modification
1. **Ju 88** 2. **He 111** 3. **Bf 110E**
The first and second place is **BF-110 E-2** and **A-20**, not sure yet which one is the shittiest. Their defensive armament is just useless. The third place goes to the **IL-2 mod.42** gunner.
1) **IL-2 1942** (ShKAS gunner modification). 2) **He 111 H-6** 3) **A-20B**
IL-2 1942, **Bf110E**, **Ju87**
1.**A-20** **2.IL-2** 3.**Bf110** - A20's low ammo count per reload and the slow gun deployment really negate the fact the top gunner has good arc and a 0.50 cal (I've never even been hit by the top gunner of A20) - IL-2 the gunner is almost useless except for calling out enemies - Bf110 has terrible arc but can hit from time to time
1.**Bf 110** 2.**Ju 87** 3.**Il2**
Its **IL2** and **Pe2** (if you know how to attack properly).
Hs 129, **Ju-87** and **He-111**.
Ju88
Ju 87, **Bf110**, **il-2**. The first two is because their 7 mm is too weak and they only 1 pair of guns. The il-2 is because the gunner is very easy to kill.
1.**Ju-87** 2.**He-111** 3.Hs-129
Anything with limited magazine capacity, gun angles, and exploitable speed. Hence: **A-20**, **Ju 87**, **He 111**, or **Bf 110E-2** (if outdated and easily outpaced).

#5. Do you frequently utilize a specific, single method to engage enemy bomber/attacker aircraft?

Yes, but there isn't "one" tactic since the situations are so different each time. But it boils down to: Ideally, I get a head on against level bombers or attackers which are en-route. A nice 20° up/down and a small, horizontal offset is ideal to get shells into the cockpit - or into the engines. Often this is not possible, and I have to attack from behind. Then I like to attack 25-45° from the side and above. (4:00 to 8:00 attack). But I like to vary the attack patterns depending on the situation. The more deflection you get and the more time you get on target the better. This is the reason that against all ground attackers it's nice if you have the opportunity to land "top down" attacks (which are very effective) when they pull up or turn. The hits are highly effective, and the attack is 100% safe. One of the reasons I sometimes time my attack and wait until a ground attacker does his first strafing run is so I can get a good shot when he turns.
The best is of course to head-on bombers or attackers; even IL-2s as long they don't see you. Otherwise attack them when they are turning. But enemy Bomber/Attackers that fly straight all the time are really dangerous, and I attack them very, very fast from above or from longer ranges. But the chance for success is quite low being alone.
I use all types of engagement angles and tactics depending on the scenario and what plane I'm flying. For Pe2s, I go in from below and in front and shoot their cockpit, trying to kill their pilot (I know how terrible that is, but its the only effective reliable way to do it on a first pass without 30mm or luck) Il2, shoot their tail with a few 20mm and their control rods break and they smash into the ground. Don't come in too fast on an il2 or you will ram it, and don't (this is with all planes) stick on it firing for too long, you gain speed and get close and can't pull away (same thing with dive). If I'm forced to fire on a pe2 from behind, as soon as I see their tracers getting close I disengage and pull away and let my buddy get a shot - and then go back in. I aim for engines or tail gunners.
Aiming for a specific part, like a left engine, or a left wing.
In general, just quick passes, never sit on the six for too long. For Pe-2s quick slashing passes from 3 or 9 o clock if they don't maneuver.
I fly Luftwaffe fighters only, so I will describe attack on Russian bombers/attackers. In general, I try to attack: a) one-engine attackers from behind and higher. b) two-engine bombers I prefer the same type of attack + head-on attack from bottom or attack from one/two or ten/eleven o'clock.
I use typically two strategies to attack attackers/bombers that I don't see often - or at least I think so: **1. Bombers in level flight:** Fly in their high 12 o'clock, in same flight path as them. Like 1km-3 km in front and 1km-2km higher. Then proceed to split S on them. * Gives a high-angle attack (I'd guess 50-80 degrees), lots of surface area to hit, and hard angle to get hit * velocity differential is big enough * velocity itself is about 600kph-650kph indicated for a 109, as such controllability is still acceptable * Landing shots under such high deflection is not easy, but hits will do more damage than from dead 6 o'clock (typically) * allows for reclimbing back into high 12 of said bomber and recommence subsequent attacks rather rapidly in same fashion **2. Attackers:** Typically, I try to intercept them before they reach objective (on serious server like TAW). Otherwise I proceed with the following: *** Case 1:** attacker does multiple passes over target : aim to dive in such way that I can shoot when attacker is turning around (positive G's), as it makes flight path predictable *** Case 2:** attacker does only 1 pass and gtfo at 600kph (typical for TAW server): ignore those. Issue here was to not intercept them before they started run - I know it sound bitchy but attacking a Pe2 on deck towards their base at high velocity is just a great way to not get back with plane/pilot. Typically, when such things happen, I cover the fighter attacking the Pe2, as the Russian fighters invariably will show up
Yes, it depends on the bomber, Peshkas i attend to attack from same altitude and to the side. while something like a Bf 110 or Il2 You can stay on its six with little worry of the gunners doing much damage
Actually I have two methods to attack bombers one is safe and second is very aggressive single flyby attack.
Theoretically it depends on what aircraft I am in. In Fw-190 or in 109, the attacking method may be a little different, the latter surely may be more careful. However, most time, I prefer a "specific, single method" to attack slow targets and deflection shooting is effective.
When they are turning at low speed on the objective after a pass (easy 90° deflection shooting on a slow target, so gunner can't aim you).
My favorite tactic is a head down from above or below whenever I can for medium and heavy bombers, however you need to find yourself in a good position from the start. If I am not in a position to go for the head on and the bomber is at high altitude I get above in front of him and start my dive there, when I get to him I should be right above him, so hard to get hit by gunners and provide a large target to aim, however you still need a good aim to achieve this. Of the bomber is at low alt I go from the 3 o'clock so when I get to him I am in his 4 or 5 o clock. If neither is possible, I aim for gunners in fast passes and just sit on their 6 when the gunners are dealt with. (Always do it from high six to kill gunners at very fast speed, never sit behind until gunners are dead).
Yes, two methods, very high angle from his six o´clock, and sometime low angle from 8:00 or 4:00 but this is most effective with the Fw-190.
I do a combination from low passes at high speed with a long approach in order to avoid detection, and regular attacks from above but not very steep. Trying to make a decision on which attacker to approach rather freely and not pre-determined in order to get a good angle on an unsuspecting target while keeping my energy.

#6. Do you modify that method depending on the type of aircraft you are attacking?

Yes. against aircraft with only one gunner like the Stuka,110, or Il-2 I sometimes like to attack from below and try to get the engine or radiator from there. But often they are on the deck anyway, there the attack is not possible. Against Pe2s I have by now a rigid “policy.” I try to stick as close as possible to “ideal” attack patterns and avoid sloppy ones. Only if the firing solution is good do I proceed. I sometimes fire from long ranges to damage the engines. Against other ground attackers the 4:00-8:00 attacks are sometimes more sloppy, and sometimes even ignored.
The logical answer would be yes, and I do when the I am able to head-on a Bomber, but usually I just simply attack and others do it as well, even they don't admit it.
Yes as said above (Question 5).
Yes, if it's a one engine aircraft I'm aiming at the wing root. If it is an IL-2 I think it's better to aim at the tail.
As above, with Pe-2s and specially s.87 I prefer to engage from the sides to avoid exposing to the gunner.
(see answer to Question #5)
Only occasionally. Sometimes I approach a Bf110 and Stuka from low 6 in their blind spot to avoid gunner fire.
Yes, as stated in Question #5
In matter of bombers/strikers not really. The only exception are fighters.
Sometime, or most time, I do not modify my attack method. Though it is well known that IL-2's weakness is its abdomen, I just waste my ammo on the well armored body in the real fight.
I use it mainly against well defended bombers (Pe2 and IL2 with 12,7mm).
I think my previous point explains enough, I do. I have 0 respect for il-2, stukas, 110. I just do quick fast passes on them and I usually kill them. On il-2 you have to aim at the same points everytime because it is very sturdy. For all other planes that I respect I do what I mentioned on Question #5.
Yes, if it is a Fighter enemy, i follow at his six low, and shoot them when i close to him . If the enemy is a Bomber, i climb 1k mts over it, at his side left or right, finally when my wing cover at him, it’s the time to attack.
Exploit gunner angles and approach angles to expose vulnerable areas.



#7. If you come upon a formation of 4 Pe-2 aircraft in a very tight formation, not evading, obviously intending to use their collective rear gunner capabilities for defense, would you engage that formation? If the answer is no, would you take on a formation of He-111s, Ju 88s or IL 2s relying on the same arrangement for collective defense?

Yes, I attack assumed there are no other factors to consider. Non-evading Pe2 are in fact easy to take out. And I expect after the first pe2 goes down the formation will break up. The gunner itself can be avoided, a pe2 is only really dangerous if the pilot denies you good attacks. A group of 4, flying strictly in a formation can't do that, though if they are all on the deck attacking might be difficult.
Yes, I would attack them!
Yes, but I'd be conservative in my attacks, go in front only! - or take long-range snipes from behind. As a Russian flyer, if I found a group of any German bombers together, yea no problem taking them out!
I would engage but only from above them (like 90 degrees) or head on. No flying even at mid-range at their six.
Yes, I would engage them. With attacks from the sides you can hit all four planes in a single pass without being exposed too much. Last TAW I engaged a 3 Pe-2 flight like that and with the help of other fighters they all went down
It depends on situation. When Pe-2 are arriving to the target I try attack them. If they are on departure, I must have good attack position. Long closing on their six is suicide...
I'll answer this question in the case this would be happening on a serious server like TAW: 1. If the formation is close to it intended target : I would fly inside the gunner trigger range (800m?) on the side of the Pe2's, dipping in and out of their arc while trying to get into their high 12 o'clock. The idea behind this is the following: A) I make them nervous and prone to lose formation. When gunners are firing, the Pe2's will most likely jostle their planes around a bit for evasive even though they don't see their attacker. B) I gradually put myself in good position to attack them (high 12, and then split S unto them). Since target is close, I actually don't expect this to occur, as I don't have the time. C) the gunners shooting attracts other defenders, as tracers are highly visible. The idea is to get to swarm them D) Note: I won't ever park myself on their 6. If I can perform attacks from high 5-6-7 with sufficient speed difference, I'll shoot from farther and break at 200m+ distance. 2. If the formation far from its intended target: climb onto their high 12 o'clock, easily 1500m higher in altitude and then split S unto most isolated plane, trying to get him from high 7 or 5 at high angle. A) The idea here is that I have some time to put myself into a good attack position, as such I can reach a position from which I launch attacks: * with high speed but not 750+kph speeds (indeed, the Pe2's will be going ~380 kph indicated at 5k if I recall correctly, as such a dive at 600kph indicated is sufficient in speed and at those speeds controllability is correct) * with good safety as I come from high 5-6-7 * and good firing solution since I come from high up the plane offers alot of surface I can touch (compared to being parked in the 6 which offers low surface) B) Once in position for the first attack (which takes some time) , subsequent attacks come in relatively rapidly. So, while patience is required, it pays off C) A way for the Pe2's to defeat this tactic is to start a slight dive whenever they see me dive, like 10 percent nose down. Them speeding up would: * flatten my trajectory compared to them, making my run from less high and thus less safe and providing a less suitable firing solution * decrease velocity difference * increase the speed i have to go into the dive, probably reaching speeds where corrections are harder to pull off * a negative side effect could be the formation becoming more loose / breaking up during those slight dives
I would not as one Pe2 gunner by itself is ridiculous. Our squad avoids Peshkas unless it's a must to destroy them. Now if it was a formation of Bf 110's, He 111's, Ju87's, Il2's, etc., I would engage as the gunners are really ineffective.
I would definitely attack both groups.
I tend to avoid attacking such Pe-2 formation directly. In fact I will broadcast its location and direction in the channel and ask for more help (or ask for someone brave to act as "cannon fodder"). If some IL-2s make a good formation on the deck level, I will also fly high and wait for my opportunity because IL-2 can easily use its cannons to shoot the passing Luftwaffe.
No except if I can do a head-on pass, or if I don't care about losing my aircraft. For the second question: Yes but I would still be careful (high speed pass).
If I have the energy when I encounter them, and they haven't released the bombs I go for them. They usually fly at high alt so you can make very good passes on them, and keep diving after your pass to avoid gunner fire. Best is head on. I explain this on point 5. Pilots should rarely ever bother chasing them after they released their bombs, they will dive away, you will take forever to catch them, very hard to make good passes, they will cover a lot of ground fast and you will find yourself deep in enemy territory before you realize it.
No, only me (alone)? definitely no, this is always bad news because they probably are not alone. Same for another planes, is very intimidating, and we have very bad experience attacking planes in formation, because always have enemy escort.
If I can set up a good approach, I don't see why not. No plane is invulnerable and has weak points and ways to engage it.

#8. What do you think is the biggest mistake ground attackers/bombers make when being engaged by an enemy fighter?

Turn too hard in evasive maneuvers to avoid a gun solution. The gunners can't shoot under high G. And for me that is an invitation. Slight weaving, or wobbling is better. Or a steep dive if possible, but no sustained hard turns. Same goes for prop hangs, they might get the fighter, but often get grilled by the wingman.
Flying alone towards an enemy objective or turning too much (not the same as evading shots - more like turning hard) when there is certainly no hope to outturn the attacking fighters.
They pull hard turns. Especially when they're in an Il2 or PE2 it gives me a great angle on them, and their defensive gunners can't shoot me as well. They shouldn't turn, but keep moving in a straight or banking line if they can't go straight.
Trying to break but at the wrong time. Instead of shaking off an opponent they are presenting themselves as a big juicy target in front of enemy guns.
If the plane has bad gunners then staying still, waiting for a miracle. If the plane has good gunners... well it's a tough choice, I guess maneuvering too hard so that the gunner isn't effective anymore.
Long and stretched climb or turn.
Pulling positive G's for more than several seconds when having a fighter bouncing you. Makes flight path computable and increases surface area that can be hit. As such, never turn with fighter on your 6, but 'jostle' plane around. Or if in a decently maneuverable attacker (Bf110G-2 for example), proceed with fighter-like evasive maneuvers.
Turning after being hit
They are flying in spread formation and often without any formation. It really makes our (fighter) job very easy.
Turning sharply or break in the wrong time will put them into a danger position. On the one hand, the defensive gunner has a limited shooting angle so he cannot shoot back, and in the meantime, wrong maneuver will expose more larger valuable size of aircraft. So I will only try some negative G maneuver when I am in a attacker/bomber and chased by a bandit.
Trying to climb behind a fighter. Even if sometimes they hit the fighter, most of the time they are getting shot down while falling out of speed.
Flying in a straight line, losing all their energy, making hard turns, being predictable.
Turn, because let me shoot easily, he exposes all of the plane and his gunner don't work very well in this position.
The biggest problem I observe is the idea of a static Attacker or Bomber: If you don't have a low speed difference and tail gunners, you need to dodge like every other plane or at least present a bad angle by flying low against an incoming speed attack or shield critical areas. Particularly the Luftwaffe flying pretty maneuverable Bf 110s and Stukas purely will try to rely on their tail guns when they can simply get out of the way instead of sitting there waiting for their tail gunner to save their butts.

#9. What do you think is the biggest mistake fighter pilots make when engaging enemy ground attackers/bombers?

Going dead six hoping they dont get hit.
Flying too close towards enemy bombers with tail gunners.
They build up to much speed and then ram the bomber - my wingman does it all the time. And they stick on to the bomber to long, they then take critical damage and have to rtb or die. Or they get to close before opening fire.
Not being a patient* and underestimating opponent / AI gunners' unpredictability. *You need to take time when approaching enemy bomber/attacker correctly. And the point is, you probably will not have this time. What I mean is, if there is no possibility to attack those 4 Pe-2s from directly above, it's better not to.
Sitting at their six o'clock for too long.
Same answer as #7 - long closing on six (If enemy has a rear gunner)
For TAW server or other serious server: Attacking bombers when said bombers are above/near their target. It is way better to intercept bombers when they're on their route to objective.
Attacking from behind
They are attacking from bombers/attackers 6 with low energy.
Actually there are three of those mistakes: 1. A fighter's approching speed is too slow, so any dive attack under 400km/h is not suggested; 2. Staying on enemy's six too long and too close is extremely dangerous, especially for the Bf-109's vulnerable engine, so a fighter should disengage around 200m; 3. Just focusing on the fight and forgetting environment awareness, every time before and after an attack, a fighter must check his six.
Turning with attackers.
Sitting on their 6 like idiots. Not aiming at the right place. Chasing them after they release their bombs (that depends on situation ofc).
Shoot behind his six o´clock without energy or high angle, or shooting him from low.
Lack of good approaches, target choice, and exit/re-engagement strategy. Attackers/Bombers mostly carry a crapton of guns and will have low wing loading with payload dropped. Treat them (Ground Attackers) as a slow fighter – not a free meal.

7.2 TANK BUSTING IN THE Ju 88 A-4 / Pe-2 / A20-B



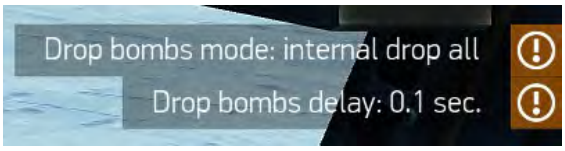
The most effective method to destroy a tank column is the multiple pass approach, most efficiently executed by the IL-2, Ju 87, Hs 129 B-2, and Bf 110 G-2 armed with the BK 37 cannon. There are two drawbacks to this approach: 1) the necessity of completely eliminating the column AAA prior to concentrating on the tanks, and 2) the tank busters' prolonged exposure over enemy territory.

An alternative, one-pass-and-gone tank busting approach is most effectively carried out by the Ju 88 A-4, Pe-2 ser. 35/87, and, most impressively, the A-20B. While there are differences between these three aircraft that must be taken in account, the basics of the technique are identical.

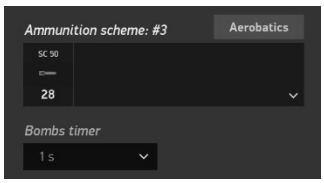
7.2.1 ORDNANCE LOADOUTS and SETTINGS

Aircraft	Loadout	Bomb Drop Delay	Bomb Timer
Ju 88 A-4	28x SC 50	.1/.05 (short)	1-second
Pe-2 ser. 35/87	10x FAB-100M	.25/.1 (short)	1-second
A-20B	16/20x FAB-100M	.25/.1 (short)	1-second

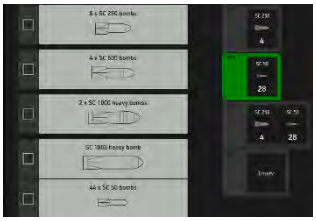
7.2.2.1 Loadout.



Ju 88 A-4. The 28x SC 50 bombs are located in the fuselage bomb bay. This centralized bomb location allows a more accurate, linear bomb drop compared to wing-mounted bombs. The .05 Bomb Drop Delay setting makes for a short but dense blast line. The .1 setting extends the blast line out approximately three times longer than the .05 setting, but the spread distance between bombs is correspondingly greater. There is also a greater possibility of bombs skipping off the road.



The 1-second bomb timer is mandatory regardless of aircraft or ordnance loadout. Although bombs may "stick" into their first impact point with the ground, most of the time they bounce and skip off the ground in a forward direction slightly left or right. A 1-second delay simply minimizes the distance traveled after initial impact, hopefully keeping the bombs in the vicinity of the column vehicles until detonation. A longer delay will allow the bombs to fly off the road much farther, and most will explode harmlessly, far away from the vehicles. If the bomb timer is set to "Impact," the bombs will destroy your aircraft.



There is an option for the Ju 88 A-4 to carry an additional 16x SC 50 bombs on the center rack beneath the fuselage. These bombs cannot be dropped individually, and there is no Bomb Drop Delay option for them. The extra dive time required to drop them after the 28x SC 50s will put you in a situation where you either start bomb release at a higher altitude, which is detrimental to accuracy, or drop the 28 SC 50s at normal drop altitude and drop the 16 wing-mounted bombs at very low altitude after dive recovery and flying parallel over the column vehicle, where they will promptly scatter off the road at any speed above 550 kph. They also cause significant drag on the aircraft in flight. It is highly recommended to stick with the 28x SC50s.

Pe-2 ser. 35/87. The Pe-2 carries six FAB-100M bombs in the bomb bay and four under the fuselage. All bombs can be set with a Drop Delay. The .1 delay setting place all 10 bombs in a very short and dense blast line, very similar to the 28x SC 50/.05 setting on the Ju 88 A-4. The .25 setting creates a longer blast line while sacrificing some blast line density.

While the FAB-100M bombs are twice as large as the SC 50s, there are only 10 of them. If the vehicles in the column are spaced apart at wide intervals, mission success is often up to fate. An accurate drop putting all 10 bombs on the road at .25 delay setting may result in several tank kills – or none.

A-20B. The A-20B's massive FAB-100M bomb payload capacity makes it the most effective single-pass tank killer in the series. It can carry 16 FAB-100M bombs in the bomb bay with an option to add four more to the wings. All bombs can be set with a Drop Delay. There are advantages to carrying the extra four bombs. As the wing-mounted bombs are released first, if the initial aimpoint is off the mark - slightly left or right of the road, two of the bombs will be on target. On the negative side, the bombs cause a good deal of flight drag. If getting to the Target Area quickly is a priority, better to leave them behind. A .1 bomb drop delay setting will produce results similar to those described for the Ju 88 A-4 and Pe-2 at .05 and .1 delays respectively, albeit with a blast line approximately 60% longer. This is a significant difference, and this setting can produce a high number of tank kills in some cases. With a little luck and proper nose angle a .25 delay setting is even more lethal, in spite of the reduced blast line density.

7.2.2 ATTACK DIRECTION

The first rule of thumb is *always attack the tank column from the rear*. This is because the Axis Sdkfz-10 Flak 38 and Allied ZIS 5-72 mobile flak guns face toward the front of the column. If



you attack from the front you are proverbially putting your head in the lion's mouth. When you approach from the rear in a high-speed dive, the flak guns must turn 180° to track and engage your aircraft. Some Allied tank columns also contain the rear-facing GAZ M4, but in terms of lethality the ZIS 5-72 is much more dangerous. The other reason for attacking the column the rear is that the bomb drop angle will often place small bombs just behind the weak rear armor of the tanks, enabling an easy kill. If dropped from the column front, the bombs will detonate into the thicker frontal armor, which will likely have no effect.

7.2.3 ATTACK DIVE SPEED – COLUMN AAA



The Attack Dive altitude and Attack Point distance to the column is based on the required Attack Dive speed, and that speed is predicated on anticipated column AAA type, number, detection range, and default facing(s). If all flak guns are facing to the front of the column by default, an Attack Dive that ends in a 650 kph speed at the time of bomb release will put the aircraft at the bomb release point before the AAA can turn 180° and engage. However, the AAA will fire at the aircraft on its way out of the Target Area.

If there are rear-facing GAZ M4 guns in an Allied column, the Ju 88 A-4 needs to attain a speed of 700 kph at the bomb release point.

Ju 88 A-4 Attack Dive Speed	**Engine Settings**	Attack Dive Altitude
700 kph	*100% ATA/RPM, Closed O. Cowlings*	2300m*
	Max. Continuous Power, 50% O. Cowlings	2500m*
The stated altitude is for warm weather conditions when the ambient temperature is 20° or higher. During subzero ambient temperatures the attack altitude can be reduced 10-20% depending on actual ambient temperature and level flight speed at the start of the Attack Dive.		

Even attacking at a dive speed of 700 kph, depending on the GAZ M4 detection range, there is no guarantee of not being engaged by GAZ M4 flak guns during the Attack Dive.





To date, the forward-facing Sdkfz-10 Flak 38 is the only motorized Axis flak gun in the *IL-2 Great Battles* inventory. Therefore, the Pe-2 and A-20B do not face a rear-facing AAA threat, and Attack Dive speeds in the 600-650 kph range are generally more than fast enough to beat the column AAA on the way in. Initial egress out of AAA range is a different story, however, and it is very important to execute evasive maneuvers until out of flak range.

7.2.4 TARGET LINE UP AND BOMB RELEASE

7.2.4.1 Pre-Flight Target ID. Take a good look at the tank column marker before takeoff. The marker indicates the location of the lead vehicle in the column. Determine the direction the column is moving, normally either toward a specific town or airfield, or generally in the direction of your team's territory. The column vehicles will be along the road behind that map marker.

7.2.4.2 Attack Point Location. Most of the time the section of road where the column is located is not perfectly straight. Scan the stretch of road on the map where the column is located and identify all curves and turns. Pick the section you intend to hit and put the Attack Point in alignment, from the rear of the column with the direction of the targeted road segment. The Attack Point should be *2.5-4 km* behind the column to provide enough time to start the Attack Dive with an accurate line up. Because it is critical to attack the column from the rear, you must extend a few kilometers deeper into enemy territory to get into position; there is simply no way around that inconvenience. Refer to **Subsection 2.4.4** for ingress movement tips to minimize the possibility of enemy fighter interception during the movement to the Target Area.
If leading a Flight Group, assign separate road sections as targets and make sure each pilot identifies the required Attack Point Azimuth necessary to align, from the Attack Point, with that specific road section.

The altimeter provides exact information on altitude, but it won't tell you when you are exactly over the planned Attack Point. With enough practice you can arrive at a skill level where you have a mental picture of where your aircraft should be in relation to the column when it is time to begin the Attack Dive



7.2.4.3 Set Yourself Up for Success. Dropping a long string of bombs down a narrow linear target while maintaining perfect alignment for the entire duration of a multiple bomb release is much more difficult than bombing a single point target. The difficulty is compounded by the requisite high speeds. If the Attack Dive is started with the aircraft nose pointing too far to the left or right of the column it will become increasingly difficult to make line up adjustments as the aircraft picks up speed. Even worse is to start the Attack Dive while still turning toward a column located 90° to the aircraft's side. The most important action you can take to ensure an accurate line up is to *start* the Attack Dive lined up with the road/column as closely as possible.

There is not enough time prior to the Attack Dive to flip back-and-forth to the map to assess the exact distance from your aircraft to the column. Practice and experience will imprint a mental picture of where to start the Attack Dive to get the desired nose angle from different altitudes.

7.2.4.4 The Attack Dive. The priority during the Attack Dive is to maintain alignment with the road by using the gunsight reticle, and to put the nose onto the dive angle needed to facilitate an accurate bomb drop on the section of road you intend to hit. If you are not assigned a specific road section and time and position permit, zoom in on the entire column and attempt to find a section where there are three to four tanks in a consecutive line.

7.2.4.5 Bomb Release Altitudes. The desired end-result of the Attack Dive is that when the last bomb is released, just prior to pulling out of the dive, the aircraft is above and aligned with the road with the nose pointed at a downward angle of 10-15 degrees. Working backwards to the

Aircraft Type	Loadout	Delay Setting	Mathematical Time	Approximate Actual Time
Ju 88 A-4	28x SC 50	.05	1.4 seconds	1.2 seconds
	28x SC 50	.1	2.8 seconds	2.41 seconds
Pe-2 ser. 35/87	10x FAB-100M	.1	1.0 second	.86 seconds
	10x FAB-100M	.25	2.5 seconds	2.15 seconds
A-20B	16x FAB-100M	.1	1.6 seconds	1.38 seconds
	16x FAB-100M	.25	4.0 seconds	3.44 seconds
	20x FAB-100M	.1	2.0 seconds	1.72 seconds
	20x FAB-100M	.25	5.0 seconds	4.30 seconds

point where the first bomb is released, the bomb release altitude is dependent on the amount of time it will take all bombs to clear the aircraft. And the length of time required to get all bombs out depends on the number of bombs and the bomb drop delay setting.
The chart shows bomb release time spans by simply multiplying the number of bombs by the delay setting. In practice, probably because sometimes two bombs drop simultaneously, actual bomb release time spans are approximately 14% shorter. Regardless, the more bombs and longer delay settings, the higher the bomb release altitude. Naturally, aircraft speed and dive angle also influence bomb drop altitude.

Consistently dropping bombs at the optimal altitude takes lots of practice, and there are eight drop altitude possibilities across all three aircraft. Practice and experience will help you to intuitively determine the time to release bombs.

While Axis bombs dropped from as low as 15 meters will arm and detonate, the Allied Pe-2 and A-20B pilots face an additional problem of bombs not having enough time to arm when dropped below 100-150 meters (actual altitude depends on nose angle). This leads to a disappointing outcome where the first few bombs dropped will explode, while the remainder, dropped as the aircraft extends the dive out to pull out/recovery, do not.

There are two scenarios to avoid: 1) A nose angle so steep that it prevents dive recovery and results in a crash, and 2) Having to pull out of the dive while bombs are still dropping. If forced

to pull out of the dive and maintain a level, 0° nose angle while the final bombs are released, those bombs will bounce off the road too high and too far away to do any damage. Climbing will throw the bombs haphazardly out to the front.

7.2.4.6 Aircraft Characteristics.

Ju 88 A-4. Aircraft handling starts to stiffen at speeds of 580 kph and becomes more pronounced as speed increases. Unlike the A-20B and Pe-2, this is not an aircraft you can pull around at 600+ kph and get an instant response. In the Ju 88 A-4, it pays to be aligned with the road/column from the beginning of the Attack Dive. On the positive side, once you are lined up, the aircraft will stay lined up (excepting high-wind conditions. See **Subsection 7.2.4.7**). There is none of the roll quirkiness found in the Pe-2.

The other major challenge to the Ju 88 A-4 is the nose trim. If not set to nose-heavy -60, the aircraft will pull up during the dive. However, if the nose angle is too steep in a 700 kph dive, you will have to crank the trim wheel to tail-heavy trim while pulling out of the dive to avoid crashing. Like many other aspects of this technique, practice and experience are necessary to master it.



Pe-2 ser. 35/87. The Pe-2 responds well during the attack dive. In fact, it responds a little too well. This aircraft will allow major directional adjustments during the Attack Dive until approximately 650 kph. The downside to this capability is that the aircraft is "roll-crazy" in the sense that it will roll from right to left at the slightest input during the attack dive. The tendency is so pronounced it often feels during an Attack Dive like you are diving through turbulence when there is none. This creates a situation where the aircraft may appear lined up, but the bomb bay is somewhat turned to the left or right, throwing the bombs slightly off the road and away from the vehicles.

Using the default trim setting, the Pe-2 will recover well at speeds less than 670 kph and nose angles less than 40°, but needs adjustment to tail-heavy +10% trim for faster speeds and steeper nose angles.

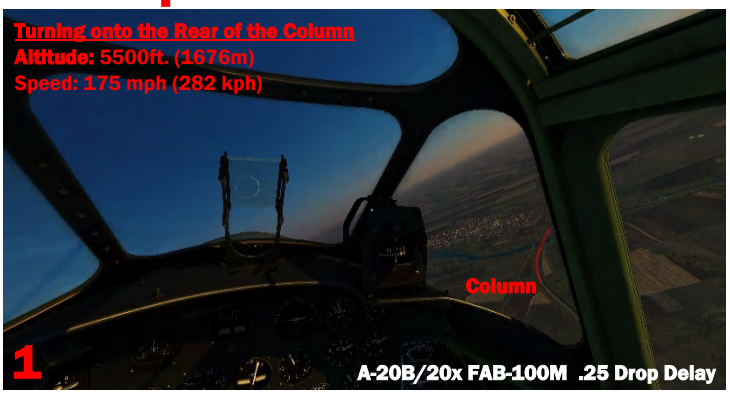
A-20B. This is the tank-killer *par excellence*. – not only due to its bomb payload but for its handling as well. It exhibits none of the Ju 88 A-4 stiffness during the Attack Dive. While it does display the roll issues endemic to the Pe-2, they are much less severe. The plane will dive and recover easily at a nose-heavy trim setting.

The A-20B gunsight displays a single red dot in the center without crosshairs or stadia. This does not significantly reduce the gunsight's effectiveness, but does force the pilot to mentally project a vertical line up and down the middle of the gunsight with the red dot in the center.

The aircraft's Achilles Heel is its low G-limit. If you pull out of the dive too sharply, it tends to lose a wing. This tendency requires a great deal of expertise regarding proper bomb drop altitude to ensure a well-timed release of bombs and smooth dive recovery.

Tank Column Attack Examples

Example 1: A-20B









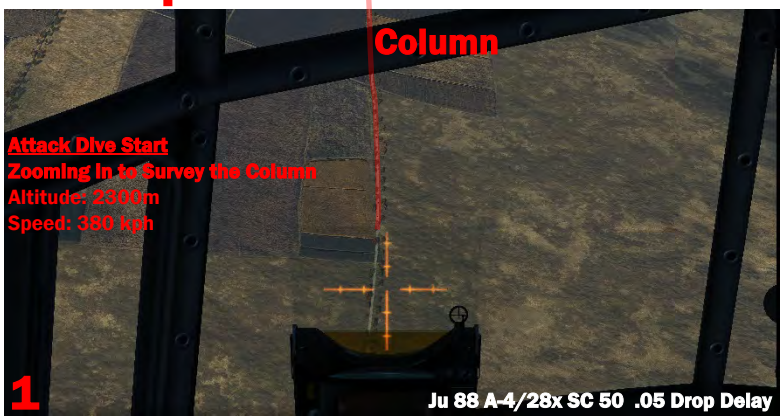


20x FAB-100M bombs at a .25 setting present the longest bomb release time of any loadout configuration listed in this Subsection and requires the highest drop altitude. Accuracy is problematic at higher bomb drop altitudes, and practice and experience are necessary to make accurate drops with this loadout configuration.

Note in Graphic #3 that the gunsight reticle is pointing ahead of the intended impact point of the first bomb while the center of the nose is squarely over the road. The distance will fluctuate depending on speed, nose angle, and drop altitude.

The column is located on a road with a slight curve. Note the slight turn to the right in Graphic #4 as the last bomb is released. It is very difficult to time an aircraft turn during bomb release to align with the curve. Another approach when targeting vehicles on a curve is to ignore the road and line up the gun sight reticle on the first and last tanks of the vehicle cluster you want to bomb.

Example 2: Ju 88 A-4







These Graphics reveal the capability of Axis bombs to arm and detonate when dropped from relatively low altitudes. While not mandatory, dropping lower gives the Ju 88 A-4 pilot slightly more line-up time compared to the Pe-2 or A-20B, and the closer drop proximity to the targeted road section engenders more accuracy. Note the 700 kph speed during bomb release – necessary to beat the tank column flak in the Tactical Air War (TAW) server.



Example 3: Pe-2

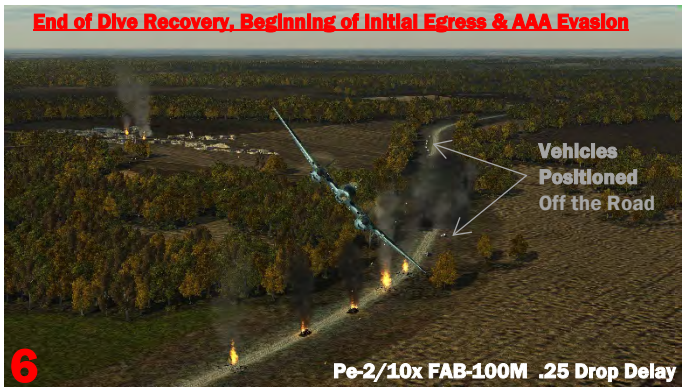












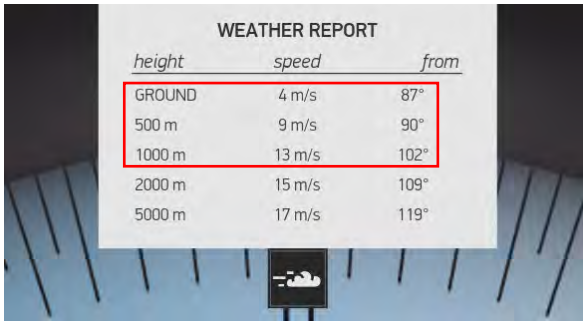
This attack was executed by 1x A-20B (yellow circle in Graphic #1) and 2x Pe-2 ser.87 aircraft. The cockpit view is from the #3 Pe-2 in trail formation. The #2 Pe-2 is not pictured. The shading of the column represents the Target Assignments of all three aircraft: Yellow – Lead Aircraft (A-20B), Orange - #2 Aircraft (Pe-2), Red - #3 Pe-2.

The Attack Altitude for this mission was approximately 2500m. Arguably, it should have been 3500m to achieve an Attack Dive speed of 750+ kph to get the jump on the Artillery Position flak co-located with the tank column. The problem with 720+ kph speeds in the Pe-2 is that the controls stiffen, making it more difficult to line up accurately with a column/road. What was done to get more Attack Dive speed from the lower 2500m altitude was to move the Attack Point much closer to the column, making for a steeper dive angle and faster acceleration during the Attack Dive – to the detriment of line-up time.

The Attack Dive started out of position – still turning during the dive to get lined up with the assigned road section. The Target Area was acquired at 1250m altitude where it became evident that vehicles at the back of the assigned area were to the right of the road, and vehicles at the front were on the left side of the road. The back vehicles were ignored and bombs were dropped, extending 5m off the left side of the road, gradually moving toward the road center.

7.2.4.7 Wind. Wind can be acutely problematic when employing this technique. You may start the Attack Dive perfectly lined up only to find you must make constant adjustments throughout the dive to stay aligned with the road/column. At bomb drop altitude, when it is too late to make corrections, you realize that despite all your adjustments on the way down, the wind has blown your aircraft too far to the side and your bombs explode too far away to do much destruction.

Correcting alignment for wind requires lots of practice.



- To begin with, do not rely merely on the server map page for wind information. Look at the wind data displayed at the top of the aircraft bomb sight screen for wind direction and speed between 1000m and the ground.
- Average the three listed speeds into a single ***Averaged Wind Speed***.
  *Using the example in the above Graphic, 13+9+4÷3=**10.25 m/s***
- Do the same for the wind "from" directions: *90+102+109÷3=**100.33°***
  This is the ***Averaged Wind "From" Azimuth***.
- Compare the ***Averaged Wind "From" Azimuth*** to the road azimuth to obtain the true ***Wind Angle***.

If the wind is blowing 70° to 110° perpendicular to the road direction at a speed of 5 m/s or more, it will play havoc with the Attack Dive target line up. The slower the wind and the farther the wind angle from 90°, the less effect it will exert. Extreme changes in wind direction or speed at different altitudes can have correspondingly significant effects on the aircraft heading during the Attack Dive.

The approach to offset the effect of strong wind is to begin the Attack Dive with the gunsight lined up to the upwind side of the road. Maintain that sight alignment during the Attack Dive, using a combination of aileron and rudder. If you use aileron-only the aircraft will be pointed 10-20° off the road angle at the bomb release point. As you near the bomb release point slowly let the gunsight crosshairs creep to about 10m away from the road on the upwind side. Keep the crosshairs 10m to the side of the road during the entire bomb release – *do not let the crosshairs drift onto or across the road* or the wind will blow your aircraft downwind of the road. Therefore, it is imperative that the aircraft nose drift toward the road is tightly controlled.

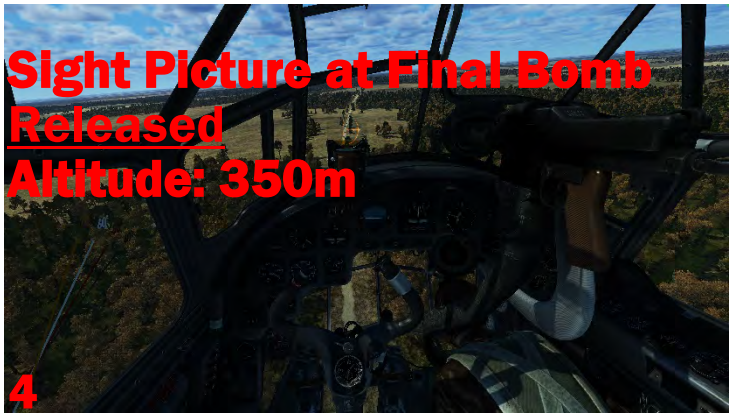
The temptation will be to move the crosshairs onto the road too early before bomb release, as instinctively it appears the aircraft is too far upwind – don't be fooled. The sight picture can be deceptive and does not clearly indicate how quickly the wind is blowing your aircraft to the side. Go against your instincts and keep the gunsight firmly on the wind side of the road. The wind will alter the trajectory of the bombs as well as the aircraft.

Example 4: Ju 88 A-4 Attacking in Strong Winds









WIND: 7 m/s Moving 90° Across the Road from Right to Left.

The road curves slightly to the right before it exits the forest. This something to keep in mind – often, many nuanced road curvatures do not display on the server map. Be prepared to encounter slight road curves in the tank column Target Area. These curves are significant because it is difficult enough to accurately put bombs down in a straight line on a road while moving at 600-700 kph. Pick your road angle at the beginning of the Attack Dive and stick with it until all bombs are out.

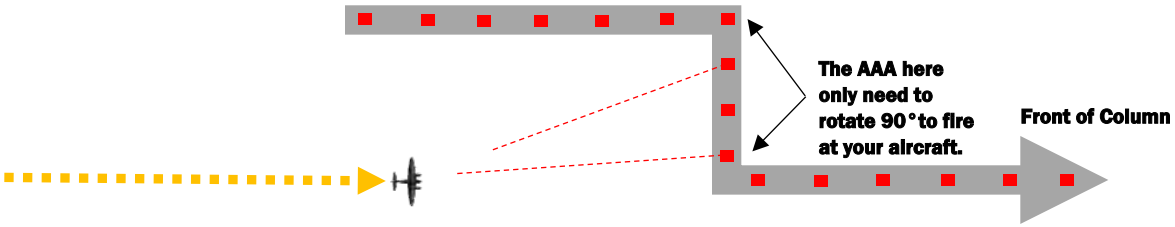
It takes some work to stay aligned with the road while keeping the crosshairs to the upwind side. Note that in Graphic #1/2/3 the crosshairs stay to the right of the road all the way down to the bomb release point. In Graphic #4 it looks as if the crosshairs drift to the left side of the road, but in fact the road curves slightly more to the right several hundred meters ahead where the gunsight is pointing.

Take a good look at the bomb impact pattern in Graphic #5. Even though the crosshairs were maintained to the right of the road throughout the release of 28 SC 50 bombs, the bombs actually landed on the left road edge. If the crosshairs had been on the road proper, the bombs would have landed 5 meters farther to the left. As stated in the last paragraph of **Subsection 7.2.4.7**, - don't be fooled by what you see through the gunsight during strong wind conditions. While the gunsight is very reliable in none-to-low wind conditions, it can trick you in these situations.



7.2.4.8 Final Reminders and Tips

- Always Attack the Column from the Rear
- Always Use a 1-Second Bomb Timer
- Get the Bombs as Close to the Tanks as Possible
- Watch for Vehicles Located Off to the Side of the Road
- If the Column is on an Intersection spanning Two Angles – Beware of Flak:



- If there are already Aircraft around the Column spinning up the AAA – they will probably pull the fire onto you:



7.2.4.9 Video Footage Click on the video links below for extensive multiplayer footage of Tank Busting in the Ju 88 A-4, Pe-2, and A-20B

Warning: Girls in bikinis at the start of each video.











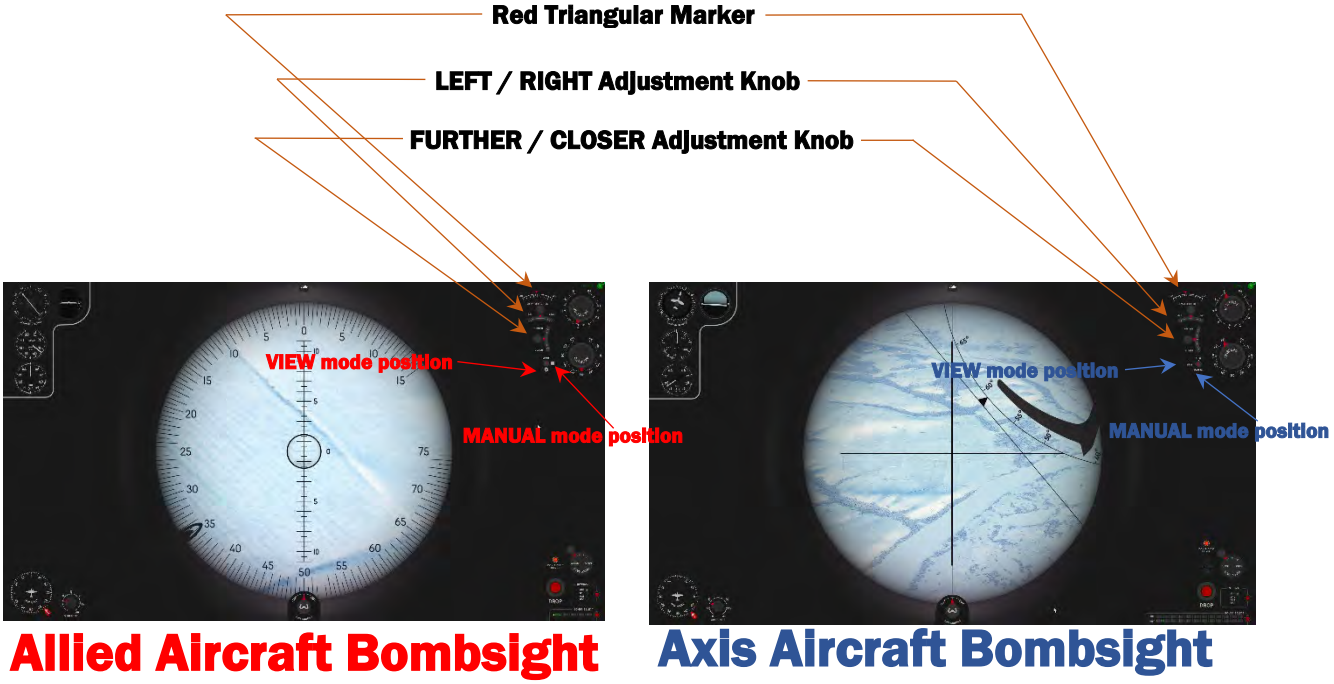
7.3 LEVEL BOMBING TIPS

7.3.1 Syncing the Bombsight VIEW and MANUAL Sight Pictures

(*In the Ju 88 A-4, He 111 H-6/16, and Pe-2 ser. 35/87, the following procedure can be performed while engines are starting. The A-20B must be airborne before it is possible to access the bombsight*).

If the VIEW and MANUAL bombsight modes are not aligned, you may have a nasty surprise when you switch to MANUAL mode to drop bombs after lining the aircraft up on the target using the VIEW mode. Depending on bomb sight adjustments, there could be a several-degree difference in the VIEW and MANUAL sight picture alignments. The MANUAL mode sight picture is the adjusted sight alignment based on the adjustments for wind speed and direction, wind angle, and aircraft speed/altitude. After setting the bombsight wind speed, wind angle, anticipated aircraft speed at bomb release, and altitude, it is important to synchronize the VIEW and MANUAL modes. To do this:

- ✓ **Go to the VIEW mode. Use the FURTHER/CLOSER adjustment knob to push the view all the way to the immediate front of the aircraft.**
- ✓ **Go to the MANUAL mode. Note the red triangular marker at the top of the VIEW DIRECTION indicator and its position.**
- ✓ **Go back to the VIEW mode to see the position of the red triangular marker.**
- ✓ **Use the LEFT and RIGHT adjustment knob below the VIEW DIRECTION indicator to adjust the position of the red triangular marker while in VIEW mode.**
- ✓ **Switch between VIEW and MANUAL modes while adjusting the position of the red triangular marker until its VIEW mode position is the same as its position in MANUAL mode.**
- ✓ **Once this is done, the VIEW and MANUAL modes are aligned and pointing in the same direction.**

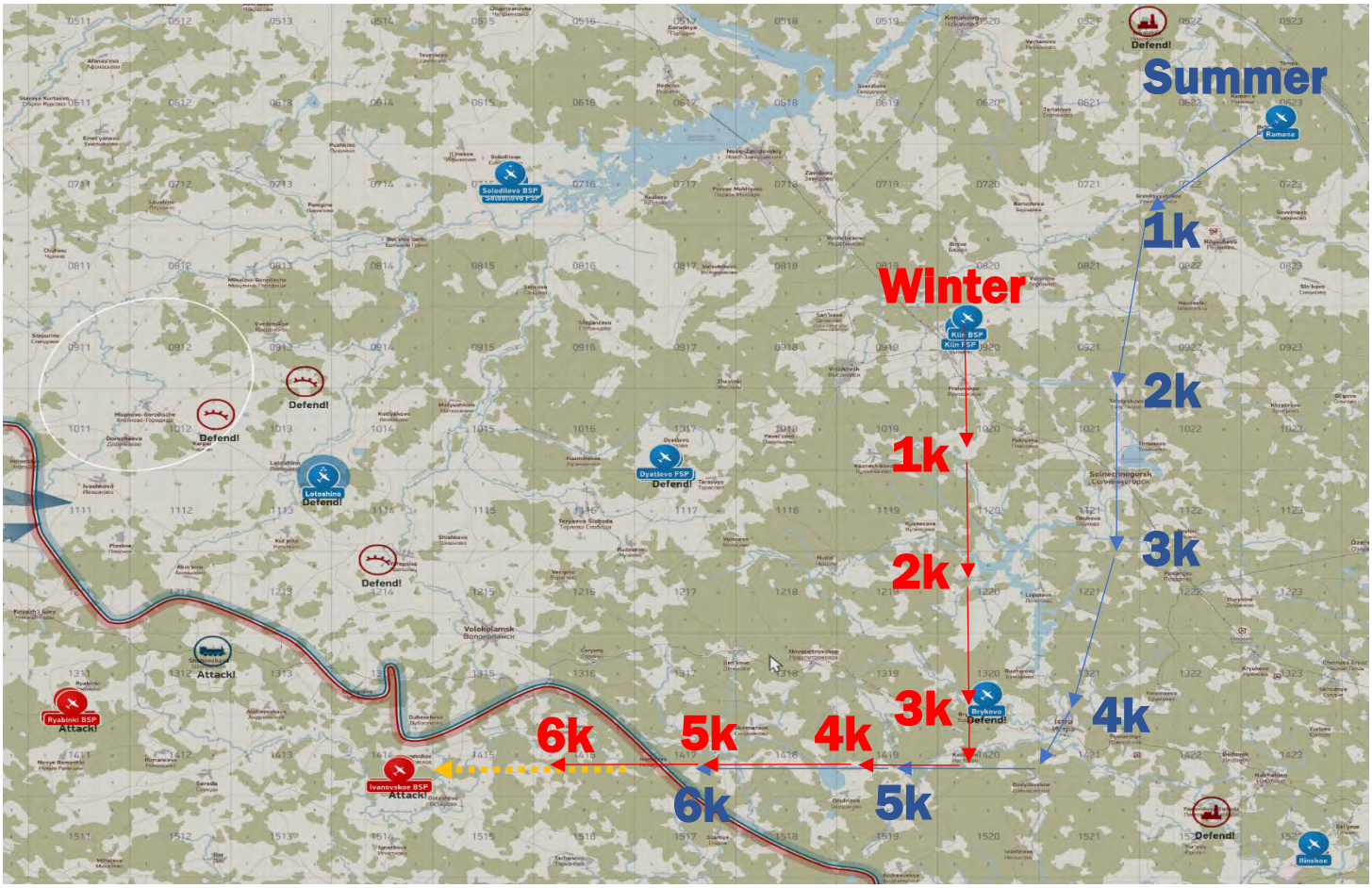


7.3.2 Bomb Release Altitude

The higher the altitude, the reduced risk of a heavy flak hit and the increased probability of missing the intended target(s). Knowing the heavy flak capability of the server where you are flying will tell you the best altitude from which to drop bombs. An altitude of 4k will suffice in many servers, but in some expert servers even 5k is no guarantee of not taking a flak hit. The bottom line, in terms of survival, is *higher is better*. Better to bomb from 6k and miss than lose a pilot and aircraft.

7.3.3 Climbing Space

Every aircraft equipped for level bombing exhibits different speed and climb characteristics, so the time required to climb to bombing altitude will vary from aircraft to aircraft. If you intend to execute a level bombing sortie and you are uncertain about how much horizontal space is required to climb to a desired bombing altitude in a particular aircraft, in hot weather plan for 20 km per 1000m of altitude. On winter maps plan for 15 km per 1000m of altitude.



Should you discover that the remaining horizontal space between you and the target area is insufficient to gain the desired bombing altitude, execute a 360° climbing turn along the flight route, *while still behind friendly lines*, until you attain the altitude projected for the current leg of the flight route, then continue.

7.3.4 Lining Up for the Bomb Run

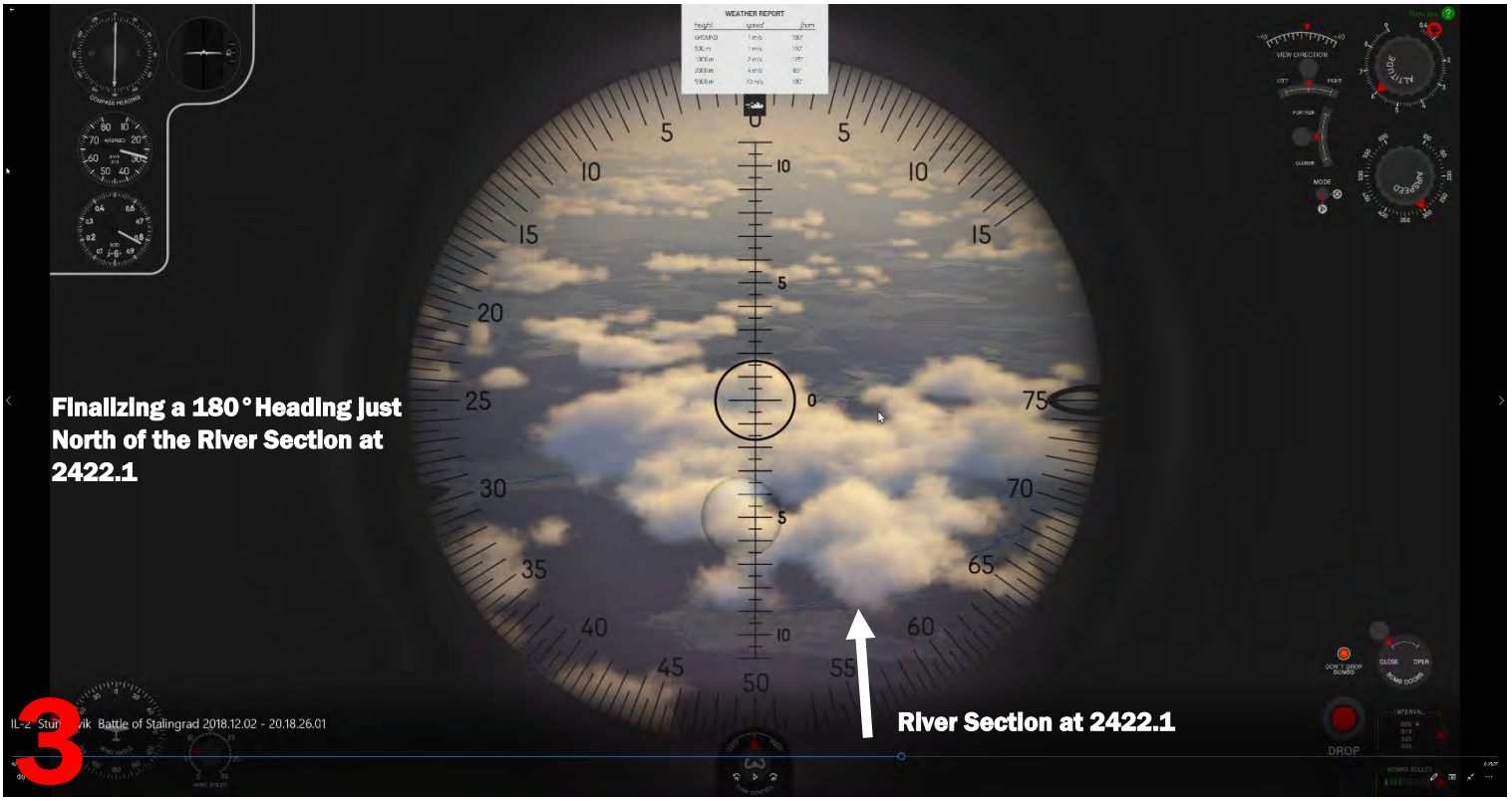
If you are scrambling to make last-second adjustments to wind angle, altitude, and speed when the bombsight crosshairs are approaching the Target Area, the potential for errors and omissions expands exponentially. Arguably, the most important action you can take to maximize the chances of a successful level bombing mission is to be lined up on the Target Area from a distance of at least 10 km, and preferably 20. A level speed of 330 kph equates to 5.5 km traversed per minute, so a final lineup from 10 km provides approximately one minute and 49 seconds of time in the bombsight to make final adjustments and make a precise target lineup.

7.3.4.1 Terrain Association. Level bombing in expert servers requires expert navigation skills that transcend merely flying from one planned azimuth to the next. When turning onto the final azimuth toward the Target Area, it is important to identify the Target Area location well in advance, preferably from the cockpit prior to going to the bombsight, even though the Target Area itself is not visible. If lining up on the final azimuth toward the Target Area from a long distance that precludes visual identification of the target area, identify key terrain features on the same azimuth heading as the Target Area as confirmation that the lineup is correct.

EXAMPLE:




Setting up for a 180° Heading at the River Section – 2422.1
River Section at 2422.1
2


Finalizing a 180° Heading Just North of the River Section at 2422.1
River Section at 2422.1
3


WEATHER REPORT
Using Terrain Association to Identify the Target Area Location
4
DROP


Konyshino
Коныжино
Vysokinichi
Высокиничи
Nijnyaya Vjazovnya
Нижняя Вязовня
Altuhovo
Алтухово
Nedel'noe
Недельное
Seliverstovo
Селиверстово
Attack!
Zaluj'e
Залужье
Attack!
Kamenka
Каменка
2521
2522
2523
2621
2622
2721
2722
2723

Making long-distance identifications of Target Areas requires an ability to accurately locate and recognize ground terrain features around the Target Area - as depicted on the map. River sections and lakes are probably the easiest terrain features to match up with their pictorial representations on the map, but in areas with no water we are forced to look for other features such as wooded area shapes, open spaces within large wooded areas, towns, and roads/rail tracks. Often it is a combination of two or more of these key terrain features that lead to Target Area identification.

The bombsight picture is little better than looking at the outside world through a periscope pointed to the immediate front. Be sure you are lined up well with the Target Area prior to going to the bombsight, because directional adjustments from the bombsight are extremely slow.

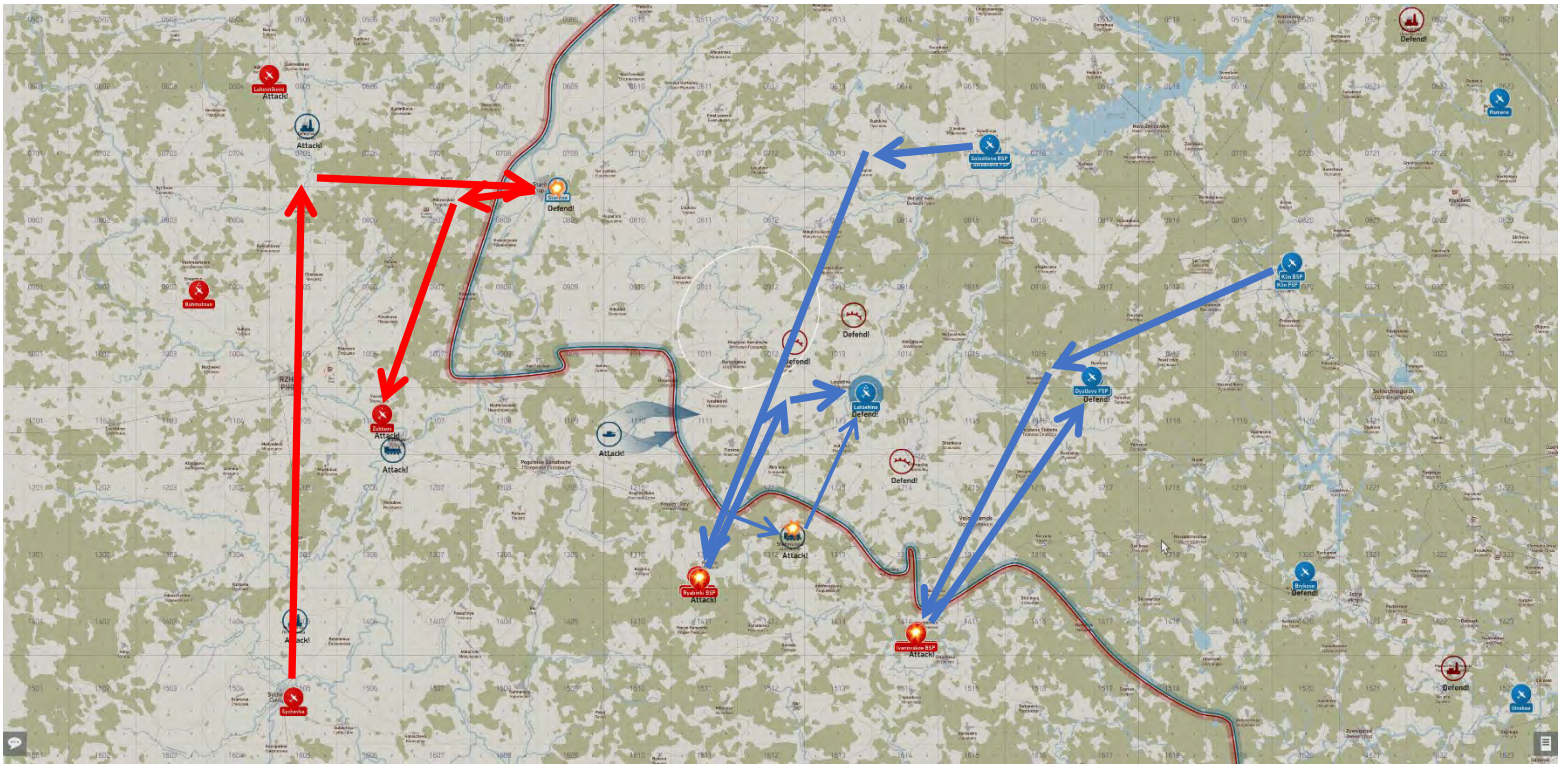
Airfield runways are visible from very long distances. If you know the location of your intended targets in relation to the runway, you can facilitate an accurate lineup from tens of kilometers away.



7.3.5 Front Line Target Areas

Target Areas near front lines present the least risk in terms of pilot preservation. The farther back the Target Area, the greater the chance of *Capture* if shot down. When attacking front line Target Areas, the climb to bombing altitude can be conducted entirely within friendly territory. If damaged by flak and the aircraft can still turn, getting back over friendly territory can be done in a matter of seconds. Depending on the distance to the closest friendly airfield and aircraft altitude, if intercepted while flying the Ju 88 A-4, Pe-2, or A-20B, the diving evasion technique described in **Subsection 7.1.3.3** may take you all the way back over a friendly airfield and a big flak welcome for your pursuer.

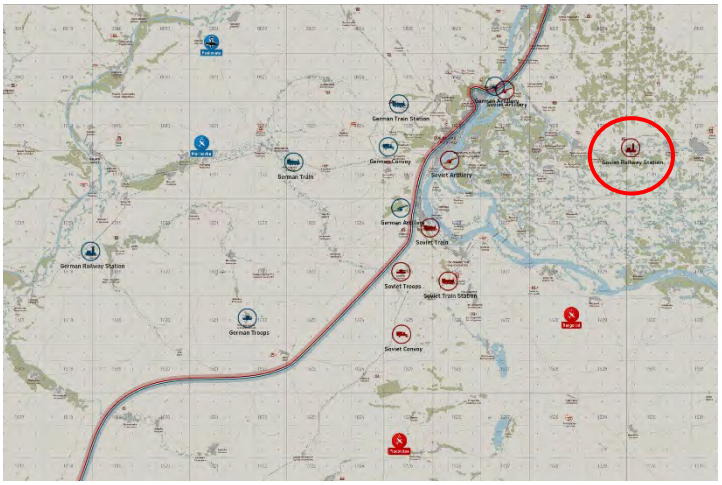
Example: Front Line Targeting Possibilities

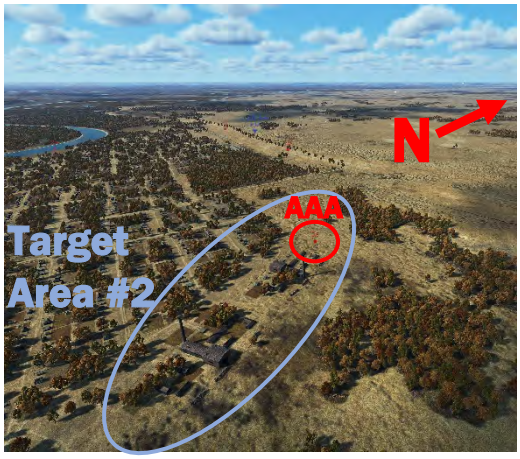


7.3.6 Creating Target Folders

Some servers may not offer recon photos on their websites, but do present Target Areas that appear repeatedly over time as the server recycles the same mission scenarios. One approach to increase one's knowledge and situational awareness when formulating Attack Plans is to record every mission in the server, take screenshots of the Target Areas from the flight recordings, then print or file them electronically so they will be accessible for future mission planning. Over time you will create several Target Area "recon" screenshots for many mission scenarios. You can file them as "target folders" under each mission scenario designation. On the following page is an example of such a screenshot for one Target Area in the *Wings of Liberty* server.

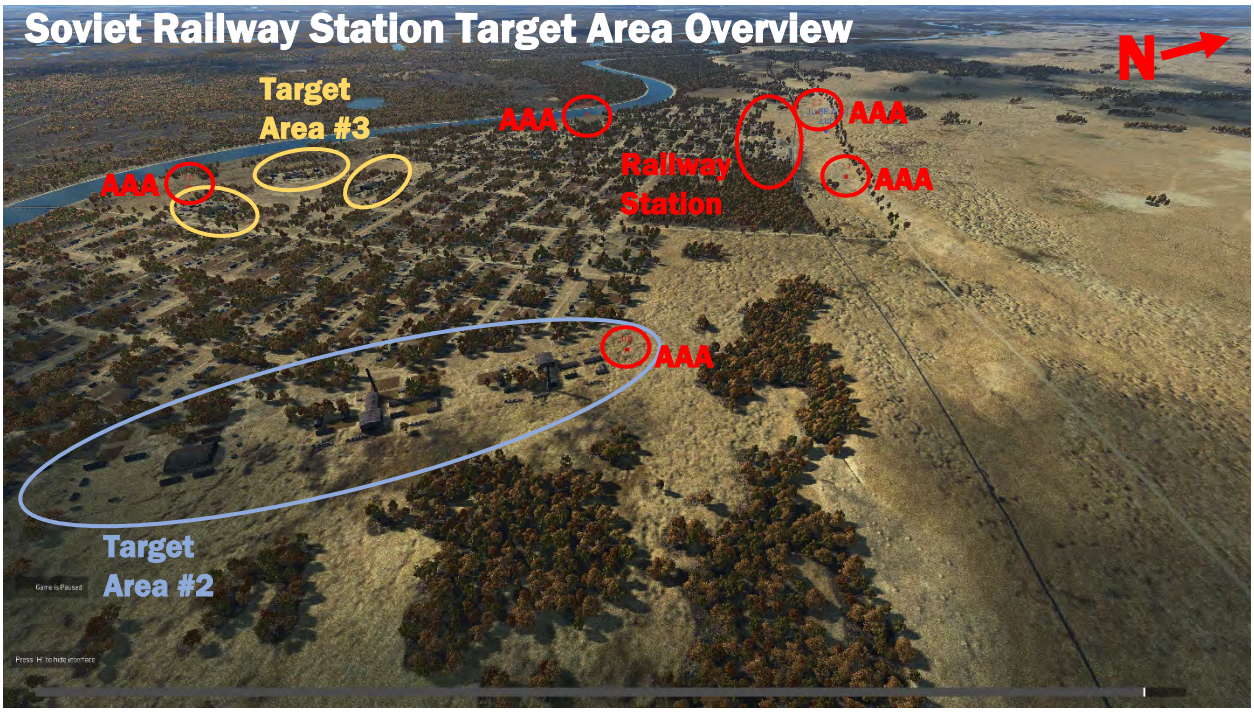
Example: Wings of Liberty-volgariverside42s-wl-306-01ns
Soviet Railway Station – 1030.1









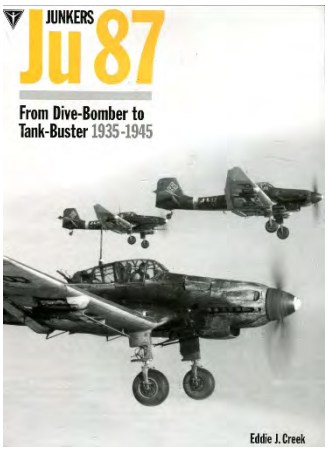


APPENDIX A

RECOMMENDED REFERENCES (ENGLISH) (CLICK)

JU 87

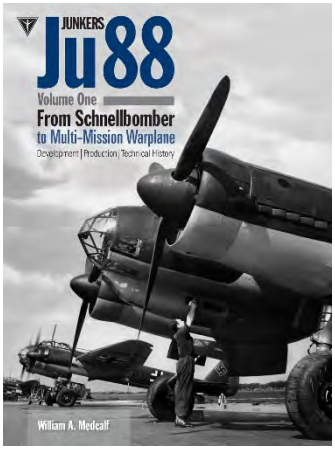


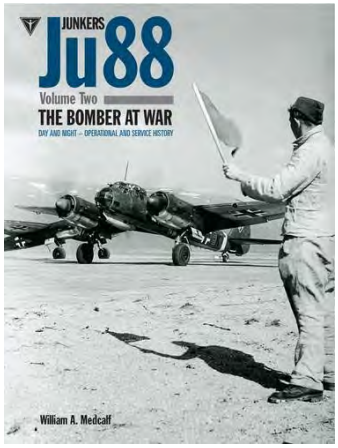


Bf 110

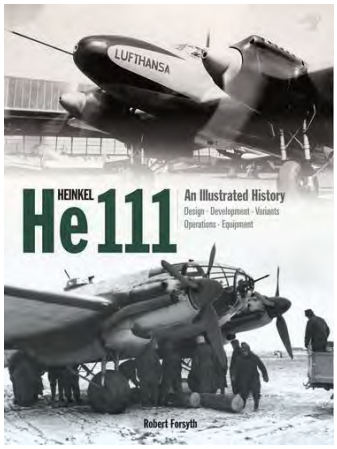


Ju 88





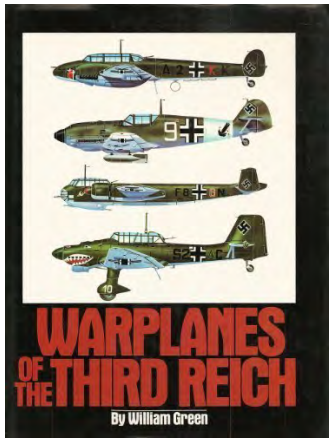
He 111



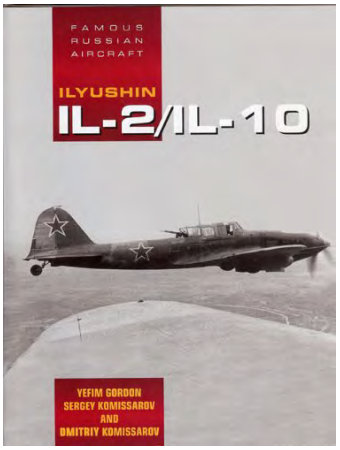
Hs 129



German Aircraft - General



IL-2



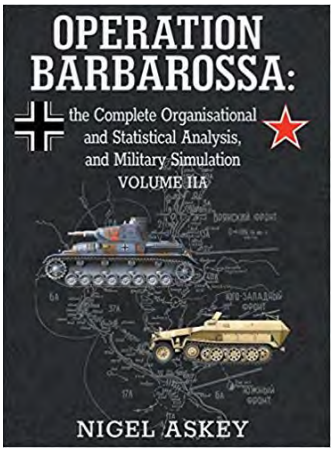
Pe-2

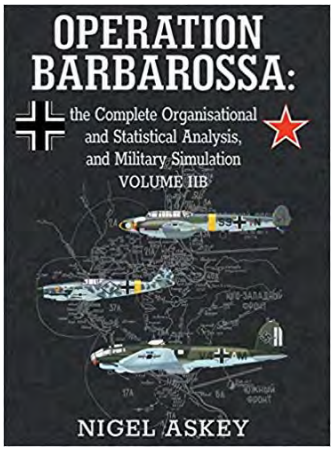


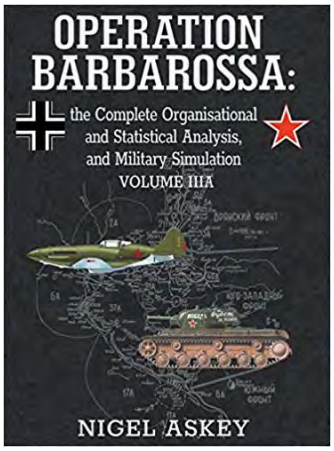
Russian Aircraft – General



Operation Barbarossa – Statistical/Organizational Analysis







APPENDIX B

ATTACK PLAN BRIEFING FORMAT

- **Intended Target Area**
- **Target Area Location**
- **Type of Attack /Attack Altitude**
- **Aircraft Type(s),**
- **Loadout(s) and Settings**
  - **Spawn Airfield**
  - **Fuel**
  - **Ordnance Package**
  - **Bomb Delay**
  - **Aircraft Skin**

- **Remaining Map time**
- **Weather/Cloud Density/Winds**
- **Enemy Situation/Player Numbers**
- **Friendly Situation/Player Numbers**
- **Target Area Condition**
- **Target Area AAA**
- **Nearby Enemy Target Area AAA**
- **Escort Availability**
- **Flight Order/Formation**
- **Designate Alternate Flight Leader**
- **Flight Plan (engine settings)**
  - **Movement to Target Area Azimuth(s) and Waypoints**
  - **Attack Point Location**
  - **Attack Altitude**
  - **Attack Azimuth**
  - **Target Assignments**
  - **Actions Over Target Area**
  - **Egress Azimuth(s)**
  - **Point of No Return / Immediate Action Plan**

APPENDIX C

CONVERSION CHARTS

Feet to Meters

Altitude (feet)	Altitude (meters)	Altitude (feet)	Altitude (meters)
500 ft.	152m	10500 ft.	3200m
1000 ft.	305m	11000 ft.	3353m
1500 ft.	457m	11500 ft.	3505m
2000 ft.	610m	12000 ft.	3658m
2500 ft.	762m	12500 ft.	3810m
3000 ft.	914m	13000 ft.	3962m
3500 ft.	1067m	13500 ft.	4115m
4000 ft.	1219m	14000 ft.	4267m
4500 ft.	1372m	14500 ft.	4420m
5000 ft.	1524m	15000 ft.	4572m
5500 ft.	1676m	15500 ft.	4724m
6000 ft.	1829m	16000 ft.	4877m
6500 ft.	1981m	16500 ft.	5029m
7000 ft.	2134m	17000 ft.	5182m
7500 ft.	2286m	17500 ft.	5334m
8000 ft.	2438m	18000 ft.	5486m
8500 ft.	2591m	18500 ft.	5639m
9000 ft.	2743m	19000 ft.	5791m
9500 ft.	2896m	19500 ft.	5944m
10000 ft.	3048m	20000 ft.	6096m

Meters to Feet

Altitude (meters)	Altitude (feet)
100m	328 ft.
500m	1640 ft.
1000m	3280 ft.
1500m	4921 ft.
2000m	6562 ft.
2500m	8202 ft.
3000m	9843 ft.
3500m	11483 ft.
4000m	13123 ft.
4500m	14764 ft.
5000m	16404 ft.
5500m	18055 ft.
6000m	19685 ft.

MPH to KPH

MPH	KPH	MPH	KPH
50	80	330	531
60	97	340	547
70	113	350	563
80	129	360	579
90	145	370	595
100	161	380	612
110	177	390	628
120	193	400	644
130	209	410	660
140	225	420	676
150	241	430	692
160	257	440	708
170	274	450	724
180	290	460	740
190	306	470	756
200	322	480	772
210	338	490	789
220	354	500	805
230	370	510	821
240	386	520	837
250	402	530	853
260	418	540	869
270	435	550	885
280	451	560	901
290	467	570	917
300	483	580	933
310	499	590	950
320	515	600	966

KPH to MPH

KPH	MPH	KPH	MPH	KPH	MPH
100	62	380	236	660	410
110	68	390	242	670	416
120	75	400	249	680	423
130	81	410	255	690	429
140	87	420	261	700	435
150	93	430	267	710	441
160	99	440	273	720	447
170	106	450	280	730	454
180	112	460	286	740	460
190	118	470	292	750	466
200	124	480	298	760	472
210	130	490	304	770	478
220	137	500	311	780	485
230	143	510	317	790	491
240	149	520	323	800	497
250	155	530	329	810	503
260	162	540	336	820	510
270	168	550	342	830	516
280	174	560	348	840	522
290	180	570	354	850	528
300	186	580	360	860	534
310	193	590	367	870	541
320	199	600	373	880	547
330	205	610	379	890	553
340	211	620	385	900	559
350	217	630	391	910	565
360	224	640	398	920	572
370	230	650	404	930	578

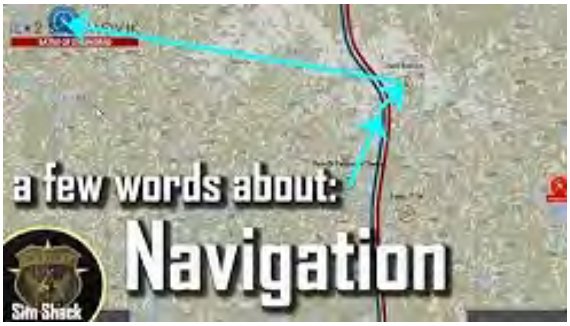
APPENDIX D VIDEO TUTORIALS

The video links in this appendix represent some of the better online tutorials currently available on the topics listed.

RECOMMENDED NAVIGATION TUTORIALS (CLICK)

Even though this handbook does not focus on navigation, it is a skill we can all improve upon. A few folks have been kind enough to explain their personal navigation approaches in one or a series of several videos. Even proficient navigators may find some tips in the videos below that will increase their repertoire of navigation tricks.

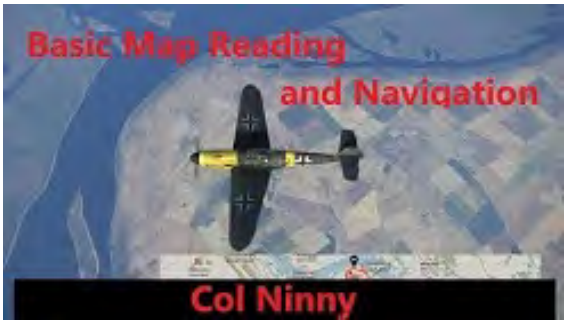












RECOMMENDED AIRCRAFT FAMILIARIZATIONS (CLICK)

Requiem's *Air Combat Tutorial Library* is the largest internet video resource for engine management tutorials on many aircraft in the *IL-2 Great Battles* series. *Sheriff's Sim Shack* contains a handful of aircraft tutorial videos among a diverse array of videos primarily focused on dogfighting in both Axis and Allied aircraft. The tutorial videos are very detailed and cover practical issues and techniques beyond the scope of engine management. Additionally, within many of the dogfighting videos lies a great deal of Fighter vs. Ground Attacker footage, and by studying these encounters there is much to learn about what to do, and not to do, when engaged by an enemy fighter.





RECOMMENDED LEVEL BOMBING TUTORIALS (CLICK)

In reality, Level Bombing in WWII was a highly inaccurate utilization of ordnance when calculating Target Area damage on a per-aircraft basis. Achieving accuracy in the game is easier than it was in the actual war, but it is certainly no cakewalk. The higher the wind speed, the more potential for inaccuracy, and the higher the altitude, the more those inaccuracies become amplified. The videos below provide an overview of Level Bombing basics, but it takes some time and many trial-and-error experiences online to develop a successful that works best for you.





RECOMMENDED DIVE BOMBING TUTORIALS (CLICK)

While focused on the Stuka, these tutorial videos are applicable to any aircraft possessing the capability to Dive Bomb.







RECOMMENDED GUNNERY TUTORIAL (CLICK)

This video by Requiem teaches a very important lesson concerning gun convergence and engagement distance and sight picture. This lesson is applicable to any Ground Attack aircraft used in the strafing role.



RECOMMENDED TAW SERVER INTRODUCTION (CLICK)

The Tactical Air War server is currently by far the most popular expert server. TAW is infamous, and deservedly so, for its heavy and extremely accurate AAA. Its second claim to infamy is the severe penalties for aircraft and pilot loss. All this being said, the afore-mentioned challenges are balanced out by the lack of a GPS and severe penalties for suicidal behavior. This places upon enemy fighter pilots the additional challenge of staying navigationally oriented – instead of simply looking for you – and discourages suicidal attacks.

The server mechanics are complex and take a fair amount of play to become accustomed to. This tutorial from Der Sheriff explains the TAW registration process, server rules, and basic mission environment. The TAW manual can be viewed HERE.

