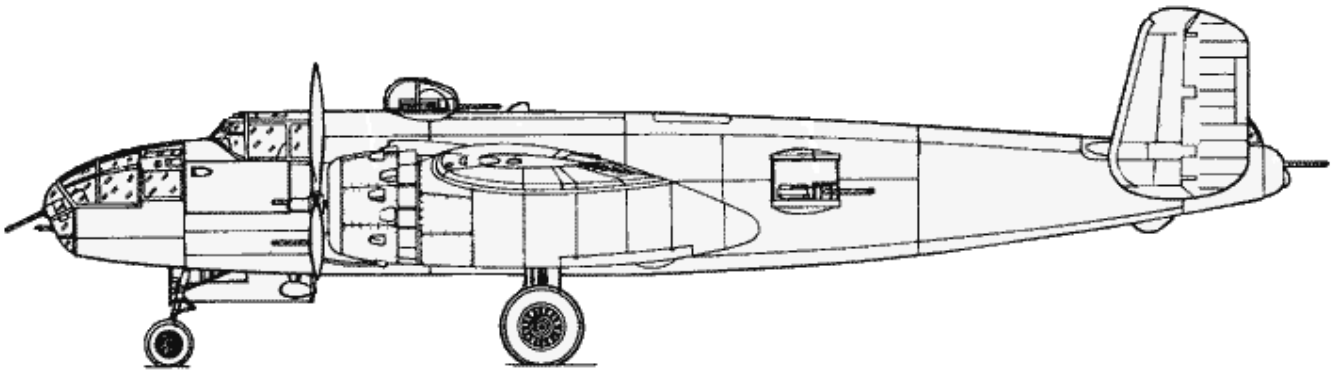
IL-2/PF Precision Ordinance Delivery Manual (B-25/PBJ)



By Crash Moses

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INTRODUCTION

Frustrated by my inability to reliably hit a known target on the first pass (knowing full well that historically, misses were the norm) and working on the assumption that, because of the incremental nature of the Norden bombsight as modelled in the game, each TAS setting should have a "sweetspot" at which altitude and speed converge to provide a "best solution", I endeavoured to create a bombing table that would allow me, and others armed with this knowledge, to strike our targets with as much precision as possible. This is it.

CAUTION: This guide is not for the casual simmer. If you're looking for a quick and dirty method of laying down an area of effect from 10,000ft then stop right here. There are many superb and well-written level bombing guides available that will arm you with more than enough information to accomplish the mission. However, if you *want* to make precision, dead on drops; if you absolutely *have to* take out that bridge at all costs; if you *must* put that 500lb'r through a second floor window from 10,000ft (or 15,000ft...or 20,000ft!) then by all means, read on...

Also, please note that precision level bombing requires fine control of both throttle and prop pitch. This requires at least two rotational joystick axis so if you've been thinking about purchasing HOTAS gear, now might be the time. CH Products and Saitek both make decent joysticks but if money is no object you might want to consider a Thrustmaster Cougar. I personally use an older Thrustmaster TQS and F-22 modified with a couple of Bob Church's digital chips. However, I had to hunt around on e-Bay a few years ago for the joysticks and Mr. Church no longer makes the chips but if you happen across a couple, snag 'em. They're worth it.

DISCLAIMER: The methods described herein are not 100% foolproof. I will guarantee however, that they are very, very, accurate...with practice. Well, okay...they are still very accurate without practice. But WITH practice they are even more accurate. So...RTM and practice, practice, practice.

Any Errata, bad grammar, misspellings, and breaches of etiquette are protected under copyright laws and remain my sole intellectual property. However, if you'd like to see them rectified in later editions jot an e-mail to crash_moses@core.com

So, you want to be an ace bomber pilot, do you? I bet you think you're ready to hop in and start blowing stuff up. Well, you're not! Just hitting the target won't accomplish the mission. You have to hit the target with the right ordinance! Do you think two or three 1000 pounders will work in every situation? Think again!

ORDINANCE

GENERAL-PURPOSE BOMBS (GP)

A general-purpose bomb is an airdropped bomb intended as a compromise between blast damage, penetration, and fragmentation in explosive effect. GP bombs use a thick-walled metal casing with explosive filler (typically TNT or Composition B) comprising about 50% of the bombs total weight. General-purpose bombs are often identified by their weight (e.g., 500 lb., 250 kg). In many cases this is strictly a *nominal* weight, and the actual weight of each individual weapon may vary depending on its retardation, fusing, and carriage.

FUEL AIR BOMBS - (FAB/FAE)

Fuel-Air Explosives disperse an aerosol cloud of fuel which is ignited by an embedded detonator to produce an explosion. The rapidly expanding wave front due to overpressure flattens all objects within close proximity of the epicenter of the aerosol fuel cloud, and produces debilitating damage well beyond the flattened area. The main destructive force of FAE is high overpressure, useful against soft targets such as minefields, armored vehicles, aircraft parked in the open, and bunkers.

3x1000lb and 2x1000lb GP----------
Drop Sequence: [1x1000 - 2x1000] and [2x1000]
Target Types: Hard targets. Ships, bunkers, tanks. Considerations: Best used for anti-shipping missions and pinpoint bombing.

6x500lb GP----------
Drop Sequence: 2x500 - 2x500 - 2x500
Target Types: Hard targets. Ships, bunkers, tanks. Considerations:

Best used for anti-shipping and groups of tanks.

4x500+1x1000lb GP----------

Drop Sequence: 1x1000 - 2x500 - 2x500
Target Types: Hard targets. Artillery, tanks, bunkers.
Considerations: Useful for hitting hard targets defended by artillery or AA

3x250+3x500lb GP----------

Drop Sequence: 2x500 - 1x500 - 2x250 - 1x250
Target Types: Mix of hard and soft. Artillery, tanks, aircraft on the ground.
Considerations: Good for hitting airfields.

4x500lb GP----------

Drop Sequence: 2x500 - 2x500
Target Types: Hard targets. Bunkers, ships, tanks.
Considerations: Only use if 6x500 is unavailable due to supply .

6x250lb GP----------

Drop Sequence: 2x250 - 2x250 - 2x250
Target Types: Soft targets. AA, aircraft on ground, vehicles.
Considerations: Great for taking out pesky AA. Good dispersion pattern.

12x100lb GP----------

Drop Sequence: 2x100 - 2x100 - 2x100 - 2x100 - 2x100 - 2x100
Target Types: Soft targets. Grounded aircraft, AA.
Considerations: Ideal for attacking airfields, specifically runway ramps.

8xFAB 100lb----------

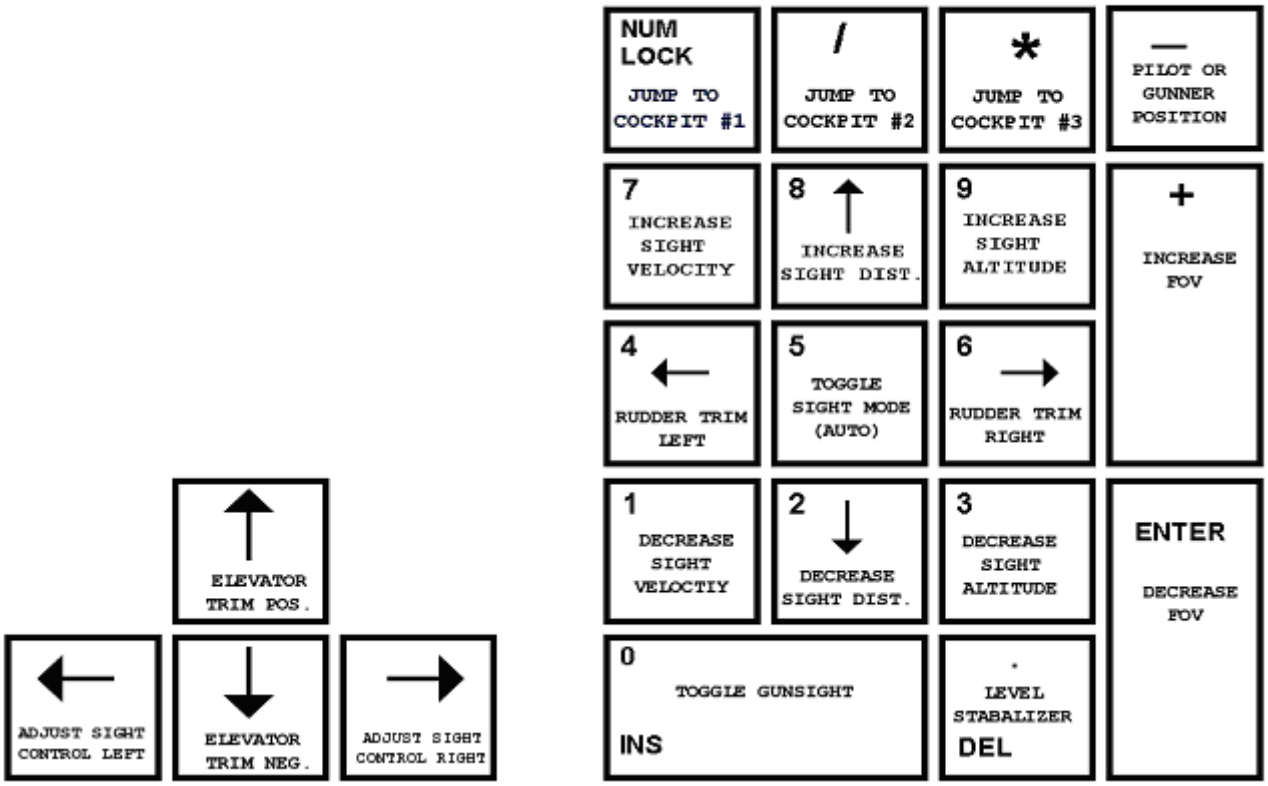
Drop Sequence: 2x100 - 2x100 - 2x100 - 2x100
Target Types: Mix of hard and soft. Tanks, vehicles, aircraft on the ground.
Considerations: Great for convoys and anything else the enemy puts in a straight line.

10xFAB 50lb----------

Drop Sequence: 2x50 - 2x50 - 2x50 - 2x50 - 2x50 Target Types: Mix of hard and soft. Tanks, vehicles.
Considerations: Same as 8xFAB 100 but bombs tend to cover a larger area.

You've determined the best ordinance for the target and your flight crew has loaded the bombs. You're not quite ready, yet! As B-25/PBJ pilots you should already be familiar with your plane's instrumentation. If not, this course is a sure ticket back to ground school. However, There are aspects to certain instruments that are critical to precision ordinance delivery...so pay attention!

CONTROLS



This is an example of the ordinance delivery control configuration that I use. I find it easy and convenient, however you may prefer a slightly different setup. But mine is still better...

AIRCRAFT CONTROLS

Level Stabilizer - *Numpad Del* - Allows the B-25 to fly straight and level (although fine adjustments can be made using trim). Do NOT confuse this with Toggle Level Autopilot. Toggle Level Autopilot designates whether or not the AI gunners automatically resume control of a position after you've vacated it.

Elevator Trim Negative - *Up Arrow* - Trims the aircraft nose high (climb)
Elevator Trim Positive - *Down Arrow* - Trims the aircraft nose down (sink)
Rudder Trim Left - *Numpad 4*
Rudder Trim Right - *Numpad 6* - Same as stepping on the ball. Left rudder trim moves the nose left and right rudder trim moves the nose right.

GUNSIGHT/BOMBSIGHT CONTROLS

Toggle Sight Mode (Auto) - *Numpad 5* - Switches the bombsight between manual and automatic. While automatic mode is more precise (especially at high altitudes) I've included manual bombsight angles because, frankly, manual bombing is just plain fun!
Increase Sight Distance - *Numpad 8* - Raises the sight angle (0 is straight down. 90 is straight ahead.)
Decrease Sight Distance - *Numpad 2* - Lowers the sight angle.
Increase Sight Altitude - *Numpad 9* - Increases bombsight altitude setting in 50ft increments.
Decrease Sight Altitude - *Numpad 3* - Decreases bombsight altitude setting in 50ft increments
Increase Sight Velocity - *Numpad 7* - Increases bombsight speed setting in 10mph increments. This is how you set your TAS (True Air Speed) in the bombsight.
Decrease Sight Velocity - *Numpad 1* - Decreases bombsight speed setting in 10mph increments.

VIEWS

Pilot or Gunner Position - *Numpad* **-** *(minus)* - Lets you cycle through all gunner positions in order.

1. Pilot
2. Bombardier
3. Nose Gunner
4. Turret Gunner
5. Tail Gunner
6. Left Waist Gunner
7. Right Waist Gunner

Jump to Cockpit #1 - *Numlock* - Pilot
Jump to Cockpit #2 - *Numpad /* - Bombardier. From here you enter the bombsight view by hitting the "Toggle Gunsight" key.
Jump to Cockpit #3 - *Numpad ** - This is a good position from which to line up your bomb run. You have good overall visibility and can use the gunsight to line up on the target.
Toggle Gunsight - *Numpad Insert* - Switches back and forth between the bombsight and Cockpit #2. Can only be used from Cockpit #2 (In other views it just zooms in a little).
Increase FOV - *Numpad Enter* - Zooms view out.
Decrease FOV - *Numpad +* - Zooms view in (great for reading gauges).

Well, you've loaded your ordinance and familiarized yourself with your instruments and controls and now you're ready to blow stuff up! Sorry, lads...not quite yet. First, you have to find the target!
INSTRUMENTATION and CONTROLS

AIR SPEED INDICATORS

The B-25/PBJ has two air speed indicators (Yes two, maggot! Weren't you paying attention in ground school?) The first, and most important, is located in the cockpit in front of the pilot. Most of your bombing runs will be made at speeds between 160 and 200 m.p.h. Unless you are using No Cockpit View to determine your T.A.S. (for instructional purposes only!) this instrument is your new best friend. Notice that the speed range between 160 and 200 M.P.H. is broken into four M.P.H. increments. The first mark past 160 is 164. The next is 168, etc. etc. Memorize this range!
Knowing your exact I.A.S. is critical. There will be no way to determine T.A.S once you graduate this course as No Cockpit View is to be used only for, what?

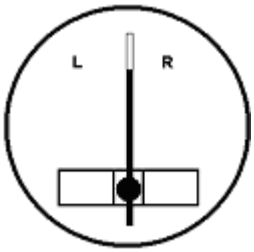
That's right...instructional purposes only!

Which brings us to the second air speed indicator located on the left side of the bombardier's station (cockpit #2). This instrument displays I.A.S. and T.A.S. (quite accurately) and is an engineering marvel...and totally useless. The government contractors responsible for the instruments and the government contractors responsible for the bombsight didn't compare notes and therefore the bombsight was calibrated to different specifications (and, of course, each blames the other. Government contractors...ya can't shoot 'em...that's illegal). Don't enter the T.A.S. from this instrument into your bombsight, lads...you'll miss by a mile. (It is interesting to note, however, that if you convert the K.P.H. in No Cockpit View to M.P.H. the result matches this instrument exactly. I think the fault lies with the bombsight guys.

VERTICAL SPEED INDICATOR (Climb Indicator, Variometer) Climb? Why do you need to know climb? The B-25/PBJ comes with a level stabilizer, right? Wrong! The level stabilizer does a decent job but it's not perfect (especially at high altitude and low speeds). In order to hit your target you have to keep your plane at the correct altitude. If you're bombing from 10,000 feet then you need to be at 10,000 feet. Not 10,050 feet! Not 9,950 feet. 10,000 feet on the nose! But wouldn't the relevant instrument be the altitude indicator, you ask? Yes, but the altitude indicator won't do you much good if you're climbing or sinking on your bomb run!

Hopping back and forth between bombsight view and cockpit view #1 or #2 to check your altitude is an inefficient way to deliver ordinance and leaves you prone to error. You need to "zero" your climb indicator early in your bomb run. Then, if you have to hop into the tail gunner position to take care of a Zero on your six you won't have to worry about maintaining altitude. Use elevator trim to zero your VSI. I recommend configuring a couple of keyboard keys for this. I've included elevator trim settings in the bombing tables but there are sometimes small variances. Remember: zero early!

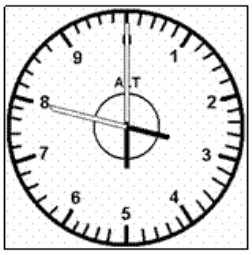
NOTE: When correctly zeroed, the climb indicator does not sit directly on zero. It sits just below the zero mark and above the first small mark.



TURN/SLIP INDICATOR

You all should be familiar with this one. It indicates turns (great for changing direction) and slips (great for sliding onto that carrier deck at the last second). The important thing to remember here is to keep your eye on the ball. Once you've lined up with the target, use your rudder trim to center the ball. You may have to make minor adjustments as you get closer to your target but, for the most part, keeping the ball in the center will keep you on track. If the ball moves to the right you need to apply right rudder and if to the left, left rudder (trim). Again I recommend assigning keyboard keys for fine adjustment (although I use two buttons on my TQS). I've also noticed that, when level bombing, rudder trim settings change very little regardless of altitude and speed. 19 or 20 clicks of right rudder should be all you need to center the ball (more at higher altitudes).

ALTITUDE INDICATOR



Another basic instrument you should all be familiar with. Nothing new here. The big hand indicates hundreds of feet and the little hand indicate thousands. The small marks between each number represent 20-foot increments but since the bombsight is adjusted in 50-foot increments we'll just ignore those. Notice the current altitude...8,000ft. Notice how nice and straight the big hand is? That's the way it should look on every bomb run. Straight up and down. What's that? It's impossible to be that precise? Bull! Do you know how many times I've heard that garbage? Your job is to shut up and listen! Let me worry about, "how"! We'll discuss that a bit later.

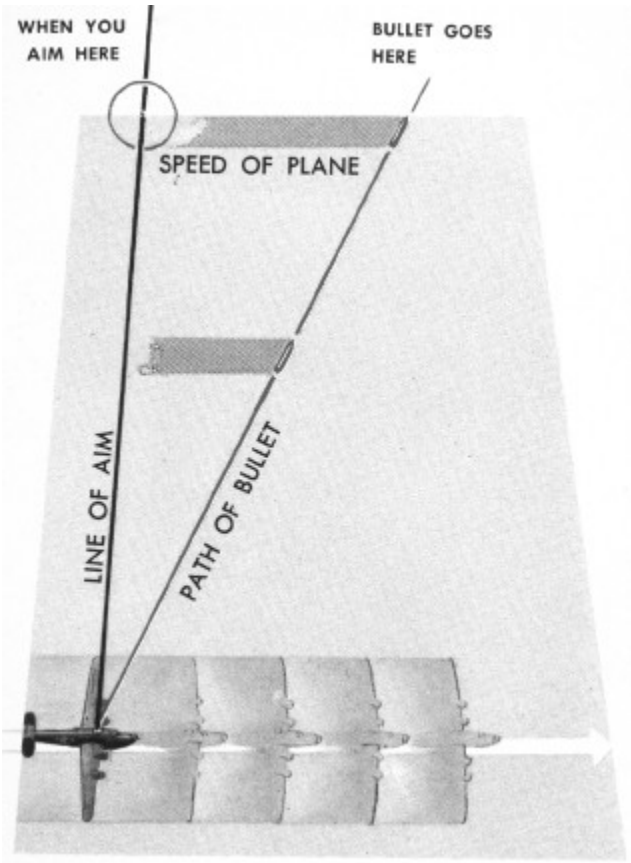
DEFENCE

The B-25/PBJ is fairly bristling with .50 cal machine guns but even flying along straight and level the gunner AI only does a fair job of keeping fighters at bay. There is nothing more enjoyable than hopping into the tail gunner position and holding a little surprise party for some unsuspecting tailgater.

The following information was taken from a booklet called "Get that Fighter!" prepared by the Army Air Forces Operations Analysis and A.A.F. Training Aids Division in collaboration with the U.S. Navy and Central Flexible Gunnery Instructors School with the assistance of Time Inc. on November 1, 1943. The information is bomber independent and is just as applicable to the SBD, Val, or Betty as it is to the B-25.

I've edited it to include only information I think relevant to the game. I recommend setting up a QMB mission with invulnerability and unlimited ammo to practice. I still get shot down more often than not but I usually end up taking one or two tailgaters with me.

GET THAT FIGHTER!



Every enemy fighter is dangerous and needs watching but he becomes really dangerous only when he starts a direct attack. That's when he's easiest to hit.

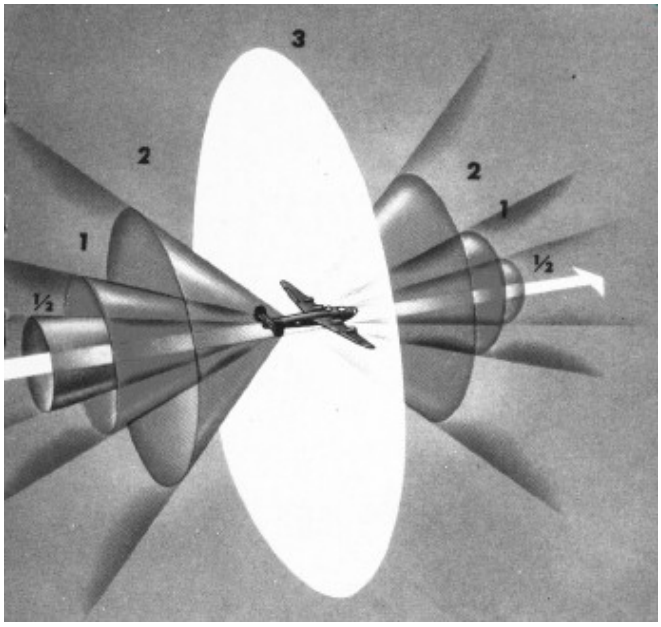
The fighter coming in to attack you must keep aiming at the spot where you will be by the time his bullets get there. In order to keep aiming at this spot he must fly in a slight curve, called the pursuit curve. As he flies along this curve he slides in toward your tail.

Believe it or not-when a fighter is making his attack you don't aim ahead as in most other shots. Always aim between him and the tail of your own plane because the forward speed of your plane is added to the speed of your bullet.

The bullet keeps this forward speed no matter in what direction you shoot-above, below, or to either side.

If you make the mistake of leading ahead of where he is pointing while he is shooting at you you will miss because you did not allow for the forward speed your plane gave to your bullet.

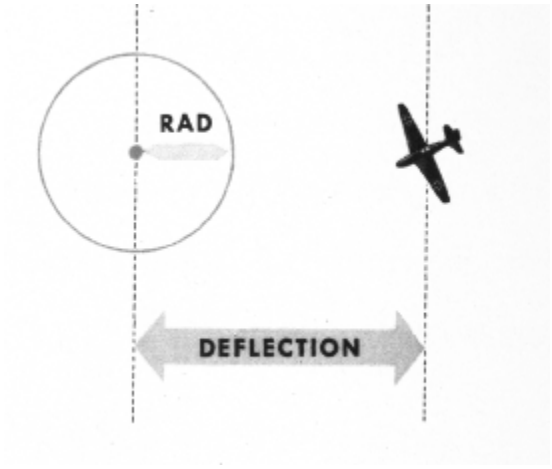
The way to allow for your forward speed is to aim between the attacking fighter and the tail of your own plane at a point on the line along which the fighter slides toward your tail. The amount you aim behind is deflection.



The amount of the deflection depends on the direction from which the fighter attacks. You must learn to recognize four directions and then learn the deflection for each. These directions go all around your line of flight and form the surfaces of cones that go out from your plane into space.

In your sight the deflection is the distance between the bead, or pipper and the fighter. The amount of deflection is measured in RADS, which is the distance from the pipper to the edge of the ring.

When a fighter flies an attack course he always slides in toward your tail. A rear attack begun on Cone 2 moves toward Cone 1. Front attacks from Cone 1 move toward Cone 2, etc. When you aim towards the tail of your plane is along this line of apparent motion of the fighter.



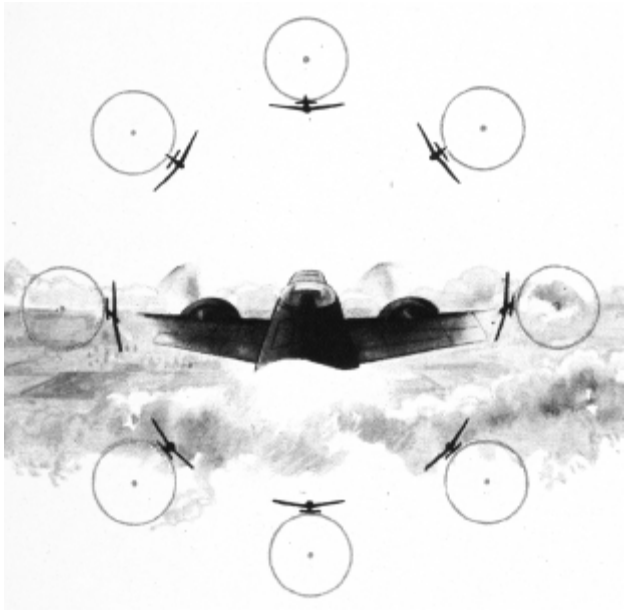
As the fighter slides from one cone to another you must adjust your deflection toward the value for the new cone. During a 2 second burst you must let the fighter drift in your sight Â½ rad toward the bead or pipper for attacks behind the beam, and Â½ rad away from the pipper for attacks forward of the beam.

Changes in speed of fighter on pursuit curve have almost no effect on deflection.

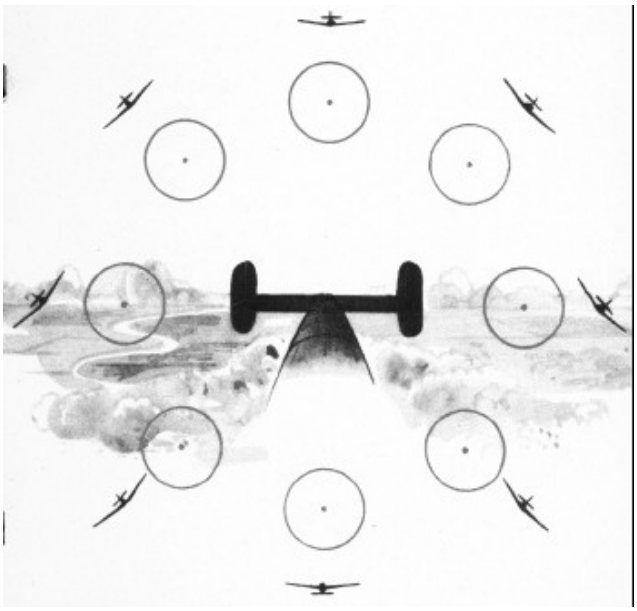
The number of rads is not affected by range.

Don't depend on tracers. Even when they appear to be going through the fighter, they may be missing him completely; over, beyond, short or under.

ATTACKS FROM THE FRONT

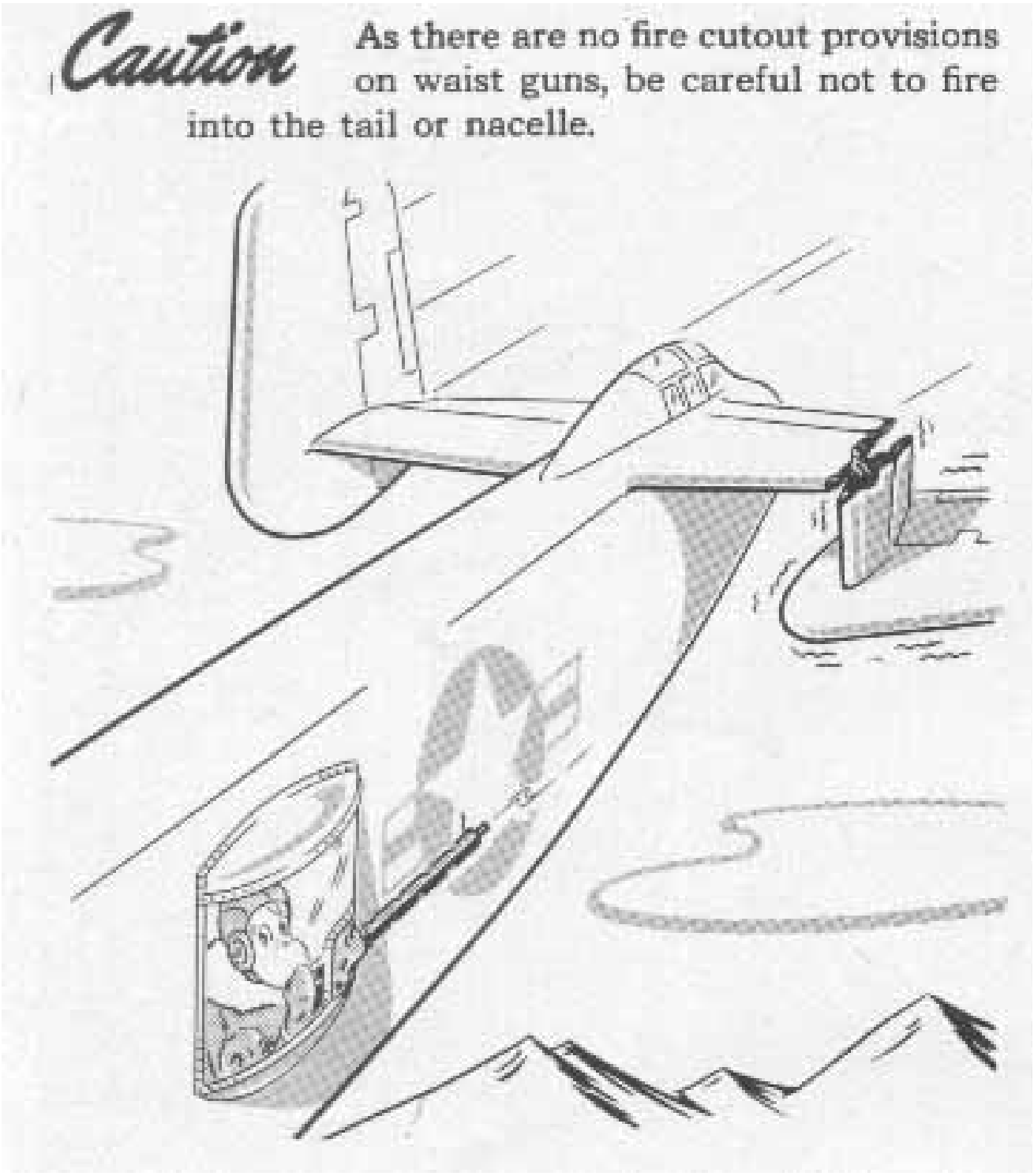


ATTACKS FROM THE REAR



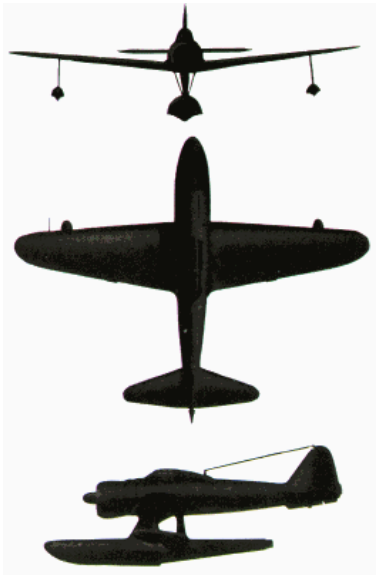
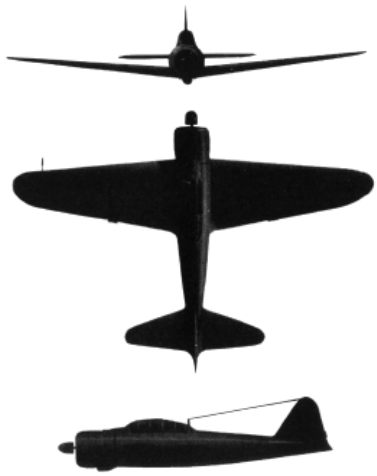
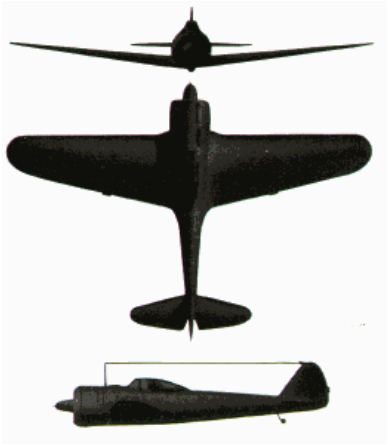
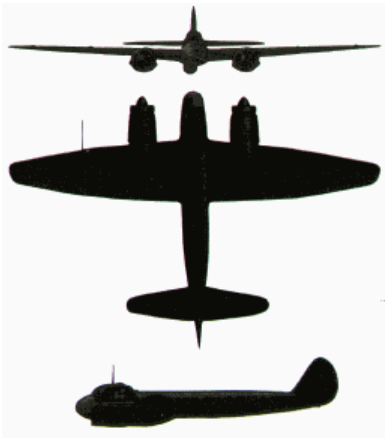
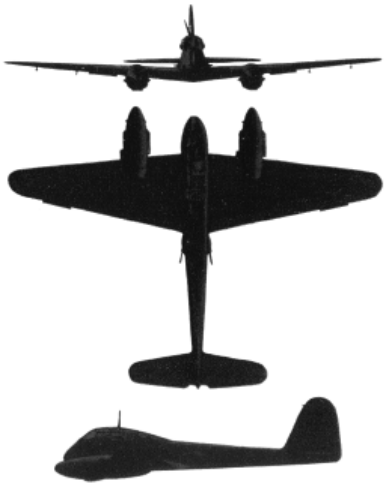
Remember these simple rules-

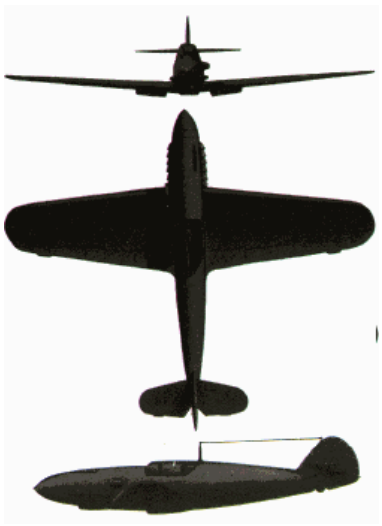
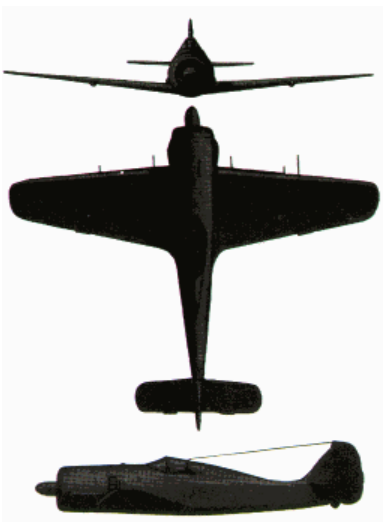
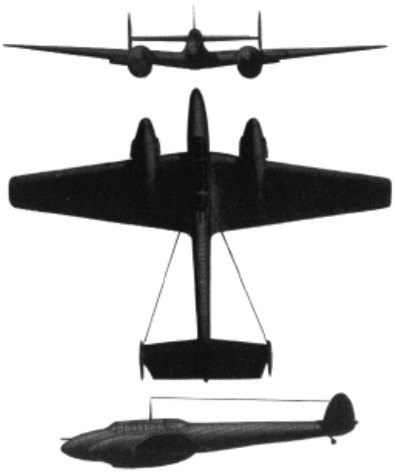
1. When the fighter has started his attack on you, aim between him and your tail.
2. Spot what cone he is on, and use the correct deflection.
3. Don't waste ammunition when he is out of range.



The booklet also goes into quite a bit of detail on the number of rads to deflect at certain speeds and cones but I was never able to get the information to jibe with what happens in game (probably because of the way perspective is modelled). If I can ever devise a test that will let me determine the rads at different speeds and cones, I'll update this section. Until then you'll just have to practice until you get a feel for it.

AIRCRAFT IDENTIFICATION----------

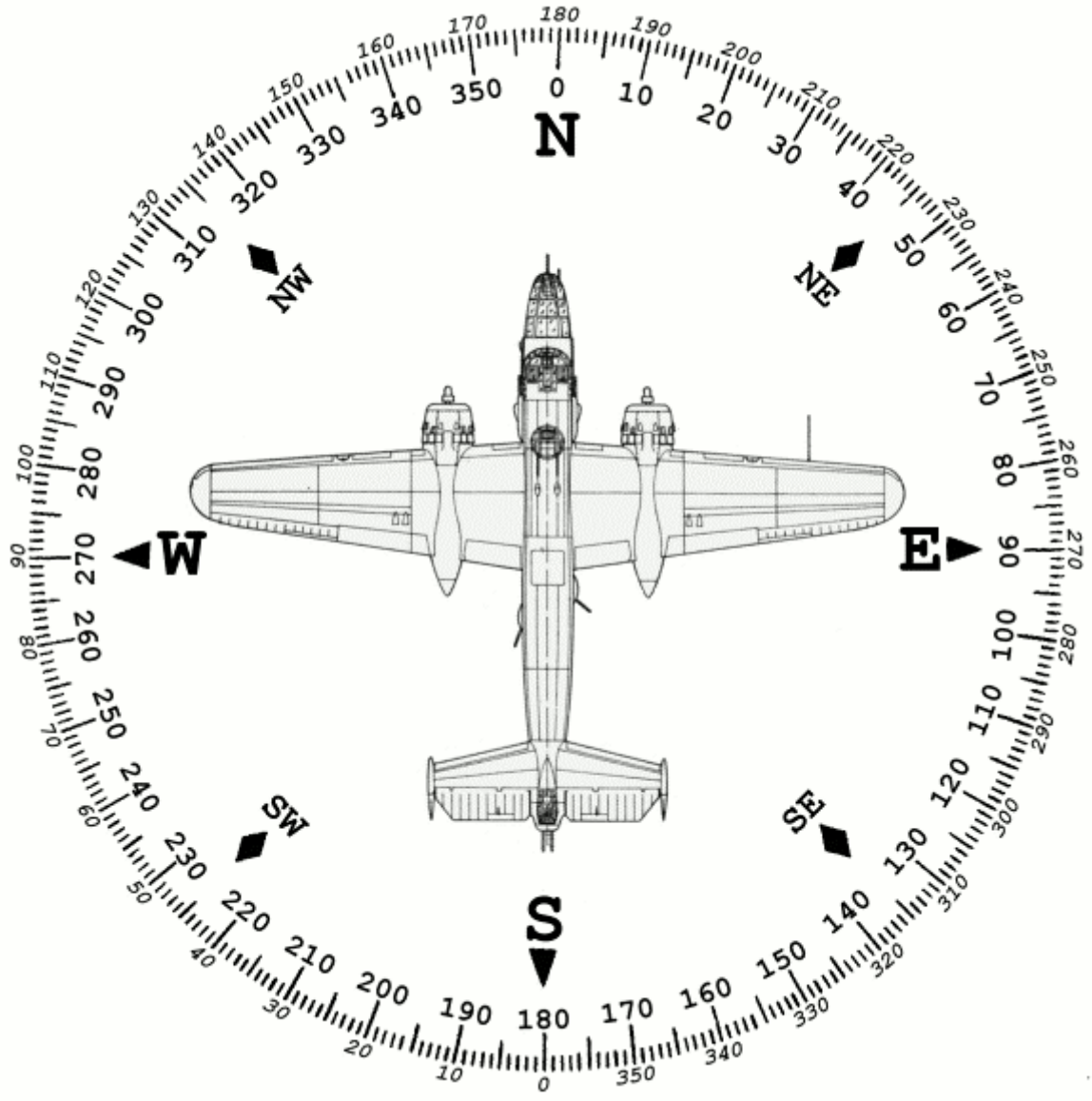
		
Oscar - Fighter	Rufe - Recon	Zeke - Fighter
		
Nate Fighter	JU 88 C-6 - Night Fighter	ME 210 - Light Bomber

		
ME 109G - Fighter	FW 190 - Fighter	ME 110 - LR Night Fighter

Well, hopefully you've chased off those pesky fighters or (miracle of miracles) you actually had some fighter cover (Not that you need it! Harrumph! You're a bomber pilot!) If not, you'd better hope your gunners can keep you in the air long enough to accomplish the mission because it's time for...

NAVIGATION

Before you even hop in your plane the first thing you should do is study your intelligence (not easy for some of you, I know). Carefully read the mission brief (especially on-line}; many objective based servers provide plenty of clues in the mission briefing. Take time to read them!). Next, study your map! Zoom in and check out local landmarks; rivers, roads, forests, mountains, lakes, airfields, etc. etc. Draw a sketch if you have to. And finally, note the heading from your take-off point! Even with full real settings and no speedbar the B-25/PBJ has four compasses! And three of 'em are right in front of the pilot! But I'll admit, it's easy to get turned around, especially in the heat of battle. Which is why I use this:



OFFICIAL CRASH MOSES PBJ COMPASS ROSE

That's right, it's an official Crash Moses compass rose.
They don't make 'em anymore and they're hard to come by.
But I have a warehouse full. This one is yours. Use it!

THE CLIMB OUT - Normally I'd recommend coddling your two R-2600 Wright Cyclone engines but gaining altitude can be tedious and time consuming (especially on-line). These two monsters will have plenty of time to cool down on the way to the target so max your throttle and prop pitch. If you do it right you should be able to reach 10,000 feet before the engines overheat.

Level out after take-off until you hit about 180 M.P.H. and then slowly adjust trim until you're climbing at 2000 feet per second.

If your target is close, or there is enemy activity nearby, I recommend circling the airfield to gain altitude.

Best climb speed in a coordinated turn at max throttle is between 130-140 M.P.H. You should be able to reach at least 5,000 feet in one circuit of the airfield.

If you are going to climb straight then you should be able to do between 140-150 M.P.H. depending on payload and fuel level.

AT ALTITUDE" After reaching bombing altitude level out and build up some speed before engaging the level stabilizer (otherwise you'll start sinking and may miss your altitude}. I recommend climbing a hundred feet above your target altitude. It's easier to adjust down than up. Once your I.A.S. is high enough (and you're on the proper heading!) engage your level stabilizer. I'll cover adjusting altitude later. You should adjust your throttle and prop pitch settings to match your target speed. It can take awhile for the B-25/PBJ to settle. If you start sinking just adjust your elevator trim to compensate.

NOTE: At certain speeds (generally below 190 M.P.H. but fuel and bomb load affect this greatly) and at certain altitudes even maximum negative elevator trim will not keep you from sinking. In these instances you will have to engage combat flaps in order to sustain altitude. This will be annotated in the bomb tables.

NAVIGATION INSTRUMENTS - The instruments below are essential for navigation both on-line and off. They can be read from the pilot position and are located at the top of the instrument panel. A second waypoint indicator is also located in the bombardier position. These instruments may seem redundant but they come in very handy should you lose one to an enemy bullet.

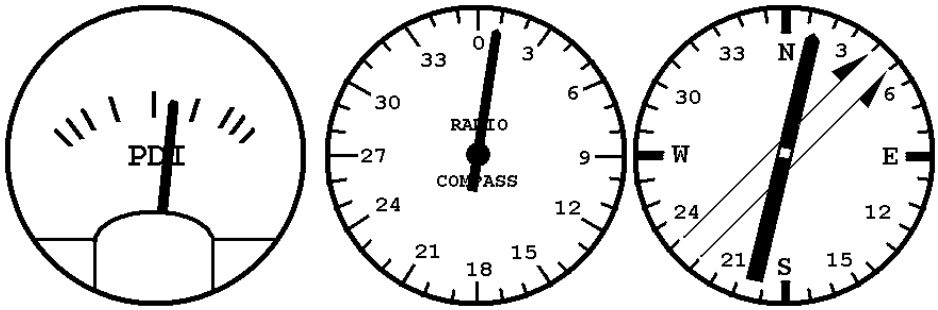
PDI (Pilot Direction Indicator) - This indicates the direction you need to fly in order to reach the next waypoint. Keep the needle centered in order to maintain the proper heading. In the absence of waypoints this points to your home base.

RADIO COMPASS - This displays your current heading in degrees. It uses radio signals from your home base to determine your heading. It's also much easier to read than the magnetic compass.

WAYPOINT INDICATOR - This displays your current heading in relation to the direction of your next waypoint. The two thin outside arrows point the way to the next waypoint. The center arrow shows your current heading. Line 'em up to head in the right direction. In the absence of waypoints this points to your home base.

NOTE: The PDI and Waypoint Indicator will give false readings close to your home base (if that is what they are pointed too). As you approach the base keep your eyes peeled as you could miss it and not realize it until long past.

Pilot Direction Ind./ Radio Compass / Waypoint Indicator



Well, you're on your way. Your bombs are loaded, you have a good idea where the target is, and you're at the right altitude. Ready to drop some bombs? Sure...but what if you're attacked? Nothing like a couple of pesky fighters to ruin a perfectly good bomb run. Which brings us to...

PRECISION ORDINANCE DELIVERY

It's all been fun and games up 'till now gents. From here on out it's by the book...

First we'll go over how to read the bombing tables.

12,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
FLAPS UP	36	220	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs			75	84	195	FP+24	386	72	90	196	FP+7	389	75	90	197	FP	391
4x500lbs + 1x1000			69	90		FP+21	385										

1. Upper left-hand box displays the altitude (in feet).
2. Below the altitude is the necessary flap setting.
3. MBA = Manual Bomb Angle - this is the same for all settings at altitude.
4. TAS = True Air Speed - This is the setting entered into the bombsight.
5. There are separate settings for different fuel levels 25%, 50%, and 75%.
6. The different bomb loads are listed down the left-hand side. Bomb loads of the same weight are grouped together.
7. Thr = throttle setting for that particular payload and fuel setting.
8. PP = Prop Pitch
9. IAS = Indicated Air Speed in M.P.H. (Taken from the cockpit speedometer).
10. Elev = The amount of elevator trim needed to maintain altitude at those settings.

FP = Full positive trim.

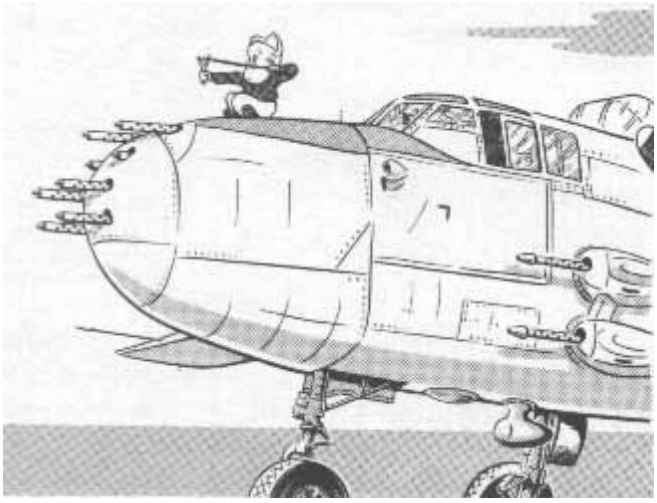
FN = Full negative trim.

N = Neutral Trim

+(x)= Number of clicks of positive trim.

-(x)= Number of clicks of negative trim.

11. KPH = True airspeed in kilometers per hour. This is for reference only as this reading can only be taken from the no cockpit view, which as you know, is only to be used for...repeat after me...INSTRUCTIONAL PURPOSES ONLY! If I catch any of you using KPH in combat I'll have you court marshalled!

12. 

DETAILED INSTRUCTIONS FOR USE OF THE BOMBING TABLES (BOMBING TABLES FOLLOW)

Don't even THINK about skipping this part! You'll regret it...last warning...

Hands off your joystick! You won't need that again until you drop your ordinance. The bombardier is now in control of the plane and he'll be using nothing but trim controls...

1. **Engage level stabilizer.** I like to engage the level stabilizer once I'm 50 to 100 feet above my target altitude. It's much easier to adjust your altitude down using elevator trim than it is to climb.

   Remember that the level stabilizer is not an autopilot (so don't confuse it with the Toggle Level Autopilot command. They are not the same thing!) The level stabilizer will keep the B-25/PBJ straight and level so you want to make sure you're pointed in the general direction of your target before you engage it.

2. **Set Flaps.** Flaps are sometimes required because at high altitudes and/or low speeds the B-25/PBJ is too heavy to maintain altitude otherwise.

   An interesting historical note: The fuel pickup in the B-25/PBJ fuel tanks was too high to get all the fuel in the tanks (to the tune of about 40 gallons). Pilots would often fly with Â¼ flaps in order to use the remaining fuel and thus extend the aircraft's' range.

3. **Verify throttle and prop pitch settings.** I recommend setting these as soon as you reach altitude to give the plane time to settle.

Find the chart that matches your altitude, fuel level and payload and change your throttle and prop pitch accordingly.

For instance: If you're going to drop ordinance from 10,000ft with 50% fuel and 4x500lbs bombs you would set your throttle to 74 and your prop pitch to 90. If your fuel level falls between two columns then use the settings for the nearest one (i.e. if you have 60% fuel then use the 50% fuel column).

NOTE: Some rows are split into two different variables. The upper numbers indicate the optimum setting. The lower numbers are a compromise for those who don't have trim mapped to a knob or slider.

4. **Center your rudder.** At this point you should be headed more or less towards the target. Use your rudder trim to center the ball.

   Important! Neutralize your trim before you take off! Your trim is not automatically centered when you start the game (I suspect this has something to do with joystick calibration). You must map keys to the Rudder Trim Neutral and Elevator Trim Neutral commands. If you don't do this the trim settings in the bombing tables will not work! Once you've done this it takes 20-22 clicks of right rudder trim to center the ball (Engine torque is the deciding factor here).

5. **Adjust your altitude.** Use your elevator trim to adjust your altitude. Positive elevator trim will make the plane sink and negative elevator trim will make it climb.

   How I do it: The best way is to start 50 to 100 feet above your target altitude. Apply slight positive elevator trim until you start to sink. I let my altitude dip slightly below my target altitude and then I apply full negative elevator trim until the needle climbs to the exact (exact!) altitude I want.

   Now adjust the trim according to the **Elev** column in the bombing chart. Negative elevator trim makes the aircraft climb and positive elevator trim makes it sink.

   There are three trim starting reference points. **FP** indicates full positive elevator trim, **FN** indicates full negative elevator trim, and **N**indicates the neutral position.

   Use the keyboard (or HOTAS knob/slider) to reach full negative or full positive trim. You'll know you've reached the limit when the control column stops moving. For neutral just hit the neutral elevator trim key. Once you've done this just tap the relevant trim key the required number of times.

   For example: Using my previous example of 10,000ft, 50% fuel and 4x500lb bombs the **Elev** column gives me FP+37. Adjust your elevator trim to full positive and then hit the Elevator Trim Positive key 37 times.

Note: Depending on how far you are from the target you may have to adjust your trim slightly as time passes. Just keep an eye on it and if the plane starts to sink or climb adjust your elevator trim one or two clicks at a time to compensate.

6. **Program the bombsight.** If you haven't done so already enter your altitude and TAS into the Norden.

   I like to do this before I take off but it can be anytime before you drop your ordinance. It's just easier to do it early and not have to worry about it. This can be done from the pilot's seat so sometimes I'll do it on the climb out.

   Use the key mapped to Increase Sight altitude to...guess...increase sight altitude! Use Decrease Sight Altitude to decrease it. Use Increase Sight Velocity and Decrease Sight Velocity to adjust your TAS setting which is under the box marked "TAS" in the bombing chart.

   Remember to allow for the height of your target above sea level. If your target is on a hill or mountain you may have to do a recon flight beforehand in order to determine the correct altitude. If your intelligence officer is any good he'll have some relief maps with altitude markings provided before the mission but chances are yer just gonna hafta be a good guesser...

7. **Line up on the target.** Jump into cockpit #2 and hit the Toggle Gunsight key. You should see the bombsight and a view of the ground below. If not just wait a bit. The bombsight won't kick on if the plane is still unstable. Use the Increase Sight Distance key to increase the bombsight angle. If you were paying attention in navigation class you should see your target ahead (hopefully far enough away to make some adjustments).

   It's doubtful you've managed to point the plane straight at the target but hopefully you're not more than four or five degrees off. Use your rudder trim to swing the plane left or right to line the crosshairs up on the target. The farther you are away the faster the crosshairs will seem to move so it's best to adjust early. If you wait too long the plane won't be able to turn fast enough to line you up. If you can't see the target directly pick a landmark you know is close (a river or lake perhaps). You did study the map before the mission didn't you? Didn't you?!

   Once you can see the target raise and/or lower the bombsight angle to keep the target centered. Adjust the rudder trim right or left as needed. If you were smart and used my keypad layout you can make all your bombsight adjustments with just three fingers of one hand. At this point the only keys you should need to press are the rudder trim keys, the sight distance (angle) keys, and the toggle sight mode key.

   Note: This is the point of no return. You are officially on your bomb run. You cannot stop. No matter what happens you must not lose sight of the target. Neither enemy fighters, flak, nor an engine fire is reason enough to stop. You will either deliver your ordinance or die trying. Mission accomplishment before troop welfare! Attack!

8. **Automatic bombing.** Verify your altitude and TAS settings and as soon as you have the target under your cross hairs press the toggle sight mode key. The bombsight should begin tracking the target. Please note that the crosshairs indicate where the first set of bombs will hit. If you want to pickle the target with multiple bombs you should place the crosshairs so the bombs release just before the crosshairs reach the target.

   If the bombsight settings are correct the bombsight should begin to creep down slowly. This is normal. As you approach the target the bombsight will begin to slow and eventually stop moving. This happens a few seconds before the bombs release so you'll have to make some adjustments to keep the crosshairs on target. There are two methods you can use:

   Method 1: Disengage the bombsight by hitting the toggle sight mode key and then reengage when the crosshairs are over the target. This can be tricky so it's best to wait until the crosshairs have crept down a bit. You may have to do this a couple of times before the bombsight begins tracking correctly. As always practice is wise.

   Method 2: Use the Increase and Decrease Sight Velocity keys to keep the crosshairs centered. You can change the bombsight velocity without disengaging the bombsight. Decreasing the velocity will cause the crosshairs to creep up and increasing the velocity will cause the crosshairs to creep down. I've found this method to be a little more accurate but it's still easy to make an adjustment too late and accidentally drop your bombs. I don't recommend using this method above 12,000 ft. Small changes have a big effect at high altitudes and you'll end up releasing your ordinance before you want to.

9. **Manual Bombing.** Find the Manual Bombing Angle (MBA) on the bomb chart, line up with the target, set the bombsight angle using the Increase/Decrease Sight Distance keys and when the target passes under the crosshairs drop your ordinance (yelling "PICKLE!" is optional).

Manual bombing isn't as accurate as using the automatic mode but it is fun. It's also handy when you have several targets separated by more than a few hundred feet. You can spread your ordinance over a larger area by manual bombing. When manual bombing you use the same angle for all settings at a certain altitude but you still need to set your prop. pitch and throttle according to your payload. You should also try and drop your ordinance just a wee bit before the crosshairs cover the target to account for that Â½ second between thought and action. I don't recommend manual bombing at high altitudes.

NOTE: Here's a little trick that will make manual bombing a little easier. Make sure your bombsight angle is 0 (pointed straight down) and when you are ready to release your bombs just hit the Toggle Sight Mode key (the key that turns the bombsight on and off). All your bombs will drop at once and you don't have to keep pounding the fire button when dropping multiple bombs.

Caution Don't use brakes until nose wheel is on runway. Braking before nose wheel is lowered causes it to be thrown violently to the ground.

10,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
FLAPS UP	39	220	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			90	80	199	N-40	384	77	90	200	FP+26	386	82	90	201	FP+10	388
3x250lbs + 3x500lbs			75	80	198	N-35	380	74	90	199	FP+33	384	78	90	200	FP+17	386
2x1000lbs 4x500lbs			76	80	198	N-31	381	74	90	199	FP+37	384	78	90	200	FP+23	387
6x250lbs			73	80	198	N-26	380	80	80	198	FP+40	382	75	90	199	FP+25	384
12x100lbs			72	80	197	N-21	379	78	80	198	FP+44	382	74	90	199	FP+29	384
8xFAB 100lbs			72	80	197	N-30	379	80	80	198	FP+39	382	75	90	199	FP+24	384
10xFAB 50lbs			74	80	198	N-16	381	82	80	199	FP+49	384	77	90	201	FP+37	388

12,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
FLAPS UP	36	220	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			75 69	84 90	195	FP+24 FP+21	386 385	72	90	196	FP+7	389	75	90	197	FP	391
3x250lbs + 3x500lbs			80	80	194	FP+31	384	70	90	195	FP+15	386	81 72	85 90	196	FP	389 387
2x1000lbs 4x500lbs			80	80	194	FP+36	384	70	90	195	FP+20	387	73	90	197	FP+5	390
6x250lbs			75	80	193	FP+41	382	68	90	194	FP+23	384	71	90	196	FP+7	387
12x100lbs			74	80	193	FP+46	382	100	80	194	FP+28	384	71	90	195	FP+12	387
8xFAB 100lbs			74	80	192	FP+37	381	95	80	194	FP+22	384	71	90	195	FP+5	387
10xFAB 50lbs			77	80	194	N-31	384	70	90	195	FP+36	387	71	90	197	FP+20	390

14,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
COMBAT FLAPS	33	210	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			65	80	170	N+38	349	69	80	172	N+21	352	76	80	173	N+9	355
3x250lbs + 3x500lbs			63	80	169	FN-34	346	67	80	170	N+27	349	71	80	172	N+14	352
2x1000lbs 4x500lbs			63	80	169	FN-27	347	66	80	170	N+37	350	71	80	172	N+19	353
6x250lbs			61	80	167	FN-28	343	64	80	169	N+36	347	67	80	170	N+17	349
12x100lbs			60	80	167	FN-22	342	64	80	169	FN-37	347	67	80	171	N+24	350
8xFAB 100lbs			61	80	167	FN-27	344	64	80	169	N+33	346	67	80	170	N+16	349
10xFAB 50lbs			61	80	168	FN-8	345	64	80	170	FN-29	349	68	80	172	N+33	352

20,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
COMBAT FLAPS	30	220	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			75	100	163	N+8	371	81	100	165	N-5	375	88	100	167	N-17	378
3x250lbs + 3x500lbs			83	90	162	N+17	368	77	100	164	N+2	372	82	100	165	N-11	375
2x1000lbs 4x500lbs			82	90	163	N+24	369	86 77	93 100	164	N+15 N+7	372 373	81	100	165	N-6	375
6x250lbs			77	90	161	N+24	365	74	100	163	N+8	369	78	100	164	N-7	372
12x100lbs			76	90	161	N+31	365	86	90	163	N+14	369	78	100	164	N	373
8xFAB 100lbs			78	90	162	N+25	366	89	90	163	N+6	369	79	100	164	N-6	373
10xFAB 50lbs			78	90	162	N+43	368	75	100	164	N+27	373	79	100	165	N-6	375

METHOD BEHIND THE MADNESS

How did I do it? It wasn't easy! I've included this section on the off chance that someone might want to either verify and/or improve on the bomb chart.

1. Set up a test mission in FMB. I used object 177 (large target) with a Japanese fishing boat for testing ship strikes (small target!) and object 177 on land with various aircraft, tanks, etc. I used object 181 (long white object) to highlight the target and make it easier to see from high altitudes. I placed the B-25 out quite a way to give it time to settle and point it in the right direction. I used a handy little program called Easy Convert to determine the starting height and airspeed (it just converts different units of measure). I also inserted a couple of cameras over the targets so I could watch the bombs hit.

2. Play the mission. I unchecked limited fuel in the difficulty setting so I didn't have to worry about changing fuel levels over time (The B-25 can really suck fuel!) After determining bombload and fuel level I start the mission...

3. The second I enter the mission I hit all the keys I think I'll need at the time. Level stabilizer, flaps, trim, turbocharger stage, etc. Then I had a checklist:

A. Set throttle and prop pitch. Determining this wasn't easy, especially when starting a new chart. As a pattern started to emerge it became easier but never really advanced beyond an educated guess.

B. Hop to no-cockpit view and adjust the throttle to reach the target airspeed. I used the no-cockpit view TAS because it was the most accurate and differences in even one KPH would affect where the bombs landed. This accuracy won't be achievable in a full-real situation but it's handy for practice. Once I've reached my target airspeed I return the throttle to its original setting.

C. Adjust trim. I'd neutralize all trim and then set my rudder trim. After that I would set my elevator trim. It usually took several attempts to get the correct trim setting.

D. Program the bombsight. Sometimes I would do this while adjusting my speed. Sometimes I just didn't feel that coordinated.

4. At this point I would start hopping between cockpit #1, the bombsight, and no-cockpit view to keep an eye on speed, altitude and direction and make any adjustments necessary.

5. As I approached the target I would hop into the bombsight view and line myself up on the target using the rudder trim keys. As I got closer I would hop in and out of no-cockpit view to make sure my speed was steady. As I said, even one KPH made a difference. Once I engaged the bombsight I stayed in that view until the bombs released. If the crosshairs moved up the target I knew I was going a little too fast and if they moved down the target I knew I was going too slow (although they're supposed to move down the target to a small degree). The sight rarely tracks perfectly.

6. Once the bombs released I would immediately go to no-cockpit view to verify my speed and then hop to the camera above the target to wait for the destruction. Where the bombs hit determined my next course of action.

A. The bombs hit. At this point I would fly a couple more missions to verify the settings and then a final mission to verify the elevator setting. When determining the trim settings I would set the trim where I thought it should be and then speed time up to see what happened. If the plane was climbing I'd slow down time, adjust the trim slightly, and then speed it up. I kept doing this until I found the "sweetspot". This was probably the most time consuming requirement (at least it felt like it!)

B. The bombs miss. I would note where the bombs fell and make adjustments on my next mission. If the bombs hit too soon I would set my throttle a little higher on the next mission. If they hit too late I would throttle back. It often took several attempts to find the correct settings. I estimate that, on average, each bomb combination in the bomb table required roughly five missions to determine the settings. Hmmm...let's see...four charts with 21 combinations each...that's about 420 missions. Nah...I bet it's more than that even...

QUICK REFERENCE

10,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
FLAPS UP	39	220	Thr	PP	IAS	Elev	KPH	Thr	PP	IAS	Elev	KPH	Thr	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			90	80	199	N-40	384	77	90	200	FP+26	386	82	90	201	FP+10	388
12x100lbs			72	80	197	N-21	379	78	80	198	FP+44	382	74	90	199	FP+29	384
8xFAB 100lbs			72	80	197	N-30	379	80	80	198	FP+39	382	75	90	199	FP+24	384

12,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
FLAPS UP	36	220	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
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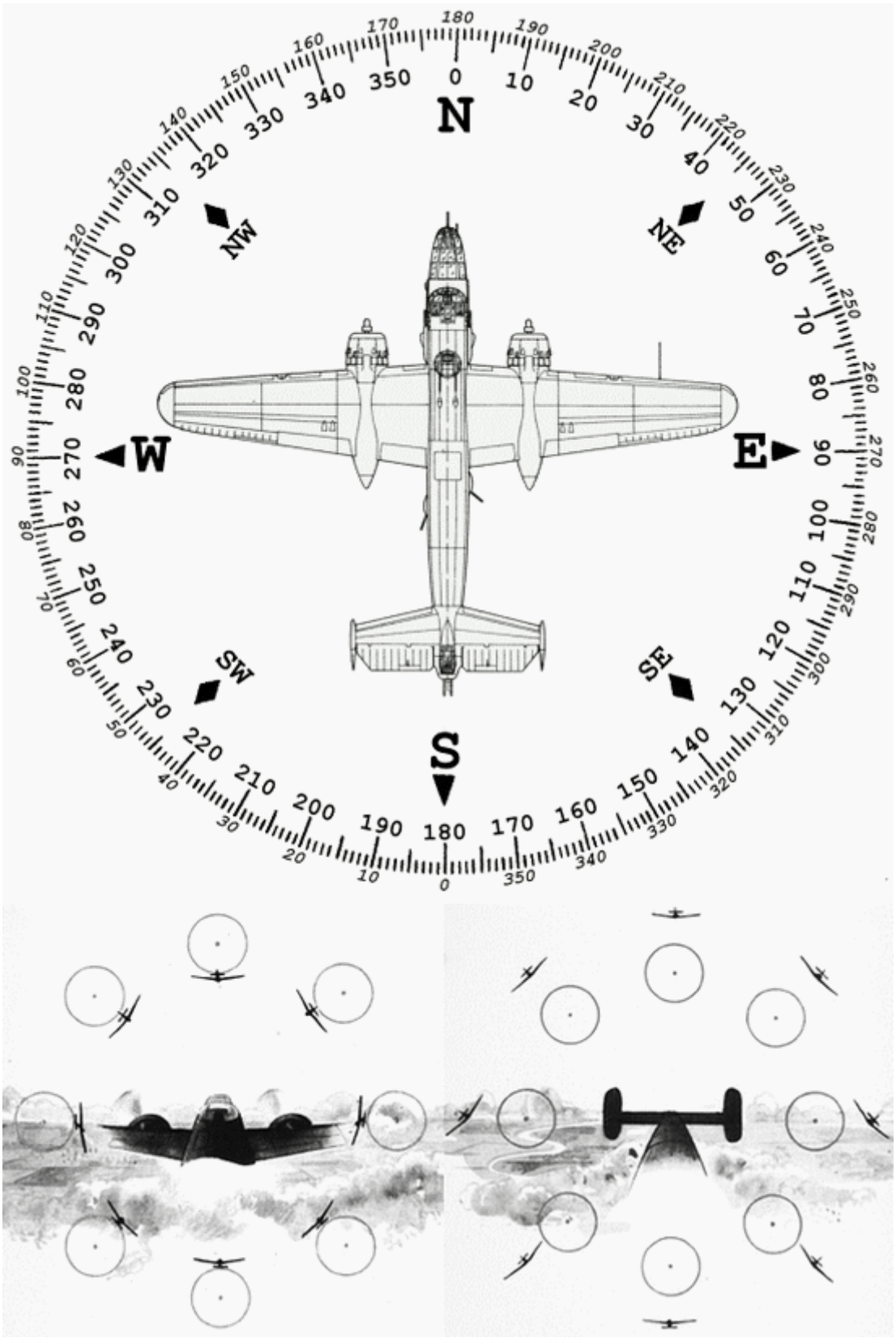
			69	90		FP+21	385										
12x100lbs			74	80	193	FP+46	382	100	80	194	FP+28	384	71	90	195	FP+12	387
8xFAB 100lbs			74	80	192	FP+37	381	95	80	194	FP+22	384	71	90	195	FP+5	387

14,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
COMBAT FLAPS	33	210	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			65	80	170	N+38	349	69	80	172	N+21	352	76	80	173	N+9	355
12x100lbs			60	80	167	FN-22	342	64	80	169	FN-37	347	67	80	171	N+24	350
8xFAB 100lbs			61	80	167	FN-27	344	64	80	169	N+33	346	67	80	170	N+16	349

20,000	MBA	TAS	25% Fuel					50% Fuel					75% Fuel				
COMBAT FLAPS	30	220	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH	Thr.	PP	IAS	Elev	KPH
3x1000lbs 6x500lbs 4x500lbs + 1x1000			75	100	163	N+8	371	81	100	165	N-5	375	88	100	167	N-17	378
12x100lbs			76	90	161	N+31	365	86	90	163	N+14	369	78	100	164	N	373
8xFAB 100lbs			78	90	162	N+25	366	89	90	163	N+6	369	79	100	164	N-6	373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