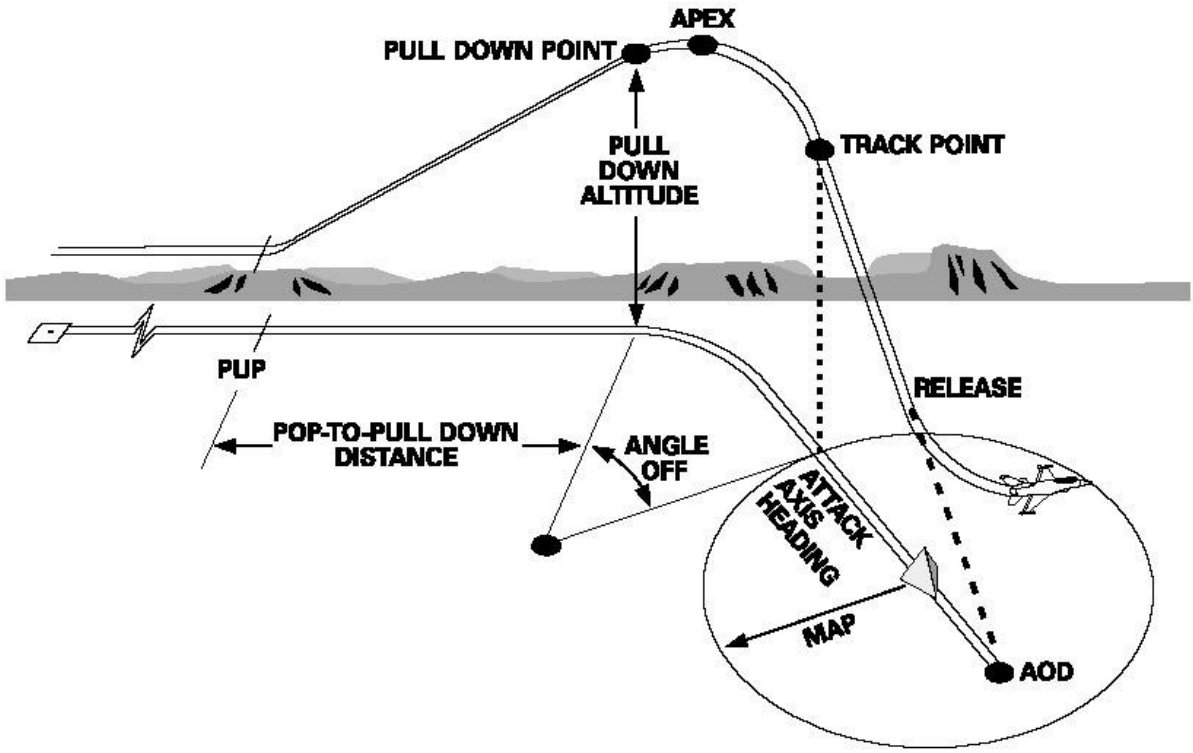
Pop-up Attack

Manual

Version 4.7

Written by

Cars "*Falcas*" Burgers



Picture from MCH F-16 Volume

Table of contents

Introduction.

Imagine you have to bomb a bridge and it's defended by AAA and SAM2's. The weapons assigned for the job are MK84's and you are coming in at 20000 feet. You see your target at your 2 o'clock, 5nm. The RWR is screaming with AAA and a SAM 2 just got a lock on you. You turn in to the target, but with everything going on around you, you lost it. Ah… there it is again. Turning the nose on it, diving to the ground. Aiming, aiming, yes you got it. Pickle and get out of here. But what was that? Altitude is 7000? BANG, BANG, BANG..... I just got hit. Engine is out and it's time to leave this piece of falling metal.

It has happened to us all. Getting shot down by SAM's or AAA while dropping your bombs. How do you get to the target and back? This is the big question for all strike missions. Planning is partly the answer. If you plan your attack, you will have a better change to survive the strike mission. But how and what can you do? One of the things that could be done is making sure you are not seen. Ok let's take a F117 or B2 and we will be ok. But we are Viper drivers aren't we? We don't have that choice.

One thing you might try is staying below the radar and pop up just before we drop our bombs. This will give the enemy only a short time to track and so, a short time to aim and shoot at you. But when do we go up? How high do we climb? The answer to this question is found in the MCH 11-F16 Vol 5 and RP5 manual. This program will give you the variables to put in the F-16's computer. The F-16 will display the visual cues in your HUD to turn, pull and dive.

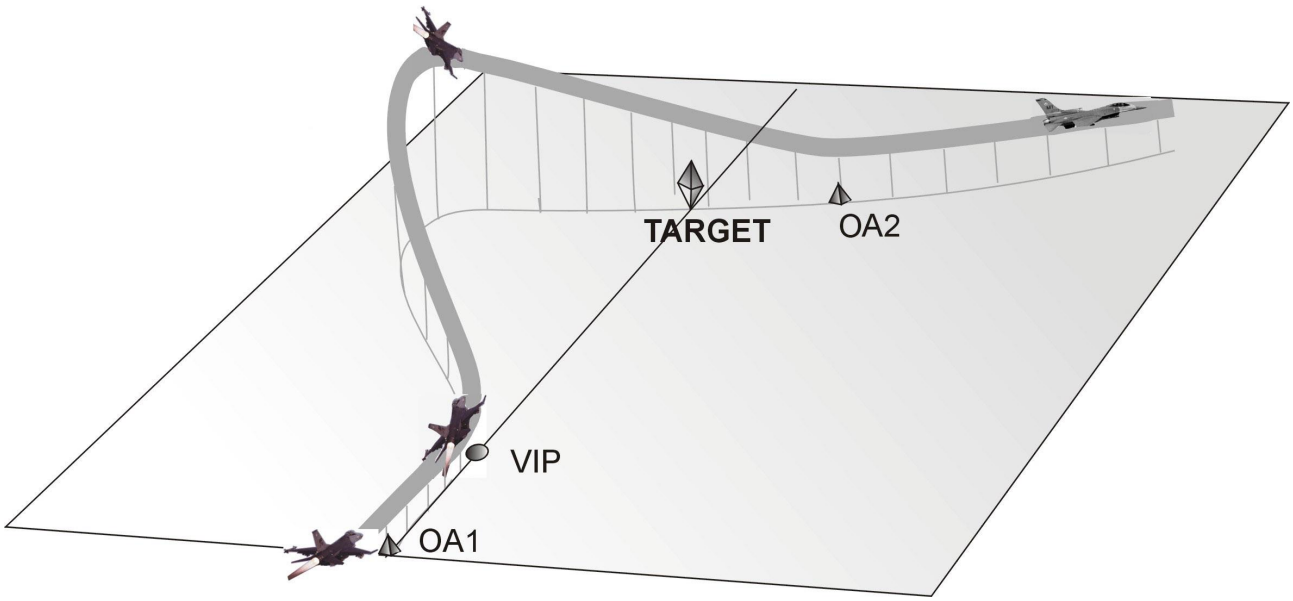
Differences between Manuals.

Different manuals use different names for the visual cues and the positions where they are placed. Some things in this manual will differ from what you might be used to. Because Falcon is a computer program and not a real F-16, it has its limitations. We need to change some small parts to get better use of what we find in real manuals. Feel free to use all the calculations as you want, just have a careful look at the names and places I gave to the points to avoid confusion. Take some time to look at the pictures and take a note where the cues are placed. I made some changes in the place of the visual cues to get an easier use and understanding of the visual cues. Where and why they are placed is explained in this manual.

But first, what do we do in a pop-up attack and after that, how do we fly the pop-up?

The profile part 1.

We have to fly a route that I call 'the profile'. In the program you can select two types of profiles, which have a slightly different route. When it is followed like it should be, you get your target under the pipper at the altitude and dive angle you wanted to have to drop your bombs. It sounds easy but you will have to do a lot of turns and pulls in a very short time. At the same time you have to know where the target is.



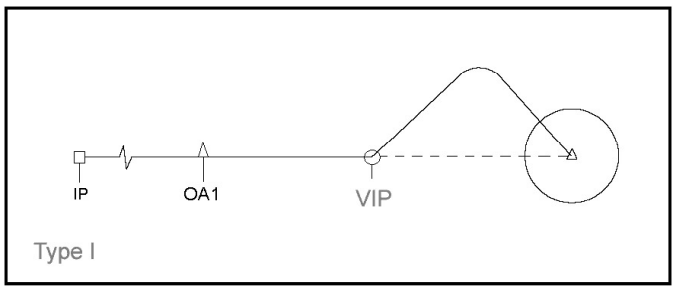
Picture 1: Type I Profile.

There is the possibility to program up to four visual cues in the computer of the F-16. These are called VIP, OA1, OA2 and VRP and are displayed in the HUD as circles and triangles.
This program provides you with the data that you should put in the F-16 computer to have the visual cues at the right position as well as the angles and heights you need.
How you fly the profile is described later in part 2.

Pop-up theory.

You can fly a lot of different kinds of pop-ups. In this program are only two of those profiles. For these pop-ups you will fly a flight profile that will always be the same. So when you got the idea how it works, it doesn't change.

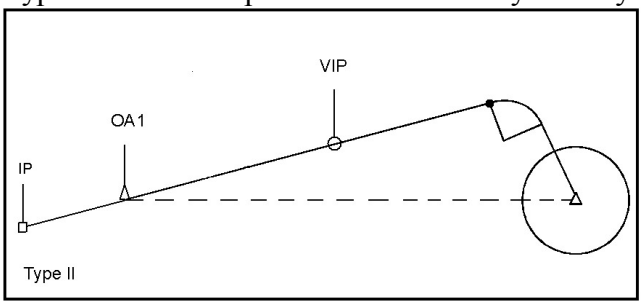
To fly an approach to the target that is relatively easy to fly and keeps you save from AAA, you will have to fly some turns. This will generate some difficulty for the AAA. To do this, you have to fly "past" the target at the right distance and then turn towards it to drop your bombs. How you fly "past" the target, can be done in two ways. The first way is to fly directly towards the target. Before passing the target you turn way from it and start your pull-up. (Picture 2)
The second option is to fly a path that is flying past the target from the beginning and start your pull-up at the right point. (Picture 3) In both cases you will get a certain offset from the target, which will give you the right distance for the final turn and your bombing run.



Picture 2: Type I Profile.

Type I and Type II.

Type I is the first option. You have to fly directly towards the target and do an offset turn before you start the pull-up.



Picture 3: Type II Profile.

Type II is the second option. No turn has to be made after the start of the profile, only some error correction and the pull-up.
Type II is a little bit easier to fly, because you won't have to do the turn before the pull-up.
How the two profiles are flown, is explained in chapter: The Profile part 2.

The VIP.

The first point I start to talk about, is the point where you start turning and climbing. This point is called the VIP or Visual Initial Point and has a known bearing and distance relative to your target. The VIP is displayed as a circle in the HUD. This is the most important visual cue of all. If you don't have the other visual cues, you can still fly the profile with relative ease. But if you miss the VIP, it gets really difficult.
Flying towards the VIP should be done with a pre-planned heading. For Type I this heading is planned in such a way that you will fly in a straight line over the VIP to the target. For Type II this heading is the same heading with which you will do the pull-up.

Line up with the VIP.

Lining up for the target is done because, for Type I you need to make a turn of an exact amount after the VIP. This will be the heading with which you pull-up. For Type II this is already the pull-up heading. To get on this heading to the VIP you need a point before the VIP. This will make it easier to line-up the VIP. For this point the IP is normally used. The IP is the last waypoint before the target and it is the square in the flight plan.
Using the IP in Falcon4 will give some difficulties. You have to place the IP very precise in the planning map before you start the flight. So I have chosen to use OA1 for this point. OA1 is a triangle in the HUD and has a given bearing and distance to the target. Now you don't have to place the IP so accurate and you will have a good point to fly to. Another advantage is the fact that you don't have to change waypoint when you are close to the target. This is a moment of high workload and you want to keep it as easy as possible. You are also more flexible with flying to the target even if you didn't plan the mission.
If you still want to use the IP as normal, just take the distance and bearing from OA1 and place the IP at that point.

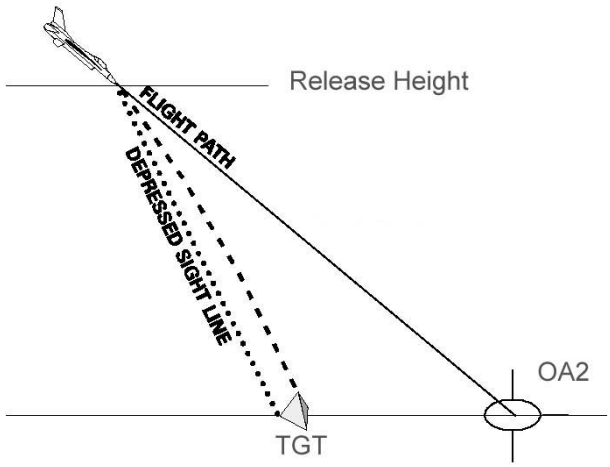
The offset.

For Type I, we turn left or right at the VIP to a predetermined heading. Like all climbs and turns, it has to be done with a predetermined amount of g's. It will give you an offset slightly away from the target. This offset is made to keep the target in sight when you do the pull-up and makes it easier to turn in to the target. You don't have to turn the airplane completely upside down, the amount of bank you have to roll is less. And this will make the profile easier to fly.
Using Type II you don't need to make a turn to get the offset you need. Just flying from OA1 to the VIP will give the right offset already.

The pop-up.
After the turn with Type I and passing the VIP with Type II, you have to pull the nose up until a certain climb angle. This is also done with the predetermined amount of *g*'s. Fly along the climb path to a certain height above the target. You are now at the pull-down point. Roll the aircraft with the lift line (looking straight up) towards the target. Pull the nose, with the same amount of g's, toward the calculated aim point. This point is called OA2 or Off Aim point 2. The distance between the Target and OA2 is called the Aim Off Distance (AOD).

The dive.
When you rolled the wings level, you should have the planned dive angle and fly to OA2, the point just beyond the target. The OA2 is indicated by a triangle in the HUD. Point the FPM at the OA2, you need to fly over the target and not in to the target. See picture 4 for clarification.

If you have flown the plane, as it should, you should have a couple of seconds to aim and pickle the weapon. At this stage it is not important any more if have the exact dive angle or not. Just concentrate on hitting the target. What is important is the height that you drop the bombs. If this is to low, you will fly in the bomb blast and will have damage.



Picture 4: OA2.

Leaving the target area.
Now break hard to the predetermined heading or pull up and climb away. The exit point can be shown on the HUD as well. It is called the VRP (Visual Reference Point) and is displayed as a circle.

Some thoughts.
Now take a moment and think about what you should see in your HUD when flying this. Flying towards OA1 you could see a lot of visual markers in the HUD. For Type I, the OA1, VIP and target should be on one line. OA1 is a triangle and after passing that you fly to a circle, the VIP. After the pop-up it's a triangle again, you aim at the OA2. And as last the VRP is a circle.
So think about triangle, circle, triangle, and circle.

Important rules.

To fly the pop-up correctly, you should fly the planned trajectory precisely. You will have to be especially focussed on several characteristics.

Climb and Dive path.

The reason for calculating all these points comes down to one simple thing. It will get you to an exact point in the air where you aim the plane at the target. You will then have the right dive angle, speed and height. Just imagine driving a car over a high round bridge. On the other side of the bridge is the target. From the highest point of the bridge to the point where you exit the bridge is a straight line. This is the same as the bombing run. It doesn't matter how you get to the highest point of the bridge, you just have to get down on that straight path.
What does that mean for us? It means that all the climb- and dive angles are a straight path through the air from one point to another. To fly a climbing or descending path, you should fly with the help of the FPM (Flight Path Marker). If you want to fly a dive angle of 30deg, the FPM in the HUD should be on the 30deg ladder. It does not matter where the nose of the plane is pointing.

The difference between TAS and CAS

In the cockpit there is an instrument that measures pressure. This instrument has an error. An airplane speed indicator indicates IAS (Indicated AirSpeed). Calculate the error of the indicator itself, and compare it with the IAS. If you delete the error of the indicator you will get the CAS (Calibrated AirSpeed). Error of the instruments is so small that you can say that IAS is the same as CAS. But you still don't have the TAS. The first problem is altitude. The higher you get, the less molecules there are in a fixed amount of air. That means you need more speed to get the same pressure in the instrument. The result is: If you climb with a fixed CAS, the TAS will increase.

The other factor is temperature. Higher temperature means less molecules in the same space and so the same effect. I believe in Falcon4 the atmosphere is modelled as the standard atmosphere. The result is that we can neglect the temperature effect.

The F-16 can show you TAS in the HUD. Look at your Airspeed tape on the left hand side of the HUD. You can see a symbol like this "_C". The C stands for CAS. Use the switch on the right lower console or the key SHF+CTRL+ALT+V to change it to "_T". The airspeed you see now is the TAS. ("_G" is Ground Speed). Just taping the key when you are on the ground won't change the indication in the HUD, but the TAS is pre-selected. It will change automatically when you raise the gear. The instrument will always show CAS when the gear is down.

The other solution is to calculate the CAS from the TAS. This should be done by looking at tables. You can find this table in the RP5 manual. Flying with CAS will increase the error of the flight profile.

Speed.

One other important value to think about is the speed you fly. It is important to fly the speeds you have planned, since all the ranges and performances are calculated with these speeds.
All the calculations are done in True Airspeed (TAS) The TAS is the speed with which you are actually moving trough the air. It is possible to use Calibrated Air Speed (CAS), but then the CAS has to be calculated from the TAS. Make sure you use the right speed indication.

Height and Altitudes.

Height and altitude can also be a problem. When you want to drop your bombs at 8000' height, but the target is on a hill that's 2000' high, you will have to drop your bomb at 10.000' altitude. So remember: height is the space between you and the ground. Altitude is the amount of feet between the airplane and MSL (Main Sea Level). Elevation is the difference between MSL and the ground. (Think of the hill, it has an elevation of 2000')

Planning your mission.

What do we need?

This is always a good question to start with. When you know what you need, you also know what you should be looking for.
For a start we need to know what the target is. Is it a "point" like a radar or is it long target like a bridge or building? If it's a "point" it doesn't matter from which direction you attack it. If it's a long bridge you might want to think about attacking it along its axes. This way you can ripple your bombs in a "stick". What is the elevation of the target? Is it on a mountain or at sea level?
What is the threat that surrounds the target? Can you find a route around AAA and SAM's?
What does the surrounding look like? There could be a mountain blocking your route during the attack or during the exit.
So you see, a lot to think about. Here are 6 steps to follow.

Step 1. Recon.

A good place to start is the recon screen. Take a look at your target. When it's a long target, write down the heading to which it is pointing. See how long the target is. Then you can decide on ripple and spacing. Notice the colour of the target. Might help during the day. Try to find out what the elevation of the target is. Also take a look at what is around the target. This is for a mental picture so you can recognise the target fast. Like a road or buildings, the factory should be to the left of the city. Maybe make a small sketch of the surrounding and the big objects.
Recon the position of AAA, SAM's and radar stations. You should get a plan working in your head now. If you can't think of any route to the target… Stay home! (Start with SEAD strikes first.)
Check if objects like mountains or cities block your entry and exit. You should look in a radius of about 10nm. The calculation starts from a point that is at the same elevation as the target. If you start higher than the target, you will end up at the wrong place when you turn in to the target.

Picture 5: Recon in Falcon.

Step 2. Ordnance.

Choose your ordnance. Think about the target to hit. Will the bomb destroy the target? Do I use low or high drag bombs? This depends on the dive angle in relation with the release height and bomb blast. Also the bomb range is different with high drag bombs. So you will fly over the target. (Low drag bombs only for this version)
How many bombs will I take? Think about the weight of the aircraft. Four MK84's and a climb to 12000' will not work. You will lose too much speed.

See what the “stick” length will be with a ripple bombing. You should drop all the bombs on the first pass and leave the area. You should never want to make a second pass over the target unless you are really, really, really sure that nothing can shoot you down!

Step 3. Dive angle and Release height.

What will be the best dive angle and the release height? High dive angles give a better accuracy, small dive angles gives you more cover from the ground. Think about the bomb blast by determining the dive angle and release height. Look at the surrounding. Maybe a mountain will cover your pop-up. Higher release altitudes are easier to fly, you have more time and space to correct errors. Dive angles of 30 degrees will give you a nice compromise to start with.

Step 4. Attack heading.

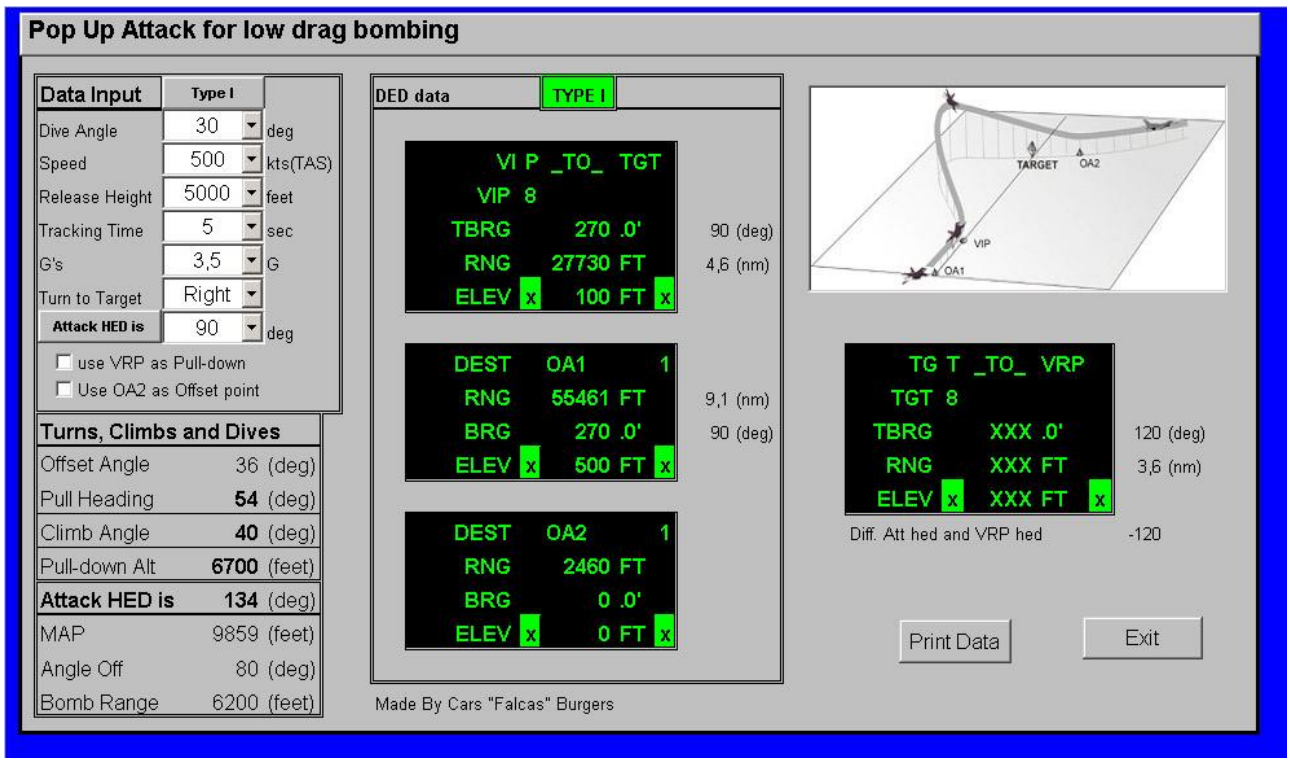
At which heading do you want to drop your bombs? Does it have to be a specific heading like bombing a long bridge? Take a look at the upper right corner of picture 5. Recon in Falcon.

Step 5. Leaving the target area.

To what heading do you have to turn to leave the area safely and how far do you want to fly in that direction? This all depends on the threat around the target and the position of the waypoint after the target. Find the safest route and note the bearing and distance from the target.

Step 6. Putting the accumulated data in the program.

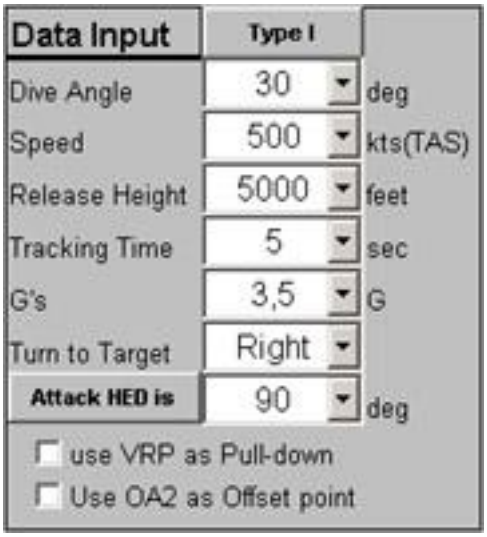
So now that we did al this research, which data do we need to put in the program? Picture 6 shows the program. It has one field to put in the data and a couple of fields to give information.



Picture 6: The program.

Data Input.

The Data input field (Picture 7) must be used to enter the data we have accumulated before. Just click on a box and scroll down the list. Select the value you want.



Picture 7: Data input.

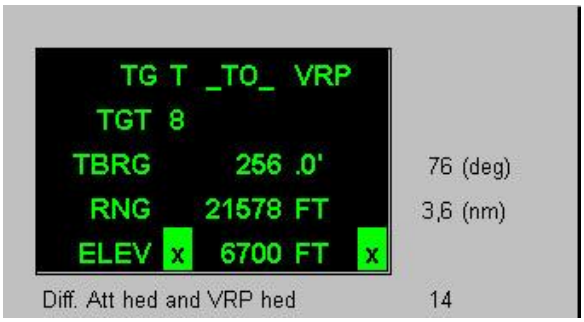
- The dive angle should be clear by now. Select one of the four options.
- In the speed box select the speed at the point you release the bomb. This speed is TAS. If you can, try to fly the whole profile with the same speed. This will give the best result.
- The release height, is the height above the target. Where you want to pickle the bombs.
- The tracking time is the time you have to aim. It starts after you rolled wings level and pointing at the target and it stops when you pickle the bombs. I recommend using 5-7sec.
- Pull-down g's are the g's with which you want to make all the turns and pull-ups.
- The Turn to Target is the last turn you make to fly towards the target. Do you want to make a left or a right turn?
- The Attack Heading can be switched to Approach Heading. If you have selected Attack Heading, the program calculates the profile with the heading you want to drop your bombs, like we talked about in step 4.
  If you selected Approach Heading, the program calculates the profile with the heading you want to approach the profile. It is the place where you want to put OA1. The heading is the dotted line in picture 2 and 3.
- If you select the box "use VRP as Pull-down" you will activate the DED data for the VRP. It will give the data for the VRP so it is placed at the point where you have to start the turn in and the dive to the target. *(Due to a problem in falcon, this point is not correctly shown in the HUD. For more information see the chapter Know problems.)*
- If you select the box "use OA2 as Offset point" the place of OA2 is not behind the target, but at the point where you start the turn in and dive. The Elevation is set to zero, so you can see it on the ground. *(Due to a problem in falcon, this point is not correctly shown in the HUD. For more information see the chapter Know problems.)*

What will the program give you?

And now for the big question: What will the program give me?
It will give you 4 fields with different kinds of information. First we have a look at what you have to insert in the F-16's computer. In the DED you have to insert the VIP, OA1, OA2 and VRP data. The program will give the data in the DED Data field (Picture 8). This field contains three pages like the DED in Falcon4. The VIP, OA1 and the OA2. For a better situational awareness you can see the distance in miles and heading to the target for the VIP and OA1. It is to the right of the VIP and OA1. In the picture it 90(deg) 4,6(nm) and 9,1(nm) 90(deg).
If you have selected the "use VRP as Pull-down point" box, the VRP data is shown. If you haven't selected the box, the planner has to choose a point as an exit point. Take any bearing and distance you want.

Picture 8: DED Data.

If you have selected the "use VRP as Pull-down point" box, the XXX will disappear and data is given from the VRP Data. (Picture 9) If you use these values the VRP is placed at the turn-in and pull-down point. To the right of the DED field is again the heading and distance to target.



Picture 9: VRP Data.

If you have selected the "use OA2 as Offset point" box, the data of the OA2 will change. The OA2 will be moved to the turn-in and pull-down point. The elevation is zero for the OA2, so you can see the OA2 when you do the offset turn. When you will do the pull-up, you are sure the VRP will be visible in the HUD. These two selections for VRP and OA2 can be used in Falcon, but you will soon find out that there will be an error. For explanation see chapter: Known problems.

It is almost time to do some flying. But you still need to know what the flight profile should look like. For this purpose is the Turns, Climbs and Dives field. (Picture 10) Here you can see how many degrees you have to turn at the VIP. In picture 10 this is 36deg. If you have selected a Type II profile, it will show XXX. No turn is done at the VIP with a Type II profile. It also gives you the heading you should have at this time. In the picture it's 54deg. After the turn you start the pull-up. Pull the FPM up until the amount is the same as given in this field. In the picture it is 40deg. When passing the pull-down altitude, which is 6700, start the turn and pull-down to the target.

Turns, Climbs and Dives	
Offset Angle	36 (deg)
Pull Heading	**54** (deg)
Climb Angle	**40** (deg)
Pull-down Alt	**6700** (feet)

Picture 10: Turns, Climbs and Dives.

Attack HED is	134 (deg)
MAP	9859 (feet)
Angle Off	80 (deg)
Bomb Range	6200 (feet)

Picture 11: Extra info.

The field to the bottom left, will give some extra information. This field is called the Extra Info field (Picture 11) In this field you see what the MAP (Minimum Attack Parameter) is. The MAP is the distance over the ground from the point you have your wings level to the target. The Angle Off is the amount of degrees that you have to move the nose in the last turn to the target. The Bomb Range it the horizontal distance the bomb will "fly" until it hits the ground.

You can use the Print Data button to get the data you need printed out before you start Falcon.

Entering data in the cockpit.

Picture 12: The ICP.

How do we use al this data and where can we put it in the F-16? The first thing to understand is what can be put in the computer of the F-16. You can only insert four visual cues that will be displayed on the HUD. It's the VIP, OA1, OA2 and the VRP. You can only see them if you are in NAV or A/G mode. The program gives the data for the VIP, OA1, OA2 and VRP. If the "Use VRP as Pull-down point" box is not selected, the planner has to give the data for the VRP. The Integrated Control Panel, or ICP is used to enter the data (Picture 12). This is the "keyboard" in the F-16. The changes and inputs given in the system can be seen on the Data Entry Display or DED. (Picture 13)

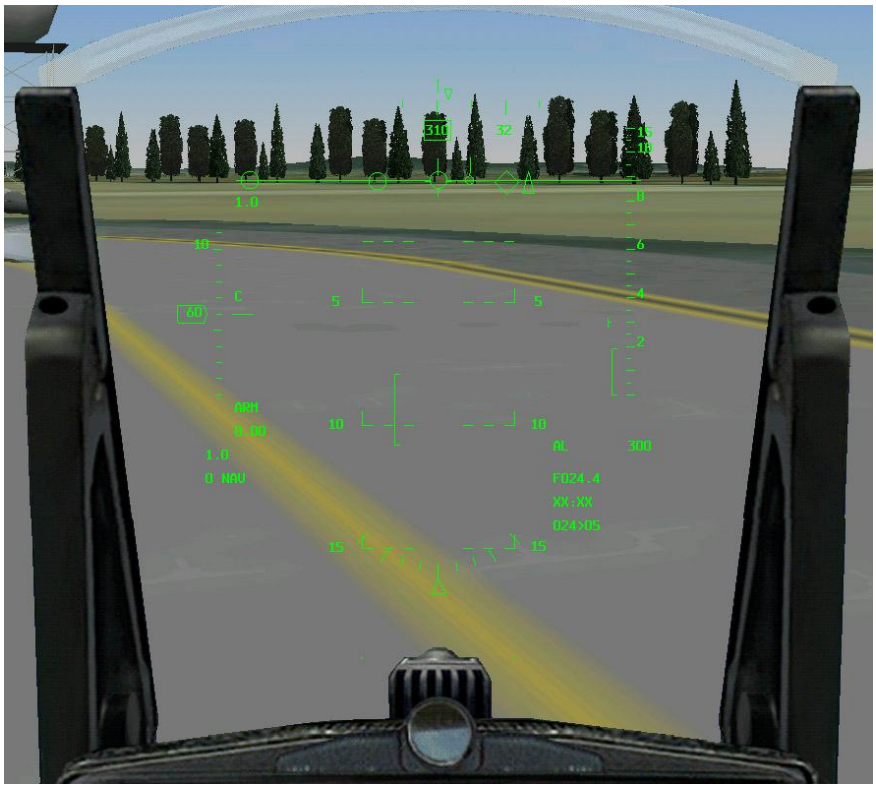
Picture 13: The DED in Falcon.

Go to your cockpit and start her up. Do all the things you need to do. When you have prepared the aircraft for taxi, it's time to insert the reference points.
The first thing to do, and this is a must, is select the waypoint where the target is located. When you made sure you got the right waypoint selected, look at your ICP and click on the LIST button. In the DED you will see the list of options. Select the VIP option by clicking on the ICP 3 button. Insert the data given by the pop-up program. The first thing you enter is TBRG (Bearing). All the headings/bearings should be inserted with one decimal. So bearing 226 should be inserted as 2260. This is done by use of the ICP and the data is entered in the system by clicking the ENTR button. Now do the same with the RNG (Range) and finish it with the ENTR button. Optionally you can insert an elevation, as you want. Some explanation is given in chapter: Visual cue's elevation. You have now programmed the VIP.

The next to program is the OA1 and OA2. First click the DCS (Data Command Switch) to RTN (the left) to set the DED to the default mode (picture 14). Just to made sure, have a look at which waypoint is selected.

Picture 14: DCS.

It should be the target waypoint. Now go to the LIST again. You have to select the DEST page by clicking the 1 on the ICP. Go back to the DCS and click on SEQ (right).
You should now be in the OA1 page. Insert the right data from the program like you did for the VIP. Again click on SEQ and you are in the OA2 page. Insert the data for OA2 and complete it by pushing the ENTR button.

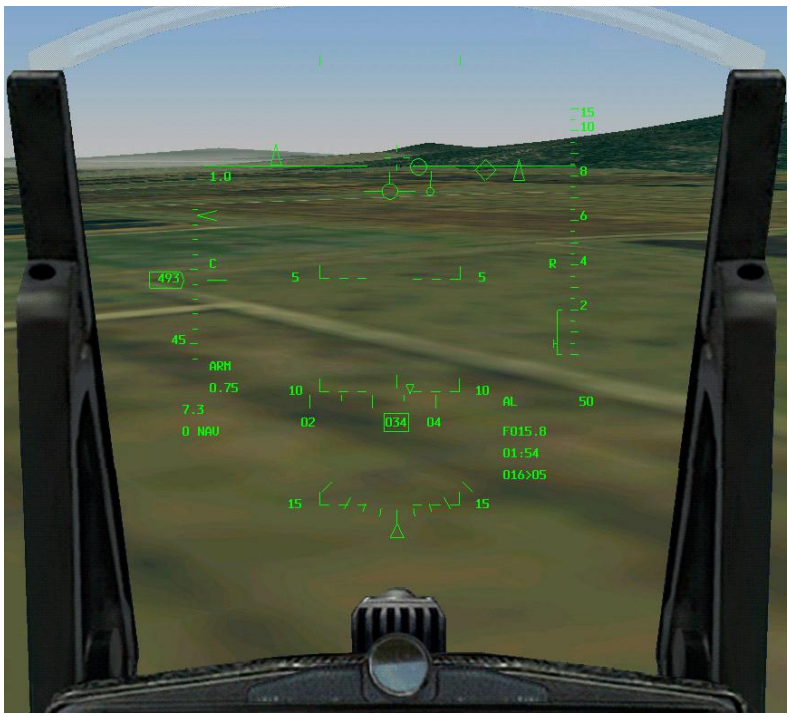


Picture 15: Taxi check.

The last to insert is the VRP. For this reset the DED to the default mode and check the waypoint. Go to the LIST page and select the VRP page by clicking on the ICP 9. Insert the bearing with the decimal and the distance in feet.

You have finished putting in the data and did all the other settings in your cockpit. You are ready for taxi. At this stage let the waypoint stay on the target waypoint. During taxi find a good place to point the nose of the airplane to the target. This is to check if the data input is done correctly.
In picture 15 you can see a part of the HUD. From left to right, you can see the VIP(circle), VRP(circle), Target(diamond) and OA2(triangle). OA1 should be more to the left.

Visual cues elevation.
The advantage of giving the visual cues an elevation is very easy. For some cues it is a must to give it an elevation and for others it should always be zero. If you use OA2 as an off aim point after the target, the elevation should always be zero. For the use of the VRP as the Turn-in and Pull-down point, the right elevation should be inserted in the elevation line. For the other cues you can use them as you want. The program will give some values as a standard, but feel free to use any other. In picture 16 you can see how difficult it is to see the difference between the OA1 and OA2 or



Picture 16: Elevation of cues.

the VIP and VRP. If you have given OA1 an elevation of 500', it is good to see that the left triangle is OA1 and in this example you have to turn to the left to line-up for the target.

The profile part 2.

Type I

For a good idea of what this profile looks like, have a look at picture 1.

Approaching the target.

Passing waypoint 4 you are in a turn to OA1 and flying low. OA1 is positioned that it is a straight line through the VIP and the target. OA1 has a distance to the target that is 2 times the distance of the action range. As an example we have a bridge that we want to attack. We will use the following parameters to do this and they are the values used for the TE Pop-up bridge, included in the zip.

Picture 17: Approaching OA1.

Dive Angle	30	deg
Speed	500	TAS
Release height	5000	feet
Tracking time	5	sec
Pull-down G's	3,5	g
Turn	Right	
Attack heading	090	deg

In picture 17 you can see the position just prior passing OA1. The triangle is seen just right of the heading indication. In this case the OA1, VIP and target are almost on one line and a correction can be made. You have to fly a bit to the left to line-up the VIP. That means the circle should be over the diamond. Is the circle a little bit to the left, as in this case, you have to fly to the left to get the circle to the diamond. This is the same principle as landing an airplane on a runway. The circle is the threshold (beginning of runway) and the diamond is the end of the runway. Don't overdo this. OA1 is placed so that you are coming from the right direction already. The error in the picture is so small that you could just fly directly to the VIP and concentrate on you flying.

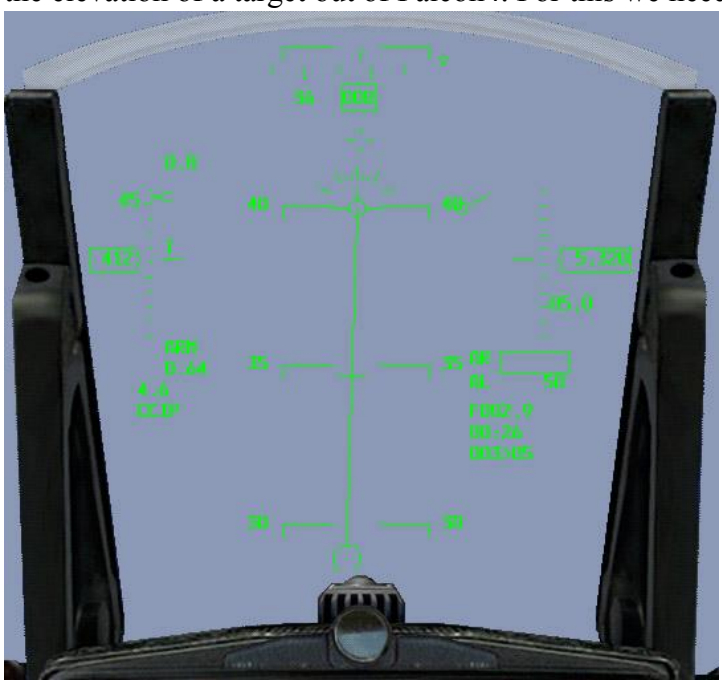
Approaching the VIP, like in picture 18, keep an eye on the distance to the target (lower right corner of the HUD). The VIP is at a distance of 4,6 nm, so be ready to turn. The first turn should be a left turn. Your heading is 046 when passing the VIP and you have to make a 36deg turn to the left. This turn should be made with 3,5 G's (Upper left corner of the HUD). After the turn you have a heading of 010deg. You can find this all in the "Turn, Climb and Dive" field.

The pop-up.

Roll the wing level and start the climb. Pull the nose up with 3,5 G's until the FPM is at 40deg up (like in picture 19). Make small adjustments to the pitch to keep the FPM on 40deg up and push up the throttles. You are losing your speed at this time. It is not a big problem to lose some speed here. You are flying a path up to the point where you are going to pull down again. Losing speed will make the next turn tighter, but you will do that turn by looking at the target. If you can, take a look at the target. It should be on your right 1 o'clock and moving towards your 3 o'clock.

Picture 18: Approaching the VIP.

The next thing to keep an eye on is the altitude. This is very tricky. You want to have the height above the target, but that's **not** what is in your HUD. It shows the altitude above MSL and not above terrain. You have the nose up high so the radar altimeter is not working or you are flying above a hill that's higher than the target. But you did a good job on the recon and you know the elevation of the target. You also have done the addition of the elevation of the target with the Pull-down altitude. The problem is that I don't know how to get the elevation of a target out of Falcon4. For this we need a trick. If the target has a very low elevation, don't bother too much. And just use the altitude.



Picture 19: The climb.

It will give you a small error, but you will get the bombs on the target. When the elevation is high, you can use the following trick. Switch you altimeter to baro. And make sure the radar altimeter is on and working. Estimate if you are on the same height as the target (or a bit higher). Now look at the altimeter and that is about the elevation the target has. The program gives a pull-down altitude of 6700 feet. If the target is at sea level this is the altitude where you start the pull-down. If the target is higher than sea level, you have to add the elevation of the target to this altitude.

The dive.

Now it's time you start to turn to the target and start the dive. What do we know about this part? We know that the dive is planned to be 30deg. We also know we have to make an 80deg turn (Angle off) to the right and do this all with 3,5 g's. The combination of the two will make us do a roll to the right that should be more than 90deg bank. This is what you have to try a couple of times. I recommend going to full cockpit view. Then switch the view up 1 time. You can see the HUD now, but also a part above the HUD. This will help you to spot the target as soon as possible and keep a track on the g's you are pulling. You found the target and pulled the nose on it. You see the diamond over the target and your heading is to the east. Behind the target you see a triangle pointing up.

Picture 20: The dive.

The distance between the diamond and the triangle is 2460 feet. The 30deg down marker of the pitchladder should be crossing this triangle. It's your job to put the FPM on the 30deg marker as well. After rolled the wings level you have 5 seconds to make your aim. When the 5 seconds have passed, you crossed the 5000 feet where you want to drop your bombs. In picture 20 you can see that it's hard to fly exact. The FPM is on OA2, the speed is a little bit low and we have still 850'(look at Radar Alt) to go before dropping the bombs. But we got the target lined up as we planned and we should have a good drop.

Leaving the target area.

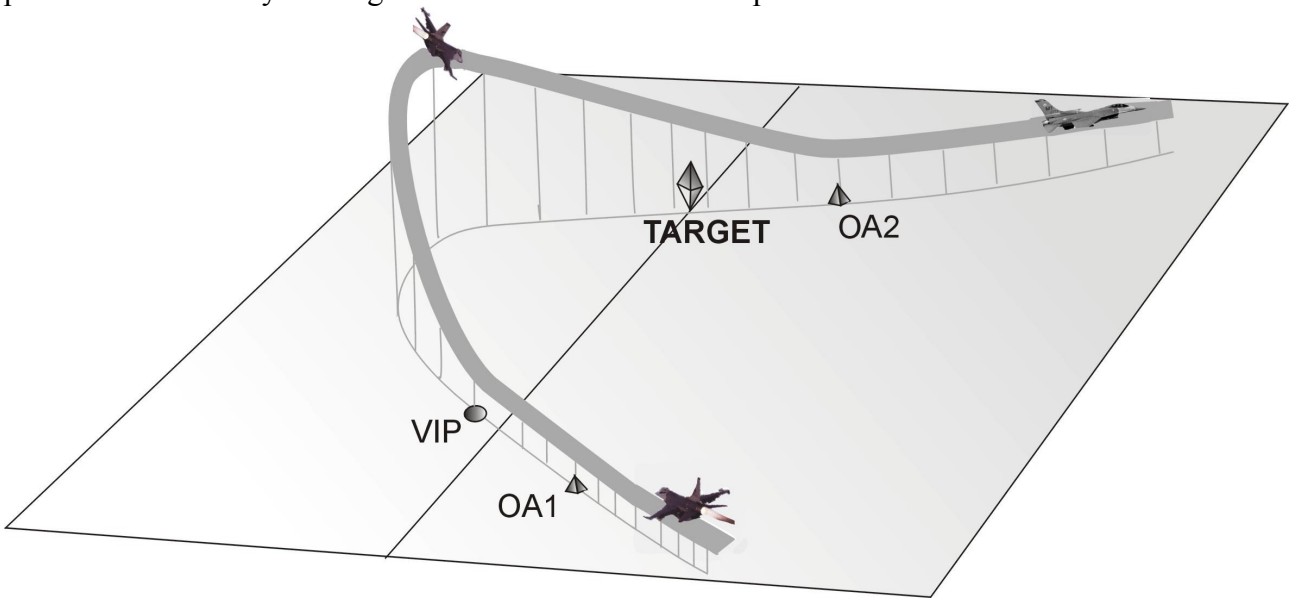
If this all worked out as planned, you just pickled your bombs and you are on your way back home. Turn to the heading where you planned to leave the area, in this case heading 170, and get out. You can go back to the deck or do a fast climb to higher altitude. That depends on the threat you are facing now. If you have put in a VRP at BRG 170,0 and 20000' you can see another circle in the HUD. This is the VRP. If you have passed the VRP, switch to waypoint 6.

Picture 21: Hit.

That's all there is to it…

Type II

The type II profile is slightly different from type I. The difference is the approach to the VIP. This is not done in a straight line to the target, but already with the right offset. As already said before, you don't need to make a turn after the VIP and just have to start the pull-up. You will see that this profile is easier to fly. For a good reference have a look at picture 22.



Picture 22: Type II profile.

Approaching the target.

You can approach OA1 from almost any direction you want. It will only be a bit easier if the approach is already lined up with the Pull-up heading. (picture 23) If so look at your HUD and place OA1 exactly over the VIP. Check the heading you have at this time and it should be the pull heading given in the Turns, Climbs and Dives field. (picture 10).

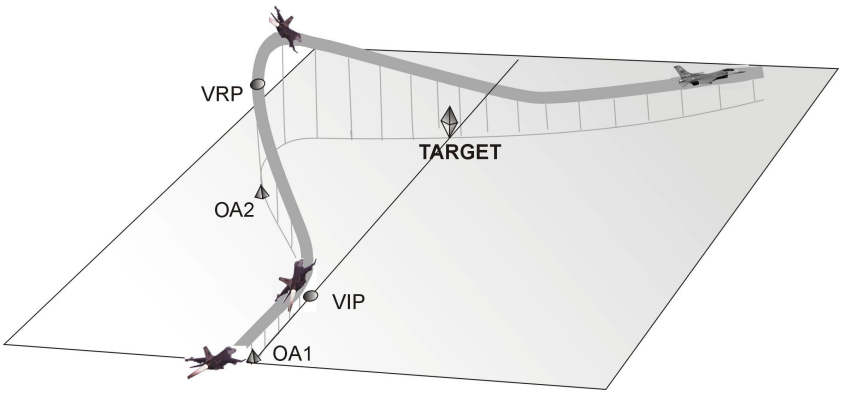
If you are approaching OA1 with an angle you should consider the following. Suppose the pull heading is to the north. You are approaching the OA1 with a heading of 300 deg. In this example the VIP and the target are to your right. If you would fly exactly over OA1 and then start your turn, you would overshoot the inbound track to the VIP. The best thing to do is to place OA1 to the right of the HUD and just before you get to OA1, turn to the right and fly to the VIP. How much before you start the turn to the VIP depends on your speed, the turn you have to make and how fast you will turn your plane. After passing OA1 the important

Picture 23: Approaching OA1.

thing to do now is to fly the right track to the VIP. This should be the Pull Heading. Make some small error corrections, but don't make large turns.

The pop-up.
After passing the VIP you have to start the pull-up. Pull the nose up with the planned amount of g's. From this point the profile is exactly the same as Type I. So for further detail see chapter: The profile part 2, Type I.

Using the VRP and OA2



Picture 24: Type I VRP and OA2 as offset.

As last I want to talk about the use of the VRP and OA2. As mentioned before, there is a problem when you use the VRP as pull-down point in Falcon. The visual cue is not placed at the right position.
The intention is the following. Select both the "use VRP as Pull-down point" and " use OA2 as Offset point". When you flying a Type II profile and lined-up your plane with OA1 and the VIP, the place for the Offset point is directly after the VIP. If you pull the nose up after the VIP, the VRP should be seen in the middle of the HUD and at the right climb angle. For a Type I profile, as seen in picture 24, you would make your turn after the VIP. You will have to turn to an exact heading and that's where OA2 should be placed. And again after the pull-up the VRP should be in the middle of your HUD. But because in Falcon these points are not placed in the right position, this is not the case. You could still use these points, but have to take in account that you change the profile. In exchange you will have a clear point to fly to. The dive won't be the same as calculated, but it will get you to the target in a good way as well. Feel free to use what you want. Just bare in mind that the visual cues are made to help the pilot fly a profile. If you get to confused or overloaded with work, remind yourself that the main objective is to get to you target and not to fly a perfect profile.

Picture 25: Type II Cues should be on one line.

Word from the author.

I started to make this little program for myself because I got more and more interested in the strike mission. Reading all the material, I found out that the way of use of the visual reference points, was different between the SP3 manual and the MCH 11-F16v5. After making the first calculations on a piece of paper I found it too much work to have fun with falcon this way. But if I had a program that would do all the calculations for me, it would be a different ball game all together. Now it is a lot more fun to plan and fly a complete mission. It gives an enormous amount of joy when it works as planned. I know that there are still some problems. I hope to solve some of these problems. I wish everybody a lot of fun with the program.

For feedback, questions or tips how to improve, contact me by Email: c.burgers@t-online.de

Known problems.

Lack of data.

The first problem encountered is the lack of data. The bomb ranges I found are not from a formula, but a table. I only have the tables for the 10,15,30 and 45 degrees dives. And that's only for low drag bombs. You can use it for the MK82, MK83, MK84 and all the CBU's or Rockeye's. I will be looking for formulas and hope to implement these.
If you use the High Drag Bombs, it will work in a limited way. The bomb ranges of the High drag bombs are a lot shorter. This way you will end up in front of the target, but have to drop the bombs at a lower altitude than given in the program.

Grid in Falcon.

I believe that Falcon uses a grid to place its waypoints and the visual cues. If you have a look at an ACMI and switch off the terrain texture, you will get an idea. This will give a number of problems for the pop-up.
All the visual cues are not placed on the right position, but on a corner of the grid. For the visual cue's that are far away from the target, like the OA1 and VIP, this is not a big problem. The grid is accurate enough. But for the VRP as pull-down point this is something different. This is the same if you use the OA2 at the pull-down point.

Placing of waypoint.

Another problem caused by the grid, is the placing of the waypoints in Falcon4. If you are attacking a complex, like a factory, the diamond can be at any place inside the complex. Mostly it is not over your target. This means that OA2 is not on the correct spot. You have to do the aiming by yourself, without the visual cue. You can see this in picture 20; the diamond is not on the bridge, but a little bit in front of it.

OA2 minimum distance.

The third problem caused by the grid, is the minimum distance for OA2 that can be given in to the F-16 computer. If the distance given in to the computer is less than 1650', the triangle will be placed on the diamond. The Aim Off Distance has to be estimated by the pilot.

References.

- SP3 Manual
- RP5 Manual
- MCH 11-F16 Vol5

Acknowledgements.

I thank Heino "*Snowman*" Burgers and Thorsten "Firebird" Graf for helping to improve and test the program as well as helping to write this manual.