Oberkommando der Kriegsmarine

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Stolzenberger Schnellhefter

Lfd. Nr. | Firma • Sache | Ort | vom

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Cover page

Geheime Kommandosache!

Torpedovorhalterechner T. Vh. Re. S3

State: 12.11.2020

Contents

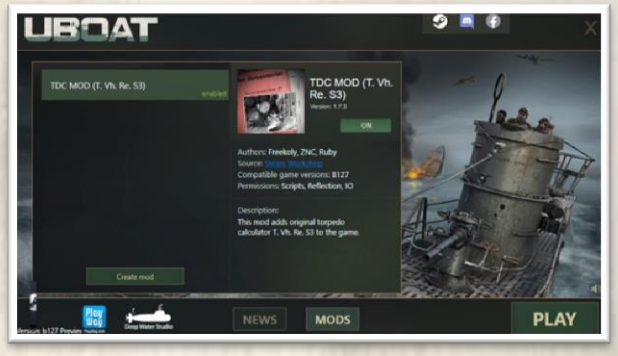
General

The TDC-Mod can be subscribed via Steam - Workshop.
https://steamcommunity.com/sharedfiles/filedetails/?id=2071624443

With which Uboat version the TDC-Mod is compatible will be published in the workshop under description.

Comments and discussions are always welcome.

Activation



After subscribing to the TDC-Mod, it must be activated in the Uboat-Launcher.

The Game Launcher is started in your Steam Library by clicking on the "Play" button and selecting the Game Launcher from the options menu.

Units of measurement

It is recommended to play Uboat in the unit of measurement "MIXED" (km, knots). The speeds on the TDC are given in knots, as on the original. This saves you the trouble of converting from km/h to knots.
You can change these in Uboat under Settings / Gameplay / Game settings / Units.

Abbreviations:

TDC:	Torpdedo data computer
TVhR:	Torpedovorhalterechner
LMC:	left mouse button
RMC:	right mouse button
hm:	hectometer

Torpedovorhalterechner T. Vh. Re. S3

This mod adds original torpedo calculator **T. Vh. Re. S3** to the game.

The device was carefully recreated from the original photos from u-boats and museums. Systems and calculation methods correspond to the real ones.

The Torpedovorhaltrechner (TVhR) or torpedo data computer (TDC) was the heart of the torpedo fire control system in german u-boats. It was located in the conning tower on the starboard side between the helmsman's station and the attack periscope. It was an electro-mechanical device that was designed for solving the torpedo triangle, calculating gyro angle and torpedo salvo spread angle.

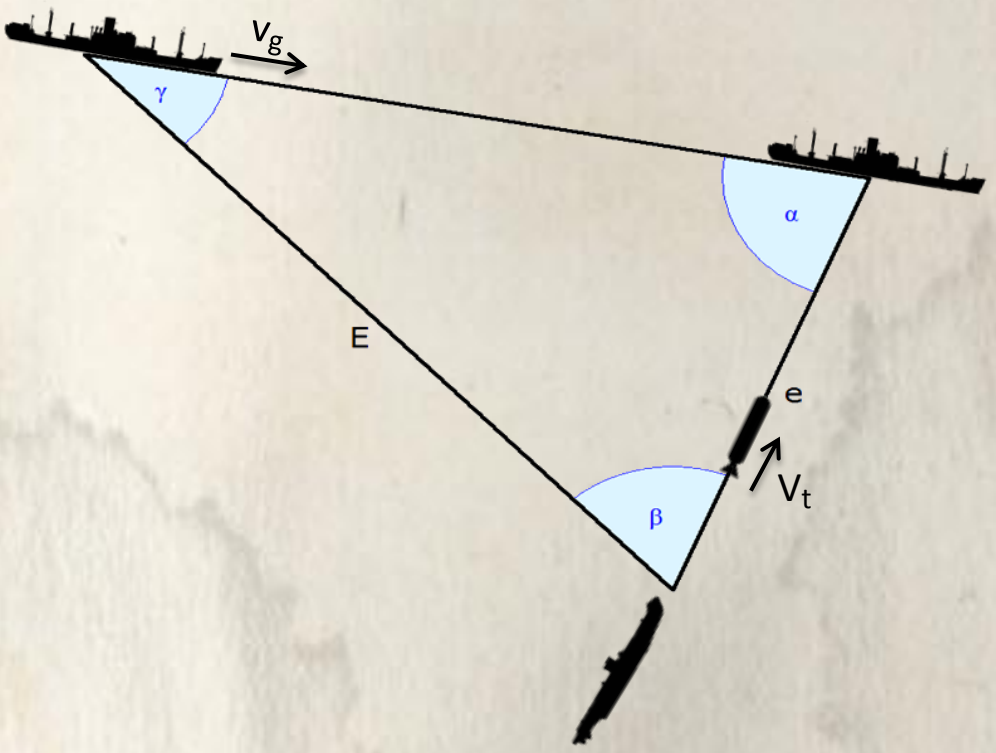
Torpedovorhalterechner **T. Vh. Re. S3**

Mathematical excursion

To understand all these parameters and settings, we will make a small mathematical excursion..

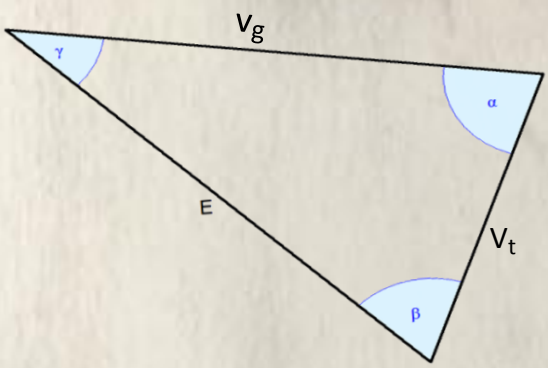
Shot triangle

We don't want to get into mathematics but this chart of a shooting triangle shall illustrate which values are necessary to achieve a successful torpedo hit.



Trigonometry Triangle

The above shot triangle can easily be represented as a trigonometric triangle.



Explanation of the terms

A short explanation of the names of the "trigonometry triangle" and where these values are entered in TDC.

V_g - target speed

- Speed of the target ship in knots
- Shown on the outer ring of the scale

E - distance

- Distance to target at the moment of torpedo launch
- Indicated in hectometres (hm)

V_t - torpedo speed

- Display torpedo speed in knots
- The inner number scale is read from right to left

α - track angle

- Lies between enemy run direction and torpedo run direction
- Is generated and measured from the torpedo direction clockwise to the rear of the target

β - target bearing :

- The target bearing is the angle between the direction of your boat and the targeted ship

γ - Angle on bow (AOB)

- The angle is between the direction of the target ship and target bearing
  Is measured from the middle of the target ship clockwise to the U-Boat position
- Is the bow of the target on the right, 0 - 180 deg. green
- Is the bow of the target on the left, 0 - 180 deg. red

e - torpedo run:

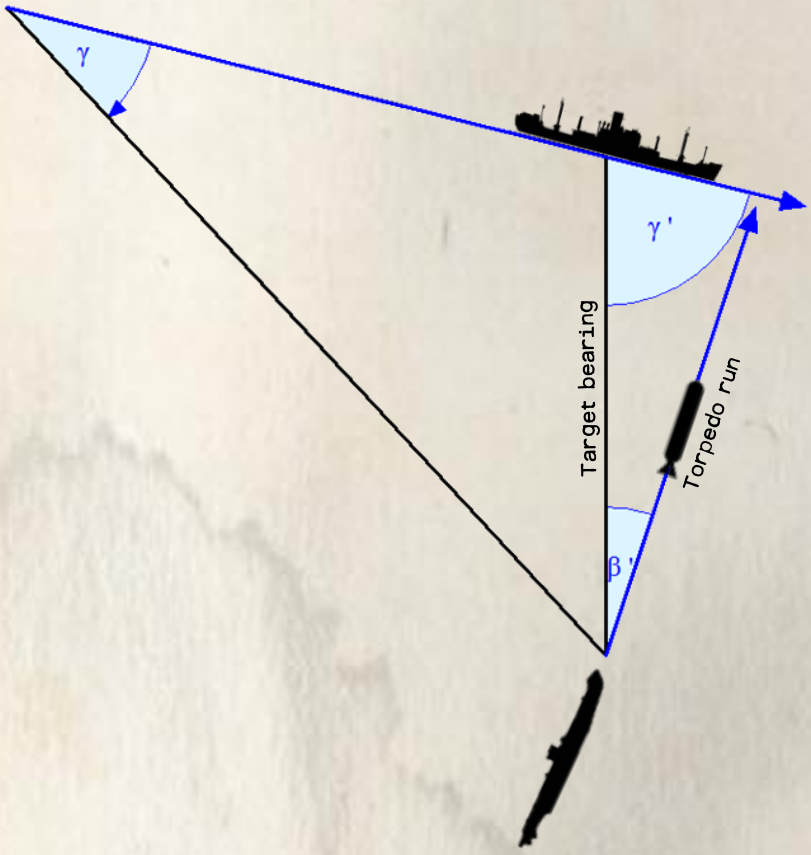
- Distance to target when torpedo is launched
- Dimensions in hectometres (hm)
- Standard setting 50 hm

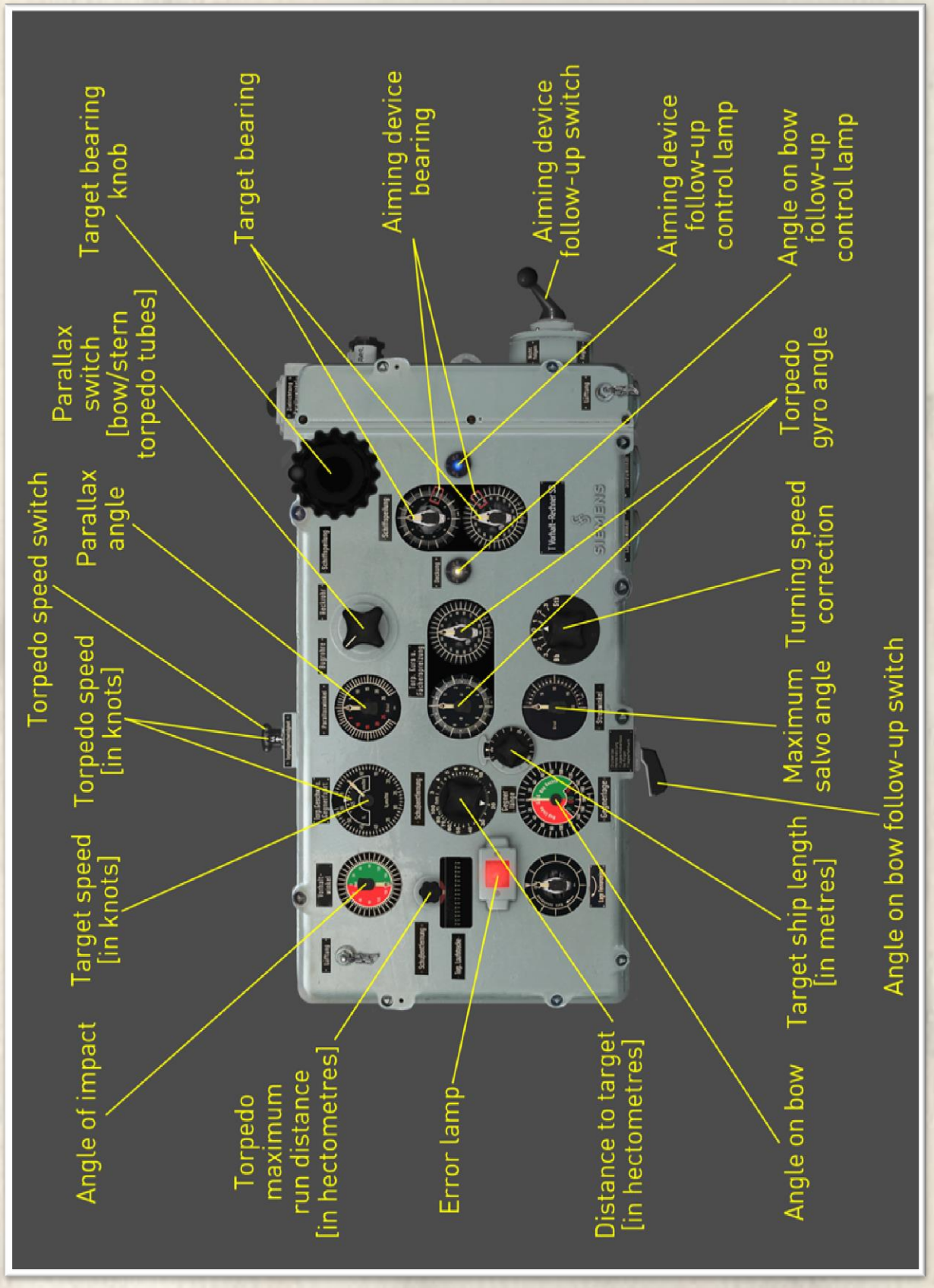
Torpedo - Firing solution

The TDC can determine a torpedo firing solution (gyro angle) based on the values determined and the ship's bearing.

You must always be aware that the torpedo run path will not be the same as the target bearing when the target ship is moving. This is illustrated in the next chart.

Y' = angle of bow (AOB)
ß' = Lead angle




Target bearing knob
Target bearing
Aiming device bearing
Aiming device follow-up switch
Aiming device follow-up control lamp
Angle on bow follow-up control lamp
Parallax switch [bow/stern torpedo tubes]
Torpedo gyro angle
Torpedo speed switch
Parallax angle
Turning speed correction
Torpedo speed [in knots]
Maximum salvo angle
Target speed [in knots]
Angle on bow follow-up switch
Angle of impact
Target ship length [in metres]
Torpedo maximum run distance [in hectometres]
Error lamp
Distance to target [in hectometres]
Angle on bow

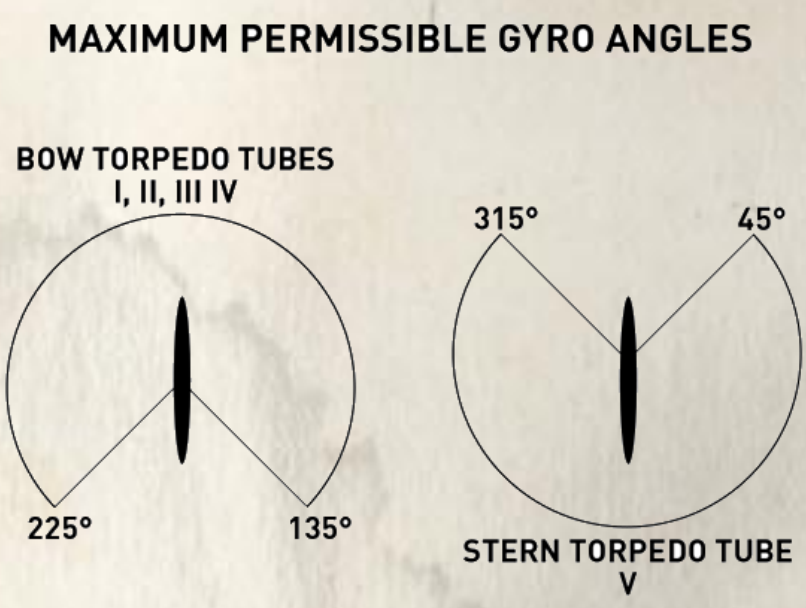
Changed mechanical properties

The TDC-Mod not only adds the TDC, it also changes the behaviour of the torpedoes.

Torpedo turning radius and gyro angle

The modulation simulates the torpedo turning radius and limits the maximum gyro angles.

- The turning radius of the torpedoes was changed, it is now almost 95 meters
- Torpedo gyro start delay
- the initial torpedo run is at about 9.5 meters
- For all types of torpedoes a torp. gyro angle of max. +/- 135 degrees is used



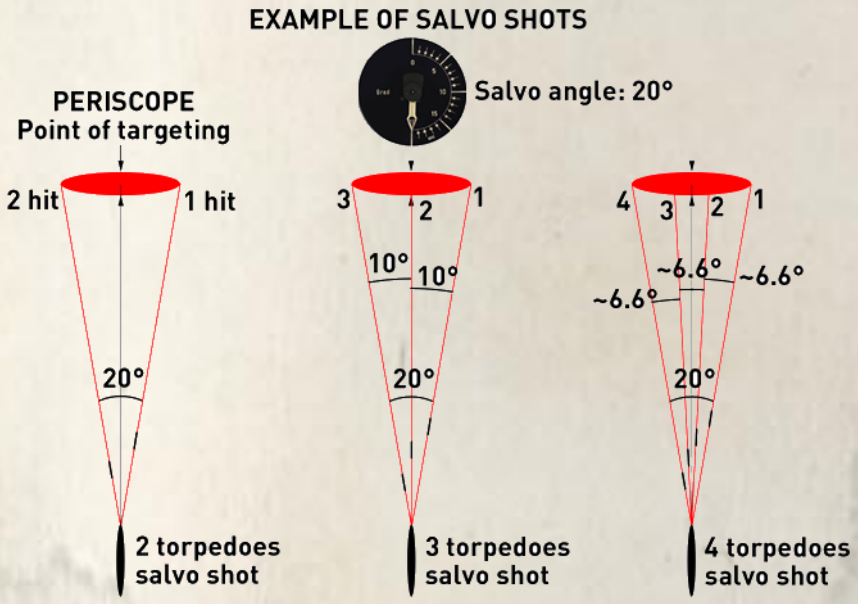
CHECK THE TORPEDO GYRO ANGLE BEFORE FIRING!!

NOTE:
If you fire a torpedo with a gyro angle greater than +/- 135 degrees, the torpedo cannot reach the specified angle and stops rotating at the maximum gyro angle.

If the gyro angle is greater than 135 degrees, the error light will be lit and the torpedo will not reach the target.

Salvo shot

The TDC-Mod changes the behaviour of the salvo shot.
The following picture shows the behaviour of torpedoes at various salvo shots with angle of 20 degrees.



PLEASE NOTE: TORPEDOES ALWAYS LAUNCH SEQUENTIALLY FROM RIGHT TO LEFT!

IMPORTANT:
The salvo spread angle dial in TDC UI just shows maximum permissible spread angle and it does not automatically updates salvo slider in ingame tropedo UI!

DON'T FORGET TO SET DESIRED SPREAD ANGLE MANUALLY OR WITH SALVO UPDATE BUTTON IN INGAME TORPEDO UI!

NOTE: Currently, the game does not allow a shot angle greater than 10 degrees.

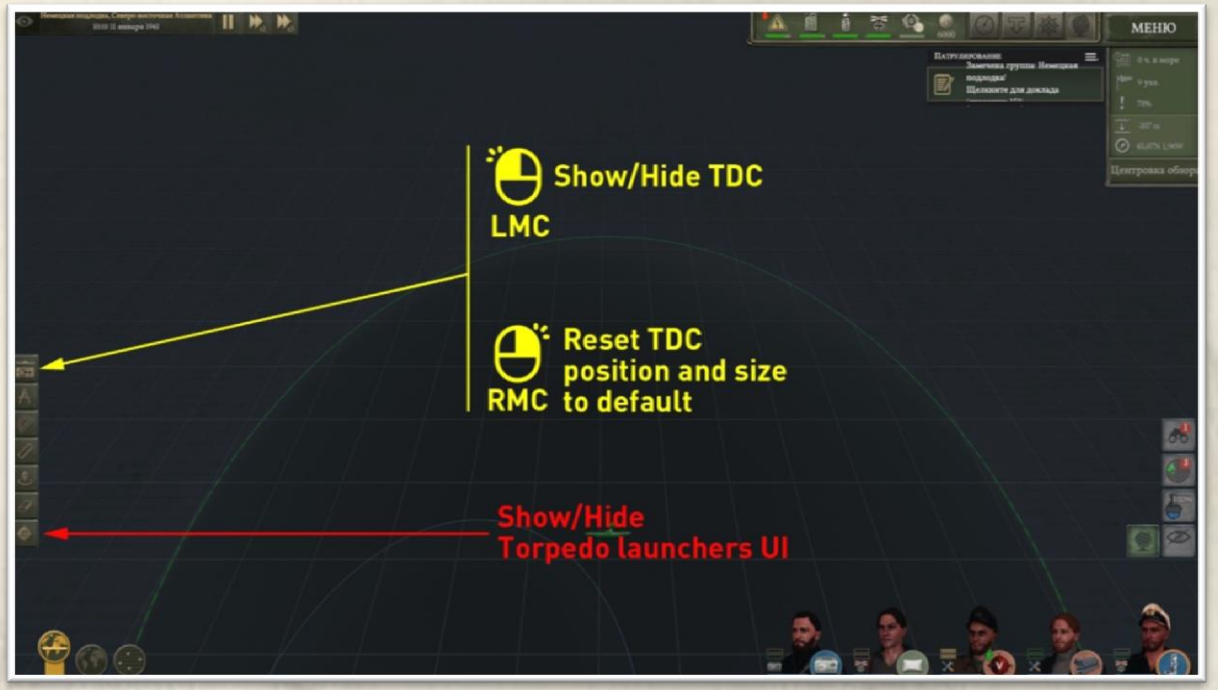
Dimensions

The dimensions in the map view are given up to 10 km in meters and then in km with one decimal place.

Map view

In map view is also now available to call torpedo launchers interface without selecting the target itself. Thus, you can make a torpedo attack without selecting target, with using only gyro angle from the TDC.

Note: In map view, the bearing in the TDC is not updated.



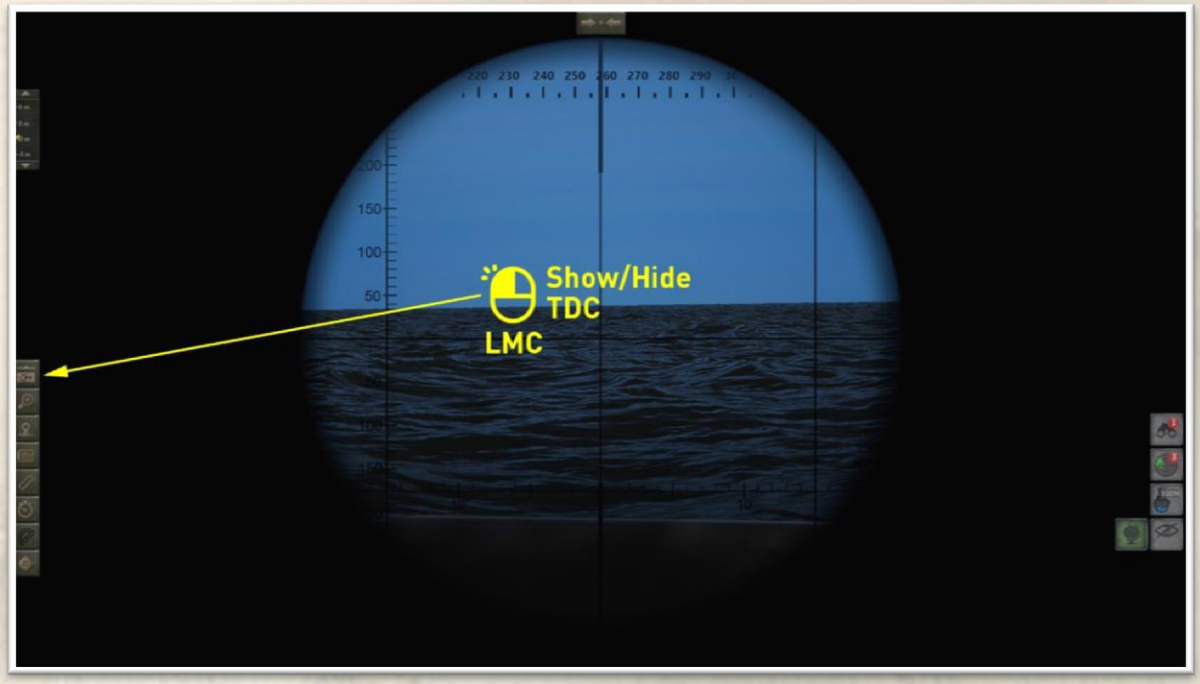
The interface like this:

Basics about user interface

Here are the basics of interacting with TDC and related interfaces.

TDC show / hide

Use this button in periscope or map view to show and hide TDC interface.



WARNING:
IF YOU INSTALLED THIS MOD FOR THE FIRST TIME AND THE TDC INTERFACE DOES NOT APPEAR BY CLICKING THE SHOW/HIDE BUTTON, TRY RIGHT-CLICKING ON THIS BUTTON.

THIS SHOULD RESTORE THE DEFAULT POSITION AND SIZE.

TDC move and scale

You can move the TDC to any position by clicking on the housing of the TDC while holding down the LMC.

Scale the TDC by clicking on the left or right bottom edge with the LMC pressed and change the TDC to the favored size.

Change display size

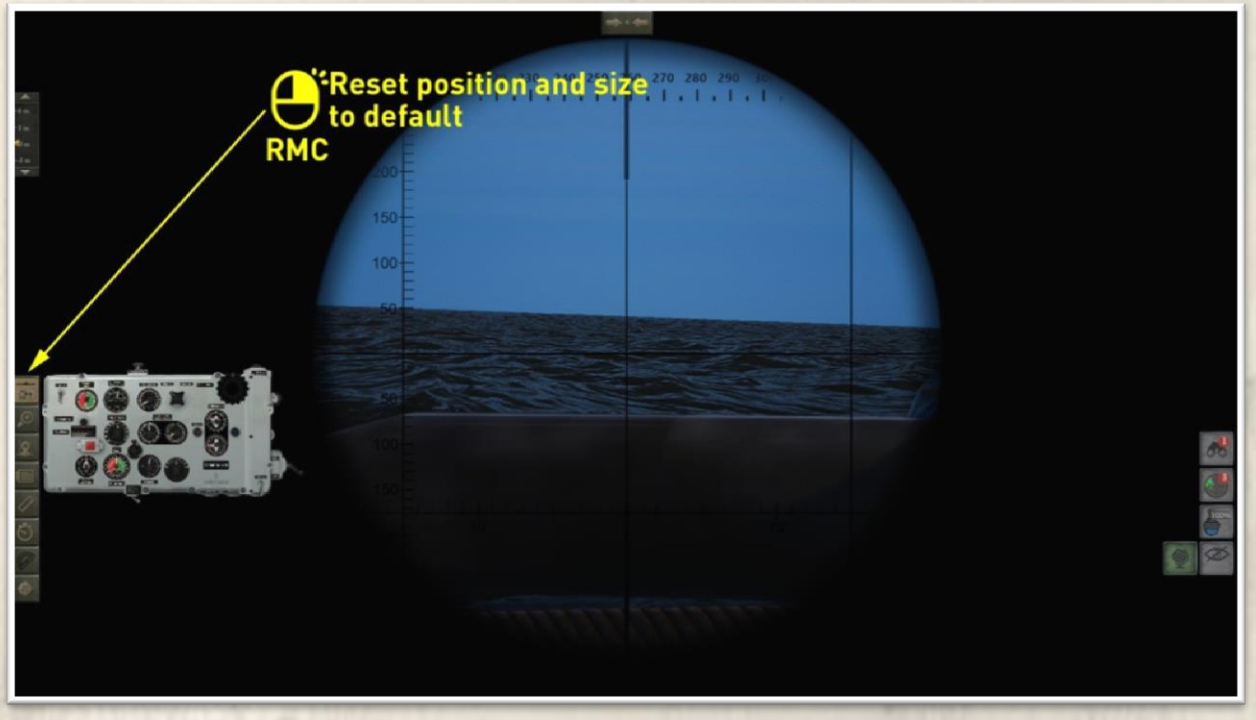
If you RMC on resizing zone TDC will get default size. RMC again on this zone to restore previous size.

Position and size are automatically saved for each station::

- Attack- / Observation periscope
- UZO
- Map view

Default size and position

If you want return to the default size and position settings, just RMC on show/hide button.



Lighting system

The TDC supports the lighting systems in the Boat and also has a day and night mode. During the day, red and blue light are only visible as light effects on the glass surfaces. From 21:00 - 06:00 o'clock the device is shown in night mode, depending on which light on the boat is switched on.

If the boat is submerged the TDC is always displayed in night mode.

Torpedo console

The torpedo launchers UI has been changed. Mod adds two new elements on it:

- TDC targeting on / off switch
- Salvo update button

TDC Switch ON / OFF

When it is switched on (Green lamp), all torpedoes will be targeted and launched according to the current TDC gyro angle, regardless of other ingame values/calculations.

Thus, your manual calculations (with standard ingame targeting tools) and calculations by u-boat crew will be ignored and the torpedo will be launched **ONLY** in accordance with the values provided by the TDC.

However, you can always enter the values that was determined by your officers into the TDC.

When it is switched off (red lamp), all torpedoes will be targeted and launched with using standard ingame procedures. In this case, calculations that was performed by you (with standard ingame targeting tools) or your u-boat crew will be valid.

Salvo-Update-button

Press this button to update salvo spread angle in torpedo launchers interface with current value of salvo angle from the TDC.

NOTE: Currently game allows to set this angle not bigger than 10 degrees.

Schematic diagram

Overview and classification of the instruments of the **Torpedovorhalterechner S3:**

Explanation of the schematic diagram

- red necessary parameters from the target ship
- orange Parameters for torpedo settings
- Blue Target bearing and course deviation, also necessary for calculations
- Green Calculations based on red, orange and blue

TDC in operation

The TDC can be used in the stations

- Attack- / Observation periscope
- UZO
- Map view

If values at the TDC are changed in one station, they are valid everywhere.

When you display the TDC for the first time, the unit will appear in its default position. If not, click with RMC on the TDC button to reposition the unit based on its display mode and scaling.

With RMC on the TDC button you can reset the TDC to the default position and size at any time.

Positioning

Position the TDC with the LMC hold on a grey area of the chassis to the desired position.

Enlarge the TDC also with LMC at the lower left or right corner.

Aiming device bearing

The boat has a bearing of 0 degrees, which is also displayed on the TDC.

- The lower ring indicates the bearing from 0 - 360 degrees
- The upper ring shows a range of detail from 0 - 10 degrees

Aiming device follow-up switch (Folgen / nicht folgen)

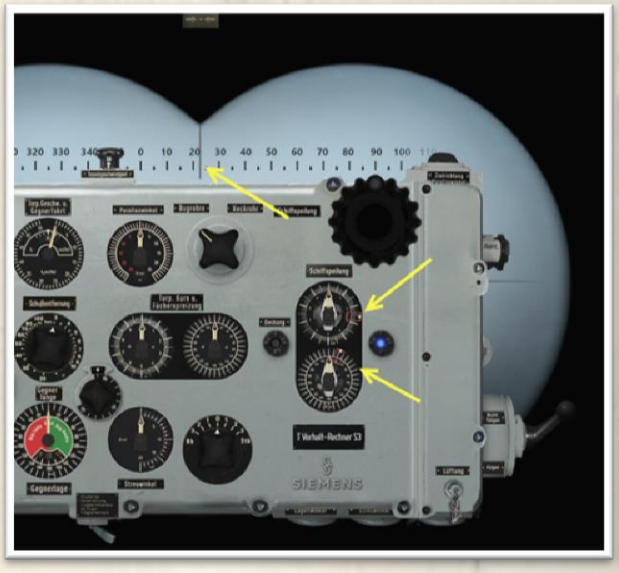
With the lever on the right side you select whether the TDC should follow the periscope or not.

The status is indicated with the blue control lamp.

- Don't follow
  - lever up
  - blue control lamp is ON
  - red pointer linked to periscope (bearing)

- follow
  - lever down
  - blue control lamp is OFF
  - red pointer linked to periscope (bearing)
  - white pointers linked to periscope (target bearing)

Don't follow



The blue control lamp is ON.
The red pointers in the scale rings show the current bearing.

The current bearing is exactly 22.5 degrees.

NOTE: The red pointers always indicate the bearing! No matter if the TDC follows the bearing or not!

The values in the TDC are **NOT** updated by changing the bearing via periscope or UZO!

This provides the possibility to enter a manual target bearing in the TDC. Fast to attack a target directly from the map. Sometimes it is enough to correct the target bearing without changing to periscope or UZO.

Manual target bearing

Turn the large knob to set a target bearing manually.

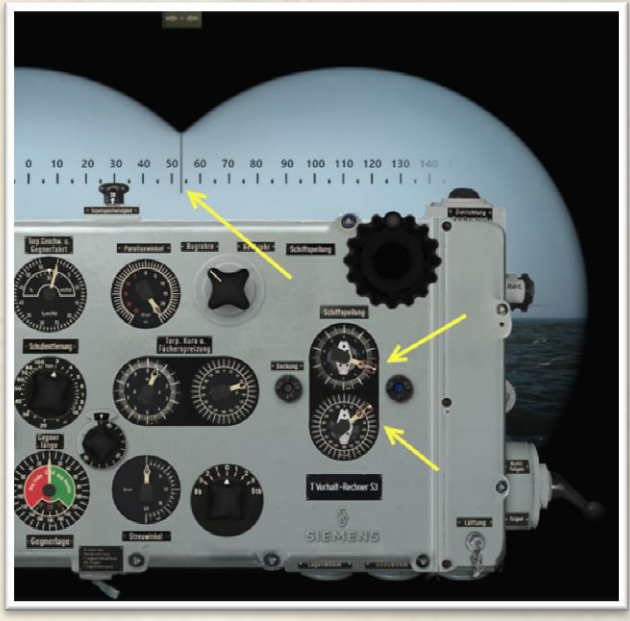
- The current bearing is 22.5 degrees
- The target bearing is 348 degrees

By changing the target bearing by the knob the values in the TDC are updated.

The target bearing set via the knob is **NOT** updated by changing bearings via the periscope/UZO!

The knob is only unlocked with "Don´t follow".

Follow



The blue control lamp is OFF.
When the periscope is moving, all the pointers in the scale rings move. All pointers run synchronously.

- The target bearing follows the bearing (Aiming device follow)
- The current bearing and target bearing are 53 degrees
- By changing the bearing in the periscope/UZO the values in the TDC are updated!
- The knob is locked and cannot be used for manual ship sounding

Target ship

To achieve a successful torpedo hit it is necessary to know and determine some parameters of the target ship.

The most important parameters are:

- Speed
- Distance
- Angle of bow (AOB)

The ship length for the TDC is only necessary if the target ship is to be torpedoed with a salvo.

Speed

There are several ways to determine the speed.

Chronometer Periscope / UZO

To use the chronometer in the periscope and UZO it is necessary to know the length of the ship.
Therefore, the target ship must first be identified using the recognition manual.

Based on the length of the ship and how long it takes the ship to pass a certain position, the speed can be determined.

ATTENTION: Here it is necessary that the U-boat does not move!

After the distance has been determined and confirmed in the chronometer, the determined speed is transmitted to the TDC.

The speed is indicated on the outer scale ring and can be changed manually.

Manual speed determination

It is not always possible to identify the target ship in order to know the necessary ship length or the U-boat cannot stop due to the situation.

In this case, the speed of the target ship can be determined on the map with a stopwatch and the distance travelled.

You can read the speed of the target ship using the enclosed tables

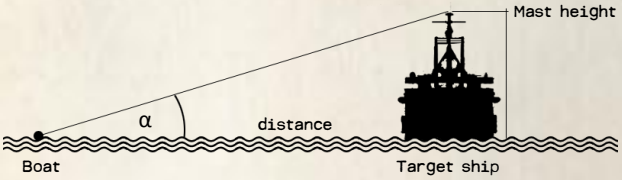
„Ermittlung zurückgelegter Strecke in Meter/km pro Minuten"

- Set a marker on the target ship and start a stopwatch
- Wait for a defined time and set a second marker
- Measure the distance between the two marks
- find the nearest value in the corresponding column Minutes
- In the column kn read the speed in knots

The calculated speed can now be entered into the TDC.

Distance

To determine the distance, the target ship must also be identified, as this requires the height of the mast.



With the help of the stadimeter the distance of the target ship can be determined.

Adjust the periscope or UZO to the waterline.

When the stadimeter is opened, a semi-transparent image of the target ship appears, which can be moved vertically with the keys Q and E.

The second picture shall be shifted so that the transverse line to be detected on it is as close as possible to the top of the highest mast of the target ship of the original picture.

After confirmation of the measurement at the stadimeter, the determined distance is transmitted to the TDC.

WARNING:

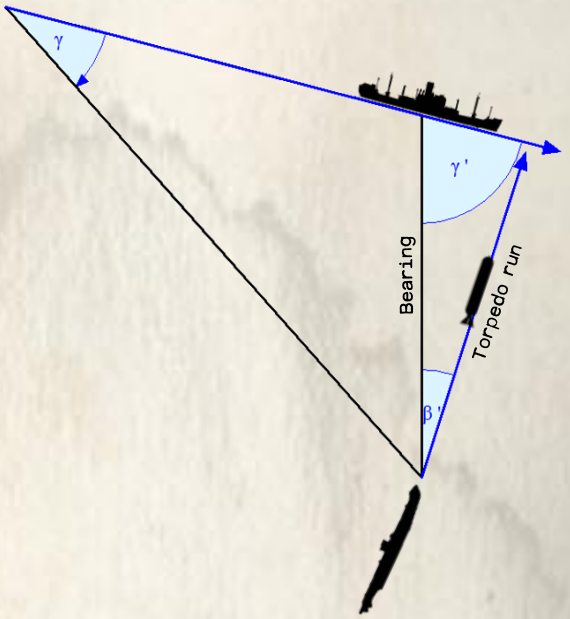
Manually entered values in the Ingame-UI are **NOT** transmitted in the TDC!

Angle of bow (AOB)

The determination of the angle of bow (AOB) is perhaps the most difficult thing for some.

First the AOB must be determined and also known in which direction it must be set.

Let us look again at the well-known shooting triangle.



The U-boat is at the position and waits for the target ship. The target ship is at pos. 1 (y) and has an AOB of y = 33 degrees.

The AOB is always measured from the viewpoint of the target ship from its own course to the position of the U-boat.

The AOB changes continuously, as the target ship moves.

When the target ship reaches pos. 2 (y'), it has an AOB of y' = 76 degrees.

The AOB can be corrected manually at any time. This is a bit complicated, because this value cannot simply be read off somewhere.

With the switch "Follow AOB" the AOB is automatically updated in relation to the bearing in periscope/UZO.

If "Follow AOB" has been activated the white lamp on the TDC is ON.

AOB 76 degrees green, follow bearing. Why green, explanation follows.

WARNING:
It is important that the bearing is first aligned to the target ship, the current AOB is entered and only now "AOB Follow-up" is switched ON.

This is the only way to ensure that bearing and AOB are correct in relation to the target ship.

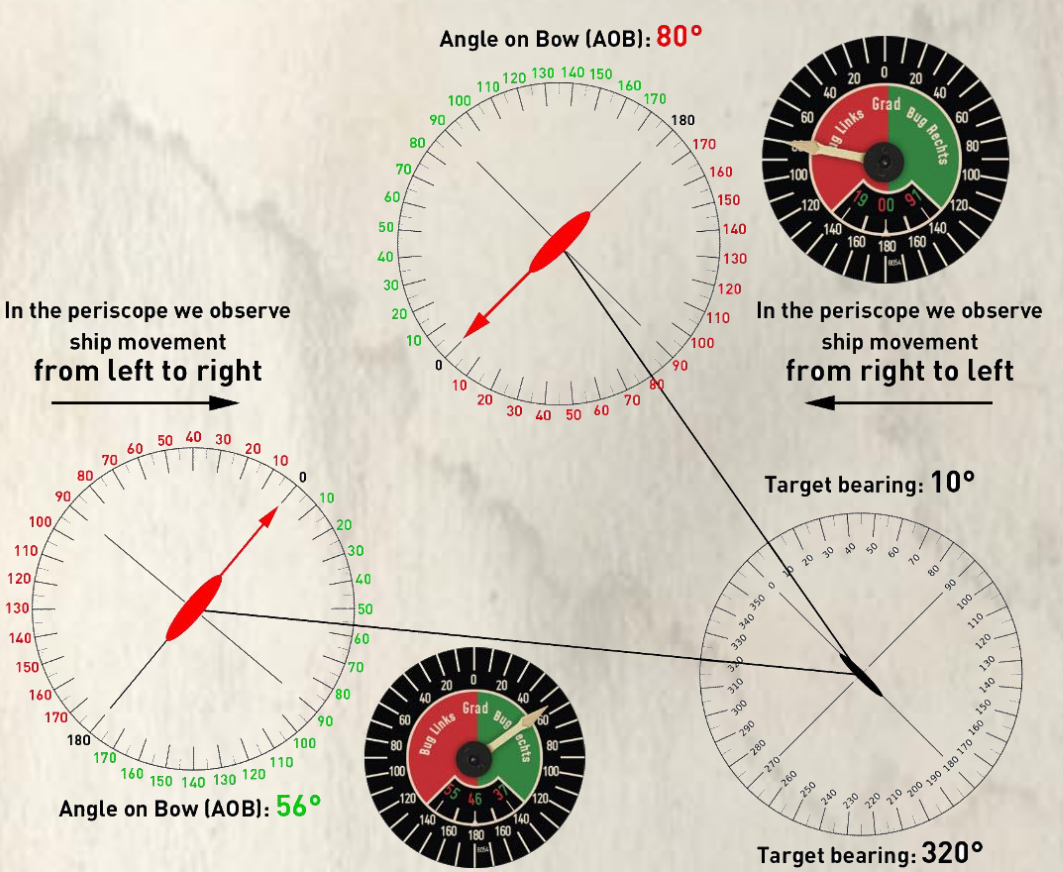
The AOB in the TDC can be readjusted manually at any time in follow-on mode.

Bow left / Bow right

Now the AOB is known, but the TDC gives you two possibilities to enter the AOB. Like so many things, it is a matter of opinion.

- If the bow of the target ship is on the right, AOB is 0-180 degrees green
- If the bow of the target ship is on the left, AOB is 0-180 degrees red

For better understanding a diagram showing both target bearings and the resulting AOB.



Own course

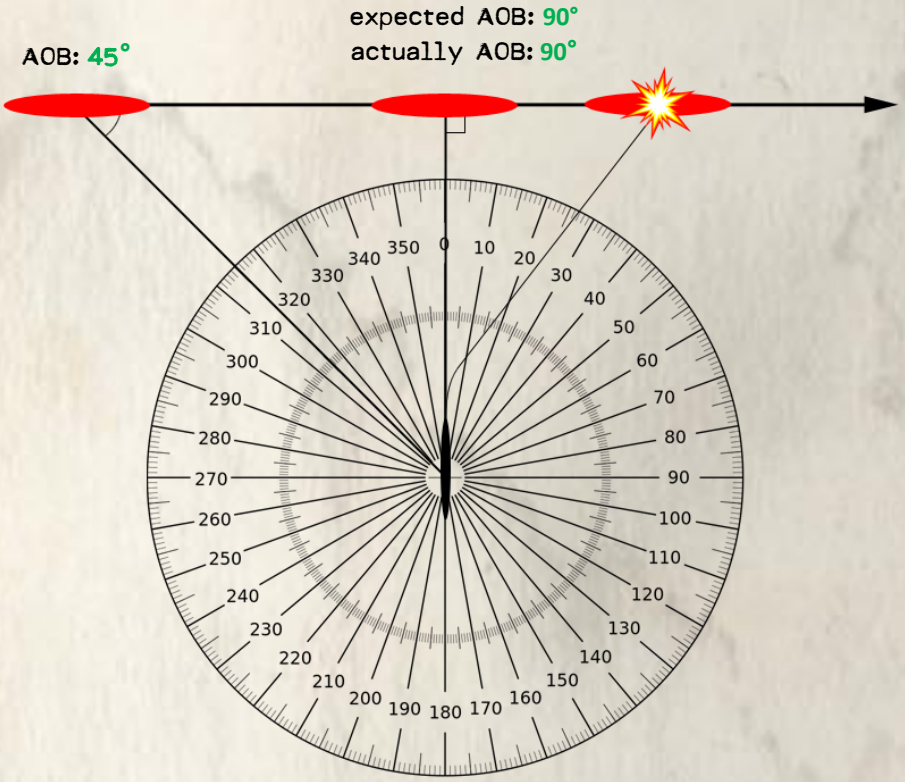
This scale tracks the current course of the U-boat and takes course deviations into account - changes for your firing solution.

A scale line means 1 degree, a rotation 12 degrees.

In order to better understand the use of the "Own course" in the TDC we would like to explain this device in more detail with two scenarios.

Scenario 1

Imagine the following situation. We have decided to attack the target ship at bearing 0 degrees. We will fire a torpedo without moving the periscope at the exact moment the target ship passes the bearing of 0 degrees.



ideal situation

Target coming up from the left.

We have calculated our target solution so that the AOB is 90 degrees when the target ship is at bearing 0 degrees.

But while we waited and the target ship was coming closer to the bearing of 0 degrees, our boat shifted 15 degrees to the right, e.g. due to ocean currents.

This changed the AOB and added the 15 degrees mentioned above.
At bearing 0 degrees the AOB is now 90 + 15 = 105 degrees.

This device is used to detect course changes of your own boat and add this value to the current AOB.

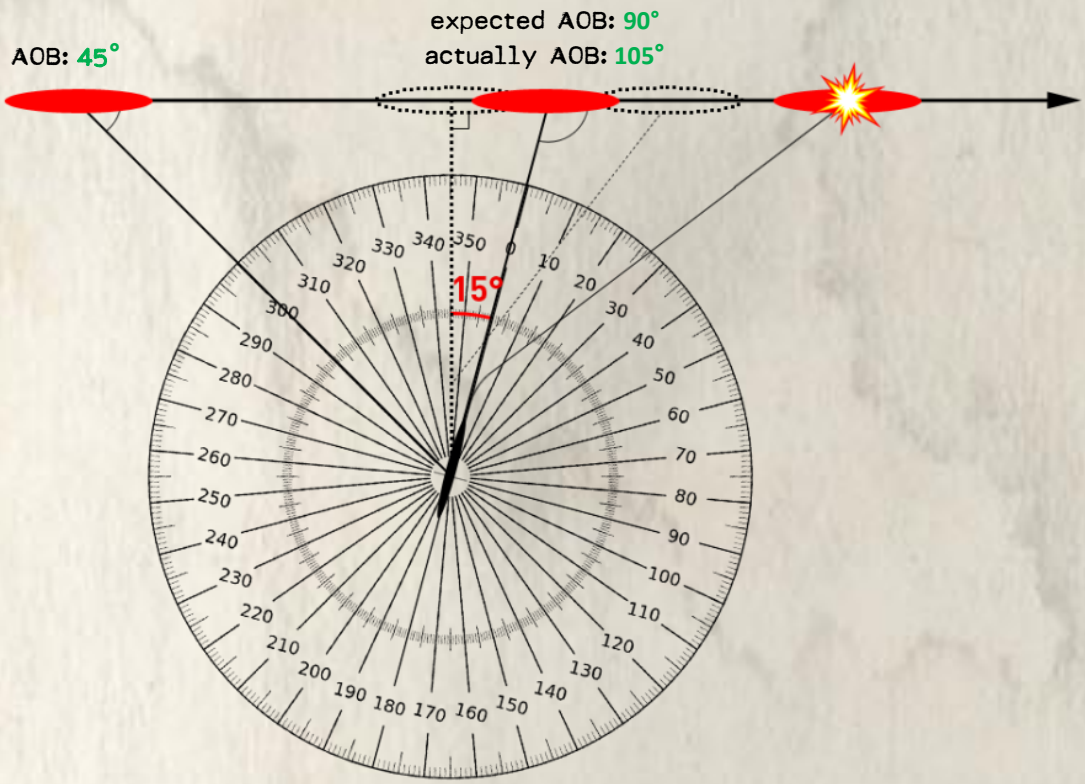
In the event of a change of course to the left, the value would be reduced.

- The U-boat turns to the right, AOB + course change
- The U-boat turns to the left, AOB - course change

Procedure:

1.) Bearing on target ship and TDC follows bearing (blue light is off)
2.) AOB determine target ship 45° (right)
3.) AOB follow (white light is on)
4.) Adjust bearing to 0 degrees, AOB updated to 90° (right)
5.) Set target bearing to "don't follow" (blue light is on)
6.) Click with LMC on "own course" (initial U-boat course)

The AOB is now automatically updated by the course angle.



Note: Please note that this will **NOT** update the AOB. Deviations due to course changes are always added/deducted for calculations of the AOB. The displayed AOB position is still 90° (green)

Scenario 2

In the second scenario we follow the target ship on a parallel course. 'We plan to attack the target from a specific direction. We have chosen a parallel attack with the target bearing 270 degrees.

There comes a moment when we are 100% sure that the AOB of the target ship is 90 degrees. We enter these values into the TDC and click with LMC on the own course to set the initial (current) U-boat course.

Then activate "Follow AOB" and deactivate "Follow target bearing" in the TDC. The bearing is set to 270 degrees.

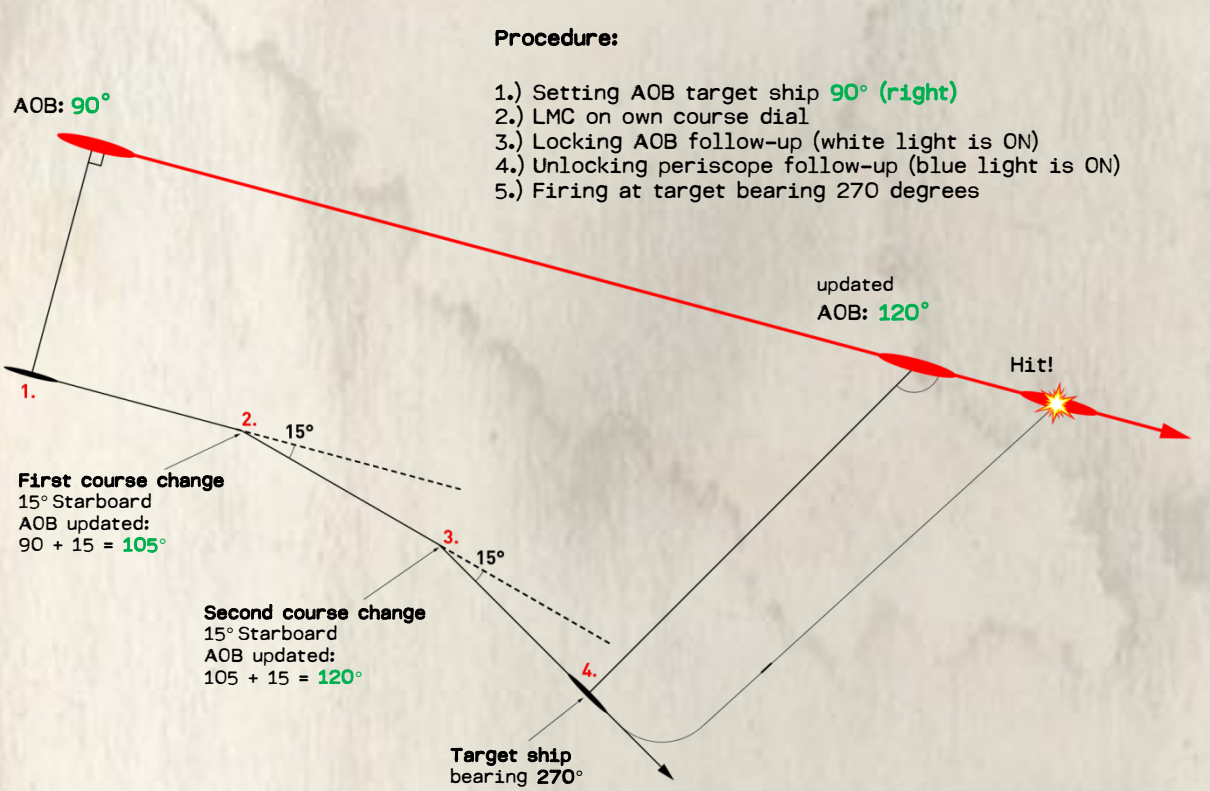
Due to certain conditions, e.g. water currents, manoeuvring, etc. the boat changes course twice again e.g. 15 degrees to the right.

However, we do not change our opinion about the 270-degree bearing attack! '
To avoid having to update the AOB, which we are no longer sure about.

Since the boat was manoeuvred and changed course, we use the scale "own course ". Whenever the boat changes course, the TDC automatically adds the value of the course angle (= course change) of the AOB to the target ship.

And even if the course was changed several times in relation to the target ship, we still have the correct value of the AOB.

We wait for the target ship to reach a bearing of 270 degrees and fire!

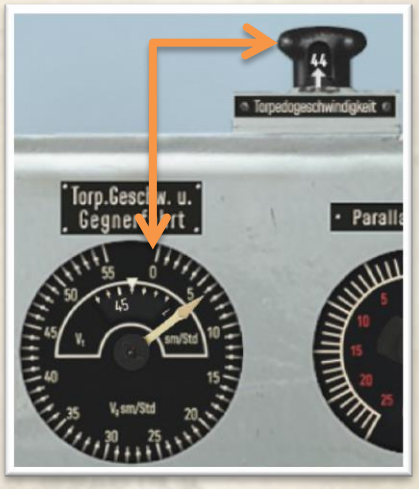


Torpedo - Settings

After all information of the target ship has been entered into the TDC, all necessary parameters of the torpedo to be fired have to be entered into the TDC.

The goal is that two moving units cross at a certain position at the same time.

Speed



There are different torpedoes that run at different speeds. In addition, some torpedoes can be set to run at different speeds. This means that they can run a shorter/higher distance.

The TDC has no direct access to the torpedoes. The values must be adjusted and entered at the torpedo (torpedo console) and in the TDC.

Click on the button to change the torpedo speed.

In addition, it must be ensured that all torpedoes have the same running speed when firing a salvo.

The torpedo speed is shown in the inner circle of numbers. Note that the speed display runs from right to left.

Bow tube / Stern tube

Set if torpedoes are fired from the bow or stern torpedo tubes.

The TDC takes this in its calculations.

If the calculations for the selected torpedo tube are not possible, the error lamp lights up.

Ship lengths

The ship length of the target ship is only required in the TDC if a salvo is to be fired.

The identification manual lists all ships / ship classes. Please enter the ship length into the TDC.

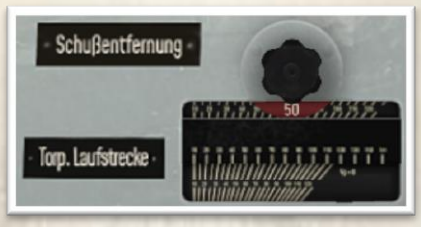
Salvo angle

A maximum salvo angle is calculated based on target speed, ship length, distance and AOB.

This value is **NOT** automatically transmitted to the torpedo console. The value can be transmitted to the torpedo console either manually or with the Salvo-Update-button.

NOTE: Currently the game does not allow a shot angle greater than 10 degrees.

Torpedo max. run distance



Enter the maximum permissible torpedo range (torpedo maximum run distance)
By default 5Ohm are given
If the target is further away than the shooting distance, the error lamp lights up.

Increase the shot distance accordingly!

Turning speed correction

The scale "Turning speed correction" has an influence on the target bearing.
It corrects the angular rotation speed of the torpedo if the U-boat moves and rotates during a torpedo launch.

Use the scale when during a torpedo launch the boat is moving and turning.

It compensates for the rotation of the boat.

This correction is connected with a launch delay at the torpedo firing bearing of 0.4 seconds. During this time the torpedo gyro is blocked in its position.

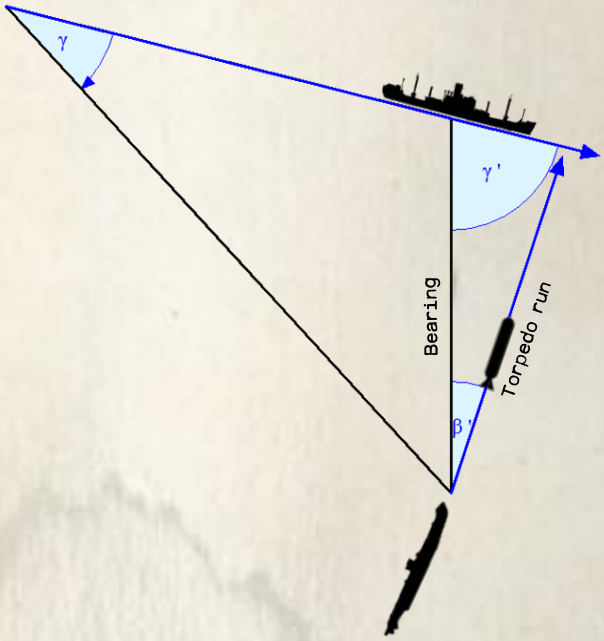
- The U-boat turns to the left, turn the rotation speed to the right 1-3
- The U-boat turns to the right, turn the rotation speed to the left 1-3

The angular rotation speed depends on the speed of the U-boat and the deflection of the main rudder. The result of the ship's bearing is slightly different from the actual bearing, which is indicated accordingly on the scale.

Calculations and information scales

The next dials and scales are very important information, which are calculated and continuously updated on the basis of the inputs and target bearing.
Of course only as long as the TDC follows the bearing.

Angle of impact (AOI)



Once again our torpedo firing solution.

Your boat is lying at the position and the target ship at pos. 2 (y') with an AOB of y' = 76 degrees.

- distance 1.500m
- speed ca. 9 kn
- AOB 76 degrees (green)
- Bearing 349 degrees
- Torpedo gyro angle 0 degrees

If we now take a closer look at the AOI with the above mentioned values in the TDC, you can see that it is a little more than 90 degrees at an optimal torpedo gyro angle.

ß' in this picture is 18 degrees, this results in an angle of impact (AOI) of 94 degrees.

Torpedo gyro angle

In principle, a torpedo can only be fired straight ahead. If the target is not directly ahead, the torpedo has to turn around after a certain time to reach its actual target course.

The initial torpedo run is about 9.5 meters, the turning radius is about 95m.

These two components pose a certain danger. If the turn starts too early / too late or the radius is too small / too large, the torpedo will not hit its target.

Therefore it is always recommended, as far as possible, to shoot from an optimal shooting position.

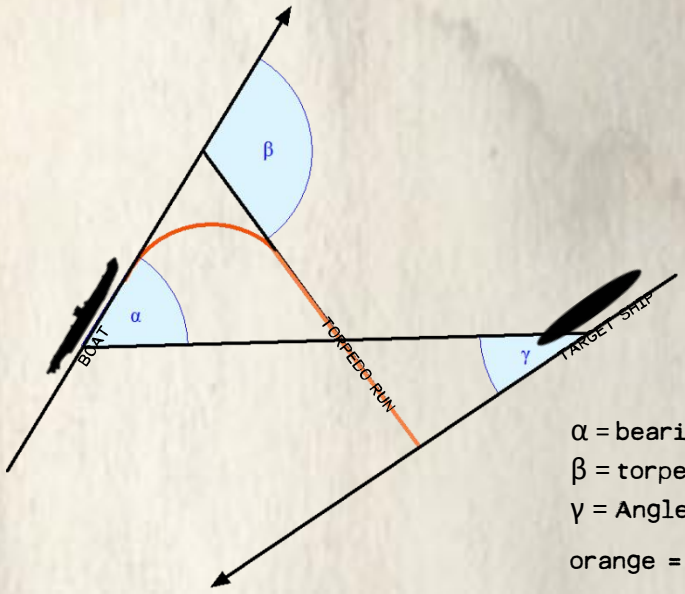
The calculated shot angle or torpedo gyro angle is displayed on the scales Torpedo course.

If the torpedo gyro angle is 0 degrees, the torpedoes run straight ahead, directly towards their target.

- The right ring shows the torpedo gyro angles from 0 - 360 degrees
- The left ring shows a range of detail from 0 - 10 degrees

It is not always possible to attack a target ship from an optimal position. This picture illustrates, bearing, AOB and torpedo gyro angle.

ATTENTION: For all types of torpedoes the maximum firing angle is +/- 135 degrees. If the firing angle is larger, the error lamp will light up and the torpedo will not reach its target.



α = bearing (57 degrees)
β = torpedo gyro angle (114 degrees)
γ = Angle of bow (AOB) (32 degrees green)

orange = Torpedo run

Parallax angle

A simple and direct solution of the torpedo triangle is not possible for torpedoes with a turning radius (gyro angle <> 0 degrees), corrections must be made.

This correction is called parallax correction, which is displayed in the "Parallax angle" scale. The torpedo triangle with the parallax correction is based on the so-called "equivalent point of fire".

A simple and direct solution of the torpedo triangle is ideal if the aiming device (observation point) is at the same position as the torpedo tube and the torpedo is straight after leaving the tube.

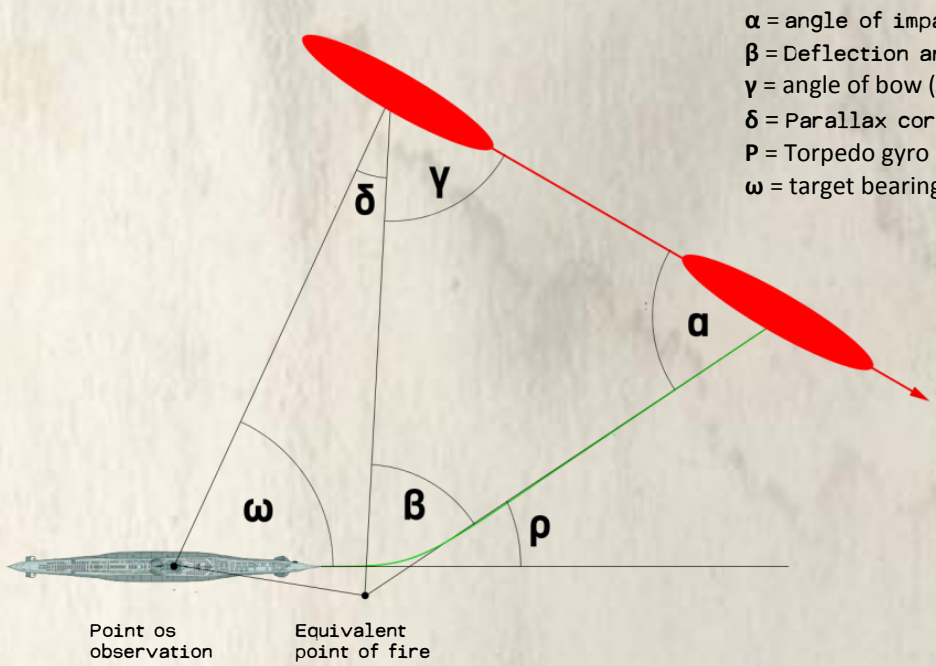
In reality, however, the situation is different.
The targeting device is located some distance from the torpedo tubes. On type VII submarines, this distance is approx. 28 meters.

This means that the shot bearing at the torpedo tube is different from the shot bearing at the target.

Also, the AOB is different from the view from the torpedo tube or target device.

In addition, when the torpedo rotates after leaving the tube, it travels on a path parallel to the line connecting the torpedo tube to the impact angle.

The actual torpedo run distance is shifted by the parallax angle, which depends on the torpedo gyro angle ρ.



In general, parallax correction δ depends on three factors:

- Target bearing ω,
- Distance to the target ship (at torpedo launch)
- Torpedo gyro angle ρ

Some general rules can be defined:

1.) bow torpedo tubes
   a. At a target bearing of 0 degrees the parallax correction is null
   b. The closer the ship's bearing is to 90 / 270 degrees, the greater the parallax correction

2.) stern torpedo tube
   a. At a target bearing of 180 degrees the parallax correction is null
   b. The closer the ship's bearing is to 270 / 90 degrees, the greater the parallax correction

3.) The closer the target is to the U-boat, the larger the parallax angle

The TDC mod simulates the "equivalent point of fire" and the parallax correction corresponds to the real behaviour.

Errorlamp

If the error lamp lights up, no successful torpedo shot can be achieved with the entered data or selected torpedo tube(s)!

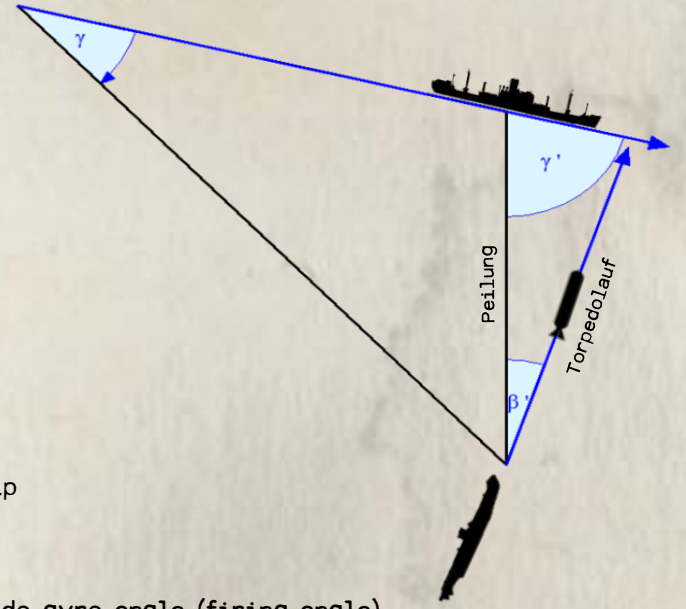
Correct the entered values or move your U-boat in a better firing position.

WARNING: A lighting error lamp does not prevent the firing of torpedoes!

Practical example

Last but not least a possible approach based on our picture of how a successful torpedo attack could be executed with the TDC.
The sequence can be any order.

1.) Lock periscope on a target ship
2.) TDC follow the target bearing (blue light off)
3.) Identify ship
4.) Determine AOB
5.) bow of the target ship is right → (green)
6.) Enter AOB in TDC
7.) Follow AOB (white light on)
8.) Determine distance
9.) Determine speed
10.) Activate TDC
11.) Torpedo(s) preheated?
12.) With salvos shot
    a. Determine ship length
    b. Transfer Salvo angle
13.) Select bow tubes
14.) Set torpedo speed
    a. at TDC
    b. Ingame-UI
15.) Flood torpedo tube(s)
16.) Check values of the target ship
    a. Update distance
    b. Check Salvo angle
17.) pay attention to optimal torpedo gyro angle (firing angle)
18.) FIRE !!!



Further practical examples can be found in the form of videos:

TDC Tutorial - Basics in English
https://youtu.be/SoUaf-UaNMs

TDC Tutorial - Basics in German
https://youtu.be/6YSoVXKOtOw

Attack aircraft carrier on parallel course with the TDC
https://youtu.be/Wkl3wTVhzLE

Fast Attack with the TDC
https://youtu.be/eFOWoszAywQ

Useful informations

Here you will find useful information to make working with the TDC easier.

Enter of exact values

It is not easy to enter exact values into the TDC. There is a solution to this problem.

Click with the left mouse button (LMC) on the instrument and pressed the LMC. Then drag the mouse out of the instrument **with** pressed LMC to increase the input radius. This is a simple way to get an angle of bow of exactly 78° green, for example.

This procedure is possible with all input instruments.

Tooltipps

Coming soon.

Historical

It is always interesting to find out whether the submarine commanders actually practiced an attack in the way we imagine it today. The community member **DERSTOSSTRUPP** has sent us a lot of information about this and was even allowed to immortalize it in our manual!

Thanks a lot to **DERSTOSSTRUPP**!

Historical procedures for determining target course and speed

When leafing through historical war diaries, it becomes clear that recognition manuals were very rarely used at that time, as far as obtaining shooting data was concerned. Instead, they were more often used to identify a ship that had just been sunk, which in many cases transmitted its identifier immediately after the hit.

That means no information from the recognition manual. What to do?!

Ausdampfen

The most frequently mentioned process is called "**Ausdampfen**". The term "Ausdampfen" in maritime terminology usually refers to the overcoming of an oncoming current, but in our case "current" is replaced by "target course and speed".

Imagine you were on a riverbank in a motorboat. Suppose the river is flowing with an overpowering current, so that you can only cross the river with a correspondingly-high own speed. But there is a problem!
There are huge rocks in the river to the left and right that you fear may sink you if you deviate even slightly from the course. So the course has to be one that brings you straight ahead directly over the river. To do this, find a fixed point in the desired direction, in this example a church tower, and keep this as a reference point in sight.

Alright, into the river!
But it's not possible for you to simply point your bow at the church tower! You'll inevitably veer off course, collide with the rocks and sink.

The river current must be "**ausgedampft**"!

You put the bow a little off course to compensate for or eliminate the displacement caused by the current of the river.
To do this, you calculate the correct "lead", put our boat in the calculated direction, and set off. If you have done it correctly, it appears as though the church tower does not move at all in your view. This way, you reach the other bank of the river exactly at the desired position, immediately enter the church and thank the Lord God that you have internalized the mod documentation and got over it safely.

As is probably obvious, the current stands for target course and speed. The church tower is the ship's bearing. The faster the ship's speed, the more you have to lead it to get a constant bearing, or you can achieve it by increasing your own speed.

Back to Uboat:
We assume that you will not look at the 3D models on the map. Don't think that you'll get this kind of insight just because you chose a church tower as your final destination before!

The procedure when to the side (abeam) of the target ship

1) When the target comes into view, estimate the angle on bow (AOB) as described above in the manual
2) Navigate your boat initially onto what you consider a parallel course and observe the bearing
3) Increase or decrease your speed until the ship's bearing hardly changes (i.e. does not shift)
4) Eliminate any remaining shift in bearing by changing course until the bearing appears to stand still
5) Note the following:
   - Own course and speed
   - the constant bearing
   - estimated angle of bow (AOB)
6) Calculate an initial target speed (see below)

It may happen that the target course is different from the one the estimated AOB corresponds to. But this does not mean that your work has been unnecessary so far!

Remember the values you wrote down? If you have discovered a course difference, you have to correct the previously-estimated AOB by this difference and perform the calculation again, using the same values as before, but of course with the newly-determined AOB.

The following rules-of-thumb apply:

- If this difference results in a smaller AOB, the target is moving faster than calculated
- If this difference results in a larger AOB, the target is moving slower than calculated

Calculate preliminary target speed

On the basis of the data obtained, a provisional target speed can be determined.

$$\boldsymbol{pre.target\ speed} = own\ speed * \frac{Sine(target\ bearing)}{Sine(angle\ of\ bow)}$$

Overhaul Maneuver (Vorsetzmanöver)

How can you be sure and get an exact course value?
An answer to this question can be found in the war diaries.

The commanders of that time always preferred (and it was also regulation) to overtake a target up to an angle on bow (AOB) of "0" depending on the visibility conditions. This was called **"Vorsetzmanöver"**, or overhaul maneuver, and served to determine an exact course value. This method has the additional advantage that the boat is exactly in front of the target, i.e. it is in the best position in case the target evades or zigs.

Procedure when already in front when the target comes into view

You are positioned in front of the target ship upon sighting. In this case you can hardly achieve a constant bearing, unless you turn the boat until the target ship's bearing is 180. So do that!

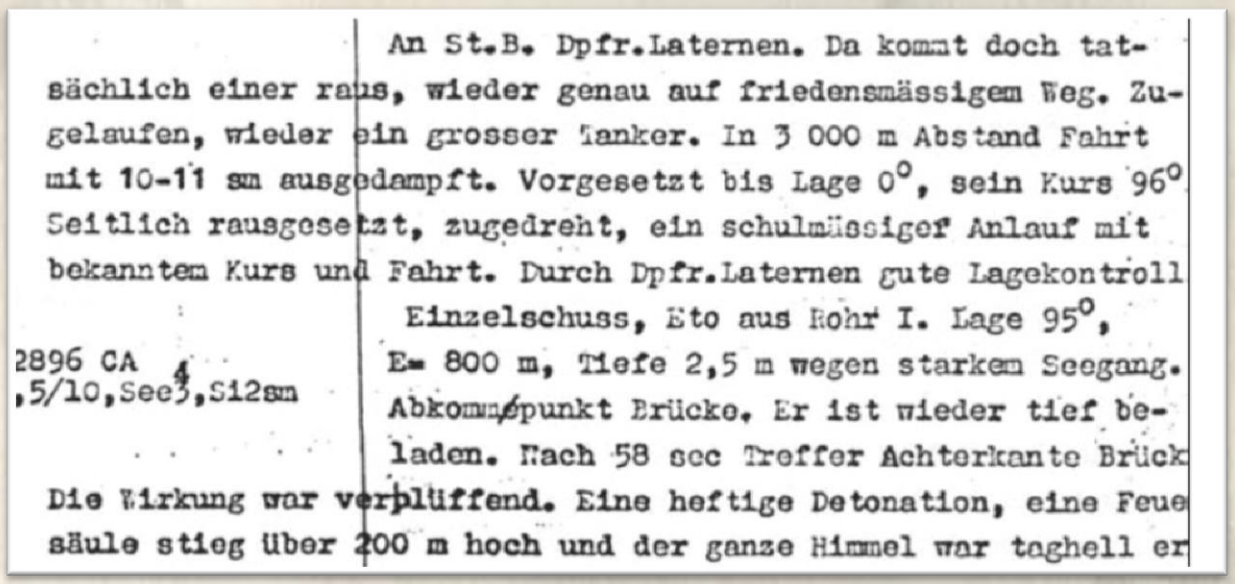
You already know the value for target course. You are almost on the target's course line. But you are still missing an exact target speed. To do this, you have to plot your own boat's movement relative to the target to determine its speed.

1) You are more or less on the course line of the target
2) You must increase your speed and open the range from the target until only the masts are visible
3) As soon as the chimney is no longer visible, immediately switch to the map and mark your boat on the map. At the same time start the stopwatch
4) Because you cannot set an exact speed, you must continuously regulate your speed via the engine order telegraph. That means, as soon as the chimney comes into sight again, select a faster setting, and as soon as it disappears, select a slower setting
5) Repeat this procedure for a specific period of time, e.g. 10 minutes, and wait until the chimney comes into view one last time
6) Afterwards switch back to the map, mark the current position of your boat again and stop the stopwatch
   Now measure the distance covered by your U-Boat on the map between the two marks. The TDC-Mod contains charts in which you can read off the speed depending on time and distance. The button for the tables is located in the chart view above the button for the TDC-Mod..

In the opposite sense, this procedure can also be performed in the wake of the target, i.e. you are behind the target at the beginning.

Incidentally, a position in front or behind should always be used to take a bearing to determine an exact target course.

Extract from a war diary



An St.B. Dpfr.Laternen. Da kommt doch tat-
sächlich einer raus, wieder genau auf friedensmässigem Weg. Zu-
gelaufen, wieder ein grosser Tanker. In 3 000 m Abstand Fahrt
mit 10-11 sm ausgedampft. Vorgesetzt bis Lage 0°, sein Kurs 96°
Seitlich rausgesetzt, zugedreht, ein schulmässiger Anlauf mit
bekanntem Kurs und Fahrt. Durch Dpfr.Laternen gute Lagekontroll
Einzelschuss, Eto aus Rohr I. Lage 95°,
2896 CA 4
,5/10,See3,Si2sm
E= 800 m, Tiefe 2,5 m wegen starkem Seegang.
Abkommpunkt Brücke. Er ist wieder tief be-
laden. Nach 58 sec Treffer Achterkante Brück
Die Wirkung war verblüffend. Eine heftige Detonation, eine Feue
säule stieg über 200 m hoch und der ganze Himmel war taghell er

Videos

For further clarification, DERSTOSSTRUPP has published a very nice video.
Subject **„Ausdampfen"**
https://www.youtube.com/watch?v=vd81EWvQeYo

Furthermore DERSTOSSTRUPP has created some more great videos for the TDC-Mod.
Thanks a lot!
https://youtu.be/vhVal-4LrLQ

Additional information

As additional and useful attachments some tables and an overview of the available torpedoes in Uboat are attached.

Torpedo overview

The following torpedoes are available from a certain point in time.

Type	Name	Price	available	preheated	Distance		Speed	
T1	G 7a Torpedo	800	01.01.1939	20 min	1	5.000 m	1	44 kn
					2	7.500 m	2	40 kn
					3	12.000 m	3	30 kn
T2	G 7e Torpedo	900	01.01.1939	20 min		3.000 m		30 kn
T3	G 7e Torpedo	1000	01.01.1942	20 min		5.000 m		30 kn
T5	G 7es Torpedo Zaunkönig	1500	01.08.1943	20 min		5.700 m		24 kn

Tafeln

Ermittlung zurückgelegte Strecke

kn	Minuten							
	1	3	5	10	15	30	45	60
1	30,9 m	92,6 m	154,3 m	308,7 m	463,0 m	926,0 m	1,39 km	1,85 km
2	61,7 m	185,2 m	308,7 m	617,3 m	926,0 m	1,85 km	2,78 km	3,70 km
3	92,6 m	277,8 m	463,0 m	926,0 m	1,39 km	2,78 km	4,17 km	5,56 km
4	123,5 m	370,4 m	617,3 m	1,23 km	1,85 km	3,70 km	5,56 km	7,41 km
5	154,3 m	463,0 m	771,7 m	1,54 km	2,32 km	4,63 km	6,95 km	9,26 km
6	185,2 m	555,6 m	926,0 m	1,85 km	2,78 km	5,56 km	8,33 km	11,11 km
7	216,1 m	648,2 m	1,08 km	2,16 km	3,24 km	6,48 km	9,72 km	12,96 km
8	246,9 m	740,8 m	1,23 km	2,47 km	3,70 km	7,41 km	11,11 km	14,82 km
9	277,8 m	833,4 m	1,39 km	2,78 km	4,17 km	8,33 km	12,50 km	16,67 km
10	308,7 m	926,0 m	1,54 km	3,09 km	4,63 km	9,26 km	13,89 km	18,52 km
11	339,5 m	1,02 km	1,70 km	3,40 km	5,09 km	10,19 km	15,28 km	20,37 km
12	370,4 m	1,11 km	1,85 km	3,70 km	5,56 km	11,11 km	16,67 km	22,22 km
13	401,3 m	1,20 km	2,01 km	4,01 km	6,02 km	12,04 km	18,06 km	24,08 km
14	432,1 m	1,30 km	2,16 km	4,32 km	6,48 km	12,96 km	19,45 km	25,93 km
15	463,0 m	1,39 km	2,32 km	4,63 km	6,95 km	13,89 km	20,84 km	27,78 km
16	493,9 m	1,48 km	2,47 km	4,94 km	7,41 km	14,82 km	22,22 km	29,63 km
17	524,7 m	1,57 km	2,62 km	5,25 km	7,87 km	15,74 km	23,61 km	31,48 km
18	555,6 m	1,67 km	2,78 km	5,56 km	8,33 km	16,67 km	25,00 km	33,34 km
19	586,5 m	1,76 km	2,93 km	5,86 km	8,80 km	17,59 km	26,39 km	35,19 km
20	617,3 m	1,85 km	3,09 km	6,17 km	9,26 km	18,52 km	27,78 km	37,04 km
21	648,2 m	1,94 km	3,24 km	6,48 km	9,72 km	19,45 km	29,17 km	38,89 km
22	679,1 m	2,04 km	3,40 km	6,79 km	10,19 km	20,37 km	30,56 km	40,74 km
23	709,9 m	2,13 km	3,55 km	7,10 km	10,65 km	21,30 km	31,95 km	42,60 km
24	740,8 m	2,22 km	3,70 km	7,41 km	11,11 km	22,22 km	33,34 km	44,45 km
25	771,7 m	2,32 km	3,86 km	7,72 km	11,58 km	23,15 km	34,73 km	46,30 km
26	802,5 m	2,41 km	4,01 km	8,03 km	12,04 km	24,08 km	36,11 km	48,15 km
27	833,4 m	2,50 km	4,17 km	8,33 km	12,50 km	25,00 km	37,50 km	50,00 km
28	864,3 m	2,59 km	4,32 km	8,64 km	12,96 km	25,93 km	38,89 km	51,86 km
29	895,1 m	2,69 km	4,48 km	8,95 km	13,43 km	26,85 km	40,28 km	53,71 km
30	926,0 m	2,78 km	4,63 km	9,26 km	13,89 km	27,78 km	41,67 km	55,56 km
31	956,9 m	2,87 km	4,78 km	9,57 km	14,35 km	28,71 km	43,06 km	57,41 km
32	987,7 m	2,96 km	4,94 km	9,88 km	14,82 km	29,63 km	44,45 km	59,26 km
33	1,02 km	3,06 km	5,09 km	10,19 km	15,28 km	30,56 km	45,84 km	61,12 km
34	1,05 km	3,15 km	5,25 km	10,49 km	15,74 km	31,48 km	47,23 km	62,97 km
35	1,08 km	3,24 km	5,40 km	10,80 km	16,21 km	32,41 km	48,62 km	64,82 km

Ermittlung Geschwindigkeit in kn

Strecke in m	Beobachtungszeit in Minuten											
	1	2	3	4	5	6	7	8	9	10	12	15
100	3,2 kn	1,6 kn	1,1 kn	0,8 kn	0,6 kn	0,5 kn						
200	6,5 kn	3,2 kn	2,2 kn	1,6 kn	1,3 kn	1,1 kn	0,9 kn	0,8 kn	0,7 kn	0,6 kn	0,5 kn	
300	9,7 kn	4,9 kn	3,2 kn	2,4 kn	1,9 kn	1,6 kn	1,4 kn	1,2 kn	1,1 kn	1,0 kn	0,8 kn	0,6 kn
400	13,0 kn	6,5 kn	4,3 kn	3,2 kn	2,6 kn	2,2 kn	1,9 kn	1,6 kn	1,4 kn	1,3 kn	1,1 kn	0,9 kn
500	16,2 kn	8,1 kn	5,4 kn	4,0 kn	3,2 kn	2,7 kn	2,3 kn	2,0 kn	1,8 kn	1,6 kn	1,3 kn	1,1 kn
600	19,4 kn	9,7 kn	6,5 kn	4,9 kn	3,9 kn	3,2 kn	2,8 kn	2,4 kn	2,2 kn	1,9 kn	1,6 kn	1,3 kn
700	22,7 kn	11,3 kn	7,6 kn	5,7 kn	4,5 kn	3,8 kn	3,2 kn	2,8 kn	2,5 kn	2,3 kn	1,9 kn	1,5 kn
800	25,9 kn	13,0 kn	8,6 kn	6,5 kn	5,2 kn	4,3 kn	3,7 kn	3,2 kn	2,9 kn	2,6 kn	2,2 kn	1,7 kn
900	29,2 kn	14,6 kn	9,7 kn	7,3 kn	5,8 kn	4,9 kn	4,2 kn	3,6 kn	3,2 kn	2,9 kn	2,4 kn	1,9 kn
1.000	32,4 kn	16,2 kn	10,8 kn	8,1 kn	6,5 kn	5,4 kn	4,6 kn	4,0 kn	3,6 kn	3,2 kn	2,7 kn	2,2 kn
1.100	35,6 kn	17,8 kn	11,9 kn	8,9 kn	7,1 kn	5,9 kn	5,1 kn	4,5 kn	4,0 kn	3,6 kn	3,0 kn	2,4 kn
1.200	38,9 kn	19,4 kn	13,0 kn	9,7 kn	7,8 kn	6,5 kn	5,6 kn	4,9 kn	4,3 kn	3,9 kn	3,2 kn	2,6 kn
1.300	42,1 kn	21,1 kn	14,0 kn	10,5 kn	8,4 kn	7,0 kn	6,0 kn	5,3 kn	4,7 kn	4,2 kn	3,5 kn	2,8 kn
1.400	45,4 kn	22,7 kn	15,1 kn	11,3 kn	9,1 kn	7,6 kn	6,5 kn	5,7 kn	5,0 kn	4,5 kn	3,8 kn	3,0 kn
1.500		24,3 kn	16,2 kn	12,1 kn	9,7 kn	8,1 kn	6,9 kn	6,1 kn	5,4 kn	4,9 kn	4,0 kn	3,2 kn
1.600		25,9 kn	17,3 kn	13,0 kn	10,4 kn	8,6 kn	7,4 kn	6,5 kn	5,8 kn	5,2 kn	4,3 kn	3,5 kn
1.700		27,5 kn	18,4 kn	13,8 kn	11,0 kn	9,2 kn	7,9 kn	6,9 kn	6,1 kn	5,5 kn	4,6 kn	3,7 kn
1.800		29,2 kn	19,4 kn	14,6 kn	11,7 kn	9,7 kn	8,3 kn	7,3 kn	6,5 kn	5,8 kn	4,9 kn	3,9 kn
1.900		30,8 kn	20,5 kn	15,4 kn	12,3 kn	10,3 kn	8,8 kn	7,7 kn	6,8 kn	6,2 kn	5,1 kn	4,1 kn
2.000		32,4 kn	21,6 kn	16,2 kn	13,0 kn	10,8 kn	9,3 kn	8,1 kn	7,2 kn	6,5 kn	5,4 kn	4,3 kn
2.100		34,0 kn	22,7 kn	17,0 kn	13,6 kn	11,3 kn	9,7 kn	8,5 kn	7,6 kn	6,8 kn	5,7 kn	4,5 kn
2.200		35,6 kn	23,8 kn	17,8 kn	14,3 kn	11,9 kn	10,2 kn	8,9 kn	7,9 kn	7,1 kn	5,9 kn	4,8 kn
2.300		37,3 kn	24,8 kn	18,6 kn	14,9 kn	12,4 kn	10,6 kn	9,3 kn	8,3 kn	7,5 kn	6,2 kn	5,0 kn
2.400		38,9 kn	25,9 kn	19,4 kn	15,6 kn	13,0 kn	11,1 kn	9,7 kn	8,6 kn	7,8 kn	6,5 kn	5,2 kn
2.500		40,5 kn	27,0 kn	20,2 kn	16,2 kn	13,5 kn	11,6 kn	10,1 kn	9,0 kn	8,1 kn	6,7 kn	5,4 kn
2.600		42,1 kn	28,1 kn	21,1 kn	16,8 kn	14,0 kn	12,0 kn	10,5 kn	9,4 kn	8,4 kn	7,0 kn	5,6 kn
2.700		43,7 kn	29,2 kn	21,9 kn	17,5 kn	14,6 kn	12,5 kn	10,9 kn	9,7 kn	8,7 kn	7,3 kn	5,8 kn
2.800		45,4 kn	30,2 kn	22,7 kn	18,1 kn	15,1 kn	13,0 kn	11,3 kn	10,1 kn	9,1 kn	7,6 kn	6,0 kn
2.900			31,3 kn	23,5 kn	18,8 kn	15,7 kn	13,4 kn	11,7 kn	10,4 kn	9,4 kn	7,8 kn	6,3 kn
3.000			32,4 kn	24,3 kn	19,4 kn	16,2 kn	13,9 kn	12,1 kn	10,8 kn	9,7 kn	8,1 kn	6,5 kn
3.100			33,5 kn	25,1 kn	20,1 kn	16,7 kn	14,3 kn	12,6 kn	11,2 kn	10,0 kn	8,4 kn	6,7 kn
3.200			34,6 kn	25,9 kn	20,7 kn	17,3 kn	14,8 kn	13,0 kn	11,5 kn	10,4 kn	8,6 kn	6,9 kn
3.300			35,6 kn	26,7 kn	21,4 kn	17,8 kn	15,3 kn	13,4 kn	11,9 kn	10,7 kn	8,9 kn	7,1 kn
3.400			36,7 kn	27,5 kn	22,0 kn	18,4 kn	15,7 kn	13,8 kn	12,2 kn	11,0 kn	9,2 kn	7,3 kn
3.500			37,8 kn	28,3 kn	22,7 kn	18,9 kn	16,2 kn	14,2 kn	12,6 kn	11,3 kn	9,4 kn	7,6 kn
3.600			38,9 kn	29,2 kn	23,3 kn	19,4 kn	16,7 kn	14,6 kn	13,0 kn	11,7 kn	9,7 kn	7,8 kn
3.700			40,0 kn	30,0 kn	24,0 kn	20,0 kn	17,1 kn	15,0 kn	13,3 kn	12,0 kn	10,0 kn	8,0 kn
3.800			41,0 kn	30,8 kn	24,6 kn	20,5 kn	17,6 kn	15,4 kn	13,7 kn	12,3 kn	10,3 kn	8,2 kn
3.900			42,1 kn	31,6 kn	25,3 kn	21,1 kn	18,0 kn	15,8 kn	14,0 kn	12,6 kn	10,5 kn	8,4 kn

4.000			43,2 kn	32,4 kn	25,9 kn	21,6 kn	18,5 kn	16,2 kn	14,4 kn	13,0 kn	10,8 kn	8,6 kn
4.100			44,3 kn	33,2 kn	26,6 kn	22,1 kn	19,0 kn	16,6 kn	14,8 kn	13,3 kn	11,1 kn	8,9 kn
4.200			45,4 kn	34,0 kn	27,2 kn	22,7 kn	19,4 kn	17,0 kn	15,1 kn	13,6 kn	11,3 kn	9,1 kn
4.300				34,8 kn	27,9 kn	23,2 kn	19,9 kn	17,4 kn	15,5 kn	13,9 kn	11,6 kn	9,3 kn
4.400				35,6 kn	28,5 kn	23,8 kn	20,4 kn	17,8 kn	15,8 kn	14,3 kn	11,9 kn	9,5 kn
4.500				36,4 kn	29,2 kn	24,3 kn	20,8 kn	18,2 kn	16,2 kn	14,6 kn	12,1 kn	9,7 kn
4.600				37,3 kn	29,8 kn	24,8 kn	21,3 kn	18,6 kn	16,6 kn	14,9 kn	12,4 kn	9,9 kn
4.700				38,1 kn	30,5 kn	25,4 kn	21,8 kn	19,0 kn	16,9 kn	15,2 kn	12,7 kn	10,2 kn
4.800				38,9 kn	31,1 kn	25,9 kn	22,2 kn	19,4 kn	17,3 kn	15,6 kn	13,0 kn	10,4 kn
4.900				39,7 kn	31,7 kn	26,5 kn	22,7 kn	19,8 kn	17,6 kn	15,9 kn	13,2 kn	10,6 kn
5.000				40,5 kn	32,4 kn	27,0 kn	23,1 kn	20,2 kn	18,0 kn	16,2 kn	13,5 kn	10,8 kn
5.100				41,3 kn	33,0 kn	27,5 kn	23,6 kn	20,7 kn	18,4 kn	16,5 kn	13,8 kn	11,0 kn
5.200				42,1 kn	33,7 kn	28,1 kn	24,1 kn	21,1 kn	18,7 kn	16,8 kn	14,0 kn	11,2 kn
5.300				42,9 kn	34,3 kn	28,6 kn	24,5 kn	21,5 kn	19,1 kn	17,2 kn	14,3 kn	11,4 kn
5.400				43,7 kn	35,0 kn	29,2 kn	25,0 kn	21,9 kn	19,4 kn	17,5 kn	14,6 kn	11,7 kn
5.500				44,5 kn	35,6 kn	29,7 kn	25,5 kn	22,3 kn	19,8 kn	17,8 kn	14,8 kn	11,9 kn
5.600				45,4 kn	36,3 kn	30,2 kn	25,9 kn	22,7 kn	20,2 kn	18,1 kn	15,1 kn	12,1 kn
5.700					36,9 kn	30,8 kn	26,4 kn	23,1 kn	20,5 kn	18,5 kn	15,4 kn	12,3 kn
5.800					37,6 kn	31,3 kn	26,8 kn	23,5 kn	20,9 kn	18,8 kn	15,7 kn	12,5 kn
5.900					38,2 kn	31,9 kn	27,3 kn	23,9 kn	21,2 kn	19,1 kn	15,9 kn	12,7 kn
6.000					38,9 kn	32,4 kn	27,8 kn	24,3 kn	21,6 kn	19,4 kn	16,2 kn	13,0 kn

Closing words

Freekoly had a great idea many months ago! A true to original "torpedo data computer" with all the functions that such a device has to offer. His first designs were extremely detailed and amazingly realistic!

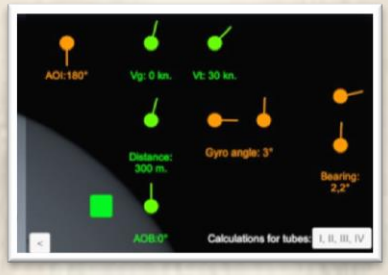
Such a device is also very complicated under the hood. As chance would have it, ZNC was very interested in programming such a complex device. What a stroke of luck!

A lot of preparation was necessary to be able to implement all the functionalities that TDC has to offer. All calculations of the TDC should absolutely correspond to the original.

A great deal of detailed work was required from both of them to ensure that the system remained realistic in its functionality and use. Every part, no matter how tiny, was sketched and then coded.

With detailed information from the dev team of Uboat the TDC could be integrated into Uboat. Many thanks also to the dev team of Uboat!

Since the device contains hundreds of gears and relays, there was of course something missing, corresponding sounds! Each scale, switch, lever has its own individual sound, which Ruby designed.



The first tests began! Pure function tests, still without design. For the integration into Uboat some adjustments had to be made to the Uboat UI.

Already the first tests, of Ruby and ZNC, were a complete success! So it was possible to integrate the TDC into Uboat quickly and step by step.

Other features, such as glass effects, night mode, stopwatch, std. tables etc. followed...

A very great story, which we enjoyed very much. The community thanks us with the many subscriptions and the positive feedback!

This motivates us for further large projects... ☺

Good luck and good hunting with the

TDC-Mod for Uboat !!!

wish you Freekoly, ZNC und Ruby