SafeTug 24.0 User Guide

Contents

1 Introduction to SafeTug **3**

2 Getting started **4**

2.1 Access to Local Network 4

2.2 Licensing 4

2.3 The settings app 6

3 PPU device setup **7**

3.1 Antenna setup 7

3.2 Connecting the iPad to a CAT device 7

3.3 GPS and device status 7

4 Understanding the panels **9**

4.1 The *Top Panel* 9

4.2 The *Contexts Panel* 9

4.3 The *Tools Panel* 9

5 Chart control **10**

5.1 Chart orientation, scaling and navigation 10

6 Passage plan **11**

6.1 Vessel setup 11

6.2 GPS antenna setup 11

6.3 Notes 12

7 Assisting a vessel **13**

8 Vessel details **14**

8.1 Own vessel 14

8.2 Other vessels 16

9 Contexts **18**

9.1 The planning context 18

9.2 The navigation context 19

10 Recording and Replaying **21**

10.1 AIS recording 21

11 Control center **22**

11.1 Display settings 22

11.2 Motion 24

11.3 Server 25

11.4 Charts 25

11.5 About 25

12 Charts **26**

12.1 PRIMAR charts 26

12.2 NOAA charts 26

12.3 Distribute charts to all users 26

12.4 Manual installation of charts 26

13 File handling **27**

13.1 Access the SafeTug documents folder of the iPad 27

Appendices **28**

A Feature layer sets **28**

A.1 The basic feature set 28

A.2 The standard feature set 28

A.3 The full feature set 29

B The sasc file format **31**

C Categories of zones of confidence **32**

1 Introduction to SafeTug

The SafeTug software is a flexible tug support tool that can be extended by modules to fulfil a wide variety of demands. This user guide consists of two parts. First are the standard settings used to customize the program to the individual captain's preference. Second is a detailed description of the SafeTug program itself.

2 Getting started

2.1 Access to Local Network

The TrelleborgPPUs create a local WiFi hotspot to which the iPad is connected (see section 3.2 on page 7). In iPadOS14 and later, SafeTug needs permissions to connect to devices on the local network to be able to communicate with the PPU. When SafeTug starts the first time it will ask for permissions. Press OK.

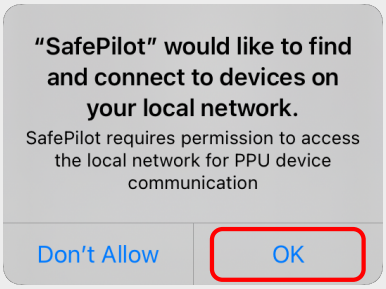

Figure 2.1: Allow local network access for SafeTug.

If you pressed 'Don't Allow' by mistake, the permission can be changed in iPadOS Settings in the SafeTug section in the field 'Local Network'.

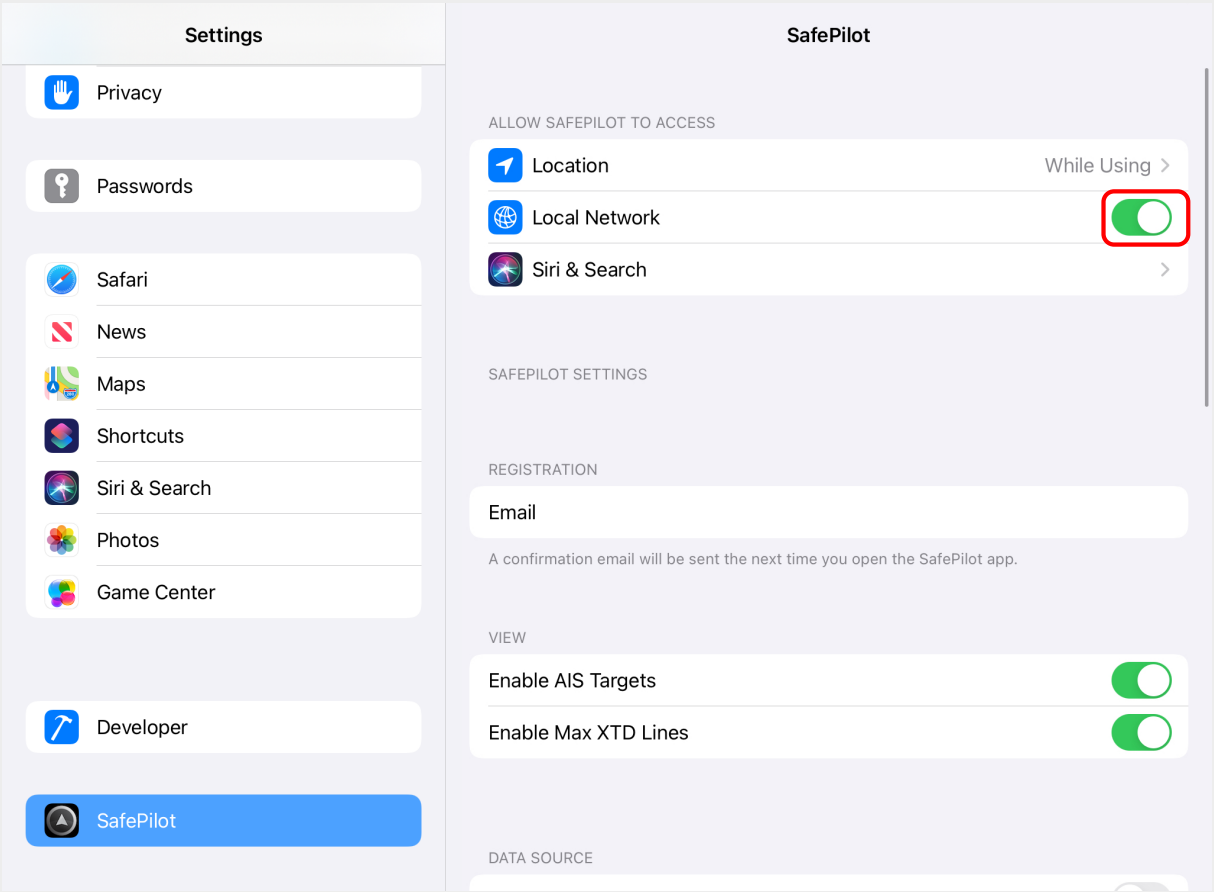

Figure 2.2: Allow local network access for SafeTug from settings.

2.2 Licensing

You need to register your SafeTug software with an e-mail address which will serve as your license ID.

This is done in the settings app (section 2.3 on the next page) and requires an internet connection to complete. Fill in the email address (fig. 2.3) attached to your license and start SafeTug. It will then check for an available license and download it. The content of the license may be validated within the *About* tab within the *Control Center* in section 11.5 on page 25.

Note 2.2-1

Every time you register a license on a new iPad, you will need to confirm the registration by clicking in the email sent to the email address by Trelleborg.

Note 2.2-2

If you are in charge of multiple devices, each device must be registered with a unique license to work properly.

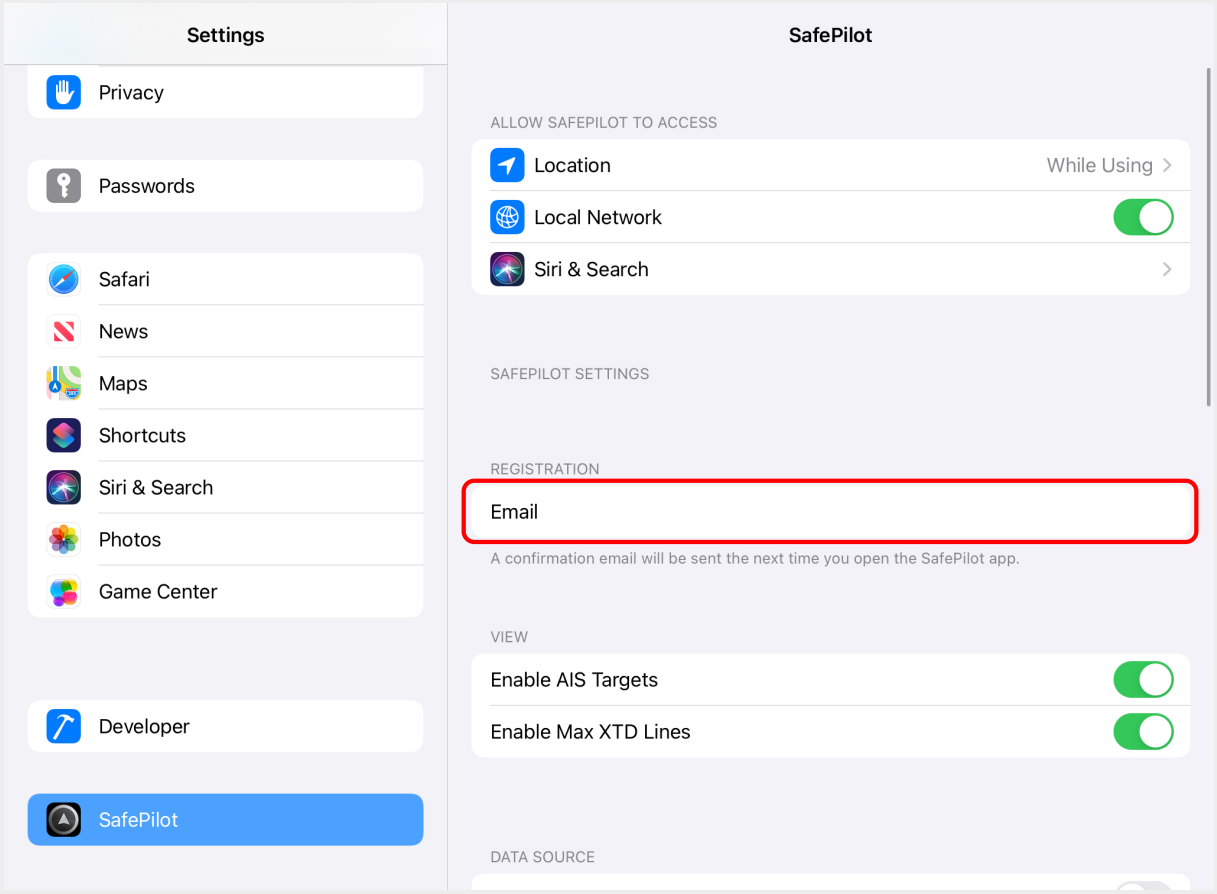

Figure 2.3: Add SafeTug license.

2.3 The settings app

You may configure personal settings for SafeTug within the *Settings app*. These settings are not meant to be changed very often and are therefore not included within SafeTug. The configurations you will find are among others:

- Licensing
- AIS targets
- Expected GPS source
- Units
- Ship details

To access the *Settings app* go to the *Home screen* → *Settings* → *SafeTug* and look at the options available. See fig. 2.4.

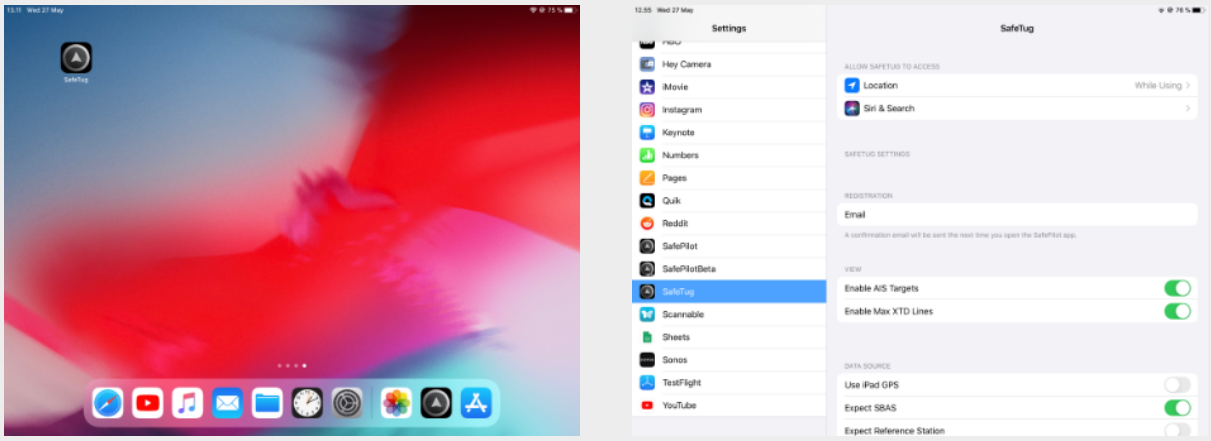

Figure 2.4: How to access SafeTug inside iPadOS' *Settings app*.

3 PPU device setup

3.1 Antenna setup

To obtain the full performance and accuracy of a CAT device the antenna locations must be chosen with care. The following points must be fulfilled for optimal operation. See an example in fig. 3.1. see further instructions in the manual of the device located at: `https://safepilot.eu/manuals/`.

1. The antennas must be a minimum of 1 meter away from any obstructions.
2. The antennas should have a clear view of the sky.
3. The antennas should be placed with a minimum of 4 meters between (baseline). A shorter baseline will result in a decrease of heading accuracy.

Figure 3.1: Note the surroundings when positioning the CAT device.

3.2 Connecting the iPad to a CAT device

All CAT devices communicate with the iPad using a local Wi-Fi network. After turning on the CAT device, the Wi-Fi network will appear in the list of available Wi-Fi networks on the iPad.

To connect to a CAT device, go to the iPad Wi-Fi settings and select the network created by the CAT device. The name of the network is the device's model name followed by a unique number.

Once connected to a CATs network, the iPad will remember the network and automatically connect to it in the future.

3.3 GPS and device status

You can always investigate the GPS and device status from SafeTug. The current status of the GPS is always visible in the left side of the *Top Panel*. By tapping on it, you will see details about the position source and the CAT unit - see fig. 3.2 on the next page.

Tapping on the satellites line in the list brings up more details about the current satellite constellation. This includes among other things the PRN number, elevation, azimuth, signal/noise ratio and what system they belong to (GPS, Galileo or GLONASS). To see the raw data received from the connected device tap on the list symbol (3 blue lines) at the top right corner. If a connected device is low on battery,

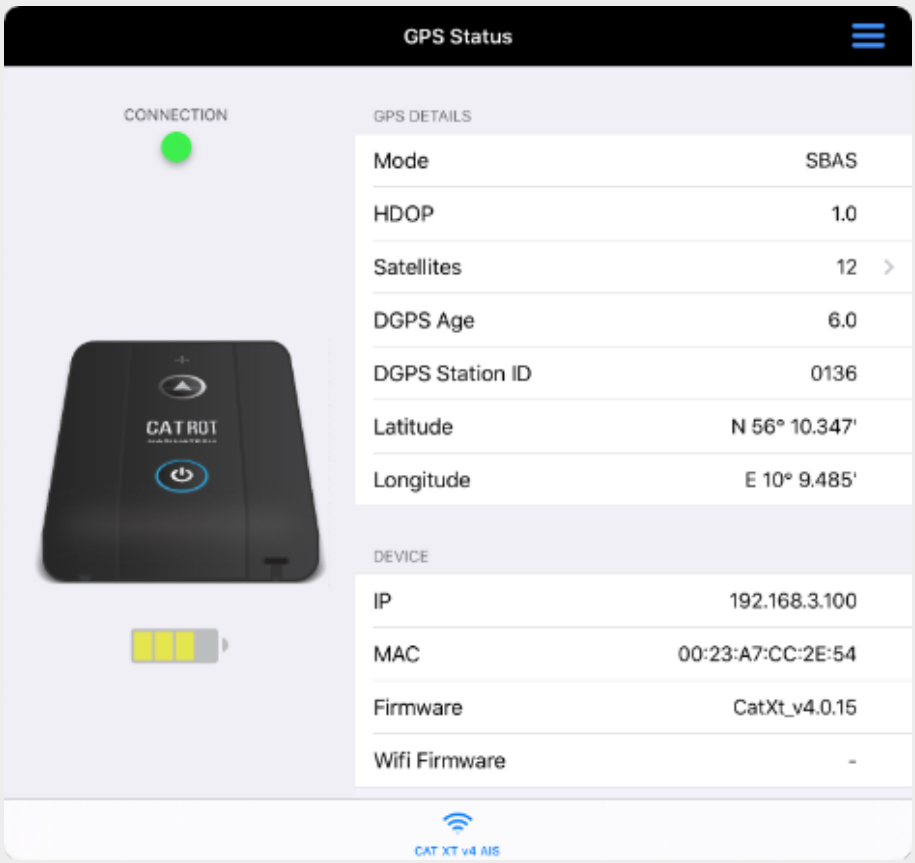

Figure 3.2: The detailed GPS and device status view within SafeTug.

a battery warning symbol is shown alongside the GPS status icon and by the battery indicator in the detailed window. If the battery level becomes critical, the battery warning symbol will flash.

The GPS mode can be used to locate the expected accuracy as shown in table 3.1.

Mode	CAT I, CAT XT	CAT MAX, CAT PRO
RTK		1-2 cm.
FRTK		20 cm.
DGPS	50 cm.	40 cm.
SBAS	70 cm.	60 cm.
GPS	150 cm.	120 cm.
AIS	Based on vessel instrumentation.	
EST	Estimated.	
iPad	Using the internal GPS of the iPad.	
INV	Invalid position data.	
N/A	No data received.	

Table 3.1: Shows the maximum +/- accuracy based on the GPS mode ordered from highest to lowest.

4 Understanding the panels

4.1 The *Top Panel*

The *Top Panel* is always displayed at the top of the screen. It contains the most important navigational information.

From the left: Position source and status, speed over ground (SOG), rate of turn (ROT), heading (HDG) and course over ground (COG).

The *Contexts Panel* is positioned on the left-hand side and is used to switch between operation modes, called: Contexts. It includes from the top:

- The *Passage Plan* (described in section 6 on page 11)
- The *Context Wheel* (described in section 9 on page 18)
- The *Control Center* (described in section 11 on page 22)

4.2 The *Contexts Panel*

In the case where more than one context is available, the *Context Wheel* is used to switch between these. Each context is specialized to display the most relevant information about the current operation.

The panel can be hidden by dragging it out of the screen, enabling more screen space.

4.3 The *Tools Panel*

Some contexts include additional panels positioned either on the right-hand side or at the bottom of the screen. These panels include additional information that is essential to the operation.

As with the *Contexts Panel*, the right-side panel can also be hidden by dragging it out of the screen.

5 Chart control

SafeTug supports instant zooming and fast response times on user input. To operate the chart view you simply do any of the following:

- Drag to pan.
- Pinch or double tap to zoom.

5.1 Chart orientation, scaling and navigation

A compass is located in the top right corner of the screen. A scale label is placed below the compass which indicates the distance from the center of the screen to the top of the screen.

By tapping on the compass you will get options to change the orientation of the chart and to quick jump between locations and vessels.

If you choose to use heading up, the compass will rotate towards north as your vessel rotates in the chart. If you hold your finger on the compass symbol, the chart orientation mode is toggled between north and heading up.

In the *Quick Jump Panel*, it is possible to define views and name them. Having named locations allows you to quickly reposition the chart on the desired location without having to pan and zoom on the chart. When adding a new view, the current zoom level and location is saved with a name. To quickly change to one of the named locations – simply tap on the name in the list. You can rearrange and delete items on the list by pressing edit. In the bottom of this window you can select the *Vessels* tab. This will bring you to the list of all vessels currently in the chart. These vessels are sorted with the closest at top or alphabetically. Select a vessel to see the list of its particulars and tap on the magnification symbol to jump to its location.

Whenever your vessel is shown on the screen, the screen will follow the vessel. If the chart is moved, so your vessel is no longer visible on the screen, the screen will be fixed on the current location and will no longer follow your vessel. In this case an arrow pointing to your vessel will be shown to indicate in which direction the vessel is heading. By tapping this arrow symbol, the chart will be repositioned at your vessel.

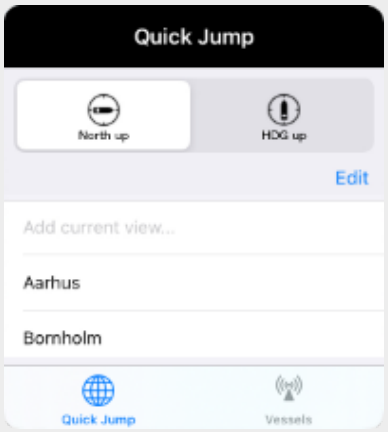

Figure 5.1: The *Quick Jump Panel*.

6 Passage plan

The *Passage Plan* allows you to configure your own vessel particulars as well as the planned route for the operation. It is accessed by tapping on the list icon at the top of the left-hand sidebar. Note that a warning symbol on the icon indicates that essential data are missing for optimal operation.

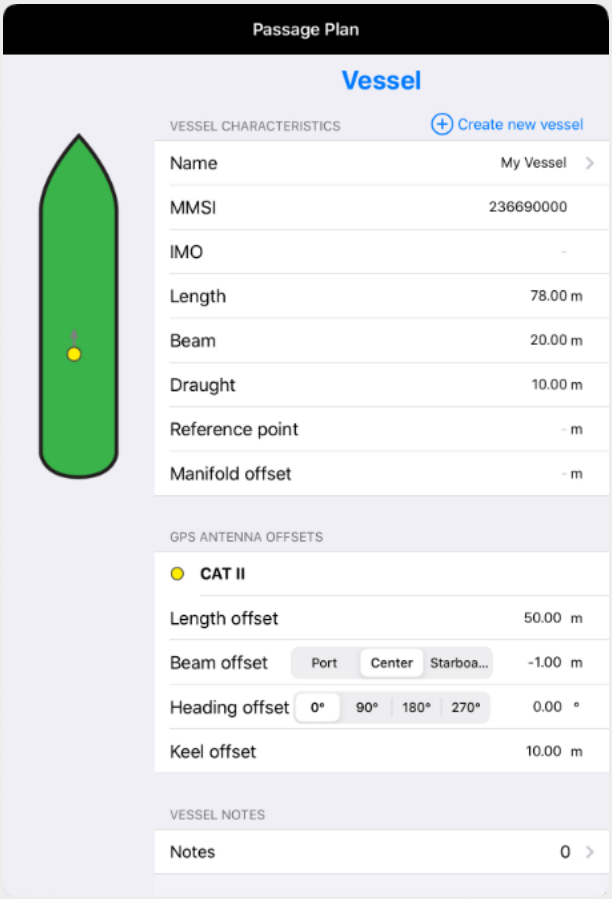

Figure 6.1: An example *Passage Plan* setup.

6.1 Vessel setup

Vessels received from AIS are automatically saved for easy setup. To select a vessel, tap the arrow next to the vessel name and select a vessel. Alternatively you may enter all data manually.

6.1.1 The reference point

The reference point is usually used as the conning position which are the base for many calculations in SafeTug. The position is defined by the distance from the bow to a point of your choice. See more about the conning position in section 8.1.1 on page 14.

6.2 GPS antenna setup

The GPS antenna offsets indicate the location of the GPS antenna(s) on your own vessel, e.g. CAT I, CAT XT, CAT MAX or the vessels own GPS antenna if you are using a CAT ROT. The vessel sketch on the left side of the *Passage Plan* shows the current antenna position based on the entered offsets.

6.2.1 Beam offset

The beam offset is used to add a sideway offset of the antenna. You can add an offset relative to port, center or starboard. When *port* or *starboard* is chosen, the offset value will move the position towards the opposite side and when *center* is chosen a positive value will move it towards starboard and a negative value towards port.

6.2.2 Heading offset

CAT MAX allows for independent heading which requires you to enter a heading offset based on the position of the antennas.

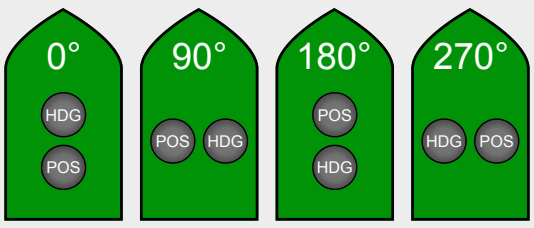

Figure 6.2: GPS antenna offset value relative to its positioning.

6.3 Notes

You may add notes to a vessel for current and future operations. If SafeTug is connected to a Port Server, these notes will be shared with other pilots connected to the same server. Select the *Notes* field to get to the list of notes, see fig. 6.3. In the list, click the first, empty row to create a new note. While editing you may tap the exclamation marks to mark this note as high priority. Notes can be sorted by priority or date by clicking the buttons at the top of the page. To delete a note, drag it to the left.

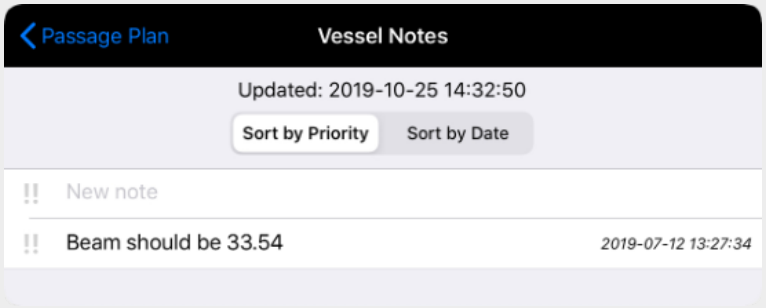

Figure 6.3: The vessel notes dialog with one note.

7 Assisting a vessel

You can assist any other vessel visible on the map. To start assisting a vessel simply long press on the vessel and select: *Assist*. The assisted vessel's navigational data will now be visible, and you and the assisted vessel will be followed on the map. To stop assisting a vessel you long press the vessel again and select: *Stop Assist*.

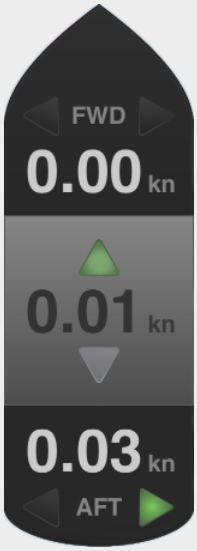

Figure 7.1: Assisted vessel movements.

Note 7.0-1

If you want to assist another vessel you may just start assisting the other vessel without stopping first.

8 Vessel details

8.1 Own vessel

8.1.1 Conning Position

The conning position is used as origin for most position related calculations throughout SafeTug. It is determined by the following prioritized rules:

1. If the reference position is set in the *Vessel Setup*, the conning position is on the center line with the given offset from the bow.
2. If a ship shape is drawn, the conning position is on the center line of the ship at the antenna's length offset from the bow.
3. Otherwise, the antenna location is used as the conning position.

The conning position used for all navigational and positioning calculations which include the following:

- BCR
- BCT
- COG
- CPA
- EBL/VRM
- Meeting points
- Motion vectors
- Passing waypoints
- Ranges
- SOG
- TCPA

8.1.2 REAL TIME UNDER KEEL CLEARANCE

Normal under keel clearance (UKC) will calculate the UKC based on a fixed draught depth, the chart data and maybe some tide sensor data. But, it does not take into account the actual movements of the vessel.

This is what Realtime Under Keel Clearance (RUKC) does. It is defined as: *The smallest vertical distance between the vessel keel and known survey points.* This requires high precision movement data and are therefore only available for our top CAT devices.

Activation of RUKC
Install the depth files files into SafeTug, see section 12.3.2 on page 26 and make sure to set all required vessel details:

- MMSI
- length
- beam
- length offset
- beam offset
- heading offsets
- keel offset

The RUKC will be shown in the vessel infobox.

8.2 Other vessels

8.2.1 AIS VESSELS

AIS targets are displayed with true shape when width, length and heading are available. If any of the data are missing, the AIS target will be displayed as a • symbol indicating the position or a triangle if the heading is available. If the heading is missing SafeTug assumes that HDG is the same as COG and the vessel shape will appear as a transparent ghost shape. If both HDG and COG are missing the transparent ghost shape of the vessel will have a HDG of zero degrees (pointing north) but is still drawn with actual size on the chart. Detailed AIS target information can be accessed by tapping on the vessel. The size of the infobox can be changed inside *Settings app*. In *Settings app* you can choose to show certain ship types with reduced detail to reduce clutter. These will be shown with a smaller symbol, no name and no motion vector.

8.2.2 STATIC VESSEL PREDICTIONS

The static vessel prediction is accessed by tapping on the clock in the lower right corner. This tool allow you to estimate where the vessel will be at a later point in time, according to the chosen value on the 'Length' slider. The prediction applies to all known vessels, which are predicted from the last known location, direction, and their current speed, for up to the next 60 minutes. You can change how this is shown on the screen by switching between the two modes. One mode moves the vessels and draws dashed lines from their original positions. The other mode keeps the vessels in their original positions and instead scales their motion vectors.

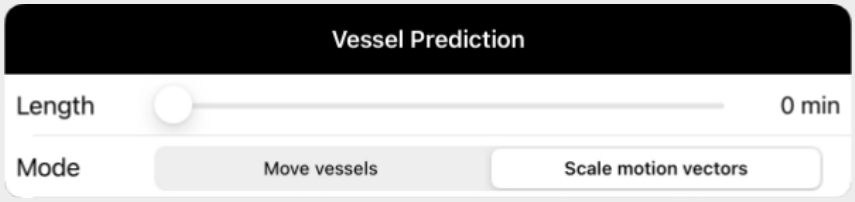

Figure 8.1: Static vessel prediction configuration dialog.

8.2.3 LIVE VESSEL PREDICTIONS

Advanced vessel movement predictions are always available for vessels with an installed SafePilotor SafeTugsystem onboard. This includes vessels connected to a Data Server. The prediction is a projection of the position and heading based on the current position, COG, SOG and ROT. It is activated by default but can be deactivated and modified in the *Motion* tab within the *Control Center*. The *Control Center* is explained in section 11 on page 22.

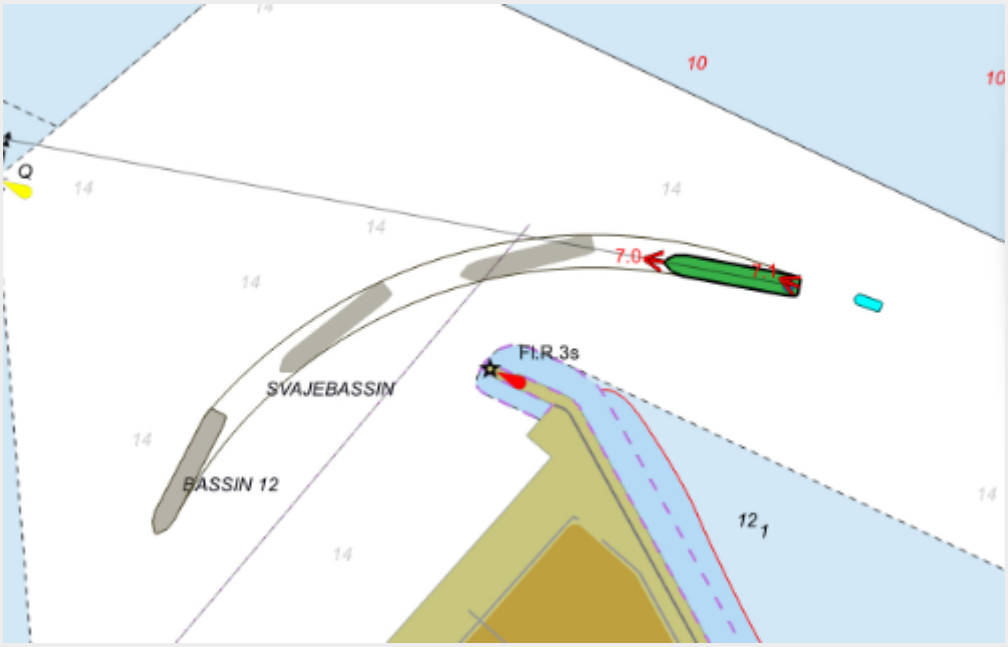

Figure 8.2: Tanker with prediction shapes.

9 Contexts

The *Contexts Panel* includes all the contexts in a *Context Wheel*. Each context will be explained in this chapter. Some of the contexts may include a *Tools Panel* as explained in section 4.3 on page 9.

9.1 The planning context

The planning context is used to plan and/or select a route to follow or to add special areas and annotations to the chart. All additions can only be edited while in this context to prevent unintended changes during operation. You have multiple tools available in the *Tools Panel* to help you create the chart elements which are described in this chapter.

9.1.1 The route tool

The route tool is used to plan the route to follow. If a proper route already exists, tap on it to activate it. When it has been activated it will be used in the navigation context - see section 9.2 on the following page. Follow these steps to create a new route:

1. Make sure that no other routes are selected by tapping on an empty location in the chart.
2. Now long press on the chart to add your first waypoint.
3. To add another waypoint simply navigate to the new location and long press on it.

You should see a line connecting the two points. Continue until your route is complete. You can move a waypoint by dragging it and turns may also be adjusted by dragging the corresponding handle. Finally, long press on any waypoint to access advanced configurations for both the waypoint and the entire route. The configurations include:

- Max cross track distance.
- Speed limits.
- Wheel over points.
- Naming of waypoints and routes.
- Deletion of waypoints and routes.

9.1.2 The EBL/VRM tool

This tool is used to add an electronic bearing line and variable range marker. Long press on the chart to add the marker and drag the outline and the line to set the range and bearing. Long press again to edit details or to delete it.

9.1.3 The annotation tool

This tool is used to annotate areas of interest by giving them a title, description and color. Annotations can be added as circles or polygons. On tool selection you will choose either the polygon option or the circle option. Long press on the chart to add an annotation and drag its components. Long press on the annotation to edit details or to delete it.

9.1.4 The distance line tool

This tool is used to add distance measurements from your vessel to the line. Only the closest distance line to each side will be active during navigation and only when it is closer than 500 meters and you are moving towards it and is always shown when closer than 200 meters. Long press on the chart to add a new line and drag the points to move it. Long press again to edit details or to delete it.

> **Note 9.1-1**
> Distance lines will also be shown for closest vessels within 500 meters. They will get precedence if they come closer than the distance line. The only exception are vessels with reduced details which will be ignored.

9.2 The navigation context

The navigation context is used during navigation along a route. A bottom bar will present the most crucial information for the route. This includes distance, bearing, ETA and XTD for both the next waypoint and the destination waypoint. See an example in fig. 9.1.

Figure 9.1: The bottom bar which appears in the navigation context.

Detailed ETA and TTG information can be inspected by tapping on either the next waypoint box or the destination waypoint box in the bar. By tapping on the next waypoint box you will see information related to this waypoint only. By tapping on the destination waypoint box you will see information related to the destination and all intermediate waypoints.

9.2.1 ROUTE SYMBOLS

A route consists of multiple waypoints where each waypoint can be shown as different symbols based on the type of waypoint and location relative to the vessel. The symbols are as following:

- Passed waypoint.
-  Next waypoint.
-  Upcoming waypoint located after next waypoint.
-  Destination waypoint.
- Waypoint after destination.

The default destination is the last waypoint along the route. To change the destination long press on the desired waypoint and select *Set as destination*. Here you can also set it as the next waypoint to skip another waypoint or set a target ETA. In this case, an infobox will display the recommended speed to reach the waypoint in time.

10 Recording and Replaying

10.1 AIS recording

All vessel movements are recorded automatically for every operation and saved in separate files for later replay. You can access these recordings from the Replay Panel which is initially hidden at the bottom of the screen. You can make it appear/disappear by either tapping or dragging the visible flap.

To replay a recording of a previous operation, tap the Recording List icon on the panel's right side to see all available recordings and select the recordings you wish to see. A blinking replay symbol will be visible in the top left corner of the screen to indicate that a previous recording is being replayed. You can use the controls on the replay panel to slow down, speed up, or jump in time in the recording.

WARNING 10.1-1

If you start a replay in the middle of an active operation the recording of vessel movements will stop and no data will be saved while replaying. Also, when resuming the active operation again, a new recording will be created, and the operation will then consist of two recordings.

Figure 10.1: A recording being replayed, indicated by the blinking replay symbol in the top left corner.

11 Control center

The *Control Center* is located last in the *Contexts Panel* as a *Gear* icon. It controls the most used options and displays among other things server connection statuses and license information.

11.1 Display settings

In this dialog you may alter the visual aspects of SafeTug and the content of the charts. Figure 11.1 shows a sample of this dialog.

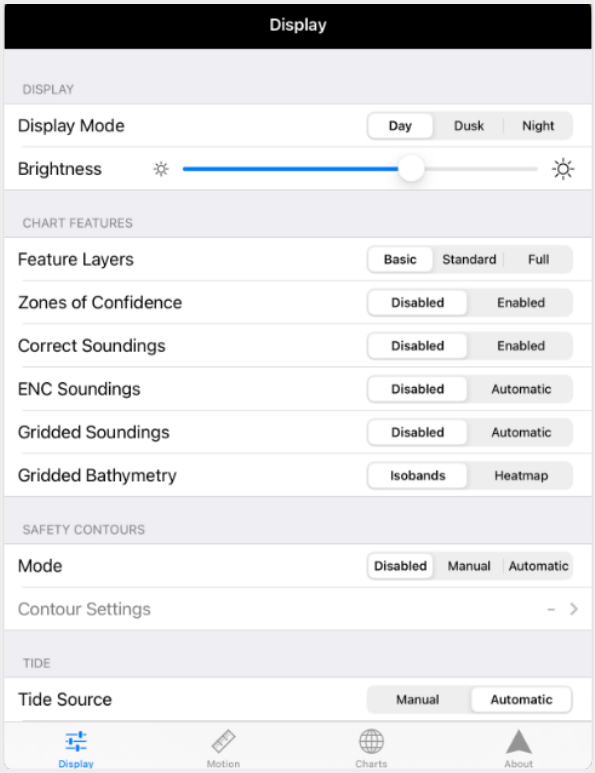

Figure 11.1: A sample of the display settings dialog in SafeTug.

11.1.1 Display

Here you may change from day, to dusk, to night mode as well as adjusting the overall brightness.

11.1.2 Chart features

Feature layers
Choose between: Basic, Standard and Full to show more or less details in the chart. Appendix A on page 28 tells exactly what is included in the three feature options.

Zones of confidence
Enable zones of confidence to get an understanding of the quality of surveyed data in the charts. A legend in the lower left corner will map each color to a quality level. Details about the quality levels are available in appendix C on page 32.

Correct soundings
This will correct soundings based on actual tide level.

ENC soundings
Displays soundings from ENC charts if available.

Gridded soundings
Displays soundings from S-102 charts and XYZ charts if available.

Gridded bathymetry
Toggle between traditional isoband represenation and heatmap representation for S-102 charts.

11.1.3 Safety contours

Safety contours are a way of indicating where it is safe to navigate and where it's too shallow. It works by highlighting soundings and depth contours that are separated by certain thresholds.

Deep soundings are shown as faded gray, safe soundings as black and shallow soundings as red. Depth contours between deep and safe areas are colored black and depth contours between safe and shallow areas are colored red.

The safety contours thresholds can be configured either as fixed depths, or calculated based on your under keel clearance or a percentage of your draught.

11.1.4 TIDE

Use tide levels from the Data Server or a tide table or set the current tide level manually.

11.1.5 PARALLEL INDEX

Display Parallel Index lines while in the navigation context.

11.1.6 SHAPE FILE COUNTOUR

Highlight the Shape File Countour depth line in the chart from shape files if available.

11.2 Motion

This tab includes settings for vessel movements and predictions. Figure 11.2 shows a sample of this dialog.

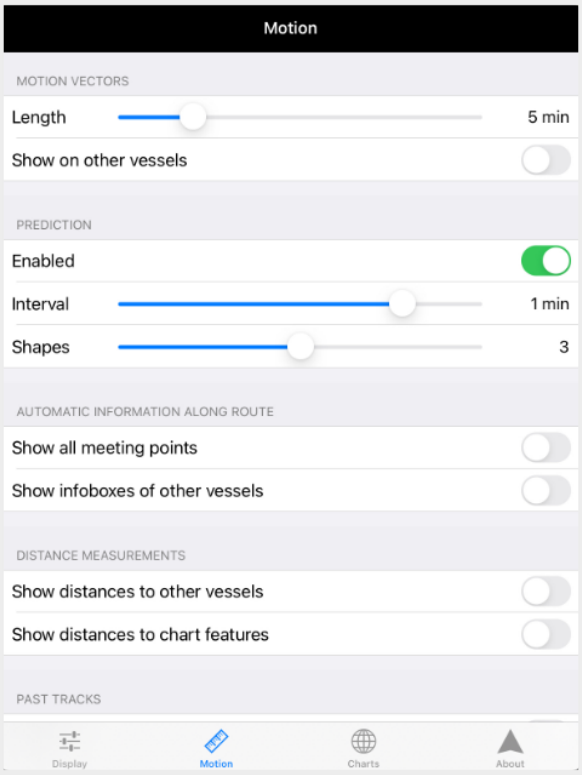

Figure 11.2: The motion settings dialog in SafeTug.

11.2.1 Motion vectors

A motion vector can be added to your vessel alone or all vessels. It will add one motion vector from your conning position based on SOG and COG. If your own vessel is moving slower than 5 knots or is turning more than 10 °/min, two motion vectors will be shown, one from the bow and one from the stern. All other vessels will only show one motion vector which will originate from their conning position if the required information are available and otherwise from their antenna position.

11.2.2 Prediction

This will predict the location of your own vessel as well as other SafePilot vessels received through the Data Server. It is shown as a shadow next to the current vessel location. You can change the interval between the shapes and the number of shapes.

11.2.3 Automatic information along route

Show all meeting points
This will show meeting points for all other ships around your current route. The only exception is ships with a SOG below 1 knot.

Show infoboxes of other vessels
This will automatically display the infobox for other vessels as long as the following criteria are fulfilled:

1. The other vessel has to be moving.
2. The other vessel has to be closer than ≈1800 meters front or behind and closer than ≈350 meters to the sides.

11.2.4 Distance measurements

Show distances to other vessels
This will toggle distance to other vessels.

Show distances to chart features
When enabled, shows the shortest measurement against a range of chart features. The chart features includes dredged areas, land areas, wrecks, obstructions, mooring/warping facilities, and more. The shortest distance from both the port and starboard side of the vessel to the feature is measured and displayed in the chart.

11.2.5 PAST TRACK

You can show past tracks of your own vessel as well as other vessels. The track can be displayed as either a line or a series of ship shapes and it automatically disappears after a chosen interval.

11.2.6 ALERTS

Speed alerts
You may enable an audible and visible warning on transverse docking speeds. If either bow or stern speed exceeds the set limit, the relevant number will be colored amber, and an audio alert will sound.

Distance alert
A distance warning can be enabled to trigger if the docking or lock distance is less than the chosen value.

11.3 Server

This tab shows if you are connected to a Data Server and/or Port Server. You can see the server addresses and enable or disable the internet AIS stream to receive AIS vessels from the Data Server.

11.4 Charts

This tab informs about installed charts. Tap on a chart for detailed information like title, edition and expiry date. See more details about installing charts in section 12 on the following page.

11.5 About

The tab shows detailed license information like what is included and the ENC user permit used to purchase charts. It also links to our customer support and this manual.

12 Charts

SafeTug supports charts from different vendors. PRIMAR and NOAA charts can be installed automatically or manually based on your preferences. But, charts from other vendors has to be installed manually. All charts can be used alone or in combination as your prefer.

12.1 PRIMAR charts

SafeTug supports ENC charts from PRIMAR. If your user permit is added to your chart order, the charts will automatically be downloaded and installed into SafeTug. The user permit is displayed in the *About* tab in the *Control Center* in section 11.5 on the previous page. SafeTug will automatically check for chart updates and notify you, when new charts are ready to be installed.

12.2 NOAA charts

SafeTug also supports ENC charts from NOAA. You have three options to install NOAA charts:

1. Using SafePilot Shore Viewer together with a Port Server to select and distribute charts to all pilots.
2. Manually install charts or chart IDs onto the Port Server.
3. Manually install charts or chart IDs into SafeTug.

12.2.1 Define NOAA chart IDs for manual installation

Please contact our support team by email It you want to manually create a file with NOAA chart IDs. It is a simple process but hard to describe so they will be happy to assist you.

12.3 Distribute charts to all users

You may choose to use SafePilot Cloud to distribute your own charts to all users of your organization. Upload the file to SafePilot Cloud to distribute these files. These charts may also be installed manually on each iPad, see section 12.4.

12.3.1 Bathymetric Inland Electronic Navigational Charts

SafeTug supports bIENC. These charts are typically created from frequently updated, high resolution survey data and represents only the seabed. They are more detailed and accurate than ENC charts. As bIENCs are designed to complement traditional ENCs and inland ENCs, they are only visible where they overlap such charts. Furthermore, they must have the underlying ENCs'/IENCs' intended usage level set in their range of supported usage levels. More information is available in the bIENC product specification at http://ienc.openecdis.org/content/bathymetric-inland-enc-product-specification.

12.3.2 RUKC charts

RUKC uses chart files of the type sasc. It is a standard asc file with a custom SafeTug header in the top. See more about the format in appendix B on page 31.

12.4 Manual installation of charts

Downloaded charts can be installed into SafeTug. All charts should be installed directly into *SafeTug Documents* directory. See section 13 on the following page for details about the installation and extraction process of files.

13 File handling

You may extract or install charts and configuration files manually into SafeTug. This includes the following:

- Annotations (.san)
- Charts (.000, .gml, .prm, .s63, .xyz and .zip)
- Display scheme overwrites (.json)
- Distance lines (.sdl)
- Fender lines (.sfl)
- Locks (.slo)
- Recordings (.log and .ukc)
- Routes (.spx)
- Shapes (.dbf, .prj, .shp and .shx)
- Soundings (.sasc)

All files should be installed in either the root of the document folder or in a subdirectory if it exists.

13.1 Access the SafeTug documents folder of the iPad

The steps varies a bit depending on which operative system you are running on your pc.

13.1.1 MacOS until version 10.14 (Mojave) or Windows

You can connect a computer to the iPad via iTunes which you can download free from Apples website at: `https://www.apple.com/itunes/`.

Follow these steps to enter the document folder on the iPad on MacOS versions:

1. Connect the iPad to the computer with a cable.
2. Open iTunes on the computer.
3. Select the *iPad*.
4. Click on *File sharing*.
5. Select SafeTug in the list.

You may now extract or install files directly into SafeTug by dragging items or using the *Add...* button.

13.1.2 MacOS from version 10.15 (Catalina)

You are able to access the files on the iPad directly through finder like this:

1. Connect the iPad to the computer with a cable.
2. Open finder on the computer.
3. Select the *iPad*.
4. Click on *Files*.
5. Select SafeTug in the list.

You may now extract or install files directly into SafeTug by dragging items.

Appendices

A Feature layer sets

As described in section 11.1.2 on page 22 you can choose between displaying only the basic chart features, the standard features or all features. What exactly is included in the different sets are explained in the following sections.

A.1 The basic feature set

This set includes a minimal set of chart features which are:

- Bridge (*BRIDGE*)
- Built-up area (*BUAARE*)
- Canal (*CANALS*)
- Causeway (*CAUSWY*)
- Coastline (*COALNE*)
- Depth area (*DEPARE*)
- Depth contour (*DEPCNT*)
- Dredged area (*DRGARE*)
- Floating dock (*FLODOC*)
- Gate (*GATCON*)
- Hulk (*HULKES*)
- Lake (*LAKARE*)
- Land area (*LNDARE*)
- Pontoon (*PONTON*)
- River (*RIVERS*)
- Shoreline construction (*SLCONS*)
- Unsurveyed area (*UNSARE*)

A.2 The standard feature set

This set includes the most used chart features. It consists of all features from the basic feature set and the following:

- Anchor berth (*ACHBRT*)
- Anchorage area (*ACHARE*)
- Beacon, cardinal (*BCNCAR*)
- Beacon, isolated danger (*BCNISD*)
- Beacon, lateral (*BCNLAT*)
- Beacon, safe water (*BCNSAW*)
- Beacon, special purpose/general (*BCNSPP*)
- Berth (*BERTHS*)
- Building, single (*BUISGL*)
- Buoy, cardinal (*BOYCAR*)
- Buoy, installation (*BOYINB*)
- Buoy, isolated danger (*BOYISD*)
- Buoy, lateral (*BOYLAT*)
- Buoy, safe water (*BOYSAW*)
- Buoy, special purpose/general (*BOYSPP*)
- Cable area (*CBLARE*)
- Cable, overhead (*CBLOHD*)
- Cable, submarine (*CBLSUB*)
- Cargo transhipment area (*CTSARE*)
- Caution area (*CTNARE*)
- Conveyor (*CONVYR*)
- Dam (*DAMCON*)
- Daymark (*DAYMAR*)
- Deep water route centerline (*DWRTCL*)
- Deep water route part (*DWRTPT*)
- Distance mark (*DISMAR*)
- Dock area (*DOCARE*)

- Dry dock (*DRYDOC*)
- Dumping ground (*DMPGRD*)
- Fairway (*FAIRWY*)
- Fence/wall (*FNCLNE*)
- Fishing facility (*FSHFAC*)
- Fog signal (*FOGSIG*)
- Harbour facility (*HRBFAC*)
- Ice area (*ICEARE*)
- Land region (*LNDRGN*)
- Landmark (*LNDMRK*)
- Light (*LIGHTS*)
- Light float (*LITFLT*)
- Light vessel (*LITVES*)
- Lock basin (*LOKBSN*)
- Log pond (*LOGPON*)
- Marine farm/culture (*MARCUL*)
- Military practice area (*MIPARE*)
- Mooring/Warping facility (*MORFAC*)
- Navigation line (*NAVLNE*)
- Obstruction (*OBSTRN*)
- Offshore platform (*OFSPLF*)
- Pile (*PILPNT*)
- Pilot boarding place (*PILBOP*)
- Pipeline area (*PIPARE*)
- Pipeline, overhead (*PIPOHD*)
- Pipeline, submarine/on land (*PIPSOL*)
- Precautionary area (*PRCARE*)
- Pylon/bridge support (*PYLONS*)
- Radar transponder beacon (*RTPBCN*)
- Radio calling-in point (*RDOCAL*)
- Railway (*RAILWY*)
- Recommended route centerline (*RCRTCL*)
- Recommended track (*RECTRC*)
- Recommended traffic lane part (*RCTLPT*)
- Restricted area (*RESARE*)
- Road (*ROADWY*)
- Sea area/named water area (*SEAARE*)
- Seabed area (*SBDARE*)
- Sounding (*SOUNDG*)
- Submarine transit lane (*SUBTLN*)
- Topmark (*TOPMAR*)
- Traffic separation line (*TSELNE*)
- Traffic separation scheme boundary (*TSSBND*)
- Traffic separation scheme crossing (*TSSCRS*)
- Traffic separation scheme lane part (*TSSLPT*)
- Traffic separation scheme roundabout (*TSSRON*)
- Traffic separation zone (*TSEZNE*)
- Two-way route part (*TWRTPT*)
- Underwater/awash rock (*UWTROC*)
- Water turbulence (*WATTUR*)
- Wreck (*WRECKS*)

A.3 The full feature set

This set includes all chart features. It consists of all features from the basic and standard feature sets and the following:

- Accuracy of data (*M_ACCY*)
- Administration Area (Named) (*ADMARE*)
- Airport/airfield (*AIRARE*)
- Archipelagic Sea Lane (*ARCSLN*)
- Archipelagic Sea Lane axis (*ASLXIS*)
- Checkpoint (*CHKPNT*)
- Coastguard station (*CGUSTA*)
- Compilation scale of data (*M_CSCL*)

- Contiguous zone (*CONZNE*)
- Continental shelf area (*COSARE*)
- Control point (*CTRPNT*)
- Coverage (*M_COVR*)
- Crane (*CRANES*)
- Current - non-gravitational (*CURENT*)
- Custom zone (*CUSZNE*)
- Dyke (*DYKCON*)
- Exclusive economic zone (*EXEZNE*)
- Ferry route (*FERYRT*)
- Fishery zone (*FSHZNE*)
- Fishing ground (*FSHGRD*)
- Fortified structure (*FORSTC*)
- Free port area (*FRPARE*)
- Gridiron (*GRIDRN*)
- Harbour area (administrative) (*HRBARE*)
- Horizontal datum shift parameters (*M_HOPA*)
- Incineration area (*ICNARE*)
- Inshore traffic zone (*ISTZNE*)
- Land elevation (*LNDELV*)
- Local magnetic anomaly (*LOCMAG*)
- Magnetic variation (*MAGVAR*)
- Nautical publication information (*M_NPUB*)
- Navigational system of marks (*M_NSYS*)
- Offshore production area (*OSPARE*)
- Oil barrier (*OILBAR*)
- Production/storage area (*PRDARE*)
- Radar line (*RADLNE*)
- Radar range (*RADRNG*)
- Radar reflector (*RADRFL*)
- Radar station (*RADSTA*)
- Radio station (*RDOSTA*)
- Rapids (*RAPIDS*)
- Rescue station (*RSCSTA*)
- Runway (*RUNWAY*)
- Sand waves (*SNDWAV*)
- Sea-plane landing area (*SPLARE*)
- Signal station, traffic (*SISTAT*)
- Signal station, warning (*SISTAW*)
- Silo/tank (*SILTNK*)
- Slope topline (*SLOTOP*)
- Sloping ground (*SLOGRD*)
- Small craft facility (*SMCFAC*)
- Sounding datum (*M_SDAT*)
- Spring (*SPRING*)
- Straight territorial sea baseline (*STSLNE*)
- Survey reliability (*M_SREL*)
- Swept Area (*SWPARE*)
- Territorial sea area (*TESARE*)
- Tidal stream - flood/ebb (*TS_FEB*)
- Tidal stream - harmonic prediction (*TS_PRH*)
- Tidal stream - non-harmonic prediction (*TS_PNH*)
- Tidal stream - time series (*TS_TIS*)
- Tidal stream panel data (*TS_PAD*)
- Tide - harmonic prediction (*T_HMON*)
- Tide - non-harmonic prediction (*T_NHMN*)
- Tide - time series (*T_TIMS*)
- Tideway (*TIDEWY*)
- Tunnel (*TUNNEL*)
- Unsurveyed area (*UNSARE*)
- Vegetation (*VEGATN*)
- Vertical datum of data (*M_VDAT*)
- Waterfall (*WATFAL*)
- Weed/Kelp (*WEDKLP*)

B The sasc file format

The sasc file is a deviation of the asc file. The asc file contains UTM coordinates and survey depths in the format:

$$<EASTING>, <NORTHING>, <DEPTH>$$

The $<DEPTH>$ is the height in meters, so for depths the value will be negative.

The header is:
UTMZone $<$*UTMZONE NUMBER*$>$ $<$*UTMZONE HEMISPHERE*$>$
DataBegin

Where *$<$*UTMZONE NUMBER*$>$* is the UTM zone number (1-60) and *$<$*UTMZONE HEMISPHERE*$>$* is either *N* for northern hemisphere or *S* for southern hemisphere.

Here follows an example of the start of a sasc file:

UTMZone 32 N
DataBegin
630992.13,6170992.13,-16.54
630992.38,6170992.13,-16.56
630992.63,6170992.13,-16.54
630992.88,6170992.13,-16.54

C Categories of zones of confidence

SafeTug implements the same categorization standard as defined by S-57. The different areas are displayed as semi-transparent colored areas matching the standard of S-57. Table C.1 summarizes the area definitions.

ZOC	Position accuracy	Depth accuracy	Seafloor coverage	Typical survey characteristics
A1	± 5m $+5\%$ depth	± 0.5m $+1\%$ depth	Full area search undertaken. Significant seafloor features detected and depths measured.	Controlled, systematic survey high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.
A2	± 20m	± 1.0m $+2\%$ depth	Full area search undertaken. Significant seafloor features detected and depths measured.	Controlled, systematic survey achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder and a sonar or mechanical sweep system.
B	± 50m	± 1.0m $+2\%$ depth	Full seafloor coverage not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth but lesser position accuracies than ZOCA2, using a modern survey echosounder, but no sonar or mechanical sweep system.
C	± 500m	± 2.0m $+5\%$ depth	Full area search not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.
D	Worse than ZOC C	Worse than ZOC C	Full area search not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.
U	Unassessed - The quality of the bathymetric data has yet to be assessed.			

Table C.1: A summary of the area definitions for the zones of confidence definition by S-57.

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Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

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