TRELLEBORG

SafePilot Control Unit

SafePilot

INSTALLATION MANUAL

Introduction

Please review this manual carefully to ensure the installation of the SafePilot SPM Control Unit is easy and correct.

Undertaking offshore operations that include berthing manoeuvres of oil or gas tankers to Buoys or Floating Production Storage and Offloading (FPSO) facilities requires precise navigation data. The SafePilot SPM Control Unit is a fixed navigation system developed to assist pilots in these operations by delivering the data necessary to make the operation as precise and safe as possible.

The system is based on communicating and displaying the relative positions of the FPSO and/or Buoy and the approaching tanker using GPS receivers and UHF radio communication links. It is flexible and can easily be adapted to different types of operations or customized to meet specific needs for various operations.

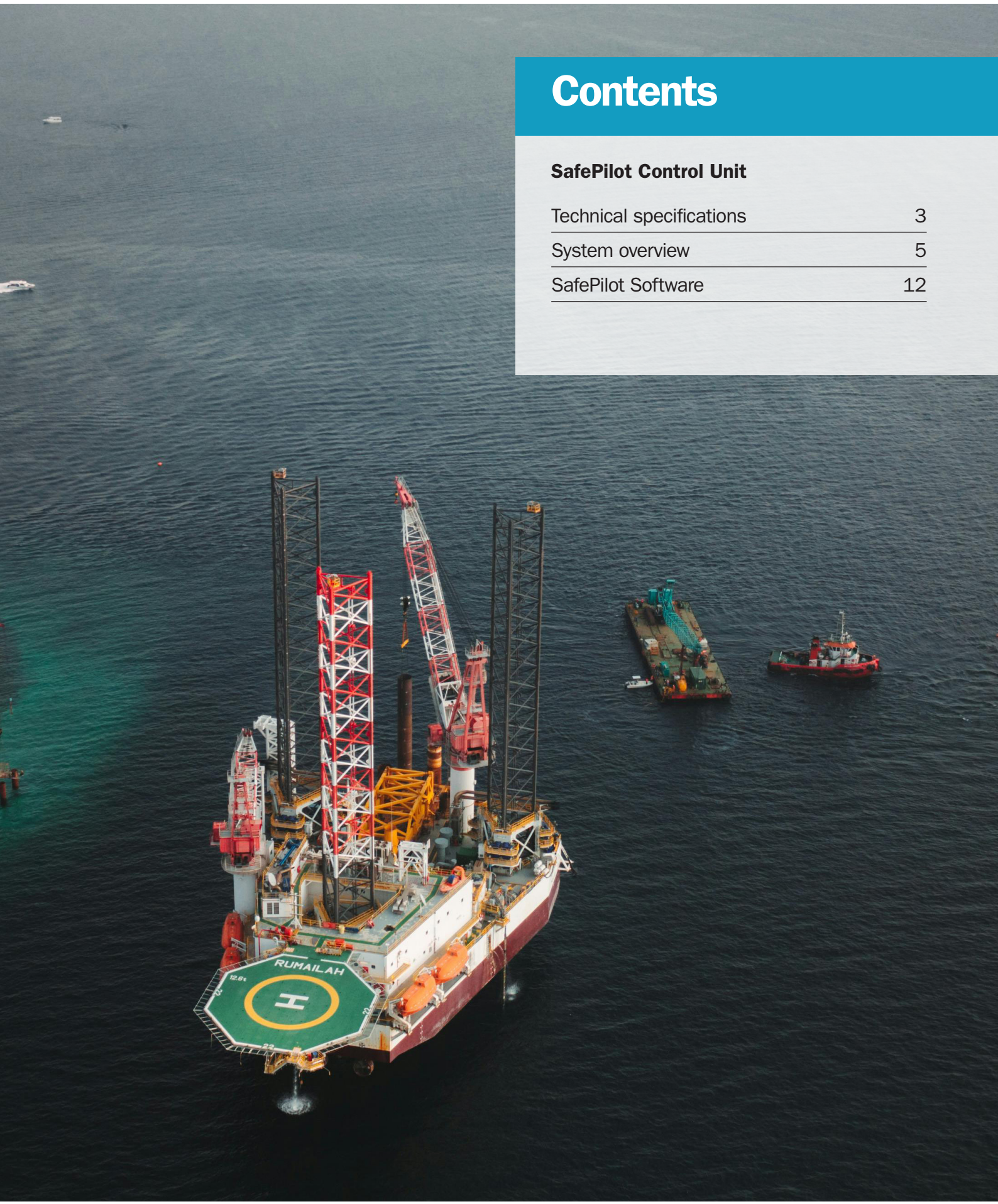
The berthing aid system provides real-time positioning for the tanker in relation to the FPSO or the Buoy during operations. By having the position and heading for both the tanker and the Buoy or FPSO, the SafePilot software can provide highly accurate data and a graphical display of the ongoing operation. This information and additional information, such as weather data, will be displayed on the pilot's iPad, providing valuable insight into the situation.

The TRELLEBORG MARINE SYSTEMS SafePilot systems are designed as a secondary navigational aid and do not relieve the user (pilot, captain, navigator, etc.) of their professional responsibility and navigational skills. Correct use, knowledge, and understanding of the performance and limitations of the SafePilot systems are the sole and only responsibility of the user.

It is important to note that the SafePilot systems and software do not override or substitute the navigation system (charts, ECDIS) installed on board as required by law.

Contents

SafePilot Control Unit



Technical Specifications

FEATURES

The SafePilot Control Unit is a GNSS base station onboard the FSRU/FPSO/FLNG that transmits GNSS correstions to the CAT MAX onboard the tanker and tug.

The SCU has 8 serial ports, 6 digital outputs, 6 digital indputs and 4 multi-configurable analog inputs for interfacing to other systems on the FSRU/FPSO/FLNG.the following section.

OPTIONAL CUSTOMIZATION:

- Heading by adding a second GNSS receiver - antenna
- Excursion monitoring
- Heave / Roll / Pitch
- ESD
- Multiple tankers
- SPM
- TUG integration
- STS operation

APPLICATIONS

For offloading operations, it provides a comprehensive overview, sharing crucial data such as environmental conditions, hawser load, mooring load, and product flow. It ensures centimeter-level accuracy in speed and distance measurements between stakeholders.

The built-in UHF radio enables seamless communication across all parts of the operation using TDMA (Time Division Multiple Access).

Below are some examples of the information that may be exchanged during offshore operations:

- Environmental Data
- Hawser Load
- Product Data (flow, temperature, etc.)

INTERFACES	NO.	INTERFACE
Serial ports	8	RS232/422/485
Digital outputs	6	N/C or N/O relay
Digital inputs	6	0 – 30VDC
Analog inputs	4	4-20mA/0-5v/Load cell
Ethernet	4/1	RJ45 (4 on back, 1 on front)

SPECIFICATIONS	
Lightening protection	GNSS & UHF has lightening arresters installed internally
Operating temperature range	-10 - +50deg. celcius
IP classification	IP20
Weight	14.5kg
Size (HxWxD)	254x483x435mm (6U Rackmount)
Supply	90-240VAC, 50/60Hz.
Power consumption	65w
GNSS RECEIVER	
Systems	GPS/GLONASS/GALILEO (optionally Beidou)
Frequencies	L1 – L2
UHF RADIO	
Frequency Range	403-473 MHz.
Channel Spacing	25 kHz
Transmission Power	Default 0.5w (max. 1w)
Modulation	4FSK

System Overview

The SafePilot SPM Control Unit is a highly adaptable and versatile system that can be customized to meet various needs for loading and offloading tankers in ports and offshore operations. This means that the system's number of units and functionalities can vary depending on the situation in which it is used. The following section will describe the different parts that the system may be composed of and their functionality.

The core element of the system is the SafePilot Control Unit. This fixed installation is most often installed onshore, on an offloading buoy, or on vessels such as Floating production storage and offloading (FPSO) facilities, Floating liquefied natural gas (FLNG) facilities, Floating storage regasification unit (FSRU) facilities, or similar vessels.

Besides the Safe Pilot Control Unit, this part of the system includes a UHF controller antenna and a receiver for the Global Navigation Satellite System (GNSS) signal. The SafePilot control Unit is self-contained, but it would always be used as part of a more extensive setup. As an isolated system, it would appear as follows:

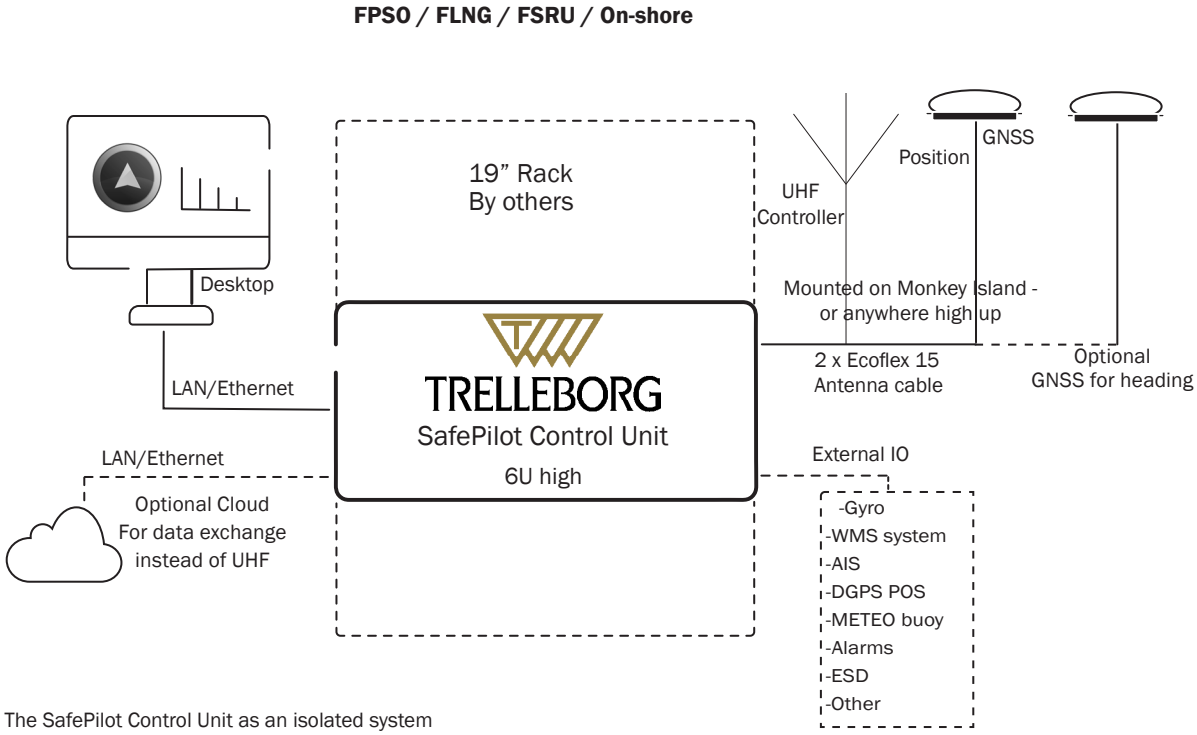


Fig 1 : The SafePilot Control Unit as an isolated system

The SafePilot Control Unit is not sufficient as a standalone system. It will require other devices, most likely placed on a tanker or other approaching vessels, to send and receive corrections to and from.

When a pilot enters a tanker approaching the location where the SafePilot Control Unit is installed, the pilot will bring the SafePilot CAT MAX system onboard. This system consists of a portable heading and positioning unit that communicates with each other through a local WiFi network. The system operates independently from the vessel's instrumentation. During the berthing operation, it continuously communicates GPS positions to the SafePilot Control Unit and receives GPS corrections in return. This allows the pilot to track the tanker's movement using the SafePilot software. Figure 2 shows this setup

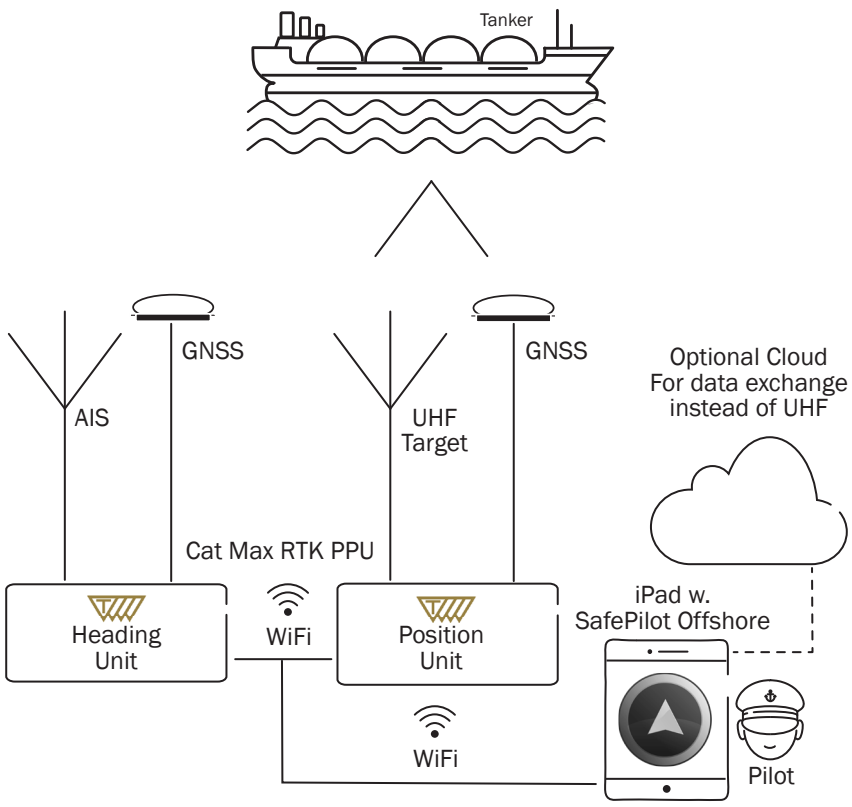


Fig 2 : The CAT MAX system brought onboard the tanker by the pilot

In an operation where the tanker is berthing directly to the facility where the SafePilot Control Unit is installed, the GPS corrections can be passed to the vessel either by mobile data through the SafePilot cloud system or a UHF radio link. In offshore operations, using UHF is often the best solution, as mobile data may not be available or unstable. In the case of port-based systems, mobile data is usually preferred due to the higher bandwidth and since there would be no need for frequency allowance from authorities.

When the two systems described above communicate through UHF signals, they will be interconnected, as shown in Figure 3.

The UHF connection allows two-way communication between the SafePilot Control Unit and other systems. Because only one unit can send information at a time via the UHF connection, each unit has a designated timeslot to send data while the others receive it. To ensure efficient communication, each unit is assigned a timeslot within a second. This means that every second, all units submit their position and other data and receive relevant data from the other units that are part of the system.

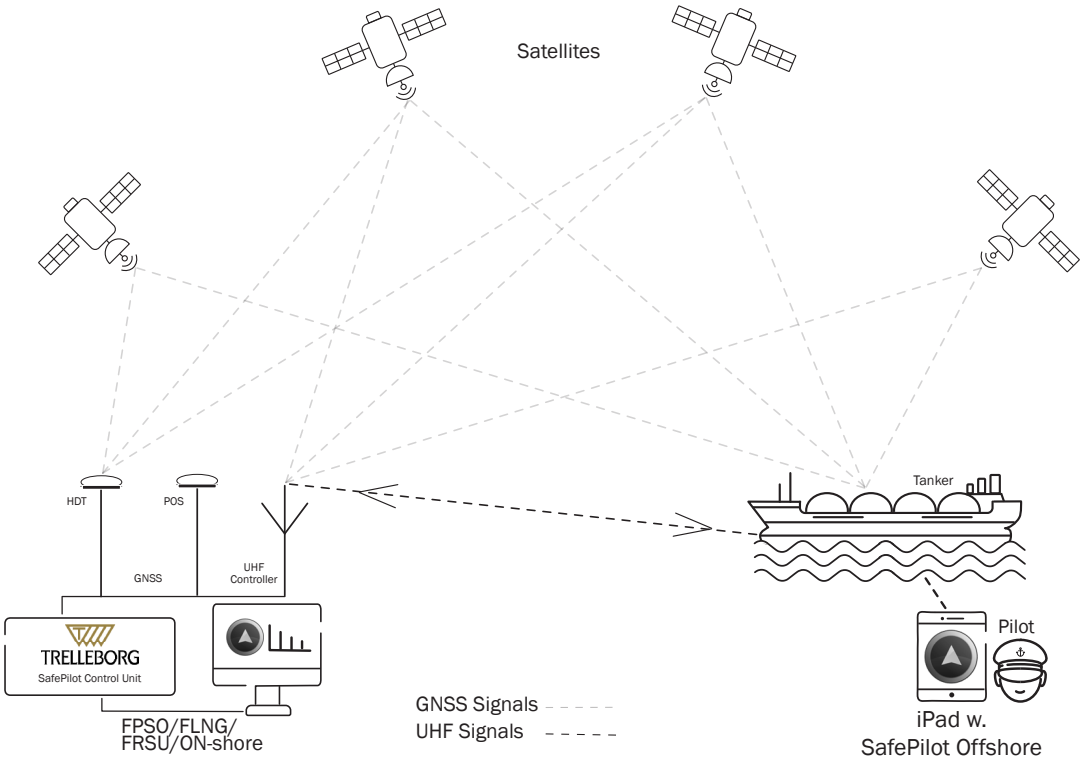


Fig 3 : Data signal and UHF communication between The SafePilot Control Unit and the approaching tanker

If needed, the system can be expanded with an SPM Control Unit. This might be necessary for offloading or Single Point Mooring (SPM) buoy operations. In this scenario, the SPM Control Unit will operate from the buoy as a fixed installation, similar to the setup shown in Figure 4.

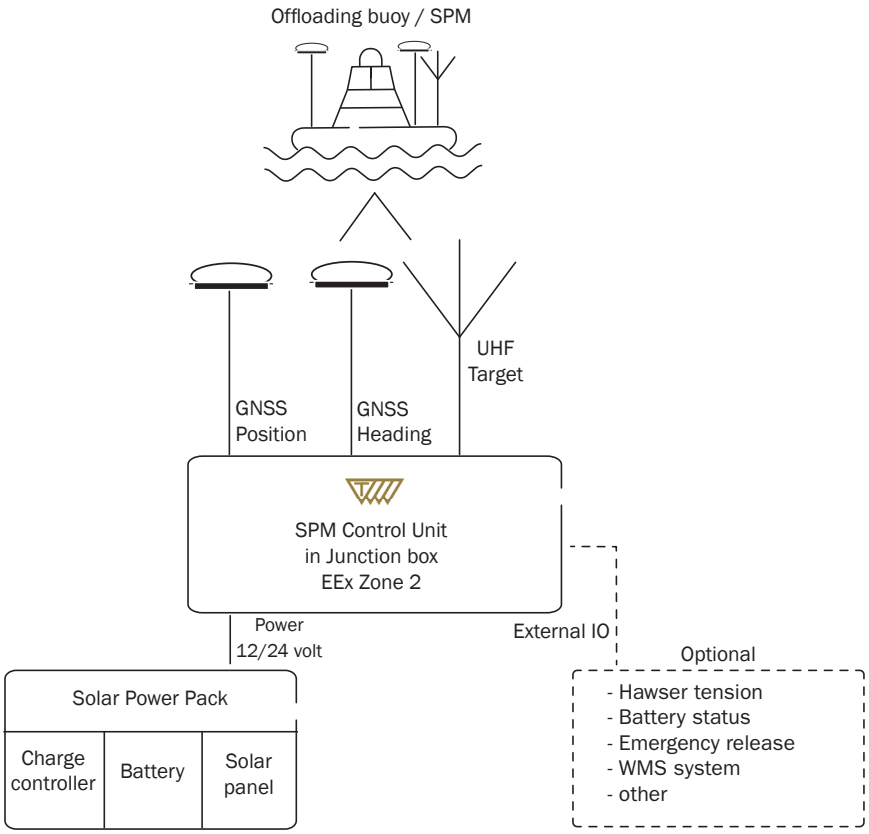


Fig 4 : The SPM Control Unit onboard the offloading buoy or SPM

In this scenario, the SPM Control Unit will use the UHF connection to transmit the buoy's position and heading. This data will enable the calculation of the tanker's precise location relative to the buoy and the facility equipped with the SafePilot Control Unit.

Simultaneously, the pilot will be able to monitor the operational progress using the SafePilot software closely. A schematic representation is provided below in Figure 5 to illustrate the communication process.

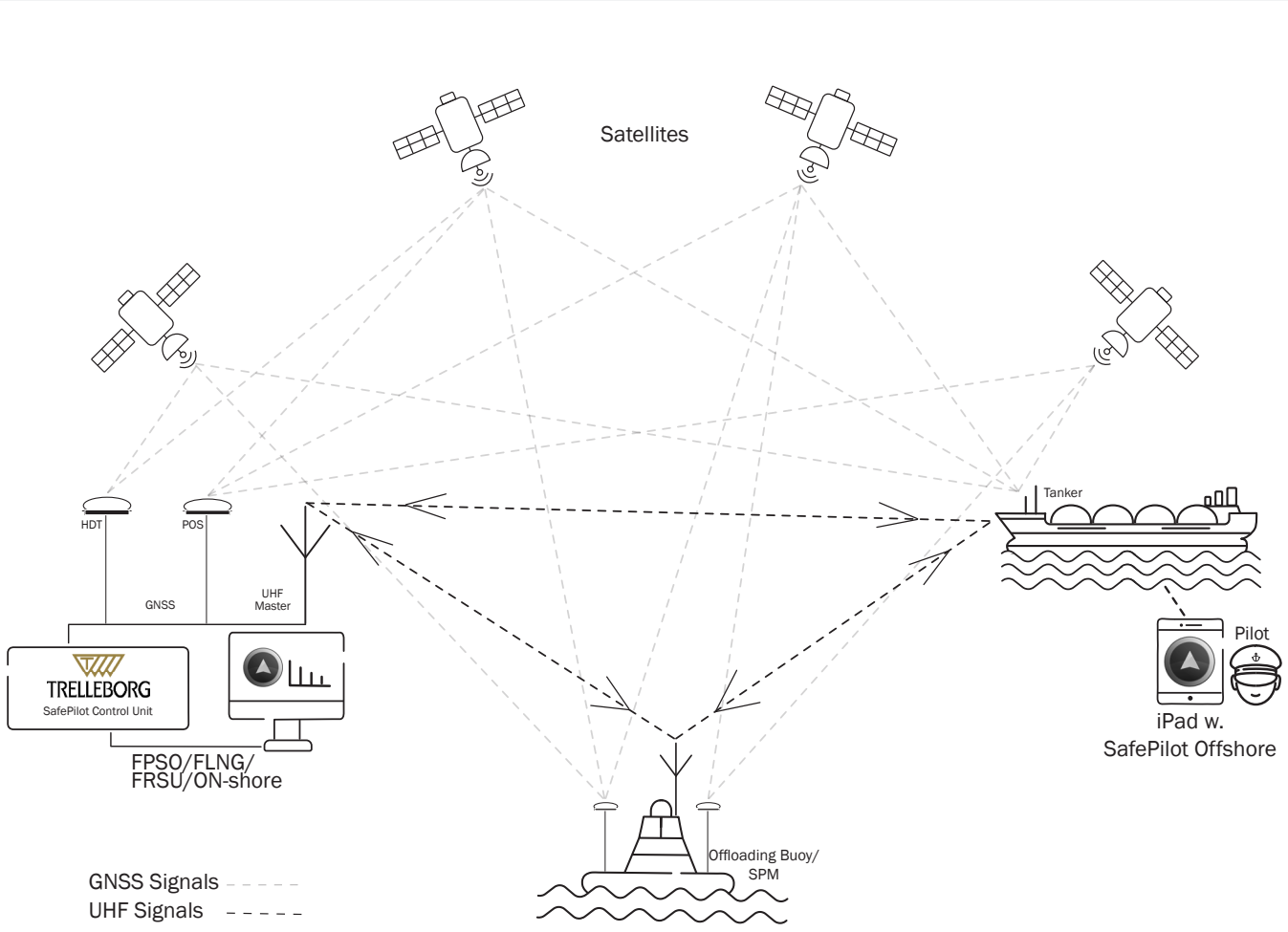


Fig 5 : Signal overview of communication and data between the SafePilot Control Unit, the SPM Control Unit, and the tanker with the CAT MAX system

Finally, if the operation requires it, the relative position and heading of tugs or other support vessels can be added to the overall system. The hardware to enable this functionality may vary, but it is most often a SafePilot P3 or SafePilot Cat MAX unit, similar to the ones used by the pilot on the tanker.

The correction data from these vessels will also be sent back through a UHF connection using the same frequency as the other units. Regardless of the type of hardware used on the various support vessels, the functionality would, in most cases, look like the illustration illustration in Figure 6:

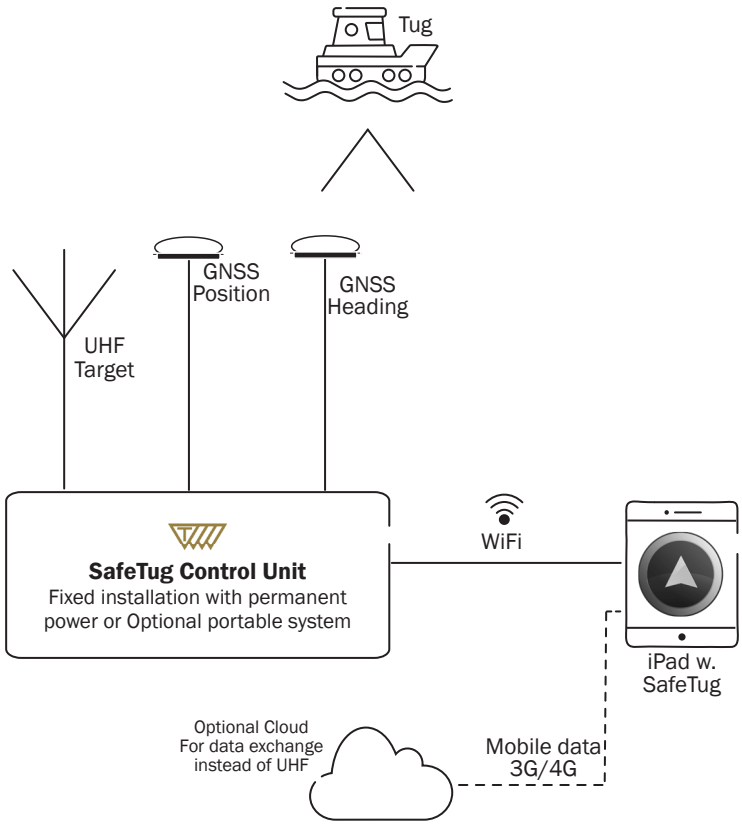


Fig 6 : The part of the system that distributes GPS corrections to the Tugs and other support vessels.

When added to the overall system, the tug and support vessels will receive UHF corrections from all other units involved in the operation. Figure 7 below shows how the system interacts when all units are put to use. Even though only one tug/support vessel is depicted on the diagram, a number of these can be added to the system if needed.

The system's design and the number of entities needed to operate it depend on the specific context in which it is used. When the units are connected, they form part of the overall system, although they are self-contained when operating independently. The necessary units for a particular context may vary, leading to different combinations. Additionally, the SafePilot software developed for this hardware is highly configurable and supports a wide range of external inputs and outputs, making the system flexible and adaptable to specific requirements.

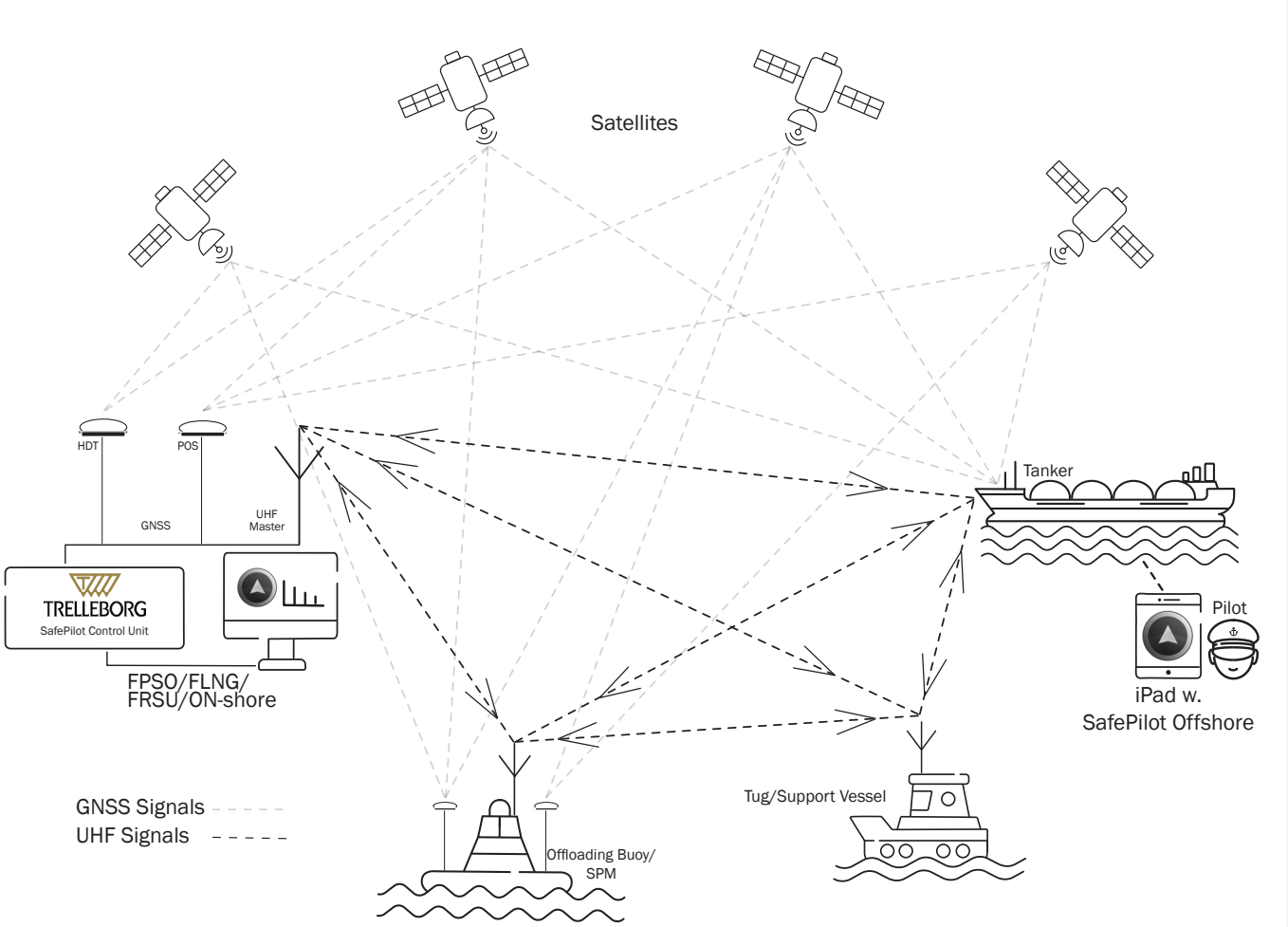


Fig 6 : Communication and data interaction between the SafePilot Control Unit, the SPM Control Unit, the tanker with the CAT MAX system, and the different support vessels and tugs.

SafePilot Software

The SafePilot is a user-friendly software available as an app for iPad and Apple Watch. It handles key tasks such as navigation data, planning functions, route and arrival times, recording, chart handling, predictions, and history. Additionally, it offers specialized functions for docking and alignment, lock operations and weather data among other things.
To learn more about our products and SafePilot, or to purchase the software, please feel free to contact Trelleborg Marine & Infrastructure or visit our website for additional information.

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