

Template 2b

CONOPS

Receives an update with every modification of the design or operating method of the vessel

1. Test request

1.1. General information

Start date

End date

Preferred location for carrying out the test project

Number and type of crew on the ship to be used for the test

Contact details of the contact person for the test project

Requesting organisation

1.2. Aim

A clear description of the objective and the background to the experiment.

A description of the mission and working method during the experiment, including the manner and degree of automation of the ship.

1.3. Vessel owner

Company/owner's name

Address

1.4. Classification

For which CEMT classes was the vessel designed?

What is the statutory minimum number of crew for this vessel? Is a claim possible under national exemptions (e.g. one-man sailing in Flanders)?

For what goods was this vessel designed (ADN or not)?

Was this vessel built to conform to the current laws and regulations? What rules does it not comply with?

Certificates: current and what is still needed in order to sail unmanned/autonomously?

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Insurance: current and show that you are covered if you sail unmanned/autonomously. This is compulsory.

1.5. Characteristics of the vessel

Length, width, maximum draught, maximum height

Tonnage

Where it was built (if new)

Information on propulsion

Information on energy capacity

2. Operation

2.1. What company operates the ship?

2.2. General description of its operation

What is the cargo, where does the vessel sail, on what kind of waterways and what are the difficulties (e.g. narrow locks, low bridges, currents, specific weather conditions in specific regions, refuelling, etc.),

What are the safety conditions in a normal environment/situation?

2.3. Level of autonomy and dynamic navigation tasks

2.3.1. What level of automation (see levels of autonomy of CCR) is used?

See <https://ccr-zkr.org/files/documents/cpresse/cp20181219nl.pdf>

2.3.2. degrees of automation and human involvement per function

The concept of operations should clearly describe all the operational tasks that the vessel will undertake that will be either fully or partly automated. Each operational task should be further broken down into sub-tasks to a level that enables a clear distinction between tasks where a human is in charge of decision-making and tasks where a system is in charge of decision-making. When a human is in charge of decision-making, the location of the decision-maker should be clearly described.

The boundary between human autonomy/remote control must be described as well as when human intervention is desired or necessary.

Here, you can make a schedule of the journey and the tasks that must be performed during the journey. Tasks can be subdivided into sub-tasks. For each (sub) task, it must be described whether it is a person or a machine that decides on the task and/or performs the task. If it is a human, we also want to know if it will be on the vessel or ashore.

2.3.3. Remote control

If remote control is used:

- Describe the roles and responsibilities of the staff at the Shore Control Centre (SCC).
- Which tasks have a high safety risk and which ones a low safety risk? In what way is monitoring performed at high risk and at low risk?
- Is there latency and how is it absorbed? What is the maximum allowable latency?
- How is work carried out (in shifts – how do you prevent fatigue ...)?

- If you first sail with a crew on board and then remotely: how does the transition proceed? What provisions have been made? How are the duties of the crew on board taken over? What equipment?

2.4. Communication

How is communication with the ship (data communication, audio communication and optical signs) (and fall-back if something fails)?

What communication methods are provided (also with other vessels)?

2.5. Passenger cruises

Optional: how are passengers treated in a normal situation.

3. Design

The design philosophy should describe the overall design decisions, requirements and constraints for the systems intended for implementing auto-remote functions. The document should describe redundancy and fault tolerance for the systems in order to ensure the capability to enter and maintain Minimal Risk Conditions (MRC) in any scenario.

3.1. Vessel design

In what way has the design of the vessel been adapted so that it can also meet safety regulations when unmanned/autonomous and so that it does not jeopardise safety on the network and shipping traffic if it is also sailing? (e.g. installing redundant systems, fire detection, ... extra sensors, ...).

Map can also be added here.

The most important functions that need to be addressed are:

- remote control and supervision;
- communication;
- navigation and manoeuvring;
- propulsion;
- steering;
- electrical power supply;
- control and monitoring;
- watertight integrity;
- fire safety;
- ballasting;
- drainage and bilge pumping;
- anchoring;
- cargo handling;
- maintenance.

The limitations of the systems used must also be described. What can they not do? Is that a problem? How is that solved?

3.2. Software and redundancy

Redundancy of systems? What pieces of software are independent from one another? How are errors prevented? See also FMEA

3.3. Verification

How are tests carried out to ensure that the equipment used is safe?

What has already been tested?

4. Safety

4.1. Minimum risk conditions

It is important to define the minimum risk conditions (MRC) before the vessel can sail.

The minimum risk condition (MRC) of a ship is that a ship can behave in such a way that it does not represent a danger to other ships, persons or the environment. The MRC can be dynamic (active positioning of the vessel, takeover by crew...) or static (anchoring)

Examples of MRCs are:

- *stay moored at quay;*
- *move away from the quay and other vessels;*
- *limp home;*
- *move as slowly as possible;*
- *navigate to next waypoint and stop there;*
- *call for assistance;*
- *drop (emergency) anchor;*
- *keep position;*
- *abort current operation.*

What the minimum in the safety philosophy should be:

1. Detailed description of the envisaged MRC of the ship
2. Description of what MRC must be available at any point in the operation (minimum two – dynamic or static)
3. There must be at least one MRC available at any point following a fire or extinction of the fire zone or waterproof area, following a power cut or loss of communication with a Shore Control Centre.
4. Critical components, systems and equipment that need to be functioning in order to make the MRC operational. The reliability of these functions must be documented.
5. Defined acceptance criteria for safe working.
6. Detailed description of the relationship of the ship with other ships

MRCs must also be applied in the risk analysis.

4.2. Cyber security

Safety measures used in order to apply the data and communications security. (mtp communication, connection to land, physical security on board, procedures for updating software and which standards are applied)

4.3. Traffic rules

A description of how the traffic rules are applied. The description must at least include the following:

1. Selected technical solution
2. Working of the ship
3. Sensor technology and sensor strategy used (including failure to go to safe state (fail-safe), restrictions due to weather conditions)
4. Any operational limitations. (E.g. interaction between the ship and control station operated on land)
5. The ability to deal with complex traffic situations, including situations in which other traffic does not comply with traffic rules.

The safety philosophy must describe how an equivalent level of safety is achieved in unmanned/autonomous activities

5. Maintenance

What is the usage and maintenance plan? A description of what happens in the case of maintenance and repairs.

Systems that diagnose and monitor the operation of ships must be described.

Description of the function and responsibility on land.

Safety-critical control and operation systems must be defined for redundancy and segregation

Describe how this can be planned. How the need for maintenance can be monitored. How you can guarantee that a vessel can still guarantee safety after maintenance (e.g. software update).