

PILOT DEFINITION AND PLAN, INCLUDING DEFINITION OF KPIs AND SELECTION OF AT LEAST 3 PILOT SITES

AVIS

Prepared by: AVIS team



Approved by: Marcos López (GMV)



Authorized by: Marta Cueto (GMV)



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1. INTRODUCTION

1.1. PURPOSE

The present document is the "Pilot definition and plan, including definition of KPIs and selection of at least 3 pilot sites" document for the AVIS project. The main purpose of this document is to define the plan to be followed for each of the 4 pilots to be performed to show EU Space Data and services' added value for automated vessels on European IWW.

1.2. SCOPE

The present document has been organized as follows:

- Chapter 1. gives an introduction to the document, including purpose and scope of the plan.
- Chapter 2. provides the list of project reference documents.
- Chapter 3. describes the methodology used for this document.
- Chapter 4. provides the pilot plan for each of the pilots.
- Chapter 5. provides the calendar with the preliminary dates for the pilot projects.
- Chapter 6. includes the definition of the identified KPIs.
- Chapter 7. provides information on the general use cases of the pilots
- Annex I: (Chapter 8.) provides specific details of the use cases for each pilot.

2. REFERENCES

2.1. REFERENCE DOCUMENTS

The following documents, although not part of this document, amplify or clarify its contents. Reference documents are those not applicable and referenced within this document. They are referenced in this document in the form [RD.X].

Table 2-1 Reference documents.

Ref.	Title	Code	Version	Date
[RD.1.]	Danube Black Sea Canal and Poarta Alba Midia Navodari Canal PAPER CHART	-	-	2019
[RD.2.]	https://www.dhmf.ro/en/ocean1.shtml	-	-	-
[RD.3.]	Analysis on the minimum requirements to provide GNSS (Galileo, EGNOS) alarms and Copernicus-based alarms	AVIS-D2.3	1.0	29 May 2025
[RD.4.]	User Requirements for Automated Navigation	D2.1	1.1	30 Sept 2024

3. CONTEXT AND METHODOLOGY

In this document produced in AVIS WP6000 "Implementation, demonstration and validation of pilot projects". The high-level methodology for the work performed in this document is depicted in the following figure:

- Step 1: to define the pilots including all relevant data for the organization (Section 4.)
- Step 2: to coordinate the 4 pilots and establish preliminary dates to execute the pilots. (Section 5.)
- Step 3: to define all relevant KPIs for the evaluation of the pilots. (Section 6.)
- Step 4: to establish general considerations of use cases for the 4 pilots (Section 7.)

The content shown in this first version of the document shows the pilot plan at a high level. All details related to the planning required to execute the pilots are specified. The planned navigation operations and the general basis of the use cases to be evaluated are specified. More specific details of the particular use cases for each pilot will be specified in more detail in future updates that will be provided prior to the execution of each pilot.

4. PILOT DEFINITION

4.1. RHINE, MOSELLE

Note: The pilot area in Germany is in the Koblenz area where the river Moselle flows into the Rhine. The pilot area therefore includes the two rivers Moselle and Rhine:

Rhine

With a total length of 1,233 kilometers, the Rhine flows through six European countries. Between Rheinfelden near Basel and the North Sea, it is navigable for 884 kilometers and is one of the busiest waterways in the world.

Due to the different gradients, the navigable Rhine is divided into

- the Upper Rhine: from Rheinfelden to Kaub,
- the Middle Rhine: from Kaub to Cologne and
- the Lower Rhine: from Cologne to Emmerich.

The Upper Rhine flows north through the Upper Rhine Plain. On this stretch, the terrain drops from 252 to 76 meters in altitude. The Rhine is dammed from Lake Constance and can only be used for shipping from Rheinfelden onwards. Between Bingen, Rudesheim and Koblenz lies the "Upper Middle Rhine Valley" World Heritage Site, a unique cultural landscape with an extraordinary wealth of high-ranking monuments. The scenic valley with its legendary Loreley Rock is regarded worldwide as the epitome of the romantic Rhine landscape. However, inland waterway boatmasters are well aware of the danger that lies beyond all fiction. The mountainous stretch between Bingen and St. Goar is still dangerous today and requires good knowledge of the route.

The Moselle flows into the Rhine in Koblenz. This is where the "Deutsches Eck" was built, with the Kaiser Wilhelm Monument as its landmark. With the cities of Cologne, Düsseldorf and Duisburg, the Rhine flows through important industrial and economic areas, with the Rhine-Ruhr region even the largest conurbation in Germany. Two parallel artificial waterways connect the Ruhr region with the Rhine: the Rhine-Herne Canal, which branches off near Duisburg, and the Wesel-Datteln Canal, 30 kilometers to the north. From Emmerich, the Rhine flows through the Netherlands and flows into the southern North Sea in an extensive delta.

The major seaports of Amsterdam, Rotterdam and Antwerp have settled in the Rhine delta. They are the first European ports of call for ships from overseas. The Rhine offers them an excellent hinterland connection to central Europe.

Around 70% of all German waterway transportation is transported on the Lower Rhine between the Rhine estuary ports and the German inland ports. The largest European inland port is located in Duisburg. Nowhere else in the inland area is container traffic as lively as on the Lower Rhine, where annual growth rates are recorded. The trend is rising. The largest inland vessels sail here. Their average carrying capacity is around 2,500 tons.

Moselle

As one of the busiest waterways after the Rhine and of international importance, the 242-kilometre-long Moselle connects the economic regions of Lorraine, Luxembourg, Saar and Trier with the North Sea ports in the Netherlands and Belgium. It is the dividing line between the Eifel and Ardennes with the Hunsrück. Thanks to its sheltered valley location, the Moselle region has a mild climate and is one of the oldest cultural and wine-growing landscapes in Germany.

The Moselle is 242 kilometers long and has 28 locks.

4.1.1.AREA OF INTEREST – RHINE, MOSELLE

For this pilot, the area of interest is considered to be the following:

- Rhine km: 499 - 603
- Moselle km: 0 - 27

The pilot area covers the Rhine from river kilometer 499 to Koblenz at river kilometer 603. The further pilot area covers the river Moselle from Koblenz upstream to river kilometer 27.

A variety of navigation operations, such as "General navigation on free-flowing rivers" and "ECDIS navigation - info/ navigation mode", can be tested on a challenging section of the Rhine. On the Moselle, which has a large number of locks and bridges, the further navigation operations, "congestion controlled rivers and canals" as well as "bridge passing" can be tested.



Rhine, Moselle Pilot area

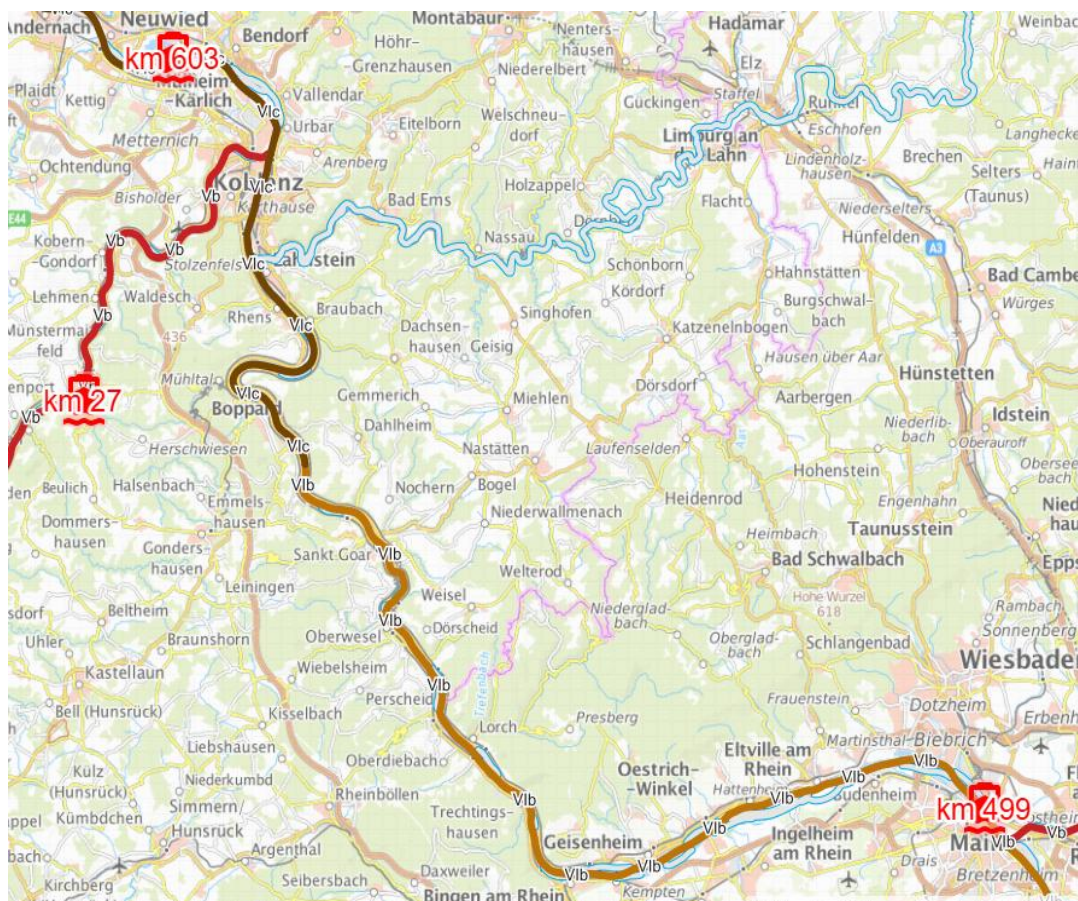





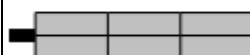
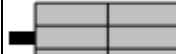


Figure 4-1 Rhine, Moselle pilot area

Figure 4-1 shows the classification of the waterways in the pilot area. Table 4-1 in turn shows which types of vessels and pushed convoys are permitted to navigate this waterway.

Table 4-1 Vessels permitted to navigate in Rhine, Moselle CEMT classes

Graphic symbol on the map	Class of inland waterway	Motor Vessels and barges				Push convoys					Bridge clearance	
		Designation	Length L (m)	Width B (m)	Draft d (m)	Tonnage T (t)	Formation	Length L (m)	Width B (m)	Draft d (m)		Tonnage T (t)
	Vb	Large Rhine ships	95-110	11,4	2,5 - 2,8	1500 - 300		172-185	11,4	2,5-4,	3200-6000	9,1
	VIb		140	15,0	3,9			185-195	22,8		6400-12000	9,1
	VIc						 	270-280 195-200	22,8 33,0-34,		9600-18000	9,1

4.1.2. OPERATIONS CONSIDERED – RHINE, MOSELLE

The operations that can be performed on a pilot depend on the characteristics of the area of interest and the equipment included in the vessel to be used. Therefore, among the operations considered in the AVIS project, a selection of them will be executed in this pilot.

ECDIS operations belonging to Group 1 of operations can be carried out under the Rhine and Moselle pilot's conditions. Due to the existing incompatible autopilot system on the test ship MS Mainz, it is not possible to connect the TGAIN to the existing autopilot on the ship. The remote control operation will be emulated, providing instructions that would be received at each moment.

With this, Table 4-2 Operations selected for Rhine, Moselle Pilot shows the summary of the operations planned to be carried out during the Guadalquivir Pilot.

Table 4-2 Operations selected for Rhine, Moselle Pilot

Navigation operations	Rhine, Moselle Pilot
ECDIS navigation, Information and/or Navigation modus	X
Track Guidance Assistants in Inland Navigation	
General navigation on free-flowing rivers	X
Navigation on small narrow channels	
Congestion controlled rivers and canals	X
Bridge passing	X

4.1.3. EU SPACE DATA SERVICES – RHINE, MOSELLE

The services to be tested during this pilot are related to the needs of each operation.

EGNSS services:

- **Galileo OS:** This is an essential service. It is necessary both for stand-alone use and for the other Galileo services as a basis to work. It will therefore be used in all operations.
- **Galileo OSNMA:** Service required to provide some GNSS-based alerts to detect certain spoofing attacks. This is a service that is interesting to use during the whole navigation, so it will be used in all operations.
- **Galileo HAS SPP:** Service required to improve accuracy performance. It is necessary in order to meet the accuracy requirements of Group 2 operations. It will be obtained by post-processing techniques. In this case, for the evaluation of general navigation on free-flowing rivers and congestion controlled rivers and canals.
- **Galileo HAS PPP:** Service used for the best possible accuracy performance. It is used for Group 3 operations. It will be obtained in post-processing. In this case it will be evaluated for bridge passing.
- **EGNOS:** Service required to improve accuracy performance. It is used to meet the accuracy requirements of Group 2 operations. The integrity provided by EGNOS can also be used to obtain alerts.

Copernicus services:

- **River edge:** This service is necessary for generating Copernicus-based measurements of river extents and related alerts. It will be used to compare with the river extent at the time of pilots.
- **River depth:** This service is required to provide bathymetry and possible alerts due to changes in river depth which will be compared to the bathymetry in pilots.
- **Object detection:** This service will be used to compare statistical vessel density with the ones taken with AIS and radar at the time of pilot.
- **Flood forecasting:** Flood forecasting service will potentially be used as provision for decision on the timeline for pilots. The use of this service though depends on the availability of the data.

4.1.4.IDENTIFIED VESSEL – RHINE, MOSELLE

The MS Mainz is a vessel of the Federal Republic of Germany, which is operated by the Federal Waterways and Shipping Administration and located in Koblenz. The vessel navigates the full distance of the Rhine, Moselle, Saar and Neckar up to Heilbronn and the lower Main River.

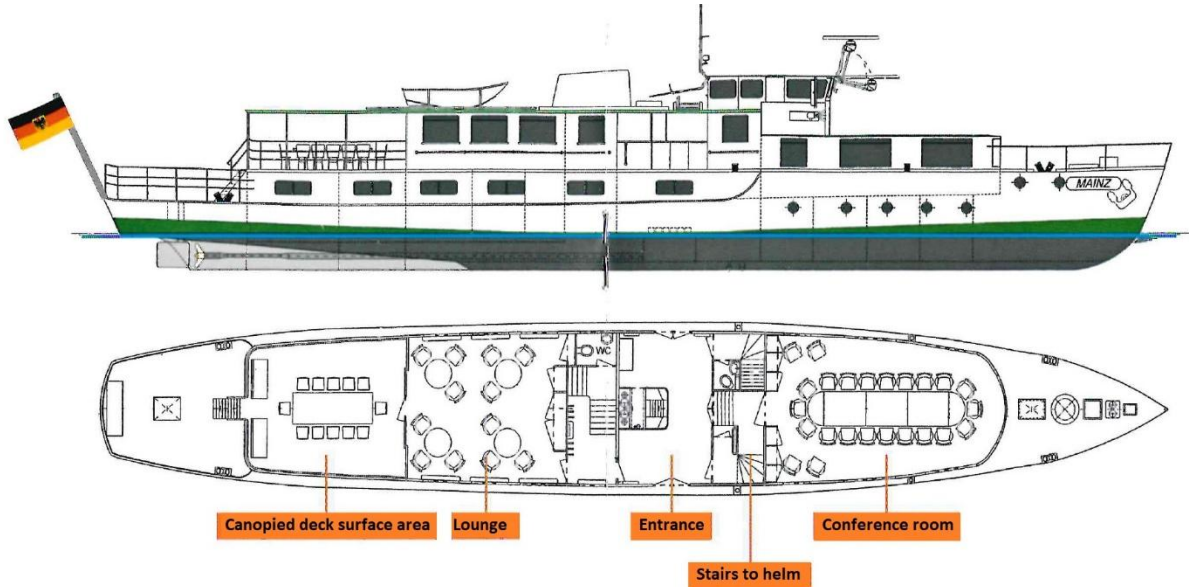


Figure 4-2 MS Mainz Profile and Plan view

Table 4-3 MS Mainz characteristics

Vessel dimensions	
length/ width/ draught	40,33m / 6,19m/1,46m
air draught	6,00m
tonnage displacement	189t
Propulsion and steering system	
Main power unit	2 x 220kW at 1800rpm
Reduction gear unit	1:2,82
Propeller	2x980mm
Auxiliary power unit	1 x 163kW at 1500rpm
Rudder gear	2 x spade rudder, hydraulically
Speed	
In 4,0m water depth	Max .23 km/h
Avarage travel speed	14km/h

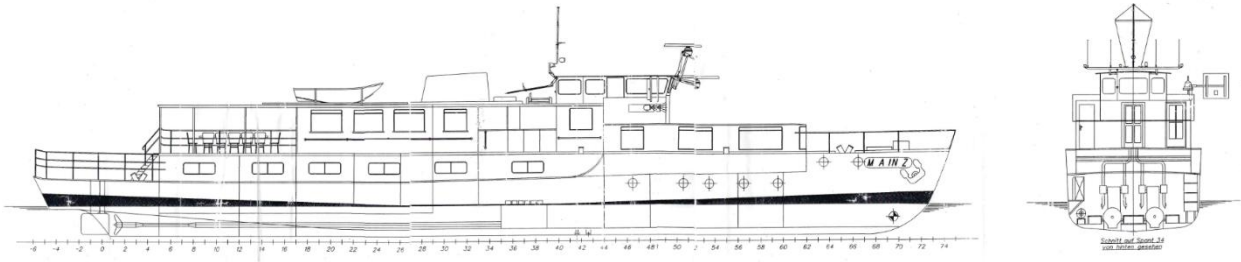


Figure 4-3 MS Mainz Profile and Front view

The operating concept of the vessel "MS Mainz" foresees tasks as a mobile test carrier in a digital test field of the WSV for most of its operating time (from the beginning of spring to the end of fall each year). The operating concept of the MS Mainz covers tasks in connection with the monitoring and validation of developments in automation solutions and digitalization approaches for vessels in interaction with the waterway transport. In addition, administrative issues are to be evaluated with international/national projects and studies as well as the development of their feasibility through prototype implementations and standardization approaches.

In the recent past, the ship was equipped with new navigation and operating equipment to be able to continue serving the operating concept of the vessel, see Figure 4-4. The following components are installed for this purpose:

- AIS transponder Class A
- GPS Compass JRC-JLR 21
- Inland AIS Nauticast A2
- 1 x Trimble BX992 GNSS-Sensor
- 2 x Trimble Zephyr 3 Rugged GNSS-Antennas
- argoRadarPilot
- Alphantron JMR 611
- Alphantron Radarmonitor 19" for ECDIS in navigation mode
- Monitor to display ECDIS in Information Mode 19"
- technic compartment 19" for test setups



Figure 4-4 MS Mainz inside cabin pictures

4.2. MIDDLE DANUBE

Hungary as a landlocked country is situated within the heart of the Danube Basin. The entire territory (93,030 km²) is found in the river basin. Danube River enters the country from the west and flow towards the south. Almost one fifth of the 9,8 million inhabitants live in the capital, Budapest which lies on the banks of the river.

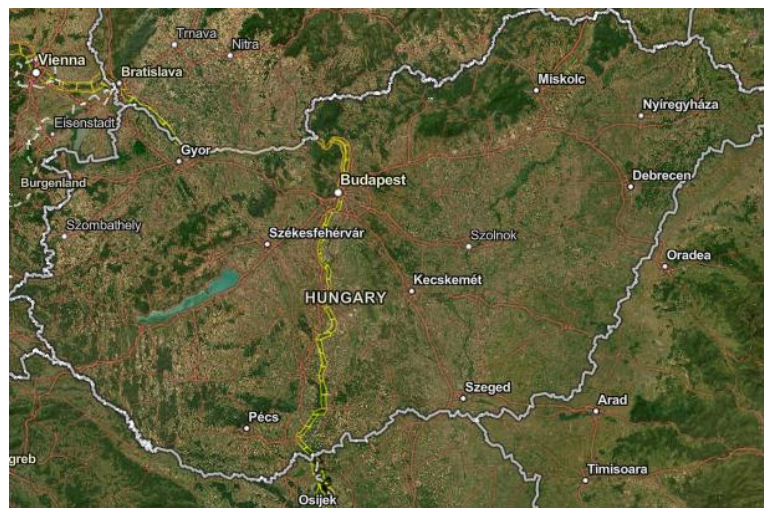


Figure 4-5 Satellite map of the Hungarian Danube

4.2.1. AREA OF INTEREST - MIDDLE DANUBE - BUDAPEST AREA

Budapest is the capital city of Hungary with approximately two million of population. The Danube river crosses the cultural and commercial city centre, and it is an important landmark of Budapest. The river

is an integrated part of the city life and besides it is an important international inland navigation route for cargo and passenger vessels, it is used by tourists, leisure sports, crossed by bridges, location of cultural and social events. In Budapest area 13 road and 2 railway bridges provide the interconnection between the Buda and Pest side of the city.

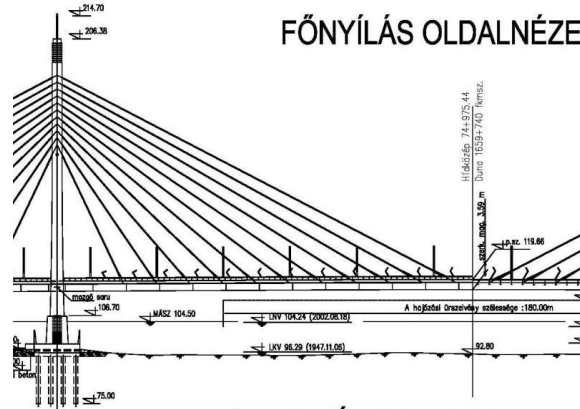


Figure 4-6 Budapest Megyeri Bridge



Figure 4-7 Bridges crossing the Danube in Budapest (15)

The inland waterway traffic in Budapest is the highest on the Hungarian Danube. Besides freight vessel there are many passenger cruisers, touristic purpose restaurant and excursion ships, leisure and sport crafts sailing on the Danube Budapest area. The Danube is also important as it provides the drinking water basis for the city and agglomeration for approximately 4 million people.

The Hungarian stretch of the Danube is 400 km long in the middle of the Trans-European Corridor VII. It is a free-flowing section of the Danube without any locks, different from the regulated Upper or Lower Danube sections. The river provides transport interconnection between 9 riparian Danube countries. Therefore, in the Budapest area the use of VHF, AIS and PNT are very important because of safety of inland waterway transport.



Figure 4-8 Pusher Convoy passing Budapest city center

In the Hungarian stretch in general, there are 13 shallow sections (fords) and 20 limited width areas, which need special attention of the Danube skippers and advanced navigation aids such as up-to-date, accurate electronic navigational charts and reliable PNT.

4.2.2. OPERATIONS CONSIDERED - MIDDLE DANUBE

Table 4-4 Operations selected for Middle Danube Pilot

	Middle Danube Pilot
ECDIS navigation, Information and/or Navigation modus	X
Track Guidance Assistants in Inland Navigation	X
General navigation on free-flowing rivers	X
Navigation on small narrow channels	
Congestion controlled rivers and canals	
Bridge passing	X

4.2.3. EU SPACE DATA SERVICES - MIDDLE DANUBE

The services to be tested during this pilot are related to the needs of each operation.

EGNSS services:

- **Galileo OS:** This is an essential service. It is necessary both for stand-alone use and for the other Galileo services as a basis to work. It will therefore be used in all operations.
- **Galileo OSNMA:** Service required to provide some GNSS-based alerts to detect certain spoofing attacks. This is a service that is interesting to use during the whole navigation, so it will be used in all operations.
- **Galileo HAS SPP:** Service required to improve accuracy performance. It is necessary to meet the accuracy requirements of Group 2 operations. It will be obtained by post-processing techniques. In this case, for the evaluation of general navigation on free-flowing rivers.

- **Galileo HAS PPP:** Service used for the best possible accuracy performance. It is used for Group 3 operations. It will be obtained in post-processing. In this case it will be evaluated for bridge passing.
- **EGNOS:** Service required to improve accuracy performance. It is used to meet the accuracy requirements of Group 2 operations. The integrity provided by EGNOS can also be used to obtain alerts.

Copernicus services:

- **River edge:** This service is necessary for generating Copernicus-based measurements of river extents and related alerts. It will be used to compare with the river extent at the time of pilots
- **River depth:** This service is required to provide bathymetry and possible alerts due to changes in river depth which will be compared to the bathymetry in pilots.
- **Object detection:** This service will be used to compare statistical vessel density with the ones taken with AIS and radar at the time of pilot.
- **Flood forecasting:** Flood forecasting service will potentially be used as provision for decision on the timeline for pilots. The use of this service though depends on the availability of the data.

4.2.4. IDENTIFIED VESSEL - MIDDLE DANUBE

The 'MS Luppa' Marking Vessel was selected for the pilot activities. It is the waterway authority's ship to maintain the Budapest stretch and nearby areas on the Danube hence it navigates regularly in this stretch.



Figure 4-9 MS Luppa picture

MS Luppa facts:

Length: 24,86 metres

Width: 7,0 metres

Year built: 2020

Main Engines: 2 x DOOSAN L086TIM (232 kW), 8071 ccm diesel, 6 valves with turbo

Side Engine: Solé 50GT, 44 kVA, 4996 ccm diesel, 6 valves

Gearbox: Dong-I DMTP 5100 (modification: 3,46) hydraulic gearbox

Equipment on-board:

- Inland AIS transponder: Em-trak A200 Class A
- Radar: JRC JMA610
- Rate of turn indicator: Alphatrio Pilot EBF01 A
- Innovative-Navigation Radar-pilot 720

4.3. LOWER DANUBE

The Danube, the second largest river in Europe after the Volga, spans across the territories of 10 countries, flowing southeast for 2,850 km from the Black Forest Mountains in Germany to its mouth at the Black Sea. In Romania, the Danube covers a distance of 1,075 km, representing the longest segment that lies within a single state – the Lower Danube. Furthermore, it serves as a natural border between Romania and four other countries: Serbia, Bulgaria, the Republic of Moldova, and Ukraine, thereby acting as a natural border for both the EU and NATO.

The Danube functions as a vital transport corridor, connecting significant production, sales, and acquisition markets in Europe.

The Lower Danube is basically split into two segments: the maritime part and the fluvial part. The traffic is more intense in the maritime part, so this is the area in which the pilot will focus.

4.3.1. AREA OF INTEREST - LOWER DANUBE

The primary route selected for the pilot covers the Danube–Black Sea Canal from Constanta (Agigea) to Cernavoda (~65 km), including two navigational locks and nine bridges.

An optional extension is considered on the Poarta Alba–Midia–Navodari Canal (~27 km), starting from the canal junction and ending near Midia Port. This secondary section is subject to traffic and lock scheduling constraints and may only be used if operationally feasible during the pilot timeframe.

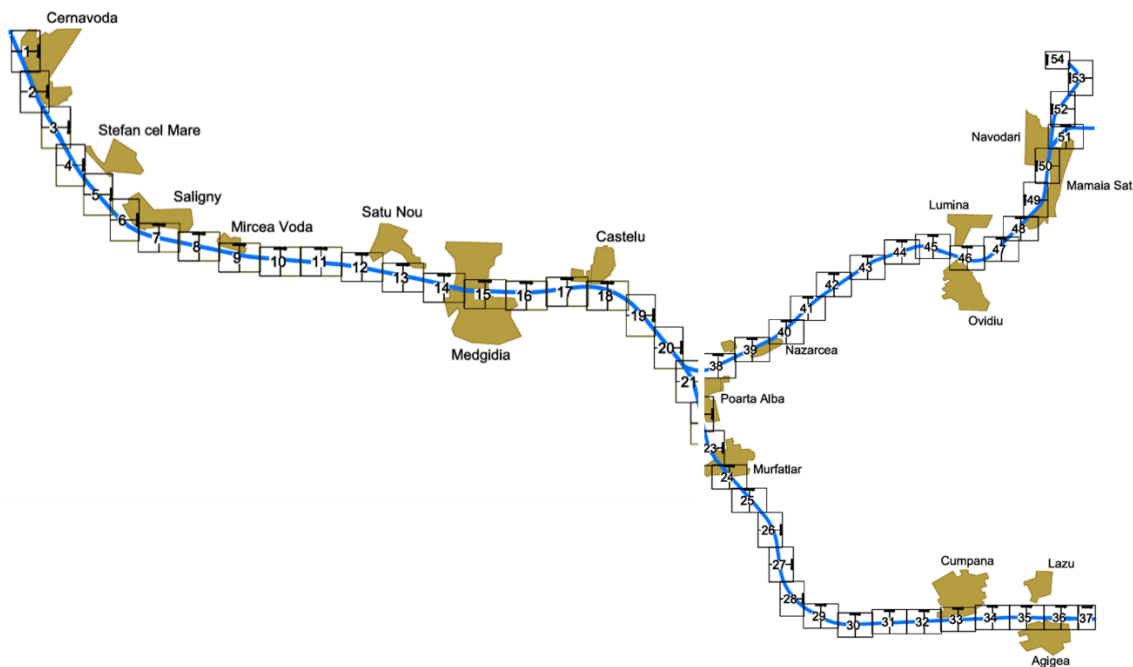


Figure 4-10 Lower Danube Indicative route ENC information [RD.1]

Table 4-5 Bridges on the Danube Black Sea Canal River [RD.1]

Bridge	Chainage (rkm)	Clearance width (m)	Clearance height (m)
Danube Black Sea Canal			
Pod rutier – Apolodor - Agigea	0.5	160	17
Pod feroviar Agigea	1.4	160	17
Pod rutier Agigea	2.7	160	17
Pod rutier Murfaltar	18.5	155	17
Pod rutier Murfaltar	23.3	104	17
Pod cale ferata Medgidia	36.1	119.5	17
Pot rutier Medgidia	40.2	120	17
Pod rutier si feroviar Cernavoda	60.3	80.8	17
Pod rutier Sfanta Maria	63.2	172	17
Poarta Alba Midia Navodari Canal			
Pod feroviar bifurcatie PAMN	26.8	110	12.5
Pod rutier bifurcatie PAMN	26.8	110	12.5
Pod rutier Ovidiu	11.3	105	12.5
Pod feroviar Ovidiu	10.9	135	12.5
Pod rutier Navodari	1.1	135	12.5

Table 4-6 Locks on Navigable Canals [RD.1]

Navigational lock	Chainage (rkm)	Number of chambers
Agigea	1.00	2
Cernavoda	60	2
Navodari	1	2
Ovidiu	12	2

4.3.2. OPERATIONS CONSIDERED - LOWER DANUBE

The operations that can be performed on a pilot depend on the characteristics of the area of interest and the equipment included in the vessel to be used. Therefore, among the operations considered in the AVIS project, a selection of them will be executed in this pilot.

Table 4-8 shows the summary of the operations planned to be carried out during the Lower Danube Pilot.

Table 4-7 Operations selected for Lower Danube Pilot

	Lower Pilot	Danube
ECDIS navigation, Information and/or Navigation modus	X	
Track Guidance Assistants in Inland Navigation		
General navigation on free-flowing rivers		
Navigation on small narrow channels	X	
Congestion controlled rivers and canals	X	
Bridge passing	X	

4.3.3.EU SPACE DATA SERVICES - LOWER DANUBE

The services to be tested during this pilot are related to the needs of each operation.

EGNSS services:

- **Galileo OS:** This is an essential service. It is necessary both for stand-alone use and for the other Galileo services as a basis to work. It will therefore be used in all operations.
- **Galileo OSNMA:** Service required to provide some GNSS-based alerts to detect certain spoofing attacks. This is a service that is interesting to use during the whole navigation, so it will be used in all operations.
- **Galileo HAS SPP:** Service required to improve accuracy performance. It is necessary in order to meet the accuracy requirements of Group 2 operations. It will be obtained by post-processing techniques. In this case, for the evaluation of general navigation on free-flowing rivers and congestion controlled rivers and canals.
- **EGNOS:** Service required to improve accuracy performance. It is used to meet the accuracy requirements of Group 2 operations. The integrity provided by EGNOS can also be used to obtain alerts.

Copernicus services:

- **River edge:** This service is necessary for generating Copernicus-based measurements of river extents and related alerts. It will be used to compare with the river extent at the time of pilot
- **River depth:** This service is required to provide bathymetry and possible alerts due to changes in river depth which will be compared to the bathymetry in pilots.
- **Object detection:** This service will be used to compare statistical vessel density with the ones taken with AIS and radar at the time of pilot.
- **River discharge:** This service depends on the in-situ Copernicus services and will be used to
- **Flood forecasting:** Flood forecasting service will potentially be used as provision for decision on the timeline for pilots. The use of this service though depends on the availability of the data.

4.3.4.IDENTIFIED VESSEL - LOWER DANUBE

The pilot will be conducted using one of the hydrographic launches OCEAN 1 or OCEAN 2, operated by the Romanian Maritime Hydrographic Directorate. These modern catamaran-type boats are compact, fast, and specifically designed for hydrographic and oceanographic work in coastal and inland waters.

With a length of around 12.5 meters, a width of 4.45 meters, and a shallow draught of about 0.8 meters, the vessel is well within the physical limits imposed by the canal infrastructure. It is equipped with

advanced positioning and survey systems, enabling precise navigation and data collection for the pilot operations.

According to [RD.2], the vessel has the following equipment:

- GNSS positioning system for high precision recording and compensation of ship movement - APLANIX POS MV WAVE MASTER II
- Positioning system with satellite corrections - RTK-CNav 5000
- Singlebeam hydrographic system- TELEDYNE ODOM ECHOTRAC E20
- Multibeam probe system - TELEDYNE SEA BAT T20R
- Underwater acoustic positioning system - USBL EDGETECH
- DOPPLER-SANTINEL V100 acoustic profiling system



Figure 4-11 Lower Danube Pilot proposed Vessel [RD.2.]

Since the vessel is a government asset used for specialized missions, its internal systems cannot be altered. All AVIS prototype components will be temporarily installed without affecting its permanent structure or equipment.

4.4. GUADALQUIVIR

The Port of Seville is the only Inland Maritime port in Spain. It is located in one of the country's most important cities, with more than one and a half million inhabitants living nearby, and in the main cargo hub in the south of the peninsula.

It is a completely multi-modal port with sea and land connections and there is plenty of space in its 850 hectares to develop logistics and industrial activities.

It is a strategic location for the European Union and has six port terminals under concessions and three which are public, more than 4,000 metres of mooring space, one million square metres of storage and a cruise terminal in the centre of the city.

The Port of Seville is strategic for Europe. It is one of the principal nodes in the Core Network and forms part of the Mediterranean Corridor of the Trans-European Transport Network (TEN-T), and also of the Atlantic Corridor with the navigable portion of the Guadalquivir.

Sailing on the Guadalquivir is based on a tidal system, so that vessels can use the waterway when the tide is high. The vessels that use the waterway take advantage of the tides and the extra amount of water they provide to increase the operating draught and optimizing the Euroway.

4.4.1.AREA OF INTEREST – GUADALQUIVIR

For this pilot, the area of interest is considered to be the entire navigable part of the river from the lock to the mouth of the river. The route along the Guadalquivir River runs under a navigation waterway called the Guadalquivir Euroway E.60.02, which forms part of the Atlantic corridor of the Trans-European Transport Network. The route from the port of Seville to the mouth of the river in Sanlúcar de Barrameda is approximately 90km long. Figure 4-12 shows the satellite view of the whole navigable part of the Guadalquivir River.



Figure 4-12 Satellite view of Guadalquivir River

As for the characteristics of the area of interest, the width of the navigable channel is about 60 to 100 meters. A draft of about 7.2 meters can be found. The bottom of the waterway is soft, consisting mainly of sand and mud. The maximum allowable air draught is 42 meters.

There is a single lock at Puerta de Mar, near the city of Seville. This lock has a width of 39 meters, a draught of 11 meters and a length of 290 meters.

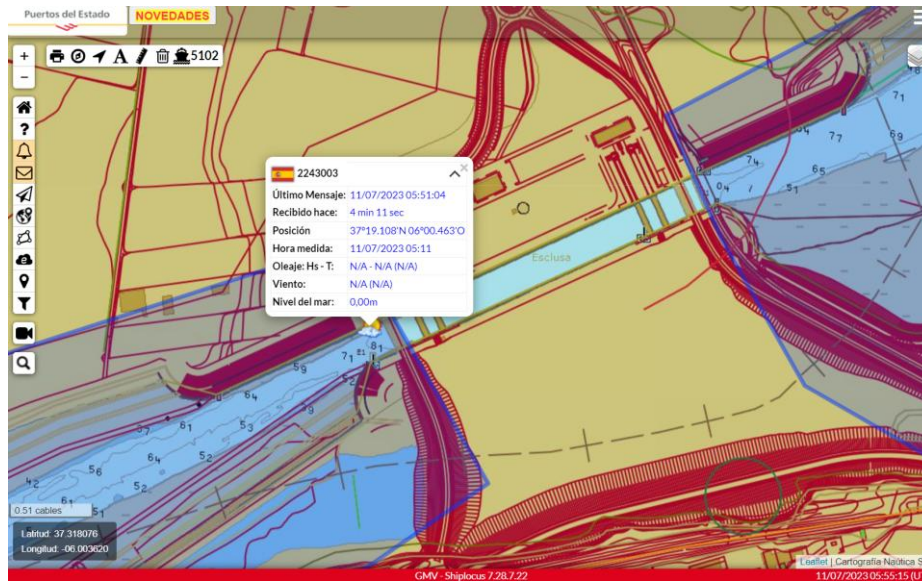


Figure 4-13 Lock on the Guadalquivir river

There are no bridges in the entire area of interest (from the lock to the mouth). There are only bridges within the city of Seville.

At the regulatory level, there are certain aspects that establish the conditions for access. The general access conditions are:

- Maximum length: 160 metres
- Maximum beam: 25 metres
- Maximum DWT: 30,000 tm
- Maximum air draught: 42 metres

Then, there are special access conditions for larger vessels. Under the terms of these regulations, vessels are considered to be large when they do not have sufficient manoeuvring aids to make and complete manoeuvres different from those made in the open sea and which are more than 160 metres long and more than 25 metres wide. This type of vessel must enter the Puerta de Mar lock and carry out the berthing/unberthing manoeuvres with the assistance of a tugboat capable of omnidirectional pull, bollard pull of at least 45 Tm and its own towing rope, and a second conventional tugboat with a bollard pull of at least 35 Tm.

Vessels must not exceed any of the dimensions listed below:

- Maximum length: 190 metres
- Maximum beam: 30 metres
- Maximum DWT: 40,000 tm
- Maximum air draught: 42 metres

4.4.2. OPERATIONS CONSIDERED – GUADALQUIVIR

The operations that can be performed on a pilot depend on the characteristics of the area of interest and the equipment included in the vessel to be used. Therefore, among the operations considered in the AVIS project, a selection of them will be executed in this pilot.

ECDIS operations belonging to Group 1 of operations can be carried out under the Guadalquivir pilot's conditions. Due to the rental conditions of the vessel to be used, it is not possible to use the TGAIN during the pilot's execution. The remote control operation will be emulated, providing instructions that would be received at each moment.

The characteristics of the area of interest mean that we do not find areas that could be considered free-flowing rivers, congested rivers or bridges, so it is not possible to carry out any of these operations. Small narrow channels are not available either, although it is proposed to emulate the existence of one and execute the operation as if we were in a narrow channel.

With this, Table 4-8 shows the summary of the operations planned to be carried out during the Guadalquivir Pilot.

Table 4-8 Operations selected for Guadalquivir Pilot

	Guadalquivir Pilot
ECDIS navigation, Information and/or Navigation modus	X
Track Guidance Assistants in Inland Navigation	
General navigation on free-flowing rivers	
Navigation on small narrow channels	X
Congestion controlled rivers and canals	
Bridge passing	

4.4.3.EU SPACE DATA SERVICES – GUADALQUIVIR

The services to be tested during this pilot are related to the needs of each operation.

EGNSS services:

- **Galileo OS:** This is an essential service. It is necessary both for stand-alone use and for the other Galileo services as a basis to work. It will therefore be used in all operations.
- **Galileo OSNMA:** Service required to provide some GNSS-based alerts to detect certain spoofing attacks. This is a service that is interesting to use during the whole navigation, so it will be used in all operations.
- **Galileo HAS SPP:** Service required to improve accuracy performance. It is necessary to meet the accuracy requirements of Group 2 operations. It will be obtained by post-processing techniques. In this case, for the evaluation of navigation on small narrow channels operation to be emulated in this pilot.
- **EGNOS:** Service required to improve accuracy performance. It is necessary to meet the accuracy requirements of Group 2 operations. The integrity provided by EGNOS can also be used to obtain alerts.

Copernicus services:

- **River edge:** This service is necessary for generating Copernicus-based measurements of river extents and related alerts. It will be used to compare with the river extent at the time of pilot
- **River depth:** This service is required to provide bathymetry and possible alerts due to changes in river depth which will be compared to the bathymetry in pilots.
- **Object detection:** This service will be used to compare statistical vessel density with the ones taken with AIS and radar at the time of pilot.
- **Flood forecasting:** Flood forecasting service will potentially be used as provision for decision on the timeline for pilots. The use of this service though depends on the availability of the data.

4.4.4. IDENTIFIED VESSEL – GUADALQUIVIR

For the Guadalquivir pilot, the vessel Morfeo, belonging to TIMON DE TRIANA, S.L.U, has been identified. A rental contract will be drawn up for the vessel, including the boat's master. This provides greater flexibility in terms of routing and operations.

The vessel has a length of 12.84 metres and a beam of 4 metres. It has a maximum capacity of 10 people excluding the crew. It has a shallow draft, with an approximate draft of 0.2 meters. Figure 4-14 shows an image of the preliminarily identified vessel.



Figure 4-14 Identified vessel for Guadalquivir pilot

Due to the conditions of the rental, it is not possible to interfere with the usual equipment of the vessel. Therefore, only the equipment brought by the AVIS consortium will be used, with the possibility of making the temporary installations necessary for the operation of the prototype.

4.5. PROTOTYPE EQUIPMENT USED

The equipment prototype defined in document D5.1 will be used in all AVIS pilots. The design seeks, for all the equipment to be used, to be easily transportable to facilitate the installation in each pilot. The aim is also to reduce as much as possible the dependencies of the ships on which the pilots will be executed, so it is planned to transport equipment that is assumed to be on the ship even if it is not part of the AVIS prototype (e.g. the 4G modem to provide internet).

For more details on the prototype, please refer to document D5.1.

5. PILOT CALENDAR – PRELIMINARY DATES

The preliminary plan contemplates carrying out the 4 pilots throughout the year 2026. The idea is to space out the 4 pilots over time so that between pilots there is time to evaluate the results and, if necessary, make updates or improvements for the next pilots.

As mentioned above, the characteristics of each area, together with the vessels available, allow different operations to be carried out. Therefore, each pilot has certain characteristics that make him different from the rest. Therefore, the initial approach is to organize the pilots in ascending order of complexity.

It is considered that starting with pilots that present less complexity increases the probability of success for all pilots. This is because it is assumed that with the execution of each pilot the consortium acquires more experience and is able to prevent a greater number of unforeseen events or complications.

The following table shows the summary of the operations intended to be performed in each pilot

Table 5-1 Summary of operations selected for all pilots

Navigation operation	Rhine Pilot	Middle Danube Pilot	Lower Danube Pilot	Guadalquivir Pilot
ECDIS navigation, Information and/or Navigation modus	X	X	X	X
Track Guidance Assistants in Inland Navigation		X		
General navigation on free-flowing rivers	X	X		
Navigation on small narrow channels			X	X
Congestion controlled rivers and canals	X		X	
Bridge passing	X	X	X	

As can be seen, the Guadalquivir pilot is the one that contemplates the fewest operations, which is why it is considered as the first pilot to be carried out.

Of the other three remaining pilots, all pilots have the same number and groups of operations. However, the Middle Danube pilot includes the operation of Track Guidance Assistants in inland navigation. This operation is considered to represent a greater technical complexity and a greater differential element. Therefore, it was decided to conduct the Lower Danube and Rhine pilots as the second and third pilot of the project and to leave the Middle Danube pilot as the final pilot of the project.

Taking into account these considerations, the following distribution of dates for the execution of the pilots is proposed:

- First pilot to be executed – Guadalquivir Pilot: The tentative date would be the mid of March 2026.
- Second pilot to be executed – Lower Danube Pilot: The tentative date would be the end of May 2026.
- Third pilot to be executed – Rhine: The tentative date would be the end of September 2026.
- Fourth pilot to be executed – Middle Danube: The tentative date would the end of October 2026.

Another reason for this distribution is to take into account the expected date of the last prototype update associated with deliverable D5.3. The latest prototype update is planned for the end of July 2026. Therefore, with this distribution, two pilots would be conducted before this milestone and two pilots after. In this way the schedule allows time to apply the lessons learned in the first pilots to the last pilots.

Note: It is important to note that these dates have been established well in advance, however, due to the nature of this activity and possible unforeseen circumstances, all dates are subject to change. Therefore, they should be considered as tentative preliminary dates that may vary. In the event of changes to the plan, they will be communicated as soon as the need to change them becomes known.

Figure 5-1 shows a summary of the tentative calendar, with all the preliminary dates identified.

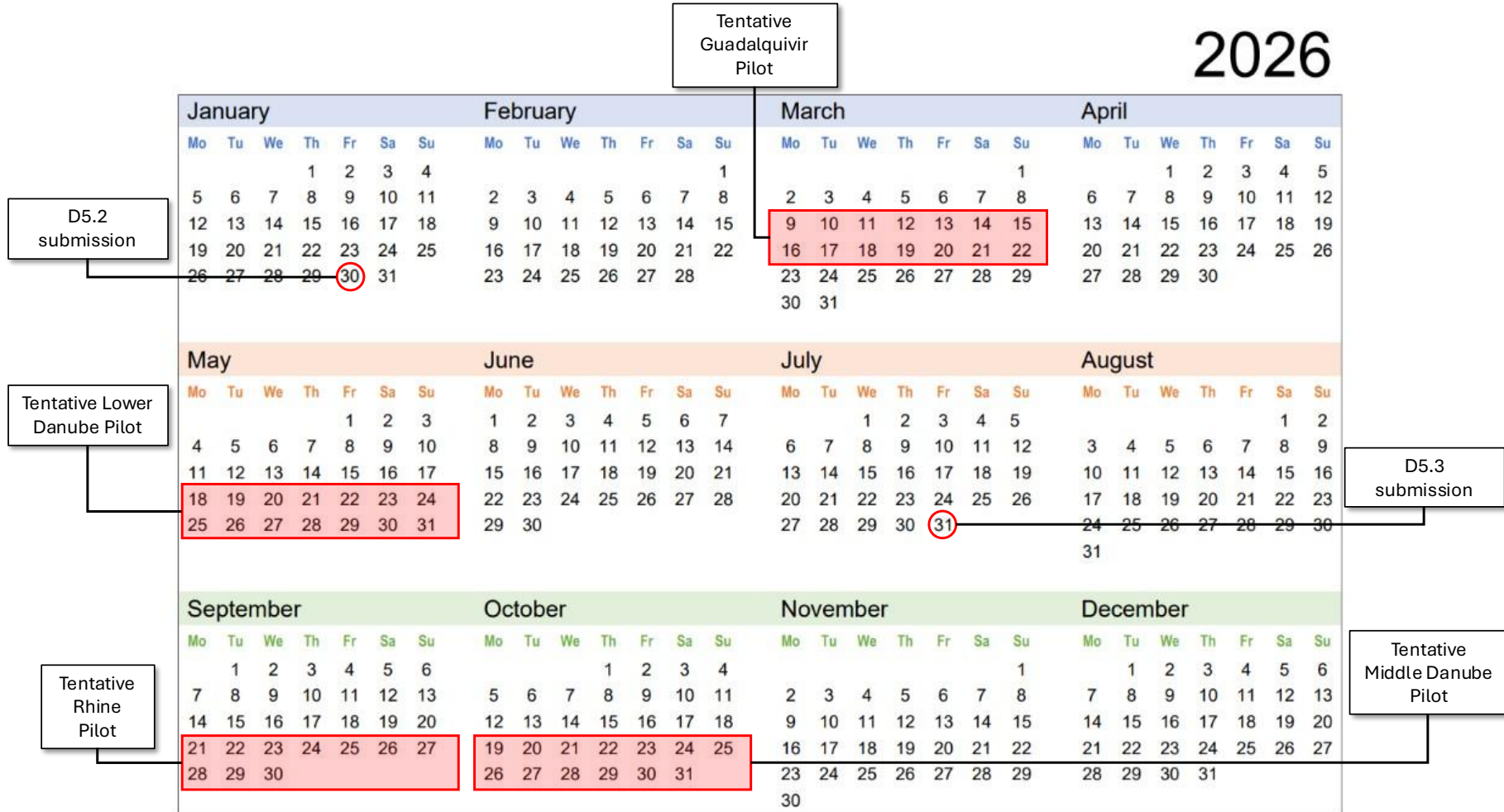


Figure 5-1 Tentative Pilot calendar

6. KPI DEFINITION

6.1. EGNSS KPIS

All the KPIs that can be extracted from the EGNSS part of the prototype are detailed below.

6.1.1. POSITION ACCURACY

Position accuracy is the degree of conformity between a GNSS-determined position and the actual (considered true) position of the receiver, obtained by a more accurate reference. For inland navigation it can be expressed as:

- **Horizontal Error (HE)**: Error in the horizontal plane (latitude and longitude).
- **Vertical Error (VE)**: Error in the vertical direction (altitude or elevation).

These KPIs are generally quantified using statistical measures. In this case, the most common measure is the 95th percentile. With this KPI it is possible to assess whether the accuracy requirements have been met in the different operations.

In order to calculate in the horizontal and vertical plane, it is important to consider the coordinates in an ENU (East, North, Up) reference.

$$HE = \sqrt{(N - N_{ref})^2 + (E - E_{ref})^2}$$

$$VE = |U - U_{ref}|$$

E, N, U refer to the components of the ENU reference position. The subscript *ref* refers to the reference position.

6.1.2. GNSS INTEGRITY STATUS

The integrity status measures whether the protection level exceeds the established alert limit according to the automation level (see [RD.4.]). At the GNSS receiver level, two protection levels will be provided: the horizontal protection level and the vertical protection level. Each of these protection levels is compared with its respective alert limit (horizontal alert limit and vertical alert limit). If the limit is exceeded, the integrity state is considered unsafe. If the GNSS receiver is unable to calculate the protection level, it is considered a caution state.

This KPI can be expressed as a percentage of time spent in each state over a specific period of time.

With all this, the following parameters can be calculated:

- **Horizontal Safe Rate (HSR)**: Indicates the percentage of time that the horizontal protection level (HPL) is lower than the horizontal alert limit (HAL) for a period of time N.

$$HSR = \frac{1}{N} \sum_{k=1}^N [HPL_k < HAL_k] \times 100\%$$

- **Vertical Safe Rate (VSR)**: Indicates the percentage of time that the vertical protection level (VPL) is lower than the vertical alert limit (VAL) for a period of time N.

$$VSR = \frac{1}{N} \sum_{k=1}^N [VPL_k < VAL_k] \times 100\%$$

- **Horizontal Unsafe Rate (HUR)**: Indicates the percentage of time that the horizontal protection level (HPL) is higher than the horizontal alert limit (HAL) for a period of time N.

$$HUR = \frac{1}{N} \sum_{k=1}^N [HPL_k > HAL_k] \times 100\%$$

- **Vertical Unsafe Rate (VUR):** Indicates the percentage of time that the vertical protection level (VPL) is higher than the vertical alert limit (VAL) for a period of time N.

$$VUR = \frac{1}{N} \sum_{k=1}^N [VPL_k > VAL_k] \times 100\%$$

- **Caution Rate (CR):** Indicates the percentage of time that the integrity cannot be computed for a period of time N.

$$CR = \frac{1}{N} \sum_{k=1}^N [isnan(HPL_k)] \times 100\%$$

6.1.3. GNSS INTEGRITY RISK

The integrity risk is the probability that the position error is greater than the protection level. Analyzing the integrity risk involves checking that the protection level always encompasses the actual position. In practice, it is analyzed by comparing the protection level with the position error at each epoch.

This KPI can be expressed as the percentage of time in which the position error exceeded the protection level.

As with the position error, a distinction can be made between the horizontal and vertical components:

- **Horizontal Integrity Risk (HIR):** Indicates the number of times that the horizontal error (HE) is greater than the horizontal protection level (HPL) for a time N.

$$HIR = \frac{1}{N} \sum_{k=1}^N [HE_k > HPL_k] \times 100\%$$

- **Vertical Integrity Risk (VIR):** Indicates the number of times that the vertical error (VE) is greater than the vertical protection level (VPL) for a time N.

$$VIR = \frac{1}{N} \sum_{k=1}^N [VE_k > VPL_k] \times 100\%$$

6.1.4. GNSS HAZARDOUS MISLEADING INFORMATION

A situation is considered to be hazardous misleading information when, with the protection level lower than the alert limit, the position error exceeds both the protection level and the alert limit. This is especially relevant for safety aspects, since an error greater than the tolerable level (set by the alert limit) is not being detected.

A distinction can be made between the horizontal and vertical components:

- **Horizontal Hazardous Misleading Information (HHMI):** Indicates the number of times that the horizontal error (HE) is greater than the horizontal alert limit (HAL) for a time N.

$$HIR = \frac{1}{N} \sum_{k=1}^N [HE_k > HAL_k] \times 100\%$$

- **Vertical Hazardous Misleading Information (VHMI):** Indicates the number of times that the vertical error (VE) is greater than the vertical alert limit (VAL) for a time N.

$$VIR = \frac{1}{N} \sum_{k=1}^N [VE_k > VAL_k] \times 100\%$$

6.1.5. GNSS AVAILABILITY

Availability refers to the percentage of time a system is usable by the user. In the case of GNSS availability it refers to the percentage of time that GNSS position can be provided.

This KPI can be expressed as the percentage of time in relation to the total time that a PVT solution has been obtained.

$$\text{Availability} = \frac{\text{Number of epochs GNSS is usable}}{\text{Total Epochs}} \times 100\%$$

6.1.6. OSNMA AUTHENTICATION AVAILABILITY

OSNMA Authentication Availability (OAA) is the percentage of time a position is provided using an authenticated navigation message.

This KPI can be expressed as the percentage of time a position has been computed using authenticated navigation data with respect to the total time in which position has been provided.

$$\text{OAA} = \frac{\text{Number of epochs using authenticated data}}{\text{Total Epochs}} \times 100\%$$

6.1.7. OSNMA ERROR RATE

OSNMA Error Rate (OER) is the ratio of the number of times the authentication of the navigation message fails to the total number of authentication attempts made.

$$\text{OER} = \frac{\text{Number of failed authentications}}{\text{Number of authentication attempts}} \times 100\%$$

6.2. COPERNICUS KPIS

The KPIs for Copernicus prototype is divided into two categories, statistical and non-statistical KPIs. Statistical KPIs are derived using comparing ground truth and prediction data for different services whereas non-statistical KPIs are operational or system-level metrics that measure the efficiency, responsiveness, or reliability of Copernicus prototype. These KPIs are not derived from comparing predictions to ground truth but rather from system behavior. Below we describe in detail different types of KPIs to be used,

6.2.1. STATISTICAL KPIS

In this section we formulate the different metrics to be used as KPIs for different ad-hoc services when applicable,

6.2.1.1. RIVER EDGE

For River Edge Detection, the metric to be used is Mean Absolute Error (MAE) distance. This metric measures the average magnitude of the error between the predicted river edge and the actual (ground truth) river edge. The corresponding formula is,

$$\text{Mean Absolute Error for river edge} = \frac{1}{n} \sum_{i=0}^n d_i$$

where:

- d_i is the distance from a predicted edge pixel to the nearest ground truth edge pixel and n is the total number of pixels,

Mean Absolute Error provides a straightforward average error magnitude. It is less sensitive to outliers than other metrics like Root Mean Square Error.

6.2.1.2. RIVER EDGE ALERT

The KPI metrics for the river edge alert services are precision and recall, defined as

- **Precision:** The proportion of generated alerts that are **true positives** (i.e., actual narrow river sections),

$$\bullet \text{ Precision} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Positives})}$$

- **Recall:** The proportion of actual narrow river sections that were **correctly detected** by the alert system,

$$\bullet \text{ Recall} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Negatives})}$$

The definition of True Positives, False Positives and False Negatives are,

- **True Positive:** An alert is generated, and the river width is indeed below the threshold in the ground truth data.
- **False Positive:** An alert is generated, but the river width is **not** below the threshold in the ground truth data (a false alarm).
- **False Negative:** No alert is generated, but the river width **is** below the threshold in the ground truth data (a missed detection).

6.2.1.3. RIVER DEPTH

Mean Absolute Error will be used as KPI to denote error in river depth, which quantifies the average absolute difference between predicted and actual river widths across various cross-sections or locations. It is defined as,

Mean Absolute Error for river edge = $\frac{1}{n} \sum_{i=0}^n |D_i^{pred} - D_i^{true}|$, where D_i^{pred} , D_i^{true} are the predicted and true river depth at location i and n is the total number of points.

6.2.1.4. RIVER DEPTH ALERT

The KPI metrics for the river depth alert services are precision and recall, defined as,

- **Precision:** The proportion of alerts that correctly identify actual critical depth conditions

$$\bullet \text{ Precision} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Positives})}$$

- **Recall:** The proportion of actual critical depth conditions that are successfully detected by the alert system,

$$\bullet \text{ Recall} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Negatives})}$$

The definition of True Positives, False Positives and False Negatives are,

- **True Positive:** An alert is generated, and the river depth is indeed below the lower threshold or above the upper threshold in the ground truth data
- **False Positive:** An alert is generated, but the river depth is within the acceptable range in the ground truth data (a false alarm).
- **False Negative:** No alert is generated, but the river depth is actually outside the acceptable range in the ground truth data (a missed detection).

6.2.1.5. OBJECT DETECTION

The KPI metrics for the object (vessel) detection services are precision and recall, defined as,

- **Precision:** Measures how many of the detected objects (vessels) are actually correct,
 - $$\text{Precision} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Positives})}$$
- **Recall:** Measures how many of the actual objects (vessels) were successfully detected,
 - $$\text{Recall} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Negatives})}$$

The definition of True Positives, False Positives and False Negatives are,

- **True Positive:** An object (vessel) is correctly detected and matches a ground truth object.
- **False Positive:** An object (vessel) is detected, but it does not correspond to any ground truth object
- **False Negative:** The system failed to detect an object (vessel)

6.2.1.6. OBJECT DETECTION ALERT

The KPI metric to be used for evaluating the object detection alert system is precision. This is the most relevant performance metric for this alert system because it specifically evaluates the system's ability to correctly identify vessels without AIS among all detected objects it flags, ensuring that alerts are meaningful and not triggered by non-vessel entities such as structures near river shore, buoys etc. The definition of precision in this case is,

- **Precision:** Measures the proportion of detected objects that are correctly identified as vessels without AIS signals, relative to all objects that the system flags as vessels without AIS. In other words, it evaluates how accurate the system is when it raises an alert for a vessel lacking AIS data.
 - $$\text{Precision} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Positives})}$$
 where,
 - **True Positives (TP):** Detected vessels without AIS that are indeed vessels.
 - **False Positives (FP):** Detected objects without AIS that are not vessels

6.2.1.7. COPERNICUS PROTOTYPE UPDATE RATE

This metrics tracks using statistical data the update frequency of the Copernicus services. This is defined as the average time between the update of the Copernicus based services and will help to evaluate the effect of external factors such as cloud cover, poor atmospheric conditions, or technical delays in data acquisition.

6.2.2. NON-STATISTICAL KPIS

The non-statistical KPIs for system behavior are defined below,

6.2.2.1. GEOSERVER RESPONSE TIME

This KPI measures the average time taken by the GeoServer to respond to incoming requests for raster queries and feature queries. Monitoring this KPI helps identify performance bottlenecks and supports optimization of server configurations and data layers.

6.2.2.2. ERROR RATE

The error rate tracks the frequency of failed requests encountered during data processing, API interactions, or alert generation. A consistently low error rate indicates a stable and reliable system, while spikes in this metric may signal issues requiring immediate investigation, such as service outages, misconfigured layers, or integration failures.

6.3. KPIS NOT RELATED TO EU SPACE DATA

6.3.1. CROSS TRACK ERROR (XTE)

Cross track error or XTE is the perpendicular distance between the actual position of the vessel and the intended trajectory, at one specific point in time.

An ideal TGAIN keeps the vessel position at all times on the trajectory. In practice this is not possible because of external (unknown) disturbances.

So, the purpose is to keep the XTE as low as possible (close to zero) along the trajectory.

Besides the calculation and the monitoring of XTE as instantaneous KPI in the TGAIN, the XTE is also used as input for the TGAIN control logic to enhance the tracking.

To get from an instantaneous XTE-measurement to an overall KPI, one can use statistics to come to a general "XTE-KPI".

6.3.2. PATH PLANNING DEVIATION

Before starting navigation from point A to point B, a route is defined through a path planning process. Although routes do not usually change in terms of starting and ending points, it is possible that certain lateral deviations from the initial route may occur in order to avoid obstacles. Therefore, a KPI can be defined that expresses the degree of deviation between the originally defined route and the route adapted to navigation requirements.

6.3.3. PERCENTAGE OF TIME BOATMASTER TAKES CONTROL WHEN USING TGAIN

When navigating using TGAIN, the vessel is able to maintain its intended route. However, TGAIN technology is not capable of detecting obstacles or dealing with unforeseen events during navigation. Therefore, at some point, the boatmaster may have to take control of the rudder and correct the course. With this in mind, a KPI can be defined that records the percentage of time during which the boatmaster takes manual control of the vessel while navigating with TGAIN.

6.3.4. NUMBER OF VESSELS WITHIN 1 KM RADIUS

Establish a count of all vessels within 1 km of the pilot's vessel during the operation. It helps to assess the degree of complexity of the operation for risk assessment. It is calculated by identifying the surrounding vessels using AIS or RADAR and calculating the distance between the other vessels and the pilot vessel.

6.3.5. NUMBER OF VESSELS WITHIN 100M RADIUS

Establish a count of all vessels within 100m of the pilot's vessel during the operation. Identifies vessels that are very close to the pilot vessel and are more likely to cross paths. It helps to assess the degree of complexity of the operation for risk assessment. It is calculated by identifying the surrounding vessels using AIS or RADAR and calculating the distance between the other vessels and the pilot vessel.

6.3.6. DRIFT ANGLE

Drift angle is the horizontal angle between:

- Heading (HDT): the direction the vessel's bow is pointing, and
- Course-over-ground (COG): the actual path the vessel is moving across Earth's surface.

It can be computed as:

$$\beta = COG - HDT$$

6.3.7. NUMBER OF TIMES THE NAVIGABLE AREA BOUNDARY EXCEEDING ALERT IS RAISED

Previously in the project, in document D2.3 [RD.3.], an alert has been defined that indicates when the protection level may exceed the limits of the navigable area. This alert counts the number of times this alert is raised during an operation.

6.3.8. NUMBER OF BRIDGES CROSSED.

This indicator counts the number of bridges crossed during navigation. This indicator helps to contextualize the environment during navigation to assess how many times a more critical area for GNSS services has been crossed.

7. PILOT USE CASES

As described in the context and methodology, more specific details of the particular use cases for each pilot will be specified in more detailed future updates of this document that will be provided prior to the execution of each pilot. These updates will be included in Annex I.

The estimated duration of the pilots is one working week. Execution is understood to mean both the preparation and installation as well as the navigation itself, carrying out the different operations foreseen. This duration may vary in some cases depending on the particular conditions of each pilot. The duration of a day's sailing will be adjusted to a working day, ensuring that the total time we require from the boatmaster does not exceed a normal working day.

As a general rule, use cases are contemplated as dynamic tests, however, during the installation phase, static tests will be performed to check that the prototype works correctly and is ready to perform the expected use cases.

Throughout the execution of the pilots, the necessary data will be recorded to subsequently evaluate the performance obtained in the pilots. Similarly, in real time, some of the contributions of EU Space Data, such as the representation of protection levels or Copernicus alerts and maps, will be displayed on the ECDIS. Taking advantage of the fact that the pilots will run with the presence of a boatmaster on the vessel, we intend to take the opportunity to ask boatmasters questions about the pilots use cases execution to also get the perspective of this type of stakeholder.

As commented in D5.1 document, the analysis of the data will be used to assess the performance and evaluate it for different levels of automation. However, the automation level during real-time navigation is not intended to exceed the AL1 level in any pilot. The aim of the AVIS pilots is to assess the value of the EU Space data in the automated navigation, hence it is not developed technology that would allow live testing of higher automation, so the prototype does not consider elements, outside EU Space data, that are necessary for higher automated navigation.

All results and conclusions obtained will be reflected in document D6.2 "Reports on the verification and evaluation of the pilots". In addition to evaluating performance from the point of view of various automation levels, comparisons will also be made between different GNSS technologies. It is also planned to compare different equipment, for example, a comparison between a GNSS receiver included in AIS equipment and a stand-alone GNSS receiver. Such comparisons are considered interesting since, as we have seen during the first part of the project, the GNSS receiver included in the AIS equipment is often the main source of positioning in inland waterway navigation.

8. ANNEX I: PILOTS ' PARTICULAR USE CASES

8.1. RHINE USE CASES

TBC before pilot execution

8.2. MIDDLE DANUBE USE CASES

TBC before pilot execution

8.3. LOWER DANUBE USE CASES

TBC before pilot execution

8.4. GUADALQUIVIR USE CASES

TBC before pilot execution