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Galileo RETURN LINK SERVICE Evolutions

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Abstract

The Galileo Return Link Service (RLS) has been declared operational by the European Commission on January 2020, bringing to the Search & Rescue users worldwide a unique feature with significant added value.
The RLS allows the user in distress to be promptly informed that their distress alert has been well received on ground, such reassurance delivers a valuable psychological lift to victims and boosts survival rates by reducing panic and improving confidence in the rescue system.

Since its entry into service, the RLS has demonstrated a very high level of performance in terms of availability and latency. Its measured availability is indeed greater than 99.9% and the average latency for the delivery of the Return Link signal (RL) within few minutes.
The Return Link Service Provider (RLSP) is the Galileo infrastructure in charge of providing the ground segment interface between the end users and the Galileo System enabling the secure communication link for the provision of the Service. The infrastructure has been designed from the ground up with high redundancy and security requirements in mind and it is operated to guarantee the Service minimum performance levels defined in the SAR/Galileo Service Definition Document.

The Return Link Message is created by the RLSP upon reception of a service request and is sent to the RLS-compatible SAR beacons through the Galileo Navigation Signal in Space (I/NAV E1).

The Galileo System ensures a safe, secure and continuous service delivery to more than 3 billion Galileo enabled receivers worldwide and it is constantly being improved in terms of System robustness and more importantly, in terms of innovative and added value Services. In this sense, the broadcasting capabilities provided by RLS (i.e. return communication link) offers the capability to reach any end user worldwide, enabling key differentiators in the field of the Search and Rescue and Emergency Management to be developed.

The paper will provide a high-level overview on the future evolutions of the SAR/Galileo RLS-based Services which are under study by the Galileo Programme. The paper aims to describe the technical and operational concepts and key benefits to the existing SAR operations of these evolutions with a focus on the Remote Beacon Activation, the Two Way Communication, and the Distress Position Sharing.

In addition, the paper will also provide a high-level overview on the upcoming Galileo efforts on the field of the Emergency Management. As mentioned before, the Return Link functionality enables a communication link with Galileo compatible receiver (smartphone or specific devices) located in a precise geographical area. Exploiting this broadcasting capabilities, the Galileo Emergency Warning Satellite Service (EWSS) will empower authorized civil protection authorities to promptly alert, through the Galileo satellites' Signal-in-Space, of a serious hazard in a timely fashion and independently of any terrestrial system. The EWSS is being designed as a complementary system to existing European Public Warning Systems and will take into account strong authentication need, necessary for this kind of application.

Finally, the paper also provides the key outputs and operational point of view from the SAR/Galileo Data Service Provider (CNES) on a number of on-going initiatives under the management of the European Commission (EC) and EU Agency for Space Programme (EUSPA) with the goal to demonstrate and validate the abovementioned new Galileo Services.

Keywords: SAR/Galileo, Return Link, Remote Beacon Activation, Two Way Communication, Emergency Waning Satellite Service

Nomenclature

BCS-UMF	=	Beacon Command Service User management Function	MEOSAR	=	MEO Search And Rescue
C/S, CS	=	Cospas/Sarsat	OSNMA	=	Galileo Open Service Navigation Message Authentication
CNES	=	French National Space Agency	RBA	=	Remote Beacon Activation
CPA	=	Civil Protection Agency	RCC	=	Rescue Coordination Centre
DPS	=	Distress Position Sharing	RLM	=	Return Link Message
EC	=	European Commission	RLS	=	Return Link Service
EWSS	=	Emergency Warning Satellite Service	RLSP	=	Return Link Service Provider
EWOKS	=	**E**nabling E**WS**S/Galile**O** Mar**K**et Uptake in widespread PWS **S**olutions	S/W, SW	=	Software
GMS	=	Ground Mission Segment	SAR	=	Search and Rescue
GNSS	=	Global Navigation Satellite System	SGB	=	Second Generation Beacon
KPI	=	Key Performance Indicator	SGSC	=	SAR/Galileo Service Centre
MCC	=	Mission Control Centre	SGDSP	=	SAR/Galileo Data Service Provider
MEO	=	Medium-altitude Earth Orbit	TWC	=	Two Way Communication
MEOLUT	=	MEO Local User Terminal			

1. Introduction

It is crucial to keep in mind that the SAR/Galileo Service is a contribution to the International Cospas-Sarsat System that is a global and free of charge satellite-based program allowing the detection and localization of distress beacons worldwide. Canada, France, USA and USSR founded the Programme in 1988. Today 45 countries or organizations contribute to the Programme either on the ground or in space segment. In 2020, the Cospas-Sarsat System provided assistance in rescuing 2,278 persons in 951 SAR events, which represents an average of more than six people per day.

The SAR/ Galileo introduced in January 2020 a new key SAR function called Return Link Function, which provides through the dedicated facility RLSP (**R**eturn **L**ink **S**ervice **P**rovider) an automatic acknowledgment to the distress beacon. The RLS allows the users in distress to be promptly informed that their distress alert has been well received on ground, such reassurance delivers a valuable psychological lift to victims and boosts survival rates by reducing panic and improving confidence in the rescue system.

The RLS acknowledgement service is a unique feature of Galileo which allows for the first time the possibility to establish a communication link to the beacons in distress. It is important to note that Galileo, through the RLSP, is the only GNSS system committed to enable the Return Link service.

The RLS acknowledgement Service is a great improvement from the current Cospas-Sarsat operations, and the backbone of additional services under study by European institutions. In that way, the EC has started various projects to demonstrate: reliable, standardized, low latency, Galileo-based services that will enhance global safety and security. All these innovations are the core of this article and are described in the following chapters.

1 SAR/Galileo Service

1.1 *How does it work*

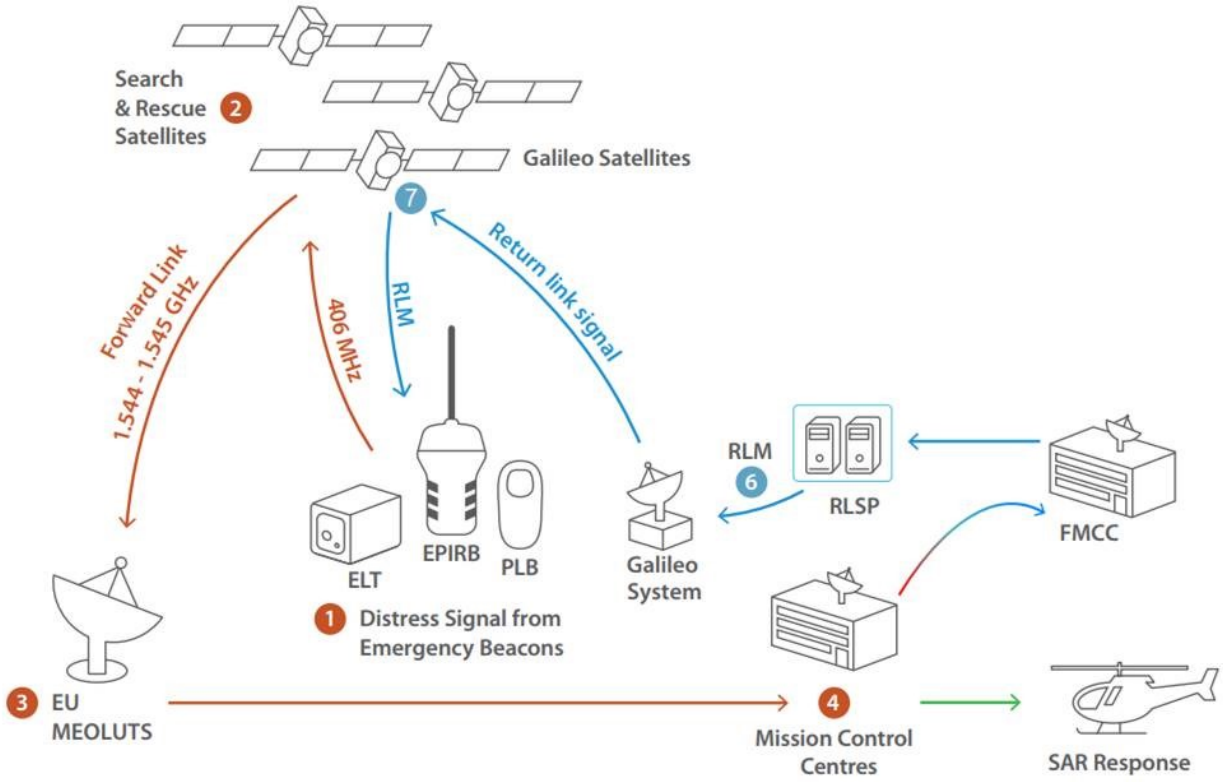

Fig. 1. The Cospas-Sarsat MEOSAR system

Galileo supports the **Search And Rescue service** by equipping its satellites with a SAR Payload that relays beacon distress signals towards COSPAS/SARSAT **(1)**.

Relayed signals from the different satellites are received by one or several Medium altitude Earth Orbit Local User Terminals (EU MEOLUTs) **(2).**

The EU MEOLUT is in charge of determining the location of the beacon, either by demodulating the beacon message or by processing the times of arrival (TOA) and Doppler shifts of the received signals (FOA). **(3)**

The EU MEOLUT then sends the estimated beacon position and other relevant data to a Mission Control Centre (MCC) **(4)**

This MCC communicates with the Rescue Coordination Centre (RCC) and the Return Link Service Provider (RLSP) through the French MCC. The FMCC sends a Return Link Message Request to RLSP.

The RCC is in charge of launching a rescue operation.

RLSP sends the RLMR to GMS **(6)**

GMS inserts the RLM data in the C band mission uplink **(7)**

The Return Link Message is downlinked to the beacon in the I/NAV signal in E1B **(7)**.

The RLS capable Emergency Beacon will receive these RLMs. Upon reception, the acknowledgement will be visible to user, thus indicating that rescue teams are on their way.

1.2 *Service Performance*

The SAR/Galileo Data Service Provider (SGDSP) team is responsible for collecting and computing continuously the SAR/Galileo Ground Segment (SGS) performances Key Performance Indicators, including the Return Link Service performance. Since its entry into service, the RLS has demonstrated a very high level of performance in terms of availability and latency. Its measured availability is indeed greater than 99.8% and the average latency for the delivery of the Return Link signal (RL) within few minutes.

The KPI are computed using a network of stations spread over the world, as showed in the next figure:

Fig. 2. REFBE and REGINA Stations Geographical Position

In term of availability, the Return Link facilities reach very high level of expectations and have proven their robustness since their commissioning:

	RLSP Availability (Target=99%)		
	Operational	**Not Operational**	**Unknown**
December 2022	**100.0%**	**0.0 %**	**0.0 %**
Last 12 months	**99.85 %**	**0.15 %**	**0.0 %**

Table 1. RLSP Availability over a year

Even in term of latency, the figures calculated over 12 months (period from December 2021 to December 2022) are excellent:

Return Link Message Latency			
Coverage	*Percentage of RLM received under 5 min*	*Percentage of RLM received under 15 min* ***(Target: 99%)***	*Mean latency (seconds)*
	Last 12 months	Last 12 months	Last 12 months
European	99.77 %	99.99 %	20.9 seconds
Global	99.40 %	100 %	22.84 seconds
ALL Beacon	**99.7 %**	**100 %**	**21 seconds**

Table 2. Return Link Message Latency over a year

To go further with the analysis of the performance of the Return Link in terms of Latency for the delivery of the RLM messages; SGDSP team measured that more than 99.7% of the time the beacon has received the RLM within 5 minutes. Moreover, the mean latency computed over 12 months was of about 21 seconds.

This excellent value of latency opens the door for new interesting features.

2 Future SAR/Galileo RLM-Based Services

The broadcasting capabilities provided by RLS (i.e. return communication link) offers the capability to reach any end user worldwide, enabling key differentiators in the field of the Search and Rescue and Emergency Management to be developed.

The SAR/Galileo has the ability to send Return Link Messages (RLM) and with this unique way of reaching the beacons several possibilities are now available. The next chapters of this article go into details about three new potential services that are anticipated as Galileo evolutions.

2.1 *Remote Beacon Activation (RBA)*

The Remote beacon activation is one of the extra features that are under study by the Galileo Programme. This capability will allow the Rescue Coordination Centres (RCC) or Aircraft companies for instance to trigger a SAR beacon on board of a vessel or an aircraft, as an additional (and optional) means of activation.

2.1.1 Use cases

Currently the Programme has identified three main use cases.

1. Aviation, in the event of:
   - unresponsive crew or non-cooperative cockpit,
   - an abrupt aircraft disappearance, as it was experienced for some well-known incidents such as the Air France AF447 and the Malaysian airline MH370.

In these cases, a beacon might be remotely activated with a Return Link Message transmitted via the Galileo Open service (signal E1). Once activated, the beacon will start transmitting distress alert messages which are detected by Galileo SAR payloads and the position of the beacon will be confirmed to the Authorised User allowing its tracking, which will facilitate search and rescue operations.

To allow such functionalities with a global coverage, the future Remote Beacon Activation (RBA) Service for aviation shall be in line with the EUROCAE's Minimum Aviation System Performance Standard (MASPS ED-277), answering to ICAO's recommendations for Autonomous Distress Tracking (ADT).

2. Maritime, the RBA will allow for instance identifying the position of an overdue vessel, when no other means of contacting the vessel are available, in case of piracy attack for example.

3. Pedestrian, the same concept can be applied to personal beacon in case of people disappearance during hiking or travels.

2.1.2 RBA Service Goals

The RBA service is planned to have a worldwide coverage, entirely free of charge, in line with other SAR/Galileo services and with a target availability of 99% in line with ICAO recommendations.

In terms of latency, strongly demanding requirements will be taken into account since the design phase. Indeed, the beacons will have to be activated in less than 2 minutes, starting from the submission of a request. The suitable monitoring will be implemented and setup at SGDSP level to guarantee this high level of expectations. New KPIs will be agreed with European instances and reported by the SAR/Galileo Data Service Provider (SGDSP).

In addition, to ensure the security of the service the design will have also to take into consideration security requirements, and for sure, only authorised users will be allowed to access the service for a set of associated registered beacons.

Example of authorized users will be the Airlines companies, National Authorities or Maritime Rescue Coordination Centre or Vessel Operators.

For the time being, the Service declaration is targeted before the entry into service of ICAO ADT.

2.1.3 Operational concept

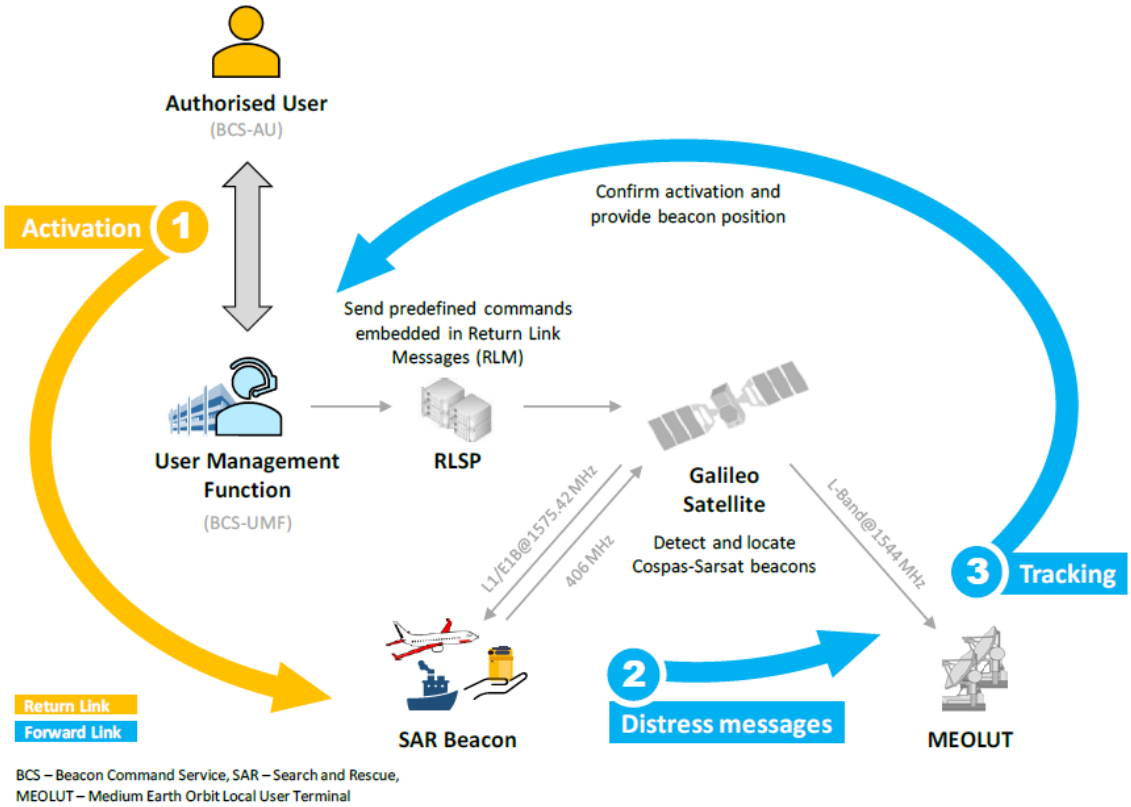

Fig. 3. RBA Operational Concept

Only Authorized User shall send the activation request to the User management Function (BCS-UMF) that will be in charge to provide inputs to the RLSP in order to trigger the beacon activation via the transmission of a Return Link Message.

Once the beacon is activated the traditional forward link, provided with Cospas/Sarsat network, will allow its detection and localization.

The User Management (BCS-UMF) will allow to manage the process for user authorization and will provide a secured interface to submit beacon activation requests.

Of course, only the Cospas-Sarsat RLS compatible beacons and with the additional capability of being remotely activated and deactivated will benefit of this new service.

2.2 *Two Way Communication (TWC)*

The two-way-communication (TWC) is a capability, which will is intended to be offered by the SAR/Galileo Return Link Function to retrieve information from the distress area. It will allow the user in distress to send short messages like SMS to answer to the SAR Forces and Rescue Coordination Centres to facilitate rescue operations.

Most of the time in a distress situation, mobile phone communications are not possible, so the use of a satellite link is very useful.

In such a case, the Rescue Control Centres (RCC) will be able to activate and send, via the RLS, Questions or Messages on an activated beacon, in order to retrieve information about the distress situation or give instructions to ease the rescue operation.

A successful demonstration was organized in October 2022. Indeed, by using the short RLMs, the beacon user was able to reply via an interface on the terminal itself, thus allowing exchanging few pre-formatted answers to inform the Rescue team about the general situation using the Cospas-Sarsat Forward Link.

Fig. 4. TWC communication exchange

- Way «Forward Link » : Alert, TWC Answers, Acknowledgments
- Way «Return Link » : TWC Questions, RCC messages, Acknowledgments

Ultimately, when the service is opened, this communication link will allow a direct verification of the distress alert, improving SAR forces awareness on the 'on-site' situation, improving significantly the success of the SAR mission in a cost and time efficient way.

2.2.1 Use cases and Concept

Here below is presented a typical Two Way Communication (TWC) use case:

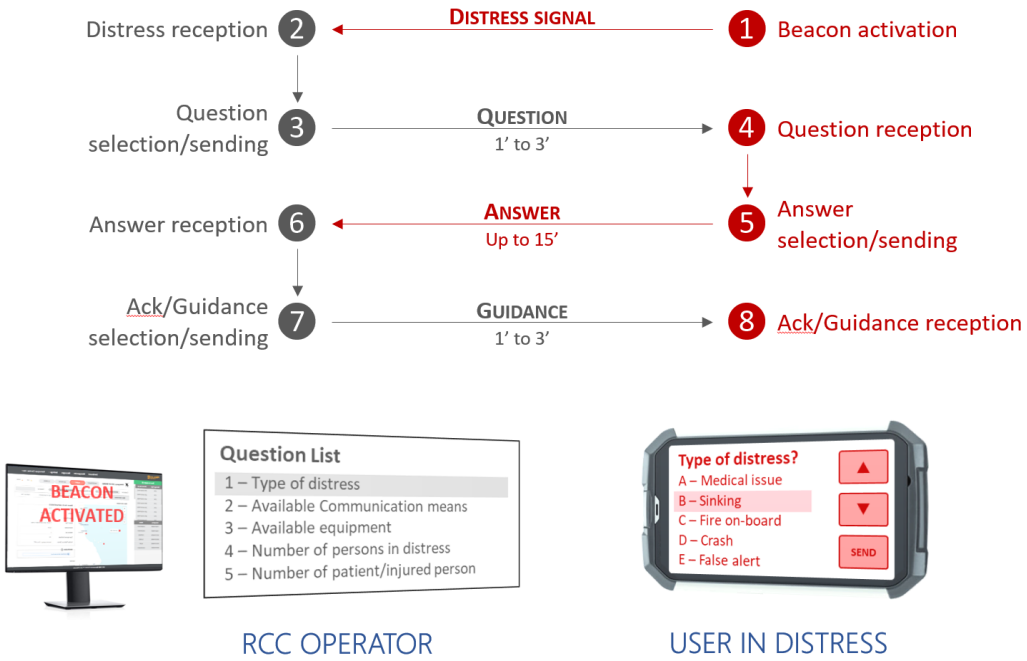

Fig. 5. TWC use case

Once the beacon **(1)** is activated a distress alert is received by the RCC **(2)**.

The RCC send a pre-formatted question **(3)** to the user in distress (like the type of the distress, the available communication means, and the number of injured persons **(4)**.

The user in distress reply with also a pre-formatted message giving indications about the distress situation **(5) (6)**.

Once the RCC has collected the necessary information, guidance to the people in distress can also be provided **(7) (8)**.

Finally, the Two Way Communication might also be very useful for the RCC in order to identify false alerts, which represent a very high percentage of the Cospas-Sarsat traffic.

2.2.2 TWC Service Goals

As well as for the RBA service, the TWC service will be free of charge, with a target availability of 99% and a worldwide coverage.

The information exchanged between the person in distress and the Rescue Coordination Centres (RCC) will be pre-coded in order to solve the issue of language barrier.

The Rescue Coordination Centre will be able to access the User Management Function (UMF) via a secured web access. Here below, a table to illustrate an example of pre-canned answers/questions to better estimate the nature of distress:

Length of the boat? ▪ <5m ▪ 5-10m ▪ 10-20m ▪ >20m	*Height of the mast?* ▪ No Mast ▪ <5m ▪ 5-15m ▪ >15m	*Is the boat dismasted?* ▪ Yes ▪ No	*Do you have a boat tender?* ▪ Yes ▪ No
Color of the boat? ▪ White ▪ Grey ▪ Black ▪ Yellow/Orange ▪ Red	*Weather on scene?* ▪ Rough ▪ Bad ▪ Moderate ▪ Good	*Visibility on scene?* ▪ Dense fog ▪ Thin fog ▪ Cloudy ▪ Clear sky	*Do you hear/see the rescue?* ▪ Yes ▪ No
SAR situation? ▪ On-board ▪ Life raft ▪ Man overboard	*Communication means on-board?* ▪ Mobile phone ▪ Satellite phone ▪ VHF/UHF ▪ None	*Survival equipment on-board?* ▪ Life raft ▪ Life jacket ▪ Flares ▪ None	*Do you have AED on-board?* ▪ Yes ▪ No

Table 3. Example of pre-canned answers/questions

For the time being, the Service declaration is targeted in a timeframe of 2-3 years.

2.2.3 TWC Service Demonstration (Serenity project)

For the time being, a European Commission demonstration project has been finalized in order to:

1. Collect and consolidate user requirements,
2. Develop a prototype of TWC enabled beacon,
3. Perform a live demonstration of the service.

A live demonstration was performed on October 1st 2022. During the demo, the TWC functionalities were proved to be technically feasible. The SGB TWC-enabled beacon prototype displayed the three pre-coded automatic questions upon alert triggering. These were answered by a naïve user during a real rescue exercise and received at RCC. From these three answers, the rescue operation was adapted to be more suitable for the actual rescue needs. Also, a new question and a demand for an update to one of the questions that were already asked were sent from RCC and answered by user. A Message containing instructions (chosen from RCC side) was also displayed on beacon to user. The rescue exercise was launched at Fécamp (France), with the participation of CROSS Gris-Nez.

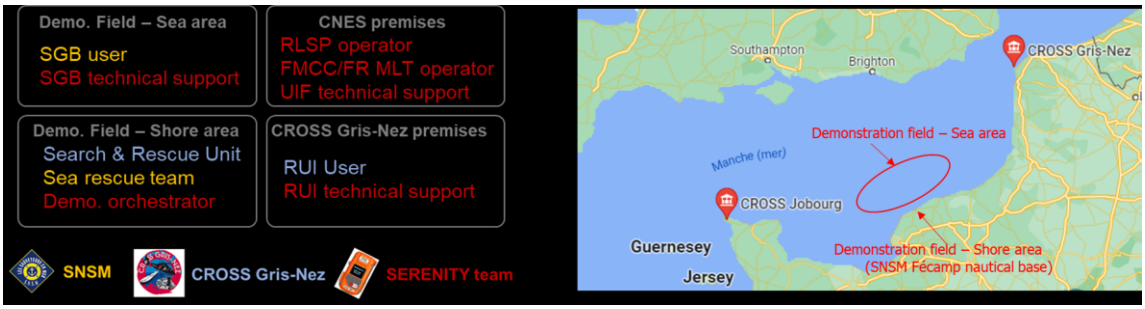

Fig. 6. TWC Serenity Demonstration organization

An example of HMI implemented in the frame of the Serenity project (TWC demonstrator) is given here below for illustration:

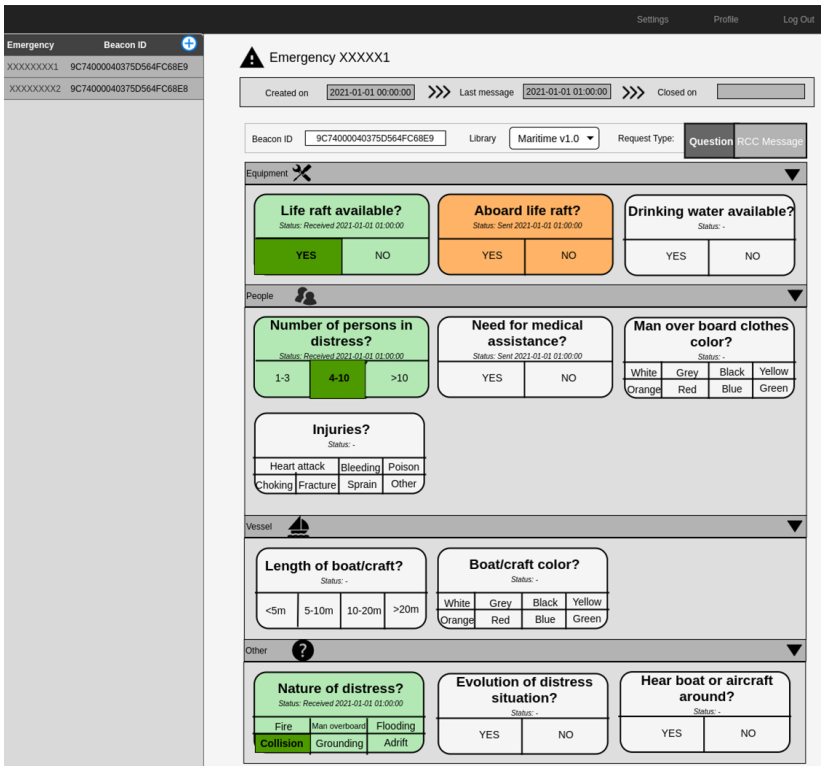

Fig. 7. TWC RCC user interface

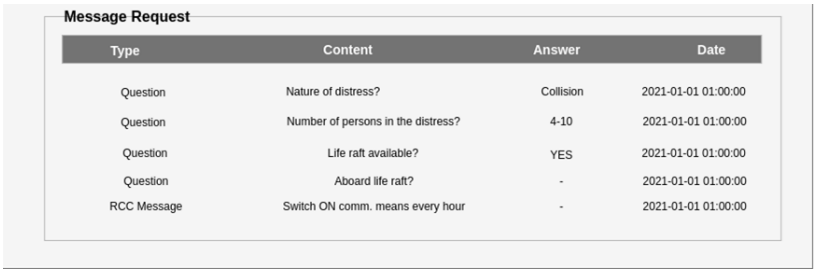

Fig. 8. TWC RCC message request

As for others SAR/Galileo services, and to guarantee the correct utilization of it, strong cyber security requirements will be applied since the very beginning of the design phase.

2.3 *Distress Position Sharing (DPS)*

2.3.1 Use cases

Two main use cases are considered for the future DPS service:

1. At sea: the DPS could allow for example to inform nearby vessels of the distress situation.
2. At land: the DPS could allow to warn people located in a determined area about the distress situation.

Under the guidance of the European institutions, several demonstration projects are on-going to consolidate the Service Concept.

Two among the possible scenarios are currently being studied:

- The beacons can be either paired in advance (for instance in the case of a race or a fleet of ships).
- The Distress alert is sent to a predefined geographical area and all compatible devices with the DPS function might receive the alert.

The distress position sharing service could help saving lives, allowing the prompt intervention of entities near the distress.

2.3.2 DPS Service Goals

As the DPS will be a function of the Return Link Service, the same targets in term of latency and availability will be applied. It means that the future DPS service will be free of charge, with a target availability of 99% and a worldwide coverage.

2.3.3 Operational concept

In the event of a distress Position Sharing, once a beacon is activated it is detected and localized though the forward link service provided by Cospas-Sarsat. The receipt of the message is acknowledged enabling an Authorized user that can be for instance a Maritime operator, to share the position of the distress to different beacons that are located in a precise geographical area or which are paired to each other.

The transmission of the position of the beacon in distress will pass through the Return Link and could be received by terminals that could be either Cospas-Sarsat beacons or other more generic devices equipped with a GNSS receiver.

For this service as well, a key facility will be introduced in the SAR/Galileo Ground Segment, which is the User management Function (UMF) that will ensure the secure authentication and authorization processes necessary to manage the access by the authorized users.

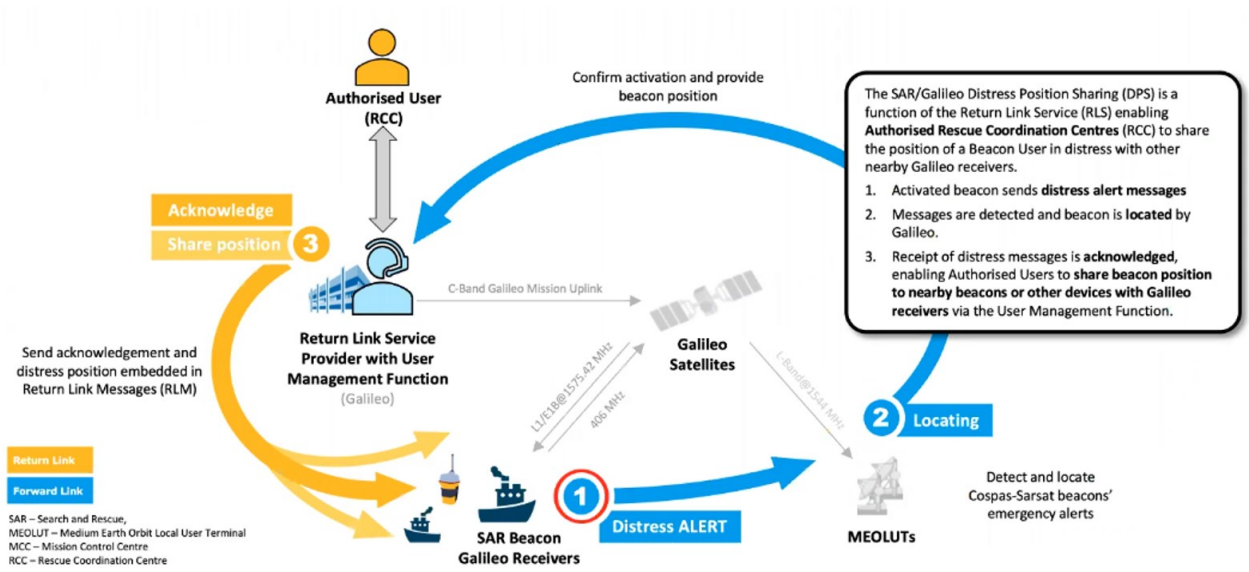

Fig. 9. DPS Operational Concept

3 Emergency Management

One of the National Civil Protection Authorities' most important tools for saving lives, reducing risk for emergency service personnel, and cutting costs is **warning citizens of emergencies**. Indeed, natural disasters can cause major losses in terms of human life and financial damage. As a result, there is a growing need for the implementation of early warning systems that address the need for the protection of civil population and physical installations.

In 2015, the United Nations adopted a new framework for Disaster risk reduction, the Sendai Framework. The 5th target within this framework recommends nations to "substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030". EWSS is the EU contribution to this target.

In its regulation (EU) 2021/696 establishing the Union Space Programme, the European Union introduces EWSS as a new service in the Galileo portfolio of services aimed at broadcasting a warning message to population facing an upcoming threat (natural- or man-made-hazard): the Emergency Warning Satellite Service (EWSS). As established in article 45§e of this regulation, "the services provided by Galileo shall comprise […] an emergency service, broadcasting, through emitting signals, warnings regarding natural disasters or other emergencies in particular areas".

EWSS is designed as an early warning system that would supplement those currently in place in EU Member States. Galileo offers, thanks to its special features, a possibility to reach out population on a large scale, including in the cases where the conventional terrestrial alerting systems cannot operate at full capacity or even collapse. Member States and their administration and services will still be competent in deciding to initiate an advisory, a warning, or an alert over their jurisdiction. The following are the primary capabilities provided by the Galileo infrastructure that can be used in the context of EWSS:

- Single point of access to Galileo infrastructure for national alert services,
- Worldwide access via the Galileo Signal in Space, independently of terrestrial mobile or internet access,
- Dissemination of an advisory/warning/alert message, including associated instructions to react,
- Authentication of the message by using the OSNMA capability,
- Geo-location information encoded in the message used to target only the relevant population.

Galileo Second Generation will deliver EWSS as one of its new services, however the European Commission (EC) believes that benefits could be gained if the service were to be launched now, at least in an initial capability mode.

3.1 *Emergency Warning Satellite Service*

The goal of the future EWSS service is to provide the ability to reach the population on a large scale and in a timely manner, including in cases where traditional ground-based warning systems cannot operate at full capacity or have collapsed.

The advantages of the Galileo EWSS service are that it will be complementary to existing means, free of charge, resilient, independent of terrestrial infrastructure, versatile, fast and geo-targeted.

The Emergency Warning Message (EWM) is embedded in the Galileo Open Signal (E1), as part of the navigation data, and can therefore be received by everyone equipped with a Galileo receiver in view of the broadcasting satellites. The user receiver reads and displays the EWM only if it is located within the area of interest encoded in the EWM. In other words, a user is alerted only if he/she is in the geographical target of this alert.

EWSS Initial Services are planned to be available in 2024.

3.1.1 Operational concept

The following is the EWSS's overarching principle: The Common Alerting Protocol (CAP)[1] standard is used by Member States' Civil Protection Agencies (CPA) to send a service request to Galileo for alerting its citizens to imminent danger. The Galileo system analyzes, verifies and confirms the service request's content before converting

it into an Emergency Warning Message (EWM). The EWM format enables the encoding of the danger type, its characteristics (such as severity, time of onset, estimated duration), the targeted region, reaction instructions, and more. The EWM is then disseminated over the area targeted by the civil protection authority using the Galileo system, uplinked by the mission section to the appropriate satellites.

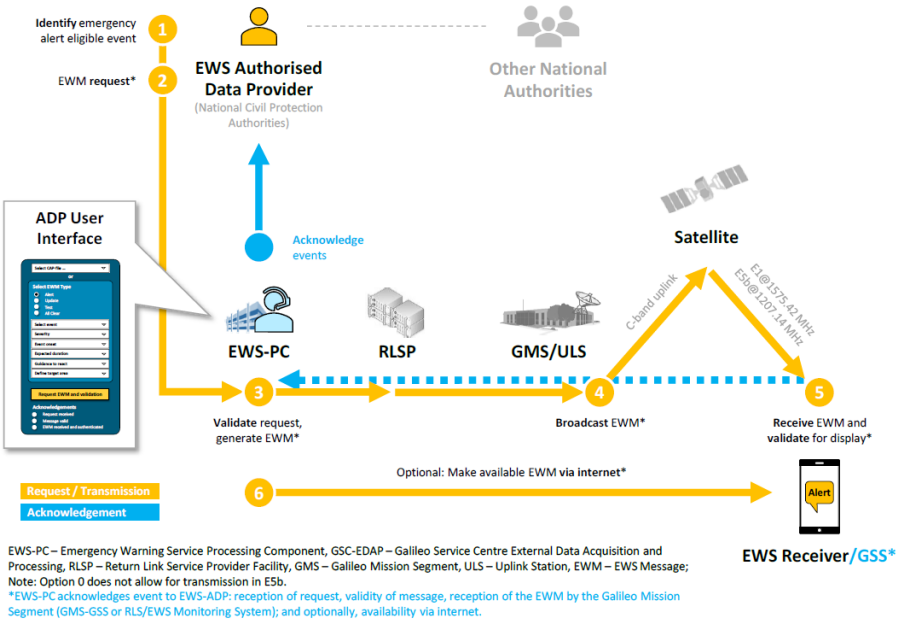

Fig. 10. EWSS Operational Concept

The user terminal must be located in the alert's geographical target area in order for notification to take place, and the CPA issuing the alert must have authorization to do so in the target nation (Member States and their administrations and services retain the right to decide whether to initiate an advisory, warning, or alert within their respective borders).

3.1.2 Service Concept

EWSS is not intended to take the place of any current system. Additionally, it is constrained by inherent factors, such as the lack of free text and interior penetration. However, it is obvious that EWSS has benefits all on its own, such as:

- Free of charge with worldwide coverage,
- The service is accessible when all other options have been exhausted (due to standard alarm systems' destruction or saturation),
- Compatible directly with cell phones or navigation devices.

The service will be on demand triggered by the Civil Protection organizations that will choose to activate the alert and get in touch with Galileo to send out a message. This way the alarm message is delivered to people's mobile phones or GNSS systems. The goal is to reach out population at large & small scale in a timely manner (~ minutes). The message's geolocation data is used to target only the appropriate population. It allows to target areas of any size. When the user terminal is inside the encoded ellipse, a message is displayed as shown in the next figure:

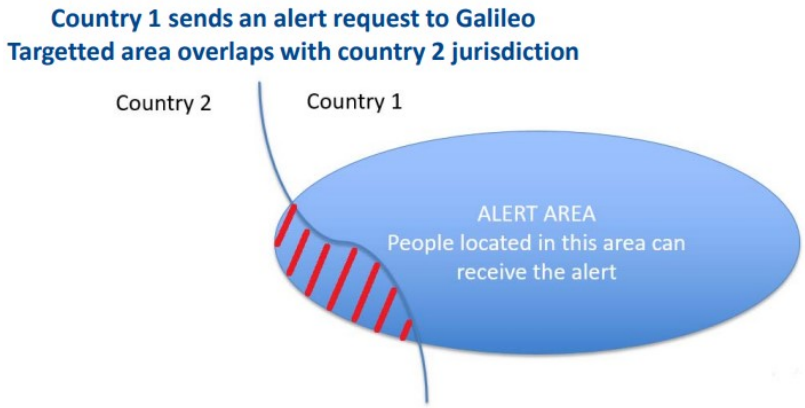

Fig. 11. EWSS Alert area

In order to provide the service, several challenges must first be met:

- Avoid transmitting a warning signal over a neighbouring nation
  - Envisaged solution: if the receiver's own position is outside the warning area, the solution is to filter out the incoming satellite data at the user equipment level. Only residents of Ellipse and Country 1 will receive notice; residents of other locations will not receive notice.
- There isn't enough space in the signal to code all the information needed for the alarm.
  - Envisaged solution: use libraries for the instructions to react and ellipse code for the target region as a solution. Common format with other GNSS-based project might be a good approach.
- No free text
  - Envisaged solution: use libraries pre-coded in user terminal

Key factors for the success of EWSS are: coordination with the Civil protection authorities, constructive discussions with the smartphone manufacturers to implement the adequate libraries directly in the firmware, promote service introduction in and interoperability with other GNSS Providers.

3.1.3 Status of development of EWSS

An H2020 project[2] to define the service was financed and overseen by the European Commission in 2017–2018. A demonstration of the Japanese QZSS satellite navigation infrastructure was organized by the project in 2018. The successful real-time demonstration was able to demonstrate the viability of the service concept.

Since 2019, the European Commission has been working with the civil protection agencies of Member States to coordinate the mission requirements for EWSS. Various inquiries about the service definition, idea, and capabilities have come up as a result of these initial encounters.

The European Commission suggested to carry out a number of sample demonstrations on conceptual use cases to highlight the service capacities in this context.

At the time being, the European Commission is focusing on two projects, STELLAR and EWOKS, to showcase and assess the end-to-end process of delivering alert from National civil protection users to the public.

3.2 *STELLAR project*

The project aims at organising and delivering in-field demonstrations of EWSS using the actual Galileo infrastructure, and to test and show case the service characteristics and benefits to EU civil protection authorities. 4 locations have been retained: France, Germany, BENELUX, Cyprus. Crisis scenarios for the demonstration campaign will address forest fires, tsunami, industrial incidents, floods. The demonstrations will take place in the second half of 2023.

3.3 *EWOKS Demonstrator Project*

The most common Galileo user terminal in the mass market, cellphones, were initially intended to handle EWSS. This was decided to assure as wide an adoption as feasible in order to maximize the amount of citizens who may be reached by the alert.

But this system has three key drawbacks:

- Galileo is not available indoors,
- Navigation data on smartphones can be disabled,
- Battery performance on smartphones is constrained.

To maximise the number of citizens reached by the alert, outdoor user terminals without power limitation and able to monitor the service continuously are required.

Currently, modern public warning systems include sirens, loudspeakers, advertising panels, highway panels, city information panels, and long-range acoustic devices (LRAD). These fixed devices would be made EWSS competent via EWOKS.

Additionally, EWOKS proposes installing fixed devices on top of buildings (public buildings, business premises, malls, SEVESO sites, etc.) that will convey the alarm via security or IT systems in order to make EWSS available to inhabitants indoors.

The targeted architecture is described below :

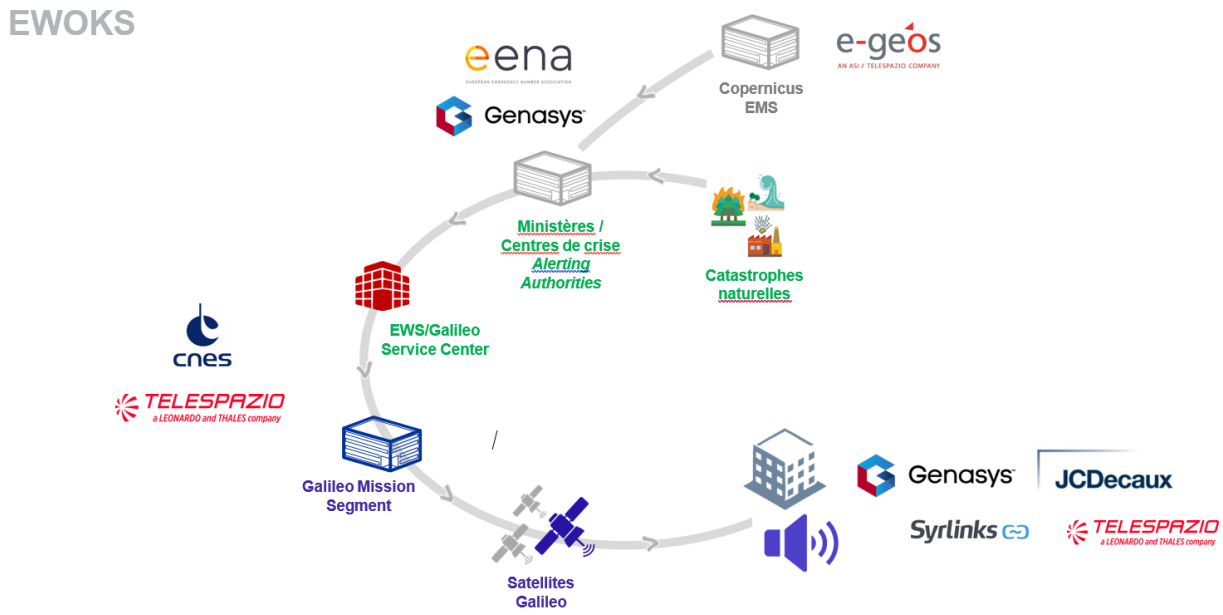

Fig. 12. EWOKS Architecture

The EWOKS project focuses on the design and development of this GNSS equipment that will deliver warning message in CAP format to Public Warning Service (PWS) devices.

The demonstration is planned end of 2024 using the current Galileo infrastructure.

4 Conclusions

At the time being, the European institutions have launched studies and demonstrators that aim to use the capabilities of the return link function. All the new services proposed will be free of charge, and are intended to facilitate the work of the rescue teams but also to warn citizens of upcoming disasters, and this with an irreplaceable goal: to save lives.

The most advanced ones such as the Remote Beacon Activation or the Two Way Communication, for which full-scale demonstrations have been successfully carried out, will quickly arrive on the market. These new services will complete the set of available tools to rescue people, and not in any manner replace them.

There are still important stages before the service opening but one is crucial. These new services are essential, and badly-intentioned persons may misuse them and suitable protection mechanisms will be required. In this line security needs have were considered from the very beginning of the studies and were incorporated directly into the design of the solution. Based on the experience gained from the security accreditation of the return link, the SGDSP team will provide support to European institutions to properly implement and qualify security into the new operational resources. This phase is indeed essential to guarantee a great success.

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