MISSION CONCEPT

Global trend to develop Disaster Risk Reduction technologies:

• United Nations’ Sendai Framework for Disaster Risk Reduction: “Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030”

• World Meteorological Organization – 2020 State of Climate Services report (13 October 2020), confirms the importance of early warning systems for disaster prevention and risk reduction

• A new approach: use the GNSS satellite capacity for alert dissemination
  • Purpose: Alerting the population in case of a looming disaster (fire, storm, floods, tsunamis, volcano, industrial accident...)
  • National Civil Protection entities decide to trigger the alert and contact Galileo to broadcast a message.
  • People receive the alert message on their mobile phone/nav’ device.
SERVICE CONCEPT (1)

- Dissemination of an alert message, including associated guidance to react
- Global coverage
- No ‘mobile’ network required, no specific user equipment required
- On-demand
- **Complementary alert system to those already operated at national level**
  - ‘the more systems, the better’
- Reach out population at large & small scale in a timely manner (~ minutes)
- Geo-fencing information is encoded in the message, so as to target only the relevant population.
  - Targetted region can be of any size.
- Message is displayed on screen when the user terminal is located within the encoded ellipse.

Example of target area for an alert message, defined by ellipse.

Ellipse radius is adjustable
The service is realised by three components:

- **Civil Protection Authorities**
- **Galileo infrastructure**
- **end users**

**MESSAGE FORMAT**

- **EWS Message format common to Galileo and QZSS now finalized, after thorough review by EC and Japan in 2022**
  - Message coded on 122 bits for transmission in the signal
  - Message format discussed with Japan space authorities since 2 years, now adopted.
    - EU-JP Joint statement soon to be published
    - **Common EWS format definition document** in preparation
    - Common format will ease service interoperability and integration in smartphones and GNSS terminals

**Common EWS Message format**
- Message Type: Alert/Update/Test/Cancel
- Country ID: ID of the country from which the alert is issued.
- Provider ID: National agency raising the alert
- Event Category: Tsunami, Forest Fire, pandemic, volcano, storm, etc
- Severity: moderate/severe/extreme
- Event Onset: Day/Hour/Minute
- Duration: in hours, from < 0.25 h to 48 h
- Target Area: 2D ellipse, with semi-axis ranging from 200 m to 2500 km
- Instructions: Generic instructions taken from library
- Additional information for message customization
FIELD DEMONSTRATIONS in EUROPE

• Several field demonstrations will be run in 2023
  - 4 locations selected for the demonstration campaign: France, Germany, Cyprus, Belgium/Netherlands/Luxembourg.

• Demonstrations will be used to test the service characteristics, the performance, and to show case to civil protection community
  - 4 thematic hazards will be tested: industrial incident (2x), tsunami/wild fires, floods
  - Several use cases will be tested:
    - various sizes of alert area (small scale, regional scale)
    - Cross border events (filter out not relevant message at Rx level)
    - Hazard with high dynamic of evolution (high cadence of messages)
    - Several KPIs will be measured (latency, probability of reception, compliance of message received)
    - Broadcast of several different alerts at the same time (peak in broadcast requests)

• Window for the demonstrations: Q1-Q3 2023
BUILDING THE SERVICE

• Service concept confirmed at Galileo programme level.
  - Engineering of the service on-going since 2021.
  - Target date for initial service: 2024 / Field demonstrations in 2023

• Multilateral coordination:
  - Civil protection authorities from EU Member States, for confirming service design.
  - Other interested nations invited to learn more about the potential offered by the common format of the alert message.
    ✓ Interoperability is key to ensure broadest reception by as many people as possible, worldwide!
  - Further promotion and use of such international service (e.g. through UN-ICG).
  - Dialogue with mobile manufacturers and operating systems developers to introduce the ‘decode & display’ functionalities in the firmware.
    ✓ Qualcomm, Broadcom, Mediatek, Apple, Google, STM, u-blox, Sony...
In order to accelerate the deployment of this service, a phased implementation approach has been adopted by the Programme, where **Phase 1** leverages on minimum modifications to the system:

- **Updates** done at the edge of the system, at **service facility level**;
- **No modification** to system interfaces or core infrastructure;
- **Reutilisation of existing signals**.

Thanks to a number of synergies with EWS, the Return Link capability of the Galileo system (part of SAR/Galileo) has been selected as the solution to support Phase 1 of EWS.

*Source: modified SAR-SDD*
Phase 1 will already fulfil many of the core needs of EWS (e.g. number of events, capacity, service monitoring, etc), thanks to the characteristics of the Return Link dissemination chain, e.g.:

<table>
<thead>
<tr>
<th></th>
<th>Phase 1 mission (through SAR RLM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWS events</td>
<td>6000 per year</td>
</tr>
<tr>
<td>EWS messages</td>
<td>120000 per year</td>
</tr>
<tr>
<td>EWS latency</td>
<td>&lt;1min (priority, cannot be guaranteed in very high loads)  &lt;10mins (normal)</td>
</tr>
<tr>
<td>EWS frequency band</td>
<td>E1b</td>
</tr>
<tr>
<td>EWS false alarm</td>
<td>1 out of 20y (cannot be guaranteed)</td>
</tr>
<tr>
<td>Service Feared Events</td>
<td>Availability/integrity/misuse/image (cannot be guaranteed end-to-end)</td>
</tr>
</tbody>
</table>
HIGH LEVEL ARCHITECTURE (PHASE 1)

Civil Protection Authorities

Clients (EWS-ADPs)

EWM Request (CAP xml format)

Internet

EWS-PC (prime) (Backup)

Updated Return Link Service Facility

EWS Receiver

Alert

RLM containing EWS data (E1b)

DDN

Ground Segment elements

Ground Segment

EWS Receiver

EWMR (EWS transmission request)

Service Facility – Ground Segment Interface

DDN
The primary objective of the Galileo EWS remains the same across Phases 1 and 2.

Phase 1 aims at enabling EWS capability in a short time frame, without modifying the core infrastructure. It allows initial operation, lessons learnt, better understanding of service features and triggers market adoption actions.

The design of **Phase 2** introduces evolutions with respect to the implementation of Phase 1:

- The future GSEG design will offer more capabilities for the EWS-related functions:
  - Satellite selection algorithm and repetition handling at the GSEG,
  - Dissemination in both in E1-b and E5-b,
  - Improved end-to-end latency,
  - Authentication via OS-NMA on ground or onboard, as per system config.,
  - Implementation of the required severities
    - Additional GSEG repetitions in case of need,
    - Long CRC at generation and link auth. till SSEG,
    - S-band/ISL and/or C/band uplink;
- A specific SiS message allocation has been designed for the baseline of Phase 2:
  - Dissemination as a single 122 bits word, over at least 2 satellites,
  - Flexible use of I/NAV pages via overwrite capability.
THANK YOU

http://ec.europa.eu/galileo