FINAL PROJECT REPORT PACKAGE

- The completed and signed forms included in this package should be sent by email to **jerico.tna@ismar.cnr.it** and **jerico@ifremer.fr** within **one month after the completion of the TNA project** by the User Group Leader.
- **Refunding of the TNA reimbursement to the user group will be processed as soon as these forms will be submitted**.
- The TNA project report will be published in the JERICO NEXT website. The report, as well as other information collected with the attached forms, will be used to report to the European Commission.
- **Please note that any publication resulting from work carried out under the JERICO NEXT TNA activity must acknowledge the support of the European Commission – H2020 Framework Programme, JERICO NEXT under grant agreement No. 654410.**

The JERICO-NEXT project has received funding from European Commission's H2020 Framework Programme under grant agreement No. 654410.

The completed and signed form below should be sent by email to **jerico.tna@ismar.cnr.it** and **jerico@ifremer.fr**

TNA PROJECT REPORT

1. Project Information

Proposal reference number[1]	JS3_CALL_2_4043_OpenLevo
Project Acronym (ID)[2]	OpenLevo
Title of the project[3]	Enhancing Wave Measurement with energy autonomous Wave Sensing Buoy
Host Research Infrastructures[4]	MARINE INSTITUTE (MI) Ireland SmartBay (SMARTBUOY)
Starting date - End date[5]	01st Dec 2021 – 30th Nov 2022
Name of Principal Investigator[6] **Home Laboratory** **Address** **E-mail address** **Telephone**	Georgios Koutras Openichnos Hellas Private Company An. Papandreou 57, 71305, Heraklion Crete **koutras@openichnos.com** +306976791019

2. Project objectives[7] (250 words max.)

OpenLevo is a wave measuring system that consists of a small buoy with a solar panel and a communication module. The project submitted for Jerico TA aimed at deploying this system in SmartBay for data comparisons and validation and to further develop the system. The deployment made use of the facilities and services in SmartBay.

A major objective of that development was to have a cost-efficient buoy for wave measurements producing different parameters associated with wave motion such as Heave, Direction, Period and Water Temperature.

Moreover, it provided us a real time wave analysis transmitting the collected data via satellite.
Additionally, the applicability of OpenLevo solution was tested in a maritime environment with long term field exposure under harsh sea conditions.

[1] Reference number assigned to the proposal by the TNA-Office.
[2] User-project identifier used in the proposal.
[3] Title of the approved proposal. The length cannot exceed 255 characters
[4] Name of the installation/infrastructure accessed with this project. If more than one installations/infrastructures are used by the same project, please list them in the box.
[5] Specify starting and end date of the project (including eventual preparatory phase before the access).
[6] Fill in with the full contact of the Principal Investigator (user group leader).
[7] Write the short-term, medium and long-term objectives of project. Use no more than 250 words.

The activity described in this report has received funding
from European Commission's H2020 Framework Programme
under JERICO-NEXT project, grant agreement No. 654410.

- Energy autonomy of the device was tested.
- Weather proofing of the device was long term tested under extreme environmental conditions (heat, wave energy, salt).
- Total endurance in real maritime conditions was tested.

SmartBay facility covered all the range of our objectives as it allowed us to verify all those measurements.

3. Main achievements and difficulties encountered (250 words max.)[8]

The installation of OpenLevo in oceanographic observing platforms provides us significant added value as a) it increases the efficient transmission of Wave data in 100% global range, b) it leads to future research in developing cost efficient Wave Sense buoys with low energy requirements and state of the art communication capability.

The proposed SmartBay facility offered us a unique opportunity for the testing of OpenLevo in a whole new market, that of the marine observing platforms. The installation and testing of the device in a wide range of environmental conditions gave us the possibility to fully exploit and test the operational capabilities of the product. Moreover, the SmartBay facility is located in areas which were ideal for satellite tracking solutions.

4. Dissemination of the results[9]

The outcomes of this activity will be presented by the Openichnos in industry and operational oceanography meetings and workshops. When the experiment started Openichnos announced this activity in the Greek Press.

5. Technical and Scientific preliminary Outcomes (2 pages max.)[10]

This project's primary goal was to test the OpenLevo Wave Buoy in Galway Bay. This region's varied sea states provide an ideal testing environment. Galway Bay has a depth of roughly 20 meters and generally calm sea conditions.

In addition, Galway Bay is home to a WAVERIDER (1) buoy, a standard for measuring waves that enables us to use the data as a benchmark. Galway Bay saw the deployment of the OpenLevo from July till August of 2022. Marine Institute was in charge of the installation.

The device installed in the JERICO S3 infrastructure operated continuously for this period of exposed to the marine environment without any maintenance or servicing procedures. The deployment period and the challenging climatic conditions at the deployment site demonstrated the OpenLevo device's reliability.

A ship of Marine Institute made the installation for OpenLevo. Deployment was made according to

[8] Describe briefly the main achievements obtained and possible impacts, as well as possible difficulties encountered during the execution of the project. Use no more than 250 words.

[9] Describe any plan you have to disseminate and publish the results resulting from work carried out under the Transnational Access activity in JERICO NEXT: scientific articles, books - or part of them -, patents, as well as reports and communication to scientific conferences, meetings and workshops. Highlight peer-reviewed publications. **Note that any publications resulting from work carried out under the JERICO NEXT TNA activity must acknowledge the support of the European Commission – H2020 Framework Programme, JERICO NEXT under grant agreement No. 654410.**

[10] Describe in detail results and main findings of your experiment at the present stage.

the following guidelines: there is a specific way of deploying the buoy in order to record the wave parameters. The buoy has to move freely and not be interrupted by any rope pulling it down.

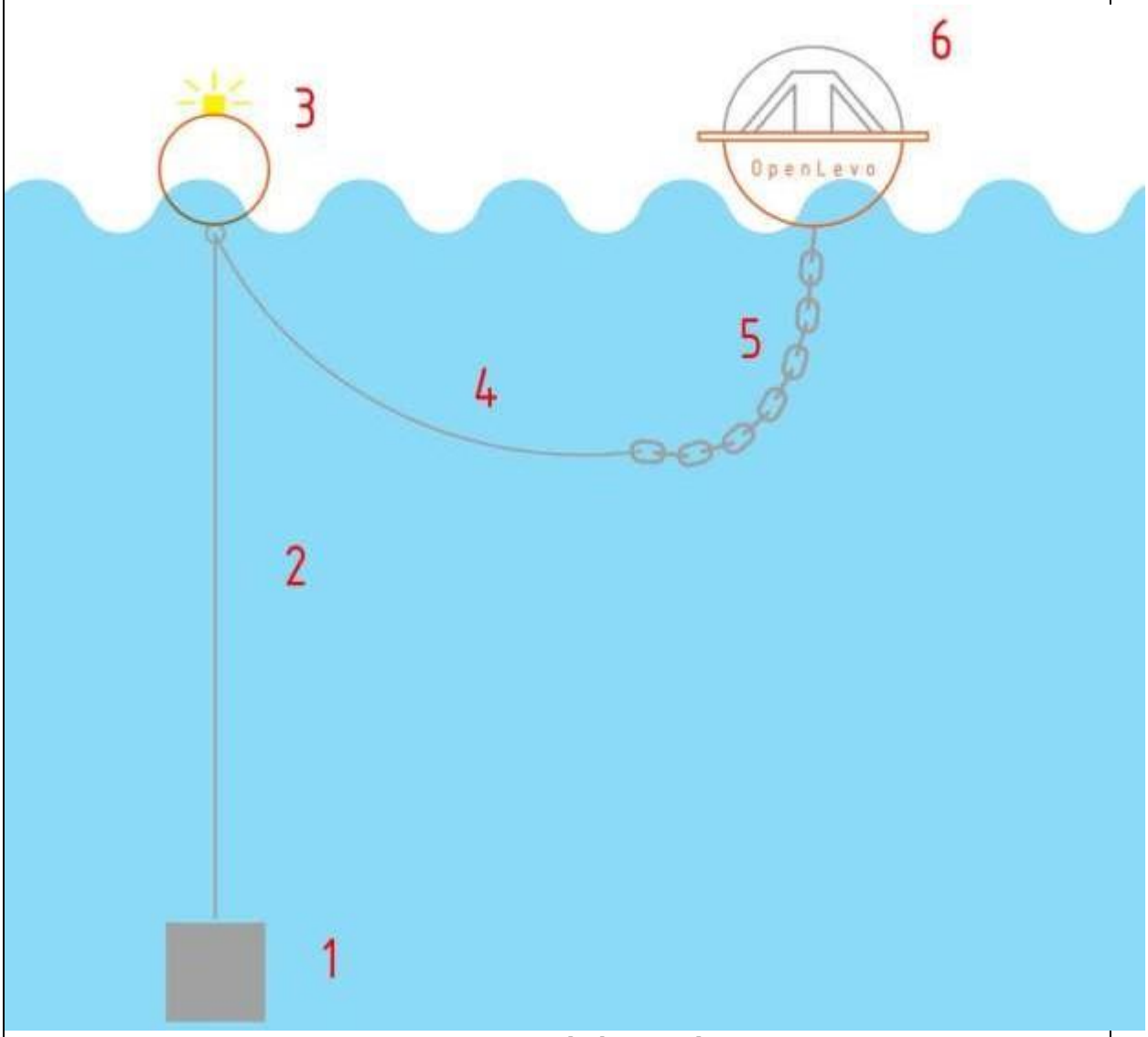

Figure 1: OpenLevo deployment diagram

1. Assistant buoy anchor
2. Assistant buoy rope
3. Assistant buoy with light indicator
4. Rope connecting the OpenLevo to the assistant buoy
5. OpenLevo Chain
6. Wave characterization buoy OpenLevo

In order to freely move and capture the wave data, the OpenLevo buoy needs to be deployed with a second buoy as an assistant in a 4 to 5 meters radius.

After the deployment in Galway Bay, OpenLevo began to collect sea measurements, which were then sent over GSM or over Iridium Satellite. Along with wave data, the buoy also communicated its GPS location and its battery status so that it can be verified that it is in the right place and its

communication parts are active. The following table presents the minimum and maximum measurements for values for the significant air wave, peak wave period and mean wave period in the deployment site whereas a more detailed report is also available. (2)

	Significant Wave Height - hm0 (m) (min-max)	Peak Wave Period - Tp (s) (min-max)	Mean Wave Period - Tm01 (s) (min-max)
SmartBay	0 – 1.6	1.70 – 10.31	1.54 – 7.11

Table 1: Minimum and maximum values for the significant air wave, peak wave period and mean wave period in the deployment site.

Preliminary outcomes

OpenLevo is a smart buoy that utilises the latest advancements in the MEMS-based sensors and IMU-Fusion algorithms to measure directional waves. The device can capture significant wave height, wave period and wave direction precisely, without any maintenance, sensing the 3D motion. Using power-efficient sensors, solar energy and satellite coverage. OpenLevo can be deployed in the sea or lakes and report meaningful wave characteristics around the world 24/7. Wave sensing buoys can improve sea forecasting models, have an important role in research programs and act as a valuable source of information for emergency situations. Galway Bay deployment gave significant insights and proper testing environment, proving our data measurement consistency.

Moreover, the OpenLevo buoy is constructed in such a way, that the center of gravity combined with the chain protects it from going upside down, and in the meanwhile being a lightweight system with a high frequency response. This had been also successfully checked through the period of testing.

A more detailed study of the results for the comparison of wave date, the geolocation information, the efficiency of transmission and their consistency will be carried out at a future period which will come as a result of OpenLevo final calibration.

References:

(1) Live wave data from the wave rider can be downloaded over a given timeseries from the following web portal: https://www.digitalocean.ie/Dashboard/Galway Select: SmartBay WaveBuoy and download data.

(2) OpenLevo measurement data throughout Galway Bay deployment https://www.dropbox.com/sh/elwaxs08gbq6j33/AACyTishY1CE4yigReSL4I17a?dl=0

Heraklion, 20/12/2022

Location and date

Signature of principal investigator

The completed and signed form below should be sent by email to **jerico.tna@ismar.cnr.it** and **jerico@ifremer.fr**

USER GROUP INFORMATION - Ireland SmartBay (SMARTBUOY)

Project Acronym[11] [insert acronym]	**Researcher**			**Employing organisation/Home institution**			**Activity Domain (Discipline)**
	Name	**Gender**	**Nationality**	**Name**	**Legal Status**	**Country**	
Project leader (Principal Investigor):	George Koutras	M	Greek	Openichnos Hellas Private Company	SME	Greece	Information & Communication Technologies
Project user 1:	Themis Koutsouras	M	Greek	Openichnos Hellas Private Company	SME	Greece	Information & Communication Technologies
Project user 2:							
Project user …:[12]							

Heraklion, 16/12/2022

Location and date

Signature of principal investigator

[11] User-project identifier used in the proposal.
[12] Adapt the table to the number of users in the project group (project user 1, project user 2, … project user n, …)

The completed and signed form below should be sent by email to **jerico.tna@ismar.cnr.it** and **jerico@ifremer.fr**

CONFIRMATION OF VISIT FOR TRANSNATIONAL ACCESS

Conall O'Malley

Marine Institute

Renville,

GALWAY

IRELAND

Dr. Georgios Koutras

Openichnos Hellas Private Company

Openichnos Hellas Private Company

57, Andrea Papandreou

Heraklion, 71305

Greece

koutras@openichnos.com

I, **Conall O'Malley**, herewith confirm that the following project was carried out at our infrastructures **Ireland SmartBay (SMARTBUOY)**, in the context of JERICO NEXT Transnational Access:

OpenLevo.

The amount of access delivered to the project group (project users) is as follows:

<In person access> Heraklion Coastal Buoy (HCB)

	Participant name	**Duration of access (start – end date)**	**Amount of access[13]**
Principal investigator:		[dd/mm/yyyy – dd/mm/yyyy]	
Project user 1:			
Project user 2:			
Project user …[14]			
Total amount of access delivered to project group[15]:			

<Remote access> Ireland SmartBay (SMARTBUOY)

	Participant name	**Duration of access (start – end date)**	**Amount of access[16]**
Principal investigator:		[13/07/2022 – 19/09/2022]	68
Project user 1:			
Project user 2:			

[13] For <In person access> the amount of access is defined as the time, in days, spent by the user at the infrastructure for this project, including weekends and public holidays (e.g., a scientist who spent 4.5 days at the infrastructure must indicate '4.5').

[14] Please expand, if necessary.

[15] The total amount of access of the project group is the sum of days when users were hosted (if users 1 and 2 have stayed at the infrastructure the same period, for instance from 1 to 5 March 2017, the total amount of access is 5 days). Please use / round to half days where appropriate.

[16] For <Remote access> the amount of access is defined as the time of remote use of the infrastructure.

Project user …[24]			
Total amount of access delivered to project group[25]**:**			**68**

Heraklion,16/12/2022

_____ _____

Signature of principal investigator[17]

Location and date

Galway, 26/1/2023

_____

___ _____

Signature of access provider

[17] The document must be 1) signed by the project leader; 2) signed by the access provider; 3) sent to the TNA office by the access provider (please respect order).