TNA PROJECT REPORT

1. Project Information

Proposal reference number	JN_CALL_2_9
Project Acronym (ID)	LETS-SAT
Title of the project	Leverage tracking efficiency on oceanographic buoys using an energy autonomous solution transmitting satellite messages
Host Research Infrastructure	Heraklion Coastal Buoy (HCB) Saronikos buoy (SB) Athos buoy (AB)
Starting date - End date	01/06/2018 – 31/05/2019
Name of Principal Investigator **Home Laboratory** **Address** **E-mail address**	Georgios Koutras OpenIchnos Ltd OpenIchnos HQ, 18, South Street Valletta VLT 1102, Malta koutras@openichnos.com
User group members	Georgios Koutras, Themis Koutsouras OpenIchnos Ltd, Malta

2. Project objectives

The LETS_SAT TNA project aimed to install and test the OpenIchnos tracking technology in fixed point oceanographic platforms under the influence of a wide range of environmental conditions (winds, waves, temperature, sea sprays etc), through the simultaneous access on three platforms for extended periods of time (1 full year) in order to fully exploit and test the operational capabilities of the product.

Although OpenIchnos tracking technology was initially developed for moving vessels, given the size and characteristics of the marine observing community (low energy, harsh environmental conditions etc), the technical and practical suitability of the system integration was an obvious challenge.

The specific objectives of the LETS-SAT project were:

1) To allow the installation of more efficient and sophisticated tracking device on moored oceanographic buoys. The geofencing module will be developed and embed to allow intelligent monitoring, thus utilizing efficient tracking and alerting for the buoys. This will provide both a primary and a backup geolocation system for fixed platforms.

2) Applicability of OpenIchnos solution in maritime environment in long term field exposure under harsh sea conditions.

3. Main achievements and difficulties encountered

The preparatory actions of the project started on the 1st June of 2018 and included the installation and the testing of the OpenIchnos modules in two types of buoys of the Poseidon network. The equipment

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was secured on the buoy masts and the whole set up was tested on land, attached in the same type of buoys as the ones in the sea, in order to secure that the OpenIchnos modules transmission and power charging through a dedicated solar panel were not affected by the buoy equipment and apparatus. The OpenIchnos trackers were deployed at the sites during the Poseidon network maintenance cruise that took place between 18th and 26th of June 2018.

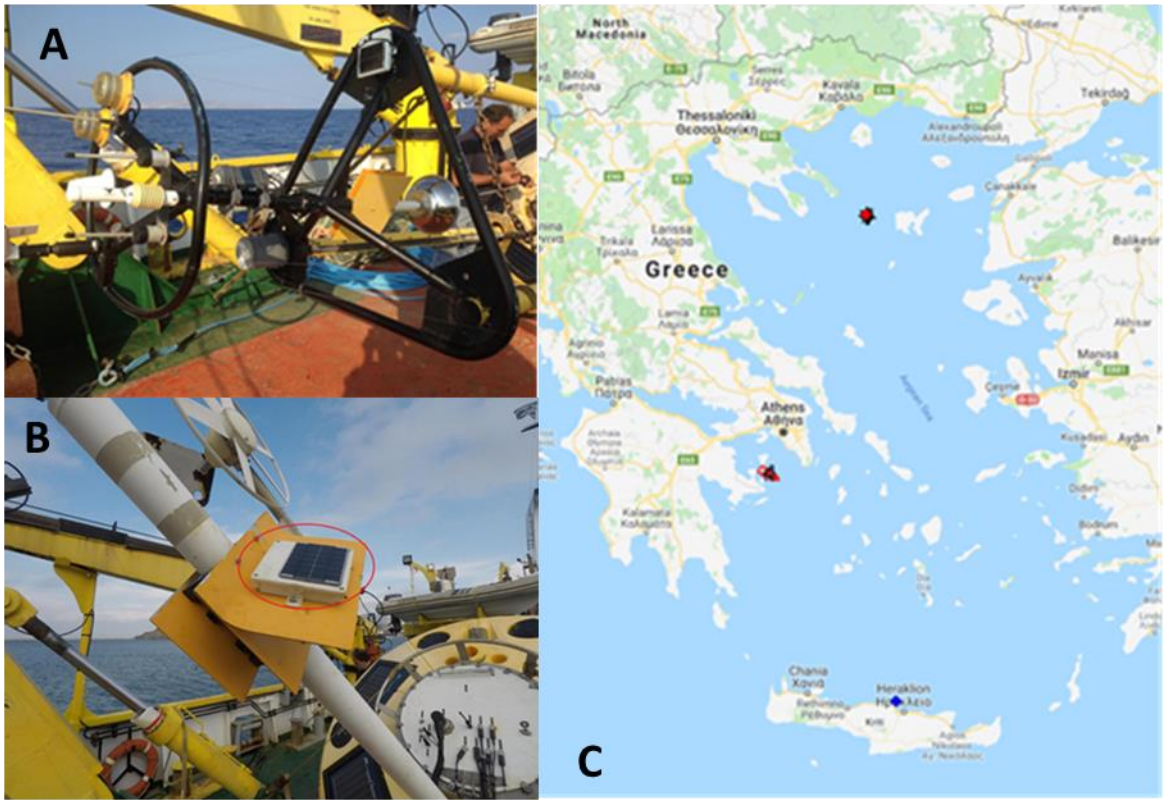

Figure 1: The OpenIchnos tracking modules installed in Seawatch (A) and Wavescan (B) buoys and the location of the TNA stations as provided by the OpenIchnos on-line application (C).

The final deployments sites were:
Herakleion Coastal Buoy (HCB): Lat 35.4339, Lon 25.0775
Saronikos Buoy (SB): Lat 37.6099, Lon 23.5669
Athos Buoy (AB): Lat 39.9635, Lon 24.7226

4. Dissemination of the results

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

5. Technical and Scientific preliminary Outcomes

The devices installed in the JERICO TNA infrastructures operated continuously for a full year exposed to the marine environment without any maintenance or servicing procedures. The long deployment

period and the harsh environmental conditions of the deployment sites (Table 1) proved the seaworthiness of the OpenIchnos tracking device. The geofencing software was tested too in a realistic environment during the deployment period (Fig 2 and 3) providing useful information about the station's status and security.

	Air temperature (min-max)	Wind speed (min-max)	Maximum wave height Hmax (min-max)
Herakleion Coastal Buoy	9.72 – 37.425 C	0 – 18. 228 m/sec	0 – 6.97 m
Saronikos buoy	12.206 – 35.91 C	0 -15.117 m/sec	0 -1.69 m
Athos Buoy	8.25 – 28.075 C	0 – 19.72 m/sec	0 -7.39 m

Table 1: Minimum and maximum values for the air temperature, wind speed and maximum wave height in the three deployments sites.

During the access period on the Poseidon network JERICO stations two incidents that triggered the HF location data transmission of the OpenIchnos equipment, took place:

Mooring line failure: On September 27, 2018, an extratropical storm developed in the eastern Mediterranean Sea. Water temperatures of around 27° C supported the storm's transition into a hybrid cyclone, with a warm thermal core in the center. The storm moved north eastward toward Greece, gradually intensifying and developing characteristics of a tropical cyclone. During this incident the mooring line of the Athos station broke and the buoy started drifting in the North Aegean Sea. Despite the severe weather conditions, the OpenIchnos module continue to transmit HF location data allowing the HCMR stuff to monitor the station location and proceed with the recovery procedures. The same module was installed next in the E1m3A station in the Cretan sea.

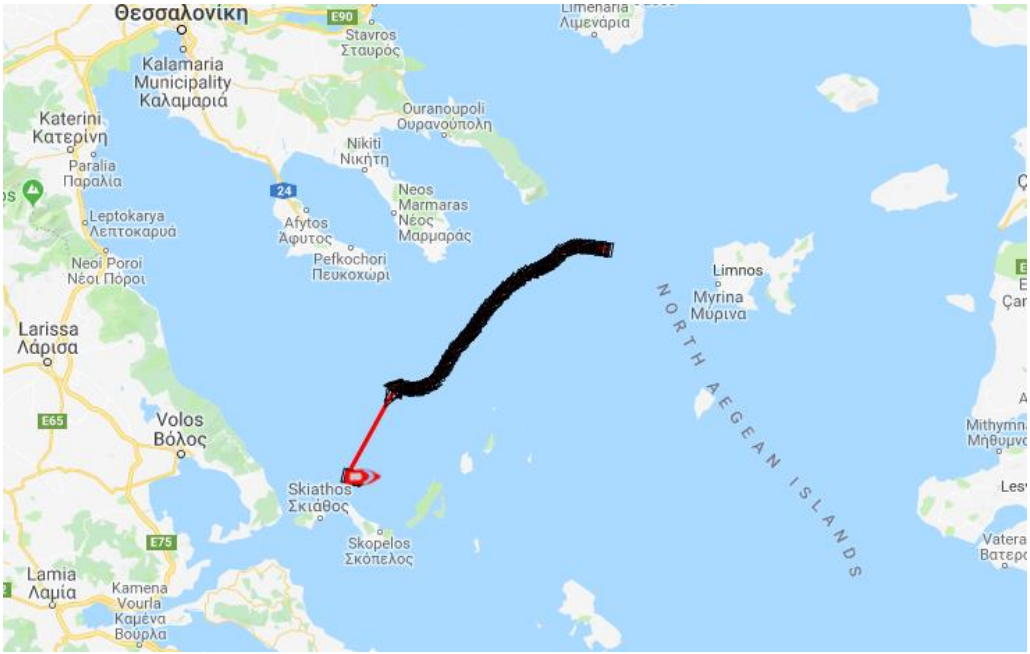

Figure 2: The Athos station drifting course in the North Aegean sea after a mooring line failure (27/09/2018-01/10/2018) before the recovery by the R/V AEGEO.

Station vandalised: On May 7, 2019 a sailing boat approached the E1m3A station and the passengers removed equipment from the buoy including the OpenIchnos tracking module. The device was transmitting data continuously so the boat course was detailed tracked and the equipment was recovered by the coast guard when the boat docked at the Rethimno marina.

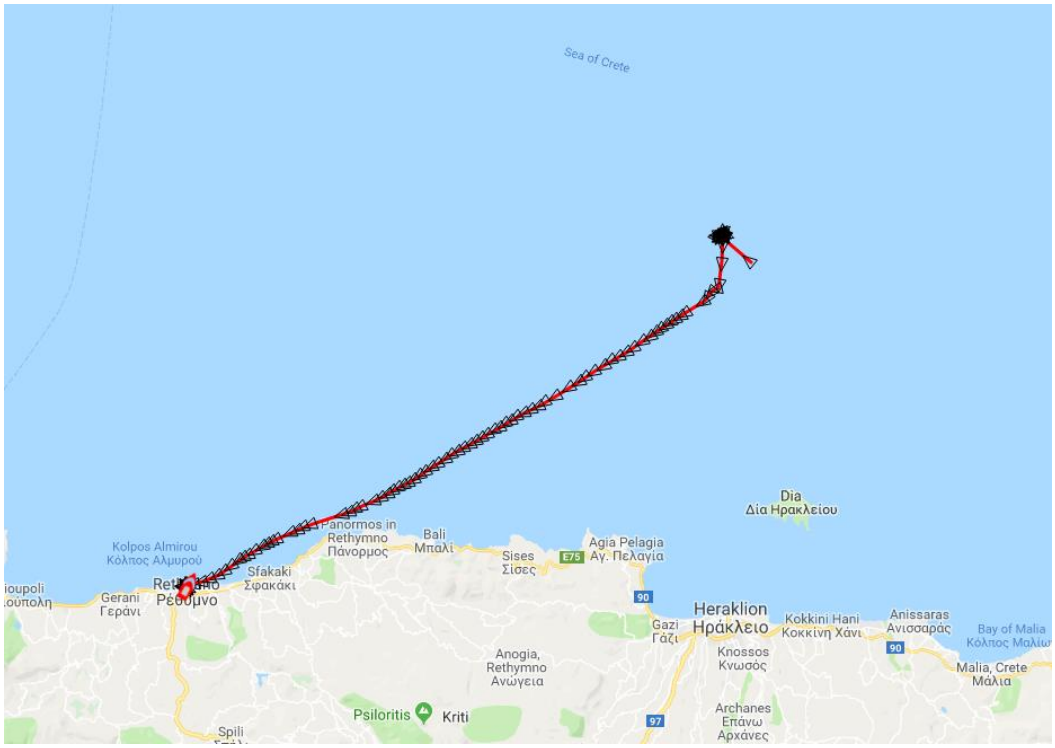

Figure 3: The course of the sailing boat that vandalize the E1m3A station, removed the OpenIchnos module and approached the Rethimno harbour. (05/05/2019).

The majority of traditional tracking systems need a power source and are limited to GSM coverage areas. Thus, neither have continuous transmission of their trace due to lack of power supply nor cover any possible area their assets may be. Moreover, solutions based on GSM network covers 50% of the terrestrial globe, leaving deep sea and coastal waters out of its range.

Openichnos tracking solution addressed these challenges, as its tracking device is designed and manufactured with very low power consumption, and equipped with a solar panel. This makes OpenIchnos a really autonomous service, able to work for 60 days without sunlight and reach full charge in just 3 days of sunshine. Furthermore, Openichnos uses the Iridium satellite constellation for transmitting data, achieving true global coverage while the asset's owners are able to monitor the whole tracking history through their PCs and mobile phones.

The installation of Openichnos in oceanographic observing platforms provides significant added value as
a) it increases the efficient tracking in 100% global range,
b) provides a reliable and autonomous primary and back-up solution for the high frequency tracking of the observing platform,
c) it increases the efficiency in case of emergency or used as a failover communication device and
d) it leads to future research in developing cost efficient observing platforms with low energy requirements and state of the art communication capability.

The proposed POSEIDON platforms offered a unique opportunity for the testing of Openichnos in a whole new market, that of the marine observing platforms. The installation and test of the device in a wide range of environmental conditions (wave, temperature, salinity, etc), through the simultaneous access on three platforms for extended periods of time (1 full year) gave us the possibility to fully exploit and test the operational capabilities of the product, transmission and their consistency especially under rough sea conditions.

A more detailed study of the results for the comparison of geolocation information, the efficiency of transmission and their consistency especially under rough sea conditions will be carried out when the devices will be recovered during the maintenance cruise of the Poseidon network.

References:

https://en.wikipedia.org/wiki/Mediterranean_tropicallike_cyclone#Zorbas_(27_Sep_%E2%80%93_1_Oct_2018).

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