MAPLE TRANSPONDER

Maritime Aids for Protection of Life in Extremes

Amnesty International report 3,500 people die per year attempting to cross the Mediterranean in ill-equipped vessels from the North coast of Africa to Europe with the number expected to rise. Dependent on the route taken, this represents a death rate of up to 1 in 20 of those attempting to cross, with young children frequently amongst the first victims. Such voyages are often undertaken at night in overcrowded, poor conditions, with no personal safety provisions, and crossing one of the busiest shipping lanes in the world. Globally, UNHCR report near 348,000 boat refugees in 2014. Vessels are increasingly small or poorly maintained in response to policies to destroy trafficked boats to avoid reuse, or to avoid detection from sophisticated surveillance and security countermeasures and so highly vulnerable. Often, they may be little more than inflatable dinghies never intended for open waters with no safety or navigational aids, at the mercy of weather, other vessels, and human error without skilled pilots. In other cases, larger vessels more suited to the open waters may be abandoned or sunk with their human cargo still aboard by traffickers attempting to escape their own capture, or with migrants left in the water for pick-up by other vessels.

It is accepted that whilst stringent prevention at point of exit offers a first line of defence from a border control perspective, preventing all crossing attempts has and will continue to prove impossible. Although some vessels are equipped to call for assistance either intentionally within target territorial waters or when in distress, many cannot, and accurate position reporting is rare. Therefore, a very low cost and last ditch emergency MAPLE Transponder is proposed, activated at the individual discretion of the migrant should they get into distress. The MAPLE Transponder utilises the Global Maritime Distress Safety System (GMDSS), able to be received by existing maritime infrastructure such as other vessels, coastguard, search and rescue assets and coastal receive stations in the vicinity. Once and only when activated by the user, the messages transmitted will contain life-saving distress and position information, as well as identification providing traceability and authentication. Such a system can reduce time spent in search, allowing more efficient rescue operations maximising the effectiveness of the limited resources available. Increasingly, space-based receivers are becoming available which will relay the signal in real-time providing global awareness, which could include NGOs responding to migrant issues. Further, and given alleged refoulement violations under Article 33 of the 1951 Refugee Convention where asylum seekers have been towed out of territorial waters to avoid processing claims, MAPLE provides policing and monitoring capability.

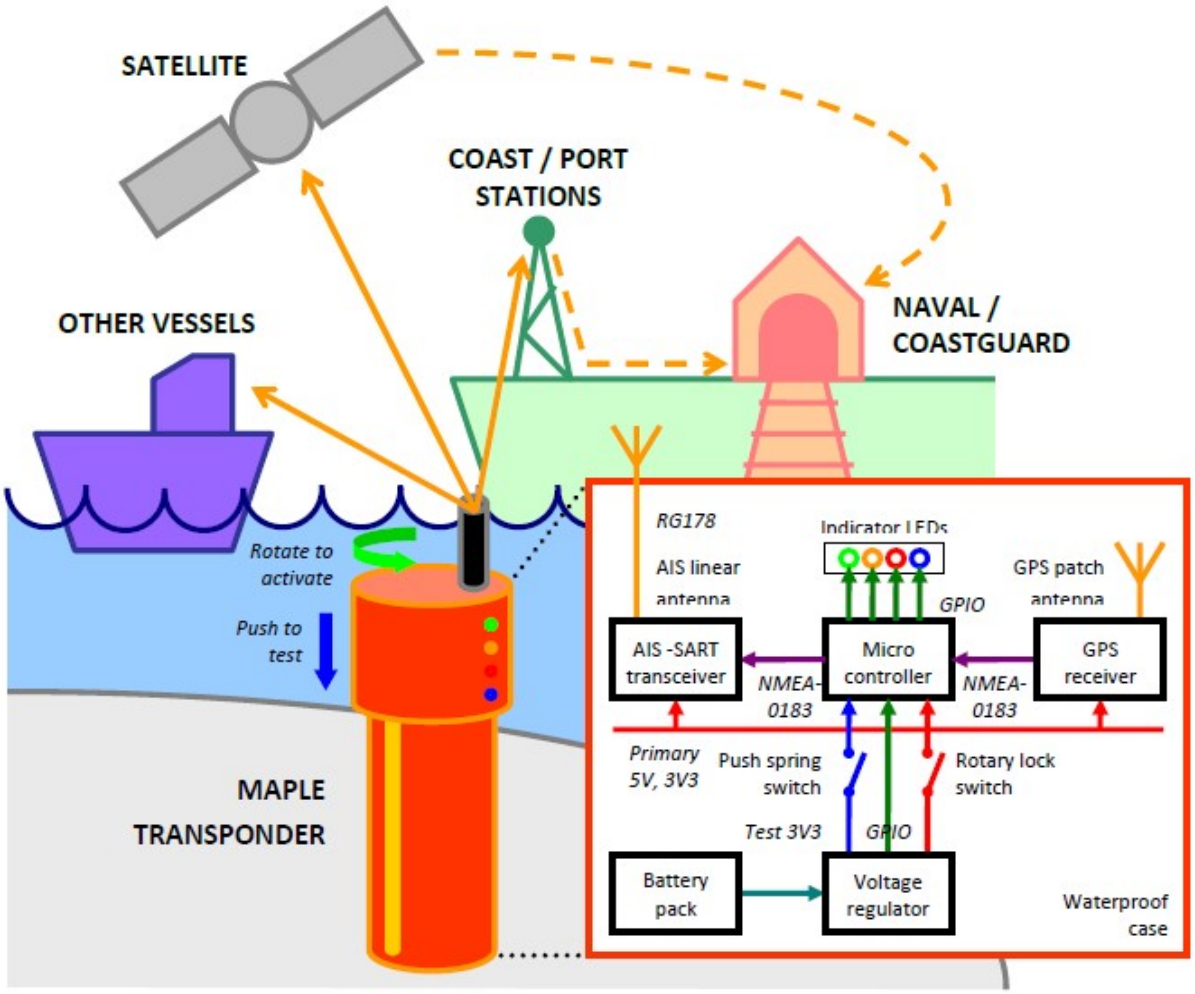
Mechanisms to distribute the MAPLE Transponders to at risk individuals using either existing distribution networks within Europe's diaspora communities or NGOs at refugee muster points enroute (where in existence), will be employed. Technical and logistical strategies, such as limited shelf-life, can be employed to effectively restrict the quantity distributed in-the-field at any time. A production cost of a few Euro may be targeted providing conformity to relevant regulatory standards using off-the-shelf electronics, emerging as a result of electronic miniaturisation and increased leisure marine demand. By creating a small and disposal single-function single-use system, sufficient safeguards will be put in place such that the unit will not be useful or activated except when life or death situations are encountered, therefore not compromising the GMDSS network, nor encouraging border violations and providing confidentiality and assurance to untrained users. This work will prototype the system, assess the licensing, distribution and legal considerations, and demonstrate the feasibility of the approach, in order to define a candidate solution to take forward for production and in-the-field tests.

1. OBJECTIVE

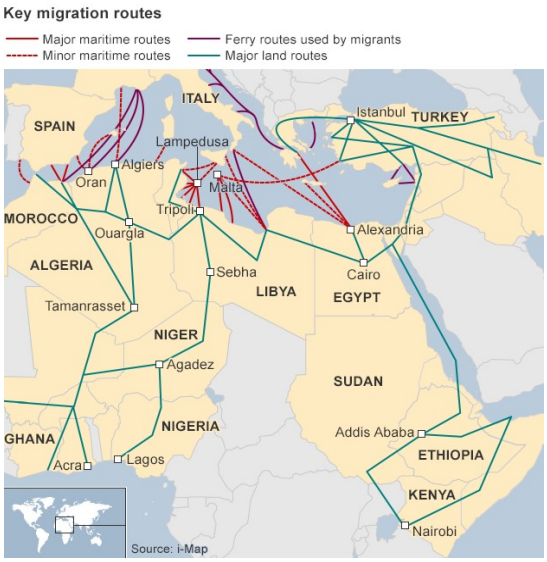
The MAPLE Transponder will alert authorities and nearby vessels to distress so maximises the opportunity to save the lives of boat refugees, helping to rapidly inform of the situation unfolding, protect other civilians and assets from unwitting involvement, and uphold human rights law.

2. BASELINE ARCHITECTURE CONCEPT

From January 2010 AIS-SART (Automatic Identification System Search and Rescue Transponder) messages have been standardised (IEC 61097-14 Ed 1.0) within the GMDSS (Global Maritime Distress Safety System), providing an effective way for communicating distress, supplementing existing EPIRB infrastructure. AIS has an advantage over existing voice and message only SART systems in that the alert data is displayed visually on receiving system displays, and growing automation and integration with search and rescue services. Since its incorporation a number of implementations both personal and vessel centric are available for commercial application. Using microelectronics developed to serve this market, a reduced functionality implementation of such a system is proposed. Previous work and products have demonstrated AIS-SART systems to capable of be received by existing maritime, land, and recently space assets, despite their lower transmission powers and specification compared to traditional AIS Class A transceivers.



The MAPLE Transponder will necessarily be simple to use and robust. On the rotation of a single-use mechanical switch the unit will be activated indicated by an amber LED and will first acquire a GPS lock providing position and timing information. Timing will facilitate synchronisation with the AIS network making the unit ready for transmission, indicated by a green LED. AIS standard Message #1 (containing position information) and Message #14 (containing SART status) reports will be transmitted in bursts periodically following the AIS protocol here implemented as POTDMA, designed to maximise probability of message reception in rough sea conditions to assets such as coastguard, other vessels, coastal stations within the vicinity (typically 10 km) and satellites in Low Earth orbit. Based on agreed protocol, using an identifier which identifies the transmission as a boat refugee in distress, appropriate responses in line with GMDSS and the International Maritime Organisation (IMO) regulations can be implemented to save their lives. Given space surveillance, international monitoring can confirm or highlight potential human rights violations. After a critical period generally 24 hours, in line with survival and rescue efforts, the battery will be drained and the unit cease to function. A test button will confirm the system is functional without activation, lighting a blue LED on pass, and red LED on fail; a restricted life span of the order 3-12 months may be incorporated ensuring those distributed do not remain in circulation without use.



There are a number of aid agencies including Médecins Sans Frontières and Jesuit Refugee Service currently operating within North Africa; however, given the chaotic nature of the journey and an as an alternative, diaspora communities within Europe with links into refugees could help in distribution.

Instructions on usage will be very simple with only two functions: activate and test, and four indicator LEDs. There is a very strong need to limit units in circulation to prevent overloading of critical maritime infrastructure. Conservative estimates for distribution would be 8-10,000 for a given muster point, to be confirmed by detailed modelling and lower number, gradually scaled field trials. Further, a built in shelf-life following distribution can be implemented, ensuring that units cannot be deliberately or naturally stockpiled. Mirror services for collecting units following a successful crossing may also be feasible, especially using a reward on return model. Rather than financial cost of the unit, return again minimises the number of units in circulation at any one time, given the limitations to numbers of AIS broadcasts.

Given the potential non-humanitarian applications, a sustainable business model may be secured in the longer term through development and further commercialisation of the MAPLE Transponder to serve other

markets, so helping to subsidise humanitarian efforts. In particular, building upon opportunities opening up with the emergence of global coverage from space-based receivers linking into existing networks, to provide safety of life services.

3. USE CASES & ASSURANCE

Initially, the unit will be targeted at users attempting crossings from North Africa to Europe, however similar requirements are anticipated in other regions. For example and owing to current conflict, Yemen is the largest source of boat refugees, UNHCR estimate 127,000 fleeing across the Gulf of Aden to Africa in 2014. Those making the crossing to Australia typically from Indonesia may be another early target, given the large open water, and danger of attempting this crossing,

- **Small vessels**; use by individuals or a group on smaller vessels where the craft has got into difficulty and is carrying minimum or no safety or navigational aids
- **Large vessels**; use by individuals or a group trafficked on larger vessels with aids but at risk from traffickers, or as a personal safety measure
- **Human rights**; use by individuals or a group on detainment by authorities to ensure human rights regarding asylum claims are respected

Generally, the following scenarios are considered on activation

- **Coastal**; user is within 10 km of a coast and/or busy shipping lanes therefore high likelihood that the signal will be received directly by other vessels or coastal stations allowing an appropriate response. Backup through space-based assets with potential for some delay until a near real-time network is in place.
- **Open water**; user is outwith 10 km of therefore out of and more reliant on space-based reception of messages. Currently, time for a satellite to be overhead may be up to 12 hours, before response may be tasked. Numerous programs are progressing AIS satellite receiver systems with constellations of 20+ planned. By 2018 continuous surveillance may be anticipated.

Given the proximity operations of AIS, and its role within conventional shipping for both normal operations and Safety of Life at Sea (SOLAS), the system must be assured to not pose a threat to the network integrity or other users, nor encourage crossing attempts: the alleged and highly disputed ‘pull-factor’. Fundamentally, by constraining distribution, limiting shelf-life and use of registered identifications for authentication within the message then threat posed is minimised, and given the greater situational awareness from identifying a vessel in distress can pose less of a risk to other maritime users. By severely limiting functionality such that the unit has no navigational value and acts as a one-time single-use system use beyond the use cases specified is more tightly constrained.

- **Conformity to regulations**; despite the low-cost of the unit it is both vital and feasible to demonstrate through test and analysis conformity to all relevant requirements within IEC standards to ensure the unit used in line with the use cases operates within the maritime environment, and ICNIRP guidelines related to human safety from RF emissions.
- **Network overloading**; in addition initial analysis indicates, that with the safeguards listed in place and considering the worst case of mass simultaneous usage, impact on the network for localised distributions of the order 10,000 in circulation is feasible, expected to meet demand. This can be explored in more depth as the design develops.

- **Attacks on network integrity**; consideration of hostile attacks including mass activation 'distraction' by traffickers using the accessibility and availability of the unit. Other more complex attacks have been conceptualised, given the high capacity for organisation within human trafficking networks and will be evaluated based on the prototype.
- **Protection of maritime users**; with validated message identifications, registered for example to the aid agency distributer, other vessels can evaluate the risks and their own capability in coming to the aid of those in distress and overall maritime situational awareness can be increased.
- **User safety**; given the potential for traffickers to feel resistance to the use of the unit, and see risk in users carrying them (as it may expose themselves to capture) care must be taken not to place the user in more danger in the scenarios where the trafficker accompanies the boat. The design is intended to be small and lightweight, able to be easily concealed.
- **Mitigating alleged 'pull-factor'**; given the desperate nature of boat refugee actions generally under severe duress and despite the very high risk of death it is highly unlikely that the availability of the unit will influence behaviour. Refugees are frequently at risk of real harm from traffickers and authorities throughout their journey, and therefore the crossing in itself is not a major consideration.

4. DEVELOPMENT PLAN

A number of distinct areas require attention during the initial feasibility study incorporating a range of disciplines. Based on the feasibility study, significant funding will be sought to productionise the concept ready for in-field tests expected in collaboration with NGO partners. As such it is proposed to break the work into a series of work packages, with focus on the following areas,

- **Unit prototyping & demonstration**; parts suitable for demonstrating an end-to-end prototype to a high conformity of AIS standards is possible using low cost commercial-off-the-shelf electronics and open source software packages for both the MAPLE Transponder and the receive end chain for demonstration and test purposes.
- **Diaspora community pilot**; through engagement with diaspora communities demonstrate the feasibility and identify challenges of distribution of the devices through a pilot study of routes into migration pathways.
- **Product development**; based on user needs, in particular around simplifying operational understanding, ergonomics, safety and use restriction, and other factors will be considered to generate CAD and/or 3DP prototypes.
- **AIS-SART system modelling**; detailed assessment through simulation and modelling of AIS-SART systems deployed within an existing AIS network, confirming the capacity of the network to support the MAPLE Transponder and providing detailed evaluation of threats and vulnerabilities.
- **Space-based market assessment**; space-based infrastructure will form a core element of the AIS-SART environment in coming years. An evaluation of the impact and opportunities will help to inform design decisions and architecture for next generation MAPLE Transpnonders.
- **Legal & regulatory engagement**; consultation with a range of stakeholders including immigration and trafficking specialists, human rights lawyers, frequency regulation, the International Maritime

Organisation. Given the highly regulated environment of maritime safety, careful planning to ensure buy-in will be required address core concerns and assurances.

- **NGO and authority engagement**; early engagement with NGOs active in boat refugee areas will be important to incorporate feedback into the plan as to a viable distribution strategy and updating in line and in preparation for support field trials.
- **Sustainable funding plan**; seed funding following the feasibility study, will consider both the overall strategy in deploying units, generating further development funding and the longer term sustainable revenue requirements.

5. FURTHER INFORMATION

For further information on the progression of this work, please contact us at Craft Prospect Ltd.

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