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# **AIS Binary Messages - RIP**

## **The move to Social Media**

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### ***Abstract***

**This presentation is a follow up to the paper ‘AIS Binary Message updates’ given at Hydro 2011 in Tampa and the implementation of the AIS ‘TideMet’ system proposed within it at Kilkeel, a fishing harbour in Northern Ireland. The author reviews the results of the installation, comments from local users and where the author feels these port information systems will develop in the future. The dissemination of live tide and weather information is of particular interest to VTS authorities for safe navigation of Ports and Harbors. The presentation will conclude with recent developments in using social media platforms to present the same data in a more widely accessible format.**

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## ***Background***

**For US Hydro 2011 in Tampa Ohmex gave a presentation about the status of using the updated AIS binary messages to transmit live tide and weather information directly to vessels. Details were given about the ‘TideMet’ equipment developed in conjunction with L3 Communications to accomplish this. Following the presentation Ohmex were contacted by Northern Ireland Fishing Harbours Authority (NIFHA) with the question “*would the AIS TideMet unit solve their particular problem at Kilkeel ?*”**

Kilkeel is a small fishing harbour (53° 03'N, 5° 59'W) located at the foot of the Mourne Mountains on the south east coast of Northern Ireland, approximately 20 miles east of the city of Newry. The town is a picturesque fishing harbour that is the home port to the largest fishing fleet in Northern Ireland, some 50 small to medium fishing vessels. NIFHA required a proposal for an AIS based weather information solution to their navigation problem at Kilkeel Harbour. The sea approaches to the harbour from the Irish Sea involve a dangerous 90 degree turn at the harbour entrance which could be against tide or river flows. The understated warning on the harbour website being :- ***"Harbour access is dangerous during winds force 5 or above from E to SW direction, this is due to the need to turn across the sea on entering the harbour thus causing a risk of ‘broaching’. Harbour entry or exit is not recommended during these conditions !*"**



**fig 1 - Kilkeel Harbour (from [Irish](#) Cill Chaoil, meaning "narrow church")**

### ***Kilkeel - Proposed System***

Originally, a breakwater extension was seen as the ideal way to solve the problem of vessels broaching at the harbour approaches, the proposed construction cost of the extension was not affordable. NIHFA decided that the alternative option was to manage the risk by providing information on the sea state and weather conditions at the harbour entrance. With this information Skippers of vessels could make an informed decision as to whether it was safe or not. A detailed contract of requirements was prepared by NIFHA and put out as an EU tender. In essence the contract required the installation of dual AIS tide and weather measurement equipment together with server based software to provide the following required features ....

- **Broadcast TideMet data** - Weather data to be broadcast directly from the weather station as an AIS binary message (known as a Type 8 message) that can be displayed on vessels with suitable software/display equipment.
- **Web based Internet access** - The information page updated regularly, the remaining possibility of delays in data transfer at the web site indicated by update timestamp on the presentation, information viewed on the Internet would be regarded as indicative only. This information is accessible on any Internet enabled device such as smart phones.
- **Direct safety related messages** - Directly addressed AIS safety related message broadcast from the harbour base station. Boats equipped with Class A 'MKD' transponders will receive an automated Safety Related Message (SRM) when they approach Kilkeel harbour. The message will say "Welcome to Kilkeel", to get current weather details the vessel should then reply to the welcome message and the weather data will then be sent
- **SMS message request service.**- The data can also be received via text message by texting "weather" to the server.

The contract was tendered and awarded to a group of companies acting together, with Martec Ltd acting as lead contractor, specialist AIS hardware supplied by Ohmex Ltd and bespoke software provided by Dolphin Marine Software Ltd. An additional requirement was to guarantee system hardware redundancy by installing a dual system that could be remotely switched over using secure Internet access to the system. With dual TideMet AtoNs connected to dual tide and weather sensors the system could be switched over to a second system in the event of hardware failure, calibration check or during hardware repair/maintenance, thus providing 100% system availability. The installed hardware consisted of the following major elements ...

- **AIS TideMet** - dual systems with telemetry switches in a weatherproof cabinet at the end of the South Breakwater.
- **Tide sensors** - Dual pressure sensors mounted in a combined tube at East end of pier.
- **Weather sensors** - Dual solid state weather sensors with mounting masts above TideMet installation box.
- **Control Server** - Local computer facility to provide UHF telemetry control of TideMet switches, Class A transponder and Internet connection.

## Hardware Implementation

The AIS TideMet is a set of transducers and a box of electronics (AtoN) programmed to transmit three AIS messages (type 21, 6 and 8) at predefined timings and sequence over the AIS frequencies. The transmit functions and MMSI of the AtoN are configured prior to installation. The configuration parameters specify what messages are transmitted over the air, how often the transmissions occur and sometimes the timing ‘slot’ on the VHF data link (VDL) they are transmitted over. Message 6 is defined as an Addressed Binary Message, data from a message 6 may contain a status report on the health of the AtoN or other status information such as a Safety Related Message. Message 21 is defined as an Aids-to-Navigation Report and is usually transmitted every 3 minutes containing the origin MMSI, name of the AtoN (if applicable), type of AtoN (fixed or floating), position of the AtoN and the positional accuracy. Unlike the message 6, this report is broadcast and meant to be seen by all AIS transponders. Binary Message 8 is a broadcast message containing a binary payload which content may vary depending on its parameters.

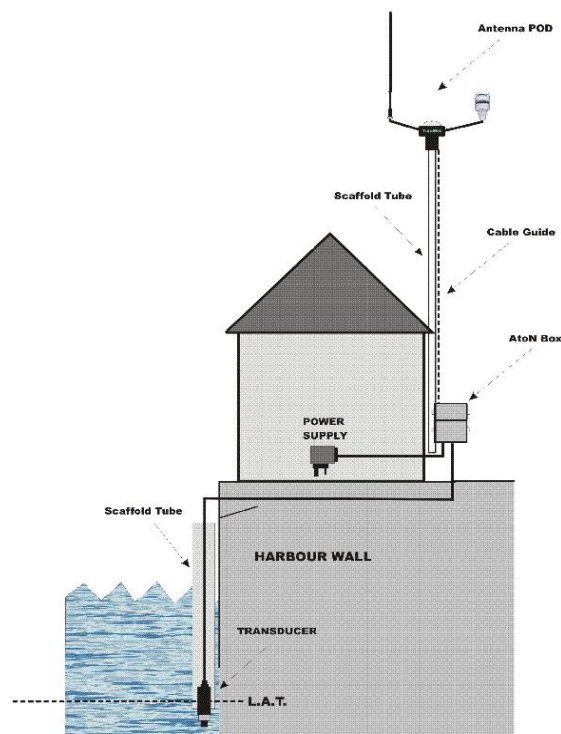


fig 2 - The TideMet Installation at Kilkeel



## System Review

One of the prime principals of transmitting weather and tide data by type 8 binary message was to reduce the amount of VHF conversation between ship and harbormaster and to avoid confusing messages concerning critical tide and weather information. The outline objective of the proposed system was to provide a system that would reduce the amount of traffic on the VHF speech channels, mainly by reducing requests to the harbour office for current tide and weather conditions. By installing a TideMet system transmitting the information over AIS it was proposed this would achieve reliable 24/7 information directly to each ship's ECDIS system.

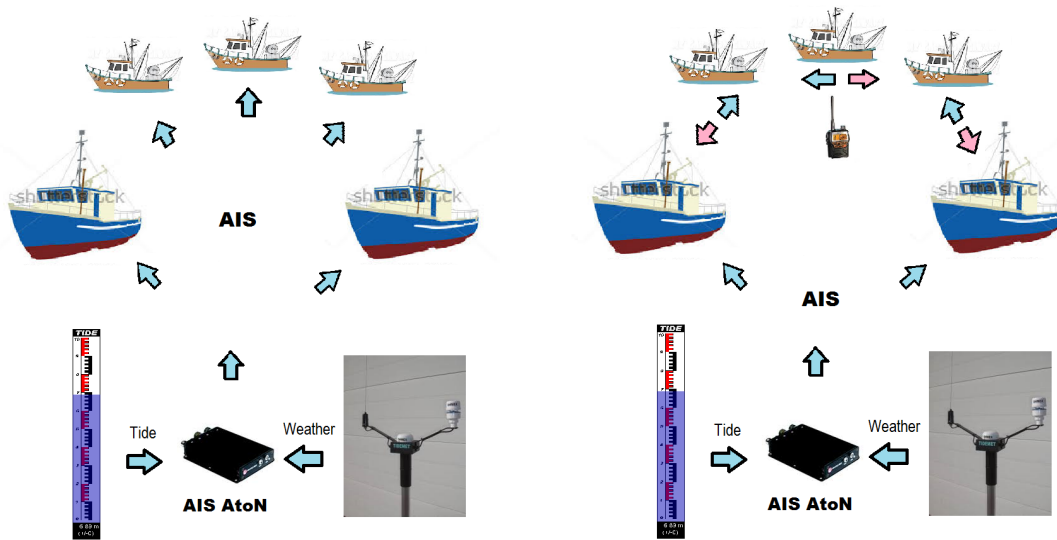


fig 3 - Proposed AtoN based System

fig 4 - Resulting 'crosstalk' System

Unfortunately the nature of fishermen has two common traits ...

- Active AIS systems that indicate where they are working are not popular.
- They only purchase equipment to the minimum mandatory requirements.

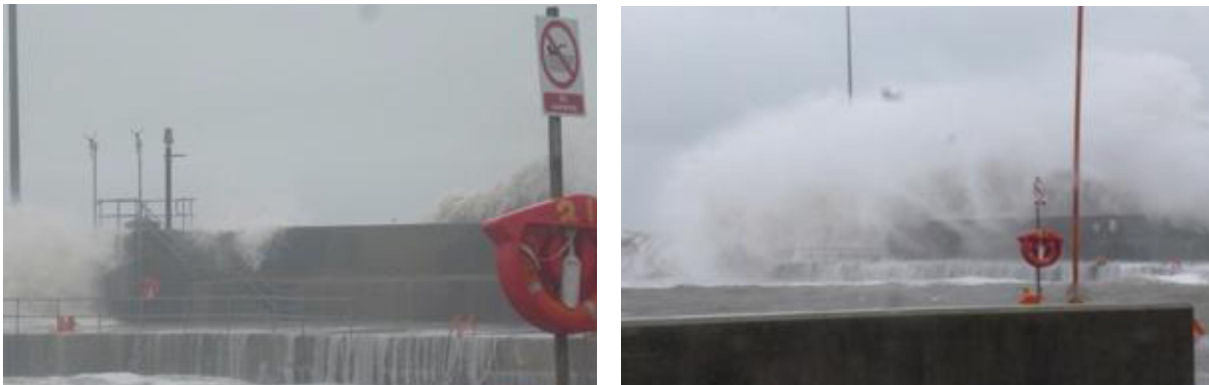
This resulted in only the larger fishing vessels equipped with full ECDIS system which could decode and view the live TideMet information. This proved counterproductive resulting in a 'crosstalk' scenario in which the smaller vessels were then not contacting the harbour office but the larger ships and requesting the data, resulting in the same amount of VHF speech traffic. The paper presented at hydro 2011 stated that a known problem was the lack of an IMO requirement for a standard ECDIS system to receive, decode and present the MetHydro data in a readable format.

*“It would be reasonable to assume that if ECDIS systems could decode binary MetHydro messages then more systems for transmitting data would exist. More importantly this equipment is not controlled or governed by IMO so if it is being used to aid navigation IMO have lost control.”*

### ***Feedback - System reliability***

As for the Kilkeel system it has been well received and is proving to be an effective reliable source of important data for safe navigation. However while relying on the SRM line to transmit basic data few boats have equipment to decode the binary message. This requires additional equipment, they tend to only carry that which is mandatory. If it was a standard feature of ECDIS systems then they would use it.

The coast of Ireland experienced a spell of extreme weather from late January to mid-February 2014 as a succession of major storms brought widespread impacts and damage. Around 6 major storms hit through this period, separated by intervals of 2 to 3 days. The period from mid-December 2013 to mid-February 2014 saw at least 12 major winter storms, and, when considered overall, this was the stormiest period of weather experienced for at least 20 years.



**fig 5 - Storms February 2014 - TideMet under waves**

During these storms the tide height pressure sensors continued to operate, the ultrasonic wind sensors suffered temporary loss when drowned in water but recovered quickly as the high winds dried them. The entire installed system was covered by huge waves on several occasions but continued to operate throughout the inclement weather period. A problem encountered was the measurement and display of the Significant Wave Height value (Hs), the measurement is not being made in a representative position for this value. Typically this value is normally a surface wave measurement in an open sea location, the tide transducer at Kilkeel is located in an area which is fully tidal and adjacent to a structure. The equipment correctly calculates the Hs value using the 4 x SD method over the measurement period, however, it was obvious that this value was being heavily influenced by tide height.

***“The equipment itself has proved to be reliable and durable as you saw from the photos during the winter. Specifically the way in which we determine wave height is still probably the weakest point. The real navigational issue at Kilkeel is that the boats are pushed around by big waves and this makes negotiating the entrance very hazardous on occasions. Better data on wave height and period in the approach channel would be helpful; but how this could be achieved without a buoy I’m not sure. Apart from that it is delivering what we wanted and needed.” - David Lindsay ( NIFHA Project Manager )***

### ***Where next - Social media based MetHydro data***

Looking to the future it appears that AIS using VHF still has a well defined role in the field of ship navigation particularly for ship's relative location and collision avoidance. However, It appears that equipment required for decoding and display of the MetHydro binary data is too complex to provide a reliable source of navigation information. The delivery medium of MetHydro data in near shore situations will probably migrate from VHF to the Internet using mobile smart phone and tablet devices, this medium offering a richer information source, with web pages used to display the AIS data. The availability of reliable 3/4G mobile connections, particularly in near shore locations where the MetHydro information is critical, will rapidly becoming the norm.

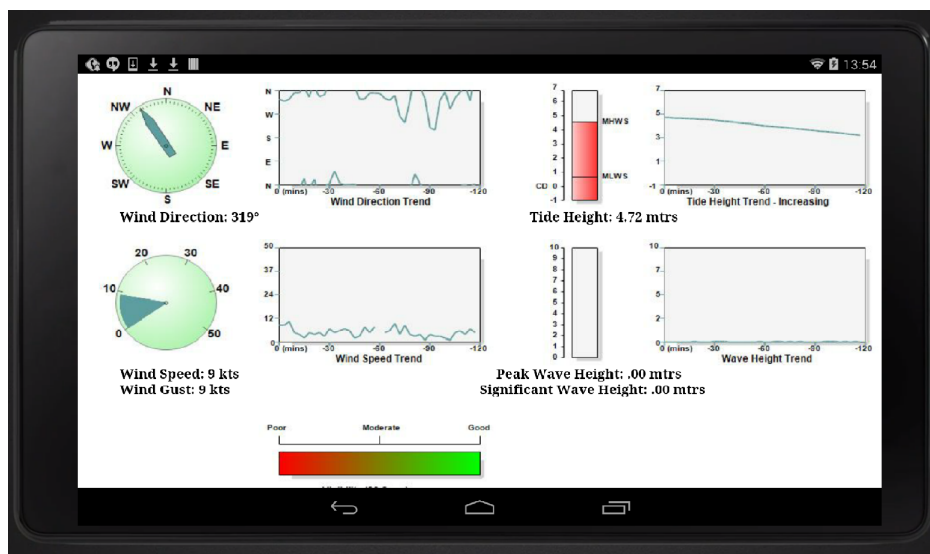


fig 6 - Tablet - www view of Kilkeel data

There are now many AIS variants of DAC/FI IDs and formats that are specific to particular locations (e.g. St Laurence Waterway and the Rhine River) that only loosely follow the IMO specification. These many variants now make the universal decoding of messages over complex and contrary to the original AIS principals of compressed data in strict format to maintain bandwidth in the VHF frequencies. To add to this confusion there are also many areas of intersection between inland and offshore authorities.

The alarming use by ports and harbours authorities of links to predicted tide values sites or to weather data sites that are not actually current 'live' data for those specific sites.

## IoT - Internet of Things

The MetHydro data transmission requires a low cost, reliable medium that is widely available; two candidates for this are standard SMS text messages or an integrated web server with delivery using HTTP messages. Although it is possible for the data measurement device to also provide an integrated web server this is not recommended for several reasons ...

- Only minimum QA checks on presented data.
- No local storage/backup facilities.
- Incoming connection bandwidth will be severely limited.

Ohmex demonstrated a low cost Tide Gauge and Weather sensor system that collected data and posted it to Twitter at 10 minute intervals. The PortM8 equipment used was an autonomous low power integrated tide gauge and weather station that can be powered by a small low voltage power adaptor or by a solar panel and rechargeable battery arrangement. The demonstration gauge was an Ohmex PortM8 instrument programmed to send an SMS text message over a simple mobile phone modem every ten minutes.



fig 7 - Demonstration MetHydro data using Twitter

By using Twitter as the information provider service the current MetHydro data can be viewed by 'following' the particular account. In addition using Twitter data storage provides the following facilities ...

- Gauge location information embedded in tweets.
- UTC timestamp embedded in data tweets.
- Last two days tweets available directly on-line.
- User controlled tweet 'following' and distribution
- Data Tweets available as direct SMS message.
- Data available by mobile web applications and clients.



**Example 'Cloud' based system using Twitter**

During an exhibition at the Southampton National Oceanographic centre in June 2013 Ohmex demonstrated a low cost Tide Gauge and Weather sensor system that collected data and posted it to Twitter as SMS messages. Twitter is a real-time information network service that connects to the latest information on a specific account the user finds interesting. At the heart of Twitter are small bursts of information called Tweets. Each Tweet is up to 140 characters long, brief but concise information packets. For the demonstration data posted by the PortM8 instrument to Twitter was used as the information server, a PHP website was set up to show how the Twitter data could be retrieved and displayed as graphic information.

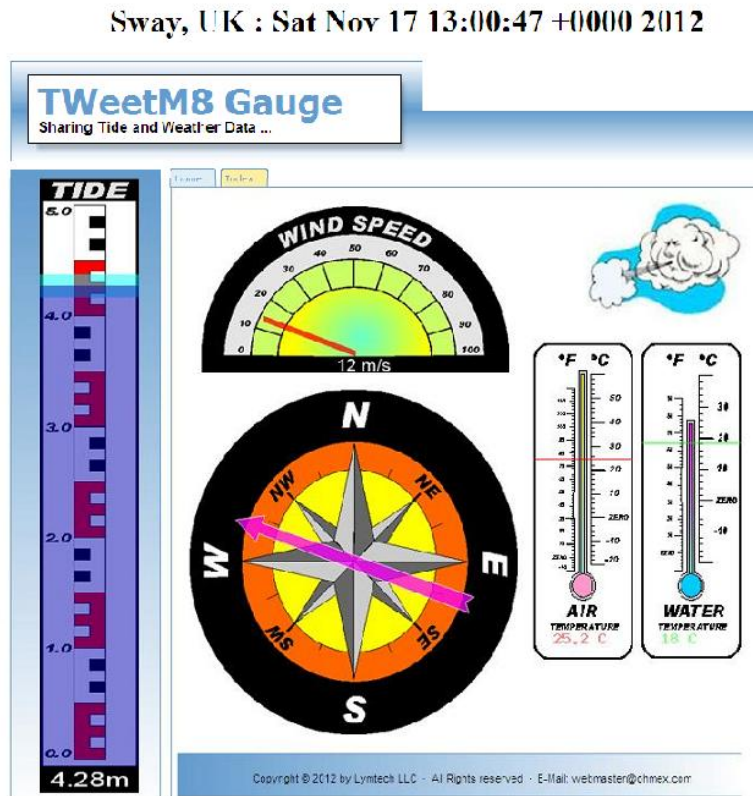


fig 8 - Example website with Twitter data as graphics

## Acronyms used

AIS - Automatic Identification System  
AtoN - Aid to Navigation  
CCOM-JHC - Centre for Coastal & Ocean Mapping - Joint Hydrographic Centre  
DAC/FI - AIS binary area and function identity codes  
IMO - International Maritime Organization  
MMSI - Maritime Mobile Service ID  
MetHydro - Binary Meteorological and Hydrographic data message  
NIFHA - Northern Ireland Fishing Harbours Authority  
NMEA - National Marine Electronics Association

## Reference materials

- IMO SN.1/Circ.289 - June 2010
- IMO SN.1/Circ.290 - June 2010
- New Standards for Providing Met and Hydrographic Information via AIS - L.Alexander
- Tidal & Meteorological data over AIS – E.F.Read, W.S.Heaps – Hydrographic Society
- IMO SN.1/Circ.236 - May 2004

## Links

Previous paper US Hydro 2011 - [http://www.thsoa.org/hy11/0426A\\_05.pdf](http://www.thsoa.org/hy11/0426A_05.pdf)  
Neal Arundale - [http://nmea.router.com/docs/ais/ais\\_decoder.html](http://nmea.router.com/docs/ais/ais_decoder.html)  
Live Kilkeel data - <http://81.137.195.86/kilkeel/>  
Example Twitter data - <http://www.twitter.com/ohmex>  
Example Twitter client - <http://www.ohmex.net>

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