

ACTIVE DATA – A LOT OF TALK BUT LITTLE ACTION?

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“The Committee re-emphasized its opinion that tides need to be a mandatory requirement in an ECDIS. It was considered that ECDIS manufacturers should be encouraged to utilize official Hydrographic Office tidal prediction software which had been written to S-57 specifications. One such product is currently available from the UKHO, but ECDIS manufacturers must be allowed the freedom to make their own choice of preferred tidal prediction software.”

Vth IHO TIDAL COMMITTEE MEETING Lima Perú April 2003

“A number of objects and attributes for enabling dynamic tides were included in S-57 when it was initially developed, however these have not been implemented. The application of harmonic or non-harmonic prediction methods has been implemented in a few ECDIS however their tidal predictions are not official and hence should not be used for ECDIS. To ensure that the results of tidal predictions are accepted as an equivalent to those in official tide tables, HOs would have to provide their full sets of tidal constituents (e.g. to populate T_HMON and TS_PRH), and their prediction algorithms. Clearly this is not viable, as tidal prediction methods varies greatly between hydrographic organizations. An alternative method may be to make use of generic prediction engine such as the UKHO TotalTide, however it is doubtful that most HOs would accepted this as being sufficiently accurate for their tidal regimes”.

Joint TSMAD18 & DIPWG1 MEETING May 2009 (Ottawa, Canada)ⁱ

The S57 architects recognised the need for tidal data to be part of an interactive cartographic solution but they stopped short of thinking through the absolute detail; Classes associated with tides are qualified by a clause *“the supplier of any parameters must be consulted on how to use data provided using this object class, and which calculation algorithms to use with the data”*.

The clear issue with this approach is that calculating tidal predictions is difficult. Several classes of algorithm are required including:

- Predicting the relative positions of the earth, sun and moon.
- Harmonic summation
- Peak finding (don't get caught out by those double stands)
- Linear and non-linear interpolation

These predictions need to be displayed usefully, accurately and quickly. The system needs to factor time zones and DST correctly. Not always trivial - some days only have 23 hours. There are special rules for dealing with partial data sets - for some ports you can only predict the time of high water. Testing, proving that the

predictions are correct is particularly onerous. Overall the effort in developing a fast, accurate tidal prediction system is comparable to that of creating a chart display kernel.

Additionally there are several variations of these algorithms and these have to be matched to the data source. One set we encountered even defines its own value of π –it's not what you might expect and this in a nutshell is where hot air has substituted for real solutions. The complexity of the subject and the need for change have hampered intellectual thought and tied stakeholders in boundless knots. True to form we have become world class at getting ready.....

The S57 approach is a proven recipe for disaster. Multiple data producers, multiple data types, multiple algorithms, multiple displays. It is also an inordinate amount of work for the OEMs. The practical upshot of this is that S57 does not provide a useful standard for tidal data and provides no practical business benefits to the OEMs (or data producers); in fact it is costly, takes up time and hamstringing your resources.

Business, Process, Technology and Innovation at the moment are not key tenets in this subject – they have been substituted for gossip, hearsay and bluff. Change is often viewed with scepticism and, worst case, cynicism by stakeholders. This is especially relevant when the crux of the issue lies not with technology or complexity but with a pragmatic ability to consider a different way forward. Lets re-wind to 2000 when:

“HO's should actively pursue the development of digital tidal products. These products should not be a “digital” reproduction of the corresponding paper product but have more functionality and “intelligence” built into it; price should be low enough to allow wide acceptance. If such development does not seem attractive for an HO, cooperation with industry is recommended. In the long term, it might be necessary to declare that “digital” products are “official” products provided their accuracy is at least as good as that of official paper products. Tides should be mandatory for ECDIS”

IIth TC MEETING REPORT ON TIDAL MATTERS IN RELATION TO TC Valparaiso Chile October 2000

And six years later:

“Delegates were reminded of the Agenda Item 5.6 from the IInd TC meeting in Valparaiso which encouraged HOs to actively pursue the development of digital tidal products which would have intelligence and functionality built into them. Delegates were encouraged to embrace the new digital culture positively and actively as mariners are increasingly turning to a digital solution for tidal predictions as opposed to paper tide tables.”

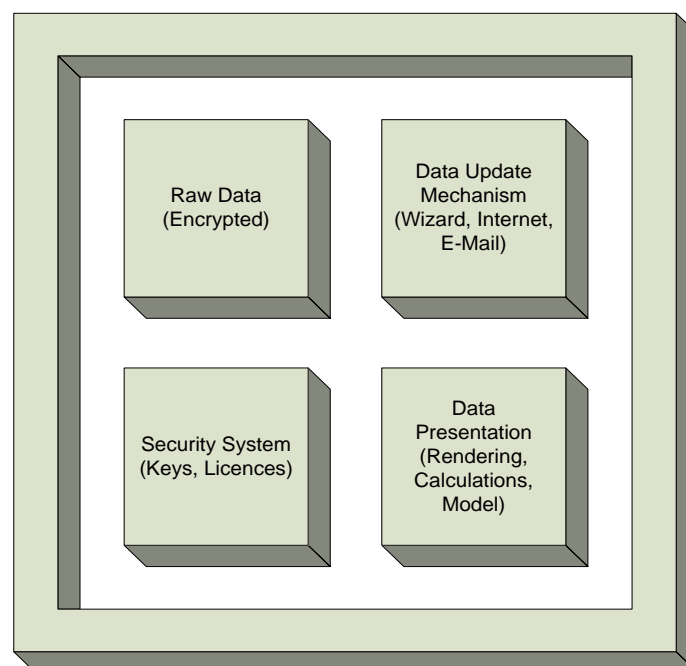
VIIth IHO TIDAL COMMITTEE MEETING Wollongong 3.4 Digital Tide Tables Australia June 2006

Purely from the business perspective change is recognised – there are 6 years worth of minutes expressing the need to embrace digital tidalⁱⁱ as proof. And yet there appears no clearer way forward than the somewhat dismissive minutes from the Vth IHO tidal committee meeting in April 2003ⁱⁱⁱ.

In fact if you recognise that the tidal prediction algorithms need to be in the domain of the data producer (the Hydrographic Office or Commercial data company) rather than the OEM then there are technologies that meet the requirement. This statement is bold purely because:

- a. Data production is not a core function of OEMs;
- b. The astronomical algorithms are only ever approximations which are fed back into the harmonics – you need to use the same approximations to generate predictions. The details of the approximations varies between producers. Algorithms need to be matched to the specific data (occasionally some data producers may be reluctant to publish their tidal algorithms);
- c. It is a core function of the OEM how the prediction is used, displayed and presented to the end user;
- d. This is based on established technology – Active Data has been meeting the requirements of data producers for several years^{iv}

Active Data (AD) is a mechanism for implementing and maintaining control over the four common aspects of any data management system and is entirely distinguishable from Passive Data^v. These aspects are data-centric and as such should be managed as part of the data supply domain rather than the application domain. That is, they are best handled by the Hydrographic Office or Commercial data company rather than being delegated to an OEM. The proposition of AD^{vi} is straight forward and best visualised as:



The four components are:

- Raw Data - This is the source information in its basic state. Associated with this will be a file format and an encryption mechanism. Traditional systems simply used the raw data. This is inefficient, error prone, expensive and difficult to support.
- Security - There will be a mechanism for granting and enforcing licences. The security system manages this and restricts unauthorised access to the data. Wizards and messages associated with security will automatically become common to all OEM applications.
- Update - A basic update mechanism involves the exchange of catalogue information and then the supply of appropriate update data. HTTP is a good, immediate, transport mechanism however SMTP is preferred for vessels at sea. The specific catalogue and update mechanism tend to be data specific. Wizards and messages associated with updating will automatically become common to all OEM applications.
- Presentation - This performs three principle tasks:
 - De-coupling from the underlying file format and security mechanism. OEMs will access the information through an intelligent interface. This provides simplicity, stability and feedback.
 - Implementation of a data model and associated calculations. Ensures the correct use of the data and also protects proprietary algorithms. Allows OEM access to the meaning of the data.
 - Rendering - correct drawing of the data. Ensures correct display of data. Allows OEM simple access to consistent presentation of data.

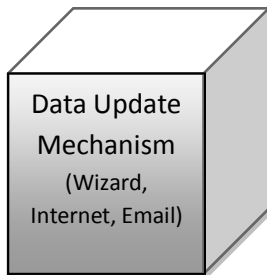
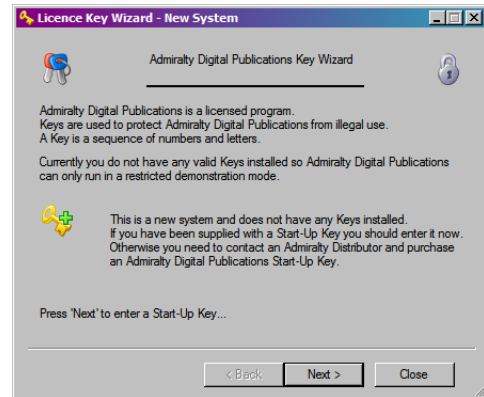
“The Chairman emphasized the need for MS to respond positively to the recommendation ... by considering the production of national digital tide tables which have both functionality and intelligence built into them. He advised the TC that it may only be a matter of 5-10 years before all major shipping vessels will be using digital tide tables in preference to paper tide tables and it is incumbent upon MS to be prepared for this event.”

VIIIth IHO TIDAL COMMITTEE MEETING Halifax Canada October 2007 3.3 Digital Tide Tables

Of course AD must address other data streams as we move to the digital superhighway that is reflected within all the industry’s current thinking. Although theoretical this is just the sort of innovation that we must pride ourselves on if we are to meet and exceed our end clients expectations and drive real and tangible benefits across the marine navigation market. The complexity of the solutions cannot be used as an excuse not to endeavour. If the status quo remains then monopolies will

S-63 is difficult. It is typical of many security systems and uses standard techniques such as encryption and digital signatures. These use publicly available algorithms. S-63 is expressed as a set of data formats. A lot of work went into its design. But it is difficult. Primar got it wrong in their original publications. The effects of this are still begin felt. 7Cs (masters of S-57) got it wrong. Every OEM faces a steep learning curve when tackling S-63. What is more it is still changing in an attempt to patch up problems not foreseen in the original design.

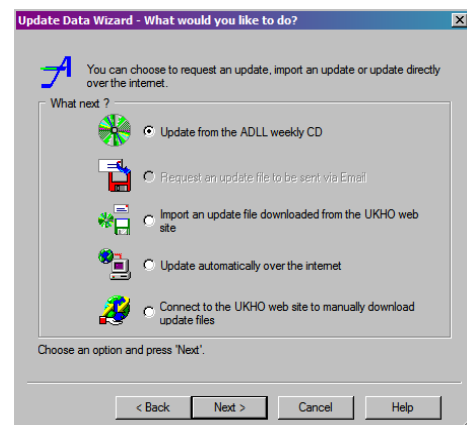
With active data the initial problem is greatly simplified because the security system does not need to be exposed. OEM implementation is trivial. The system can be modified without extensive repercussions – TotalTide licensing has changed several times. The Mariners experience is consistent and reliable.

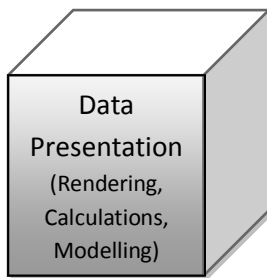


The **Data Update Mechanism** is critical. The ADLL application already has an excellent update mechanism. This will fetch update information via HTTP or SMTP and apply it to the old data. It does this efficiently and is guaranteed to be error free. Making this available to the OEM is no more than adding a function call to the Active Data interface.

Implementing an update mechanism through data formats is almost impossible. S-57 has a well defined transmittal mechanism which is extended and implemented differently by every chart producer. HCRF is from a single source but the data formats failed to anticipate the full complexity of updating a working portfolio. It took many OEMs several years to implement an effective CD based update mechanism and they are all very different.

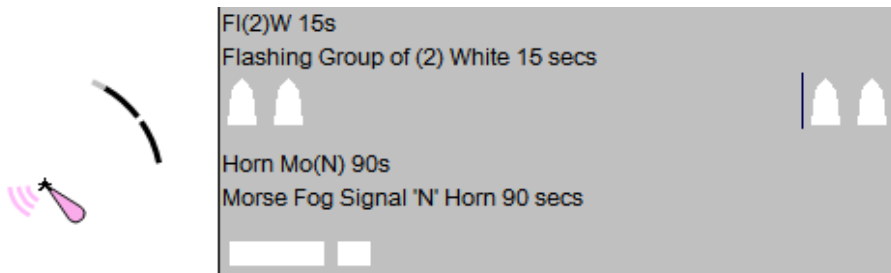
As with security, each OEM faces a steep and expensive learning curve. The implementations will all be different so the Mariner needs to learn different ways to do the same task.





Data Presentation can be done in many ways, however irrespective of the data format an enormous amount of additional knowledge is required to render this information correctly. Here are three examples of rendered data:

England — Isles of Scilly						
A0002	Bishop Rock (TH)	49 52.38 N 6 26.74 W	FI(2)W 15s	44	24	Grey round granite tower 49
-	Horn Mo(N) 90s
						<i>fl 0-3, ec 1-6, fl 0-3, ec 12-8.</i> Partially obscured 204°-211°(7°). Obscured 211°-233°(22°). Obscured 236°-259°(23°). Racon. Helicopter platform above lantern <i>bl 4-5, si 2, bl 1-5, si 82</i>



Attempting to document and implement this for an OEM is a major undertaking. However through Active Data the OEM system can render a light by simply indicating a format and a position on the screen.

The benefits and costs of any system must be clearly articulated and clearly there will be an initial investment by the HO in an Active Data solution. Returning to an AD solution that is already mature, robust and enabling Hydrographic business I will draw on our experience with TotalTide. The key is to bring tangible benefits to the OEM and have a clear understanding of the operational needs that the solution must meet - interoperability with ECDIS is critical.

We have developed a bespoke solution for the UKHO called TotalTide which heralds from our Active Data Family suite of applications. TotalTide is an AD system. It is also an end-user application. A mariner can buy it, install it and use it just like any other software application.

Critically TotalTide can also be used by the ECDIS. In fact the ECDIS can switch off the standard TotalTide interface and expose all the information through the ECDIS just as if the TotalTide functionality were part of the ECDIS.

Instead of reading some static (dumb) data and trying to work out what to do with it the ECDIS can ask questions from a running software component. The ECDIS works to an active interface rather than a static data format.

Likely questions that an ECDIS might ask, programmatically, are:

- Give me a list of the stations in this geographic area.
- Give me the name, type and position of this station.
- Tell me the tidal heights at one minute intervals for the next hour for this station.
- Give me next week's peak ebb and flow values for this station.
- Display the tidal height graph for this station.

This is not new technology. This is using industry standard mechanisms for inter-process communication. Applications on your laptop are doing this sort of thing all the time.

The **business benefits** of this system are quantifiable – the data, algorithms and other information get mashed together and tested just the once. Instead of many companies writing different code to produce the same answer, it is done once. This is the unique solution that then defines the real positives of adopting this technology; for the Hydrographic Office:

- Safe
- Accurate
- Accessible
- Correct use of Data
- Enhanced verification procedures
- Business driver & licensing rules
 - Coherent view of clients usage
 - Links to sales and marketing strategy (real time reporting)
- Increase business processes; date to market
- Shortens testing time and resourcing issues

Importantly the OEMs and other end users get associated benefits with the adoption of this system:

- Low integration costs (matter of days)
- Ease of use
- Core business for the OEMs
- Innovation

In short, Active data is a low cost, efficient mechanism for establishing a pipeline from the data producer to the mariner.

Active Data is the way forward for data producers, OEMs and end users. The ability to qualify data quickly, efficiently and, most importantly, safety are the key drivers for the adoption of this solution:

- Active Data establishes a co-operative environment which positively encourages the use of additional digital data types by OEMs and so opens new markets.
- Active Data does not set the HO up in competition with manufacturers of digital marine software.
- Active Data establishes an effective route to customers for data from Hydrographic Offices
- The HO are happy that their data is being used correctly. It is displayed properly. IPR is respected.
- It has been adopted by many OEMs for many purposes – not just ECDIS.
- The S57 approach does not work. Active Data does.

If in doubt hold a meeting, be cynical and dismissive of technology. Complex questions often have complex answers – add technology into the mix and it is very easy to be negative and repetitive.

Aligning business, technology and complex solutions is not straight forward and, often, it is very easy to lose sight of what the end user actually needs.

The key is to constantly innovate.

ⁱ This is an acknowledgement that the S-57 data-centric approach has failed. Time has shown the TotalTide product to be extremely accurate. The issue is that there are differences in the way predictions are calculated.

ⁱⁱ But please do not limit your thoughts to just tidal data or there will be 6 years more minutes espousing the need for change.....

ⁱⁱⁱ Opening paragraph.

^{iv} An early adopter of this solution was the United Kingdom Hydrographic Office with the award winning TotalTide product

^v Passive data is the traditional file format approach. The supply to an OEM consists of data in a defined format plus a lot of documentation and a licence agreement. S-57 (ENC) + S-63 is an example of passive data.

^{vi} Active data is defined by an interface specification. The supply includes compiled, active, code which is run on the customer's computer. TotalTide uses Active Data.

^{vii} The primary overhead in setting up this arrangement is the cost of developing, testing and supporting the software required to handle the data.