What Capability does a Paper Chart add to a Survey Echo Sounder – is it Really Necessary?

At CEE HydroSystems we do not make echo sounders with paper chart recording devices. This is despite organizations that still request a paper chart record for single beam hydrographic surveys. Here are our views on the paper chart and an explanation of what it really is.

Early recording survey echo sounders used a special paper on a continuous roll as the recording device. The paper was supplied with a special clay coating through which a signal at a time relative to the depth was used to burn a trace through the paper. The paper roll was printed with a scale (or scales) matching the depth range of the echo sounding instrument. The signal was provided via a stylus fixed to a rotating belt. The signal was derived from an analogue echo, amplified and rectified to DC and then applied to the stylus. The paper chart roll was the recorded data. Superimposed over the echo trace manually generated fix mark lines represented position marks. The fix mark lines were numbered and corresponded to numbered records of X&Y co-ordinates or sextant angles. Actual depths were read off the paper chart. This relatively simple system provided a full water column record of all echoes, and the bottom was easily distinguished by the strength of the echo returned by the bottom. Reading the depth values off of the paper trace and matching the fix marks on the paper trace with the horizontal positions was both time consuming and tedious. Paper trace rolls provided a permanent record of surveys. As the recording system was very much an electro-mechanical system the provision of a paper trace increased the size of an echo sounder and significantly increased the power requirement. Maintaining calibration was difficult because as the stylus belt speed varied so did the indicated depth, likewise as the stylus itself ‘burnt away’ the contact point changed. The market for recording paper rolls was relatively small and restricted and so cost was significant. Nevertheless paper trace instruments were a vast improvement over a hand written log sheet of depths and they were the standard for many years. In general it was thought that if your echo sounder did not have a paper trace it was not a real echo sounder.

As technology advanced, improvements were made in both positioning (introduction of GPS positioning) and in echo sounding. As in almost every field of electronics the advantages of digital techniques over analogue found its way into the design of echo sounders, none more so than in the design of survey echo sounders where the demand for accuracy was a major design consideration. However the notion that a

paper trace was essential in a survey echo sounder was so strong, so well accepted that most manufacturers found it commercially sensible to give the Customers what they thought they needed. Fortunately the advantages of digital electronics included the availability of thermal paper printers. These printers printed digital signals and had a huge market as fax machines; it was relatively easy to adapt the technology and integrate a thermal printer into the newer digitised survey echo sounders. Now both manufacturers and users were happy. The manufacturers could further exploit the advantages of the digital world whilst the users were happy, many believing that they were still looking at an analogue trace rather than realising that they were looking at a reprint of digital data they had already stored on the recording device.

As technology has continued to advance with society accepting that we live in a digital world where most important records are already stored digitally (Banks, Population registers, Land Cadastre, etc.) so too is the hydrographic world accepting that paper trace echo sounders have little to offer the surveyor. The sheer volume of data available from modern instruments is far beyond the capacity of paper to handle. Digital data can be replayed and re-digitised, used to create 3D (TIN) models, colour contoured, easily processed to yield areas, capacities and volumes to the extent that leading manufacturers have dropped paper altogether. Some forward thinking manufacturers never offered paper as a recording medium. Occasionally, tenders are still published specifying an echo sounder having a paper trace. These tenders invariably originate from third world countries.

So to answer the questions:

What capability does a paper chart add to a survey echo sounder? - *None at all. The digital data is far better viewed and stored electronically. A paper trace capability adds weight and volume and consumes a lot more power.*

Is a paper chart necessary with a modern digital echosounder? *Absolutely no!*