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Tide Aware ENC: Demonstration of an Operational Concept

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Abstract: The size and draft of ships calling on United States ports has steadily grown over the past 50 years. Today's vessels may be transiting into port with as little as 0.3 meters (one foot) beneath their keel. This increase in the size of the vessel has caused the mariner to ask questions of the chart and its data that the tradition products, both paper and electronic versions, are incapable of answering. An operational solution to this problem may be constructed using existing technologies. High resolution bathymetry and their associated uncertainties provide the foundation for using algorithmic cartography to render the data in new, more intuitive ways. When this high resolution bathymetric foundation is combined with real-time water levels, telemetered to the underway vessel via the Automatic Identification System (AIS), it is possible to create an electronic navigational chart which is capable of displaying a "tide-aware" ship's safe contour to the mariner. Since both the bathymetry and the water level interpolation method have a computed uncertainty value, an expressed uncertainty of the charted display may also be presented.

This paper describes an operational model for how this may be achieved and discusses results from initial field trials. In particular, tidal information is provided in XML format and relayed via AIS to all vessels underway within radio range of the shoreside AIS transmitter. Once this data is received aboard the vessel, it is utilized by a software engine developed in Coast Survey's Hydrographic Systems and Technology Program (HSTP) which computes a water surface model based on the Tidal Constituent and Residual Interpolation (TCARI) method. This water surface model is then provided to navigation software also developed in HSTP called ECS++ (for Electronic Chart System with enhancements). This software then combines the high resolution bathymetry with the water surface to arrive at a bathymetric model with values representative of the actual water depths. This model is in turn displayed in the ECS++ display window to show the available water within the navigational theater, based on modeled water levels. Using this methodology, ECS++ is capable of estimating the water level at a vessel's position for any location and instance in time.
