A major concern in designing restricted waterway channels is draft. Draft is the vertical distance from the bottom of a ship, the keel, to the waterline, the horizontal plane that contacts the water surface and hull. Ship captains must use draft and speed to determine safe navigation vectors to avoid collisions caused by the phenomenon known as squat. Squat is caused by displaced water being pushed between the ship’s hull and the sea floor, creating areas of higher flow resistance resulting in higher flow velocities and lowered pressure. This lowered pressure moves vessels deeper in the water line and can cause groundings, hull contact with the sea floor or land [1].

Predictions from equations, GPS, and buoy data are able to guide regulations and orders determining restricted waterway navigation based on draft height. Equations like Korvin-Krouskovsky and Jacob’s strip theory for heave and pitch motions in head waves, and more modern theories like Smith and Salvesen’s head seas motions, are able to adequately predict ship pitch and roll under variable loads, factors that can influence squat and draft [2]. The channel analysis and design evaluation tool, CADET, is a program that predicts the most cost effective dredging plans for adequate sea floor to keel clearances. The program requires several input variables, including ship draft to make an analysis that had an average over-prediction of less than a tenth of a meter [1]. GPS has created an ability to better measure ships positions and heights to validate proposed models such as a stepwise regression tree method to predict ship squat, finding linear relationships between squat and speed [3], and determining the effects of hull design on squat [4]. Error caused by environmental effects such as waves and tidal heights can be filtered from GPS data [5]. Despite having these predicted models, no real-time draft measuring systems are available outside of visual inspection which can pose a safety risk to the ship’s crew.

Using a new system to take real-time measurements of draft and squat can improve or validate real-world measurements and help channel engineers and ship captains to make safer navigation decisions. A possible solution to taking such draft readings uses lasers to find the distance between their static locations on the ship’s hull and the water surface. By placing laser sensors on opposite positions located on the bow, mid-ship, and stern a real time measurement of the ship’s draft can be determined [6]. These measurements can be analyzed by a computer to return squat, pitch, and listing information to ship captains, avoiding the risk of a visual draft inspection or relying on generalized models.

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