

## APPLICATION NOTE H-ADCP PORT OF ROTTERDAM

### Introduction

One of world's biggest container transshipment terminals of ECT is located at Rotterdam's Amazon harbor. This harbor is a critical harbor in consequence of its orientation and design. The harbor is relatively narrow and situated perpendicular to the entrance channel. Because of the harbor's geometry, ships have to make a sharp turn to enter. Moreover, the ships must approach the harbor at low speed, making the effect of the local currents relatively large.

The entrance channel (Beerkanaal) is on the north side connected to the main channel (Nieuwe Waterweg) and on the south side connected to the Hartelkanaal channel. These channels are connected to respectively the river Nieuwe Maas and river Oude Maas, which are in open connection with each other. Due to this complex situation the currents in the Amazon harbor area are driven by tidal influences and the river discharge which are both coming from two directions.

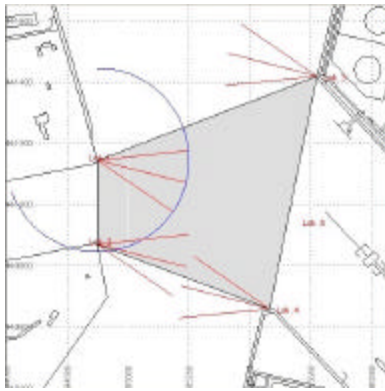


*Rotterdam's Amazon Harbor gets its currents from two sides. This results in complex currents patterns.*

Within the Port of Rotterdam the Rotterdam Port Authorities (RPA) control the assigned time for ships to enter the harbor. These assignments are based on the time window and the draft of the vessels. Throughout the whole Port the RPA has traffic control centers from where the ship movements are monitored. For security reasons RPA restricts large ships to enter the harbor at specified tide periods of 3 hours per tide cycle. In order to help pilots maneuvering the ships into the harbor, real-time current information of the Amazon harbor area is of importance in the Amazon harbor area. Moreover the current information may lead to enlarging the restricting tide period. This could increase the amount of vessels that can enter the harbor, which is of importance for the economy.

### Location

By order of the Dredging and Hydrographic department of Port of Rotterdam (BNI), Aqua Vision examined the best location for a real-time current measurement station. Out of five possible options, the best location was found at the corner of the Amazon harbor and the main channel.



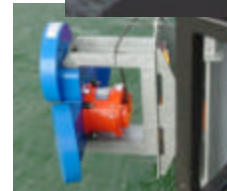
*Out of five locations, the corner of the Amazon harbor was found to be the best location for a current measurement station (Lok 1).*

## Equipment

At the indicated location a three beam 300 kHz narrow beam horizontal ADCP of RD Instruments has been installed. The horizontal ADCP provides continuous real-time current information that is transferred through telemetry, a LAN connection and VISEA-H to the BNI office. Here, the data are continuously monitored and a subsection of the data is sent to HYACINT, a database in which all hydrographic and environmental data is combined. From HYACINT the data is forwarded to the oracle database AMETYST containing all nautical data. Pilots do not have real-time access to this database but receive the essential current information from their coordinators who have real-time access.

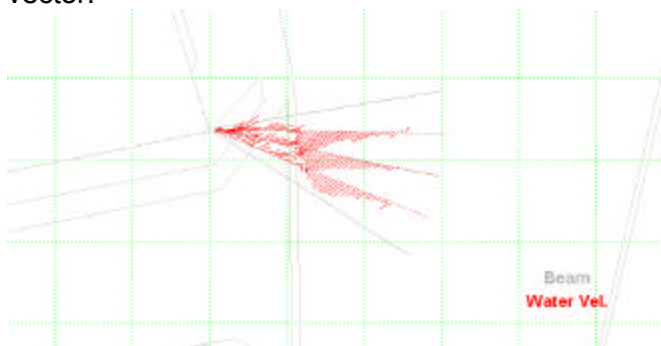


*The H-ADCP is connected to the office through telemetry and a LAN connection.*



## H-ADCP data

The HADCP data are acquired by Aqua Vision's VISEA-H software. To measure the complex currents in the Amazon harbor area with a higher accuracy, the VISEA-H coordinate transformation options are enlarged. For each ADCP bin, VISEA-H calculates three velocity vectors, respectively based on beam 1 and 2, beam 1 and 3 and beam 3 and 2. The quality of the three solutions is determined by the Cauchy-Schwarz theorem that is based on the closing vector.



*VISEA-H gives velocity data based on three combinations of the beam data.*