

# **A Report On Tide Gauges In Singapore**

## **Introduction**

1 The Republic of Singapore is an island city-state situated at the southern tip of Peninsula Malaysia, approximately 1° north of the equator. It consists of the island of Singapore and some 64 offshore small islands with a total land area of 647.5 sq. km.

2 Prior to independence on 9 August 1965, all hydrographic surveys were conducted by the Royal Navy of the United Kingdom. A Conservancy Section within the Port Master's Department was established in November 1964 to take over the hydrographic surveys before the British Force pull out from Singapore. On 1 October 1971 the Section was upgraded to Hydrographic Department to take over the functions of hydrographic surveys, chart production, and the provision, operation and maintenance of aids to navigation in Singapore waters.

3 Hydrography plays an important role in the rapid growth of Singapore economy, in particular, areas such as safety of navigation, coastal and port developments. The Department now comprises the following sections:

- a) Survey
- b) Hydrodynamics
- c) Cartographic
- d) Navigational Aids
- e) Electronic Navigational Chart

## Tide Gauge Stations

4 A total of 12 tide gauge stations are installed around Singapore waters of which 4 are located at offshore islands and the remaining 8 along the coasts of the main island of Singapore (Figure 1). Prior to 1996, the instrument used for the measurement of the tidal heights at each station was A.OTT Tide Gauge of mechanical float type. The tidal heights recorded on the analogue charts were collected monthly from sites to office for manual processing. Hourly and high and low waters tides were obtained by digitising the analogue charts

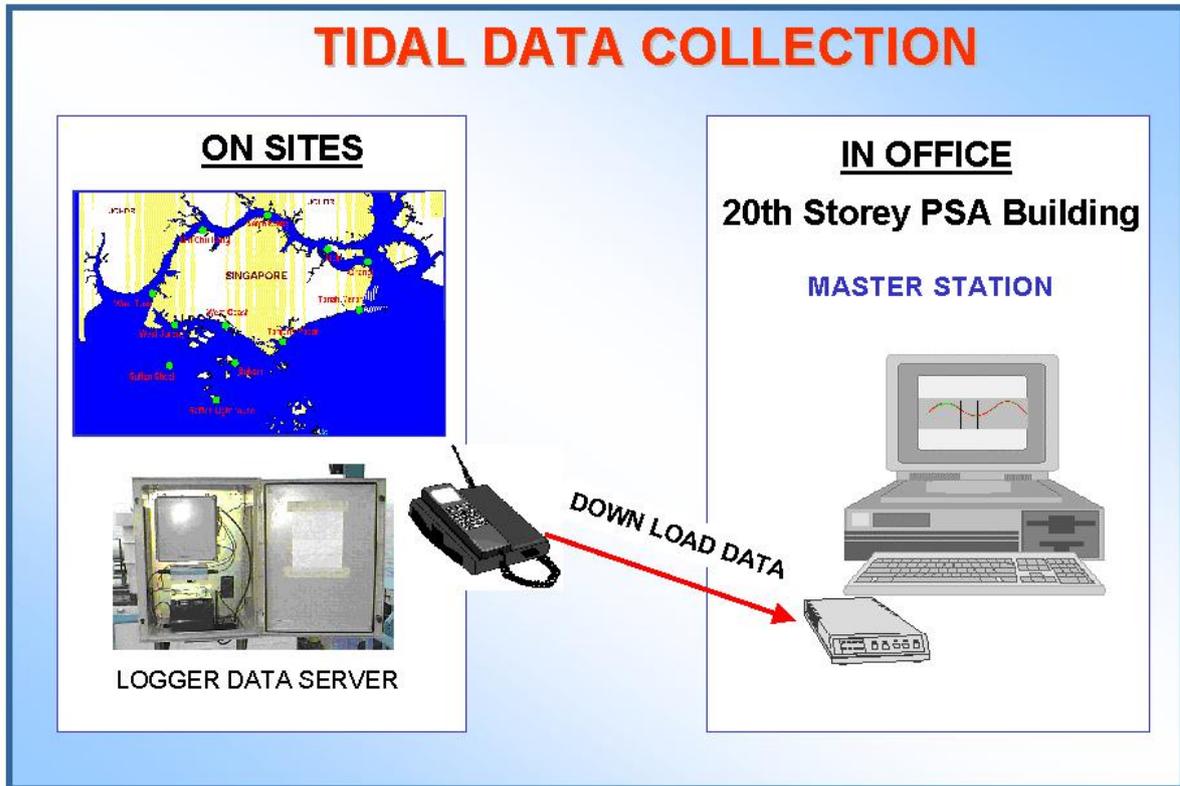
Figure 1



5 The 12 mechanical tide gauges were replaced by digital acoustic tide gauges in 1996. These new tide gauges are capable of transmitting data from sites to the master station located in the Hydrographic Office at 20<sup>th</sup> storey, PSA Building, Alexandra Road via telephone or cellular phone lines as shown in Figure 2. This will obviate the

necessity to collect the data from sites. This results in the savings of manpower and travelling time. In addition, the digital tide gauges provide better accuracy.

Figure 2



### Master Station

6 The master station consists of a Pentium personal computer (PC) running on Windows-based management software capable of performing the following functions :

- a) A program to setup and define the tide gauges, sensors, communication ports etc.
- b) Automatic polling of tide gauges at predetermined time, usually once a day for data that are stored in the field acquisition unit.
- c) Checking, verifying the integrity of data received.
- d) Conversion of data to engineering units
- e) Storage of data.

### **Verification of Tidal Data**

7 The tidal data received from all the tide gauge stations through telemetry system are downloaded in the master station everyday. These tidal data are then verified with the predicted tidal data from the same station.

8 After the verification, the tidal data are stored in the computer.

### **Verification of Vertical Datum**

9 The vertical datum of each tide station is checked once a year to ensure that it does not shift.

### **Calibration of Acoustic Sensor**

10 The acoustic sensor of each tide gauge is calibrated yearly.

### **Harmonic Analysis**

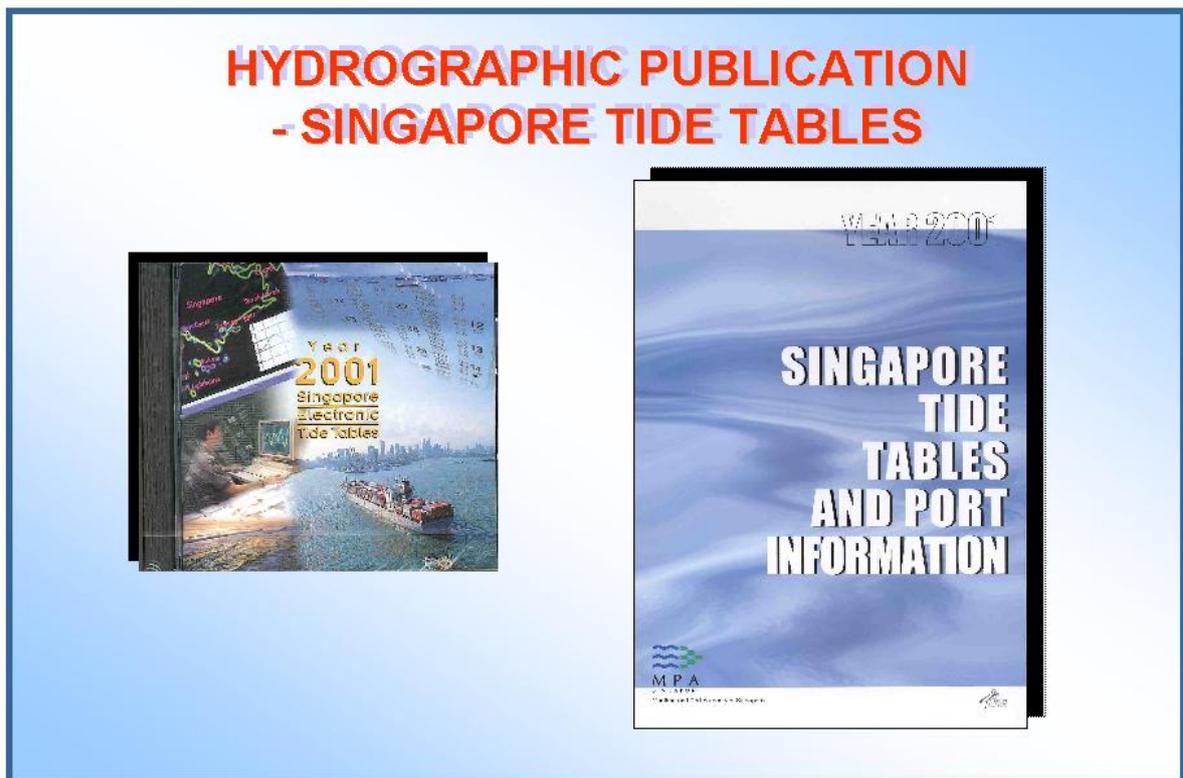
11 This office adopted the harmonic method of analysis, in which tides are predicted using tidal harmonic constants, node factor, equilibrium argument, etc. One year data which generate 112 constants are used for the predictions.

The predictions are published in the "Singapore Tide Tables and Port Information" for use by the port users and mariners for safe navigation in Singapore Waters and the approaches thereto.

### **Singapore Electronic Tide Tables (SETT)**

12 In addition to the Tide Tables, this office also produces the Singapore Electronic Tide Tables in CD ROM (Figure 3) which runs on Microsoft Window or Window NT environment.

Figure 3



13 The Department will continue to supply tidal data to GLOSS for mean sea level study.