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ESTABLISHMENT OF THE HYDROGRAPHIC DEPARTMENT
THE SINGAPORE EXPERIENCE

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INTRODUCTION

Singapore is a small island city-state located strategically south of the Malaysian Peninsular at the cross-roads between East and West. Due to this geographical advantage, it has grown from a British trading outpost established in 1819 to the World's busiest port in 1990, in terms of shipping tonnage (483 million Gross Registered Tonnage GRT). It also holds the leading position in the global container port league. One vessel leaves/enters the port waters every 6 minutes.

Prior to Independence, on 9 August 1965, all hydrographic surveys were conducted by the Royal Navy of the United Kingdom. Following Independence, a Conservancy section within the Port Master's Department was established. This Section had a staff of seven and its functions were restricted to hydrographic surveying. It had no nautical chart making capability. On 1st October 1971, the Section was upgraded to a Department and its function expanded to include chart production. The first chart was published in 1975. Today the staff strength stands at 93 and the Department has published 30 charts covering the port waters and the approaches, including the routing system in the Malacca and Singapore Straits.

Gratitude is expressed to the British Admiralty, the Indian Navy, Japan's Maritime Safety Agency and the US Naval Oceanographic Office for their invaluable advice, support and the training accorded to the staff without which it would not been possible to achieve the present capabilities. Particular acknowledgement is made to the Colombo Plan Assistance Scheme for the attachment of Cdr. N.N. SATHAYE to this office. His contribution was instrumental in the establishment of the Department.

Hydrography is recognised as playing a small but important role in its contribution towards the rapid growth of Singapore's economy, in particular, areas

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such as safety of navigation for shipping and, coastal and port developments. In view of the shipping tonnage handled by the Port of Singapore, the ensurance of navigational safety is one of the primary purposes for the establishment of the Department.

This paper highlights the challenges faced in the establishment of the Department and also identifies the present and future challenges.

CHALLENGES FACED IN ESTABLISHING THE HYDROGRAPHIC DEPARTMENT, SINGAPORE

The increase in demand for hydrographic surveying was generated as a result of the speed at which the Singapore's economy developed since Independence. Due to the two factors of rapid development and Independence, the Port of Singapore is faced with the challenge of establishing an autonomous Hydrographic Department capable of performing the following functions:

- conducting hydrographic surveys within Singapore waters for use in charting and engineering studies;
- publication of nautical charts;
- providing, installing and maintaining aids to navigation.

With the functions defined, factors necessary to achieve and sustain an effective Hydrographic Department were examined and determined. The areas of challenge identified were as follows:

- **Recruitment**

  Like much of the rest of the world, Singapore was faced with the lack of qualified personnel for recruitment. This situation is caused by the fact that Singapore does not have any hydrographic surveying training facility. Coupled with this problem, a career at sea has never been a preferred choice for Singaporeans.

  In defining the organisation structure, three grades of positions were identified for recruitment, namely, Assistant Hydrographers, Technical Officers and Technicians. Potential sources of personnel with relevant background and qualifications were identified. The sources of personnel identified for the post of Assistant Hydrographer included persons with Master Foreign-Going Certificate, Naval Officers and Graduates in the field of Land Survey / Mathematics / Physics. For the grade of Technical Officer, a Diploma in Land Surveying is required. Whereas for the grade of Technician, individuals should hold an 'Ordinary' / 'Advanced' level of the General Certificate of Examination.

- **Training**

  Staff training is an essential long-term investment. However, it is time consuming and costly. This is further aggravated by the fact that there is no formal hydrographic surveying training facility available

in Singapore's tertiary institutions. As such, training depends on overseas institutions.

The Department has adopted the practice of providing newly recruited staff with a one-year practical training conducted in-house. On successful completion, the trainee proceeds to an FIG/IHO accredited institution for a formal course. Some of these institutions include the Royal Navy's Hydrographic School, Indian Navy's Hydrographic School, the US Naval Oceanographic Office, Japan's Maritime Safety Agency and Plymouth Polytechnic in the United Kingdom.

The Department is convinced that the present practice offers the best opportunity for the Department to assess the staff's aptitude and potential before committing further investment in his training.

- **Rapid Developments in the Marine Industry.**

With the rapid development of Singapore's marine industry, an immense demand has been placed on the hydrographer in terms of :

- surveys conducted, in accordance with IHO's standards;
- improvement in the rate of data acquisition and processing;

The marine industry's developments include construction of oil terminals and port facilities, designing of navigational channels and reclamation of coastal waters. To meet the demands of these developments, the Department embarked on a programme to improve the method of surveys. In 1972, the use of Electronic Position-Fixing Systems (EPF) i.e. the Sea-fix chain, was introduced. This was subsequently replaced, in 1981, by a Microwave System (Plessey Tellurometer-MRD1), which also formed part of the Department's programme to automate hydrographic survey data acquisition and processing. However, the effort and success of this programme was limited due to the highly demanding requirements of hydrography as compared to the limitation in the available computer technology. Nevertheless, it represented the beginning of the increased use of electronics in hydrography. It also revealed the vast potential and possibility of integrating EPF systems and computer technology to improve accuracy and productivity in hydrography.

- **Aids to navigation**

The function of providing, installing and maintaining the aids to navigation, including the lighthouses, within the Singapore waters was transferred from the Light Dues Board in 1974.

Since then, the Hydrographic Department has had an eventful period, particularly in experimenting with various sources of energy for use by the aids to navigation, from gas to the cumbersome battery and to the present solar-powered aids to navigation.

With regard to the lighthouses, difficulties have been experienced in recruiting staff to replace those who were retiring. Therefore, as an alternative a project to automate the lighthouses was set up. In 1978,

Bedok Lighthouse which is situated on mainland Singapore was successfully automated. This provided much of the needed confidence to proceed with the automation of other offshore lighthouses using solar power. In 1982, Sultan Shoal was the first offshore solar powered automated ligthouse. Despite the automation, the lighthouses crew are still employed but their role have been redefined to one of housekeeping instead of lightkeeping.

PRESENT AND FUTURE CHALLENGES

Strategy for Staff Recruitment and Training

To help overcome the on-going problem of recruitment, training and rapid development in the marine industry, a long-term strategy has been formulated. The principal consideration in formulating this strategy is the recognition that Hydrography is a profession which is dynamic, highly practical and related to fields like navigation, civil engineering and environmental science. In addition, it also recognises the need for development and training of the individual as well as the team. Thus, the guiding principles are as follows;

- training should be aligned to the conditions in Singapore.
- staff must be committed and capable of producing, in time, a first-rate hydrographic organisation, which will fulfil its obligations in a manner respected internationally.
- offering a working environment that permits an individual to develop his fullest potential coupled with the objective of establishing an organisation which is self replenishing, homogeneous, and capable of producing staff of a high technical calibre. They would in turn have the ability to develop the organisation to meet challenges of a growing economy and rapid technological progress.

The results of the Department's effort in recruitment and training was evident by the early 1980's when a cadre of qualified personnel was achieved. Since then technicians have been trained in-house. It is hoped that this would be extended to training of the Technical Officer level.

Depending on the need and demand for formalised hydrographic surveying training, establishing a National Training Facility may be considered. Perhaps the course could then be extended to participants from other Asian Region in the future.

Automation: From Data Acquisition to Chart Production

The development of automation in Hydrographic Surveying has been monitored as early as 1980. During this period, staff has been progressively trained in computer concept and application. Then, in 1989, it was timely to meet the challenges of the next decade by fully automating the process of data acquisition, processing and chart production, at a total cost of S$3.1 million.

With this Automated System in which data are in digital form, the Hydrographic Department will almost certainly monitor the development of the Electronic Chart and Display Information System (ECDIS) and perhaps participate in its further development in the near future.

Use of Electronic Technology

It is recognised that development of hydrography in the past decade has been very much influenced by advancement in electronic technology. It is foreseen that this technology will continue to influence and dominate technological advancement for the next decade.

One area that will be in the forefront of further development will be the ECDIS. This can play an effective part in improving the safety of navigation vis-à-vis providing mariners with an Integrated Navigational System incorporating essential chart features, interfacing to echo sounder and positioning systems, port information, etc. This would leave mariners more time to concentrate on avoiding collisions and other navigational hazards. In this regard, Singapore sees the potential of ECDIS complementing the existing Vessel Traffic Information System to further improve safety of navigation in Singapore Straits.

It is also anticipated that the other potential areas of development would be the Laser Bathymetry, Acoustic Current Profilers and the Global Positioning System. The continuous growing need for hydrography to be more productive and accurate would almost certainly stimulated development in these areas.

CONCLUSION

It can be said that economic success is one of the key factors responsible for the growing importance of hydrography in Singapore. The other attributing factors have been the ability to anticipate user requirements and the development of a highly qualified cadre of personnel who have the ability and enthusiasm to learn and use new technology. These are important considerations in a continuously changing environment and for ensuring a continuous effort to improve hydrographic survey methods and standards.

Hydrography and its interrelated fields like ECDIS will see further developments in the 1990s. The Singapore Hydrographic Department hopes to continue to play an important role in contributing towards the improvement of hydrography in the 1990s and beyond. In this perpective, two main objectives for the Department have been set:

- to maintain a self replenishing organisation to meet the future needs and challenges.
- to use advanced technology and equipment to improve work quality and increase productivity.