

TRAINING COURSES IN PORT AND COASTAL HYDROGRAPHY

organised by the University of Bordeaux I, the Port Autonome de Bordeaux,
and the Etablissement Principal du Service Hydrographique,
et Océanographique de la Marine (France)

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The importance of maritime transport in the economy of coastal States has led the latter to promote their policies of port and coastal development.

The development of port sites requires a precise knowledge of the environment, in which hydrography plays a large part.

The economic constraints during recent years have encouraged the rapid development of the techniques used in hydrography, but any system, however sophisticated, would be no more than a modest aid if it were not entrusted to people who are competent, motivated and capable of taking part efficiently, alongside those persons with economic responsibilities, in the fight against coastal erosion and the maintenance of port approaches.

Awareness of this fact, supported by the results of a study carried out in 1984 as an initiative of the Directorate of Ports and Maritime Navigation, and emphasizing the diversity in the training and status of the personnel responsible for hydrography in French ports and maritime services, strengthened the Port Autonome de Bordeaux, in its conviction, that it had become urgent to organize specific training in port and coastal hydrography.

Finally, a third factor added strength to this idea. This was the contacts established by the Port Autonome de Bordeaux with developing countries in the context of its engineering activity, highlighting the considerable needs of these countries with respect to hydrography and the relevant training.

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The need existed. The action rapidly embarked upon led to the opening of the first training session in 1986 at the University of Bordeaux I. Four years later, this course received Category B accreditation by the Fédération Internationale des Géomètres and the International Hydrographic Organization (FIG-IHO) Advisory Board.

The short account which follows presents the context, the organization and the syllabi of the courses.

THE CONTEXT

THE SITE

What site could be better for such training than the estuary of the Gironde ? With the diversity of the environments offered (ocean, estuary, river), the complexity of the natural phenomena (swell, tides, courants) and the variety of the bottom materials (rock, sand, consolidated or suspended silt) the largest estuary in Europe provides the most ideal of 'workshops'.

THE ORGANISATIONS CONCERNED

Both national and local organisations decided to support and participate in the realization of this course without delay; and these included:

- The University of Bordeaux I, and more particularly:
 - the University Institute of Technology (IUT), which made available teachers for the basic subjects, premises for the lessons, and an administrative structure.
 - the Institute of Geology of the Basin of Aquitaine (IGBA) with its experts on sediment phenomena characteristic of port or coastal areas.
- the Etablissement Principal of the Service Hydrographique et Océanographique de la Marine, (EPSHOM).
- The Port Autonome de Bordeaux, (P.A.B.) whose surveying and dredging services are daily faced with the problems of sounding and dredging in the port areas and approaches.

THE AIMS

Designed to give future port surveyors the means of being immediately operational, this course enables them at the end of their training period:

- to conceive and organise a hydrographic unit or service,
- to define the material resources intended to equip it and the work methods to be set up,

— to organize, carry out and interpret bathymetric measurements so as to best meet the relevant needs:

- safety of navigation,
- verification and organization of dredging operations,
- monitoring the natural evolution of the depths, essential basic data for any development study.

This course is not limited to only hydrographic aspects, but also touches on the aspects of dredging and development studies so as to enable trainees to be aware of their responsibilities and of the part played by hydrography in political and economic choices as regards the development of port approaches and the defence of the coastline.

FOR WHOM IS THE TRAINING INTENDED ?

- for French or foreign students holding a university qualification corresponding to two years' study after the French baccalaureat, or its equivalent,
- for deeply-motivated technicians possessing wide experience,
- for advanced-level technicians eager to perfect their knowledge in the technical field.

THE DIPLOMA

This training results in the award of a Diploma in Advanced Technical Studies in Port Hydrography (DEST) issued by the University of Bordeaux I. As noted previously, this Diploma obtained, in 1990, Category B accreditation by the FIG-IHO International Advisory Board on Standards of Competence for Hydrographic Surveyors.

GENERAL ORGANIZATION

DURATION

The course, extends over nine months and utilizes 900 hours of study, it begins each year on the first Monday in January which falls on a working day.

INSTRUCTORS

Teaching is carried out jointly by the lecturers of the University of Bordeaux (IUT, IGBA) and professionals specialised in hydrography and maritime and port matters (EPSHOM, PAB).

STRUCTURE OF THE COURSE

It is organized in three modules:

- **the first module** of three months, gives the basic training that is essential for the subsequent stages (Fig. 1). It takes place at the University of Bordeaux in the form of theoretical lessons or directed practical work in the basic subjects (trigonometry, mathematics, optics, acoustics, physics, computer science, ...). It is given by university lecturers and by port engineers. Its aim is to give trainees the information essential for the understanding of the equipment they will use at a later stage. Technical English is also one of the subjects in this stage of the course.

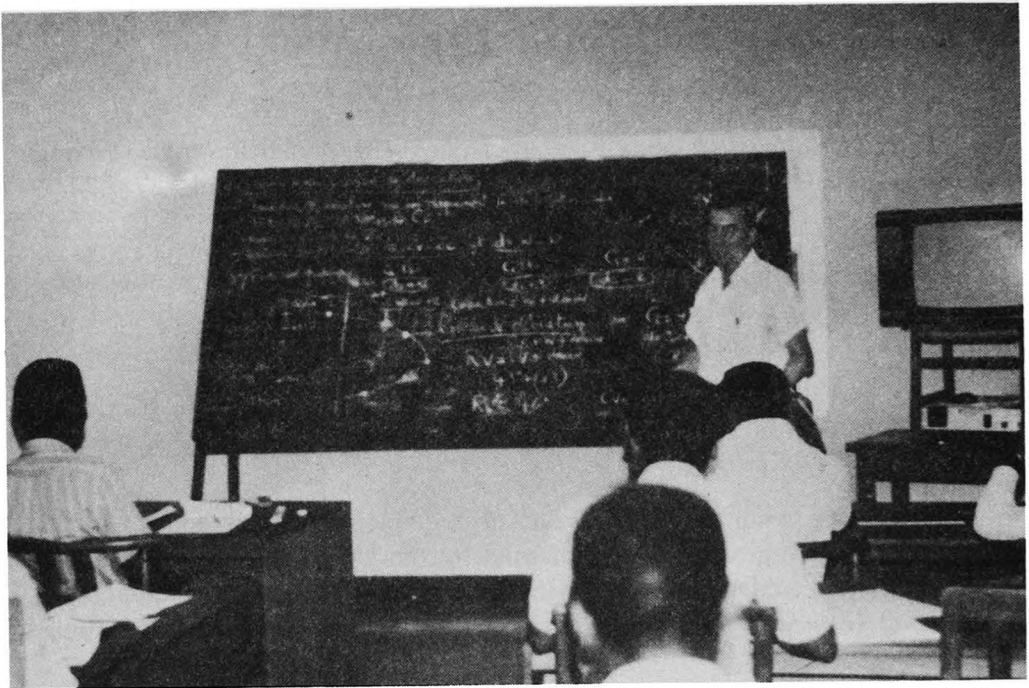


FIG. 1.— Mise à jour des connaissances de base.

- **the second module** lasts about two and a half months. The trainees go to Brest, to the EPSHOM Hydrographic School, where EPSHOM's hydrographers give them intensive training in hydrographic surveying.
- finally, **the third module**, after returning to Bordeaux lasts two and a half months and involves training periods aboard the vessels of the Port of Bordeaux Authority, to learn modern surveying methods using radio positioning systems and automatic processing of sounding data on micro-computers.

The syllabus also includes the programming and follow-up of dredging work by reconnaissance surveys, visits to the various port services (buoyage and beaconage, the Harbour Master's office, the pilot service ...) including the legal aspects and port economics.

This education, conceived in stages or 'modules', opens up the possibility of training periods for professionals wishing to develop their knowledge in one of the modules only.

KNOWLEDGE TESTING

Testing of knowledge is carried out continuously.

At the end of the training period, a practical project completes the course. It consists in the organization of a survey, the processing of the data, and the plotting and interpretation of the results, to verify that the trainee has really assimilated hydrography, geodesy and tidal gauge studies.

AWARD OF DIPLOMA

At the end of the training period, the 'Conseil de Perfectionnement et d'Organisation' meets as a jury and decides, on the basis of the results achieved by each candidate, whether to award the 'Diplôme d'Etudes Supérieures Techniques (DEST)' in port hydrography. The diploma is awarded to all students obtaining the general average of marks, with no 'eliminating mark'.

NUMBER OF PARTICIPANTS

In order to make the course efficient, the maximum number of students is limited to nine or ten per school year. A minimum of six students is required to run the course.

LANGUAGE

The course is normally given in French but may be organized in English for a minimum of six trainees.

ENTRY FEES

The fact that the teaching requires high-technology equipment and training periods aboard ship limits the number of students, as indicated above, and determines the entry fees, the amount of which is reviewed each year. For foreign countries having joint programmes of scientific and technical cooperation with France, this type of training may form part of a specific agreement in the context of such programmes.

COURSE SYLLABUS

To attain the objectives set by the 'Conseil de Perfectionnement et d'Organisation' the syllabus has been drawn up taking into account:

- the minimum syllabus laid down in the Standards of Competence for Hydrographic Surveyors of Category B level, as defined by the Fédération Internationale des Géomètres and the International Hydrographic Organisation (FIG-IHO)
- supplements linked to port and coastal specialisation, including, in particular:
 - radio positioning and automatic methods of acquisition and processing of sounding data,
 - dredging techniques and the programming and follow-up of dredging operations by hydrographic sounding,
 - studies for port and coastal improvements,
 - legal aspects of port economics.

Details of the syllabus and the timetable are described hereafter:

MODULE 1 — REVIEW OF BASIC KNOWLEDGE REQUIRED (18 WEEKS)

The subjects included during this stage prepare the trainees for an understanding of the working methods, equipment and systems which they will subsequently have to utilize.

a) Review of basic knowledge in the following essential subjects:

- analytic plane geometry,
- spherical trigonometry,
- units of measurement,
- practical technology of measurement,
- measuring of time,
- oscillatory mechanics,
- electronics and radio-electricity,
- sub-marine acoustics,
- optics for beaconage.

These subjects are introduced as a preliminary to the technical themes to which they are linked.

b) Computer science (lessons: 20 h — practical work: 49 h)

The evolution of the equipment and working methods used today in the field of hydrography is strongly linked to the recent progress in computer science and electronics. That is why the course includes practical training on computers which has the twin objectives (Fig. 2):

- 'de-mystifying' them as regards computer languages and equipment,

- giving the future hydrographers the necessary knowledge to enable them to participate in the choice of computer systems for data acquisition and processing and to enable them to eventually develop or adapt software.

This subject is taught in 20 hours of theoretical lessons dealing with the following:

- terminology,
- programme languages and learning of a programme language,
- introduction to computers and calculators, plotting tables, magnetic media,
- introduction to systems for the acquisition and processing of data.

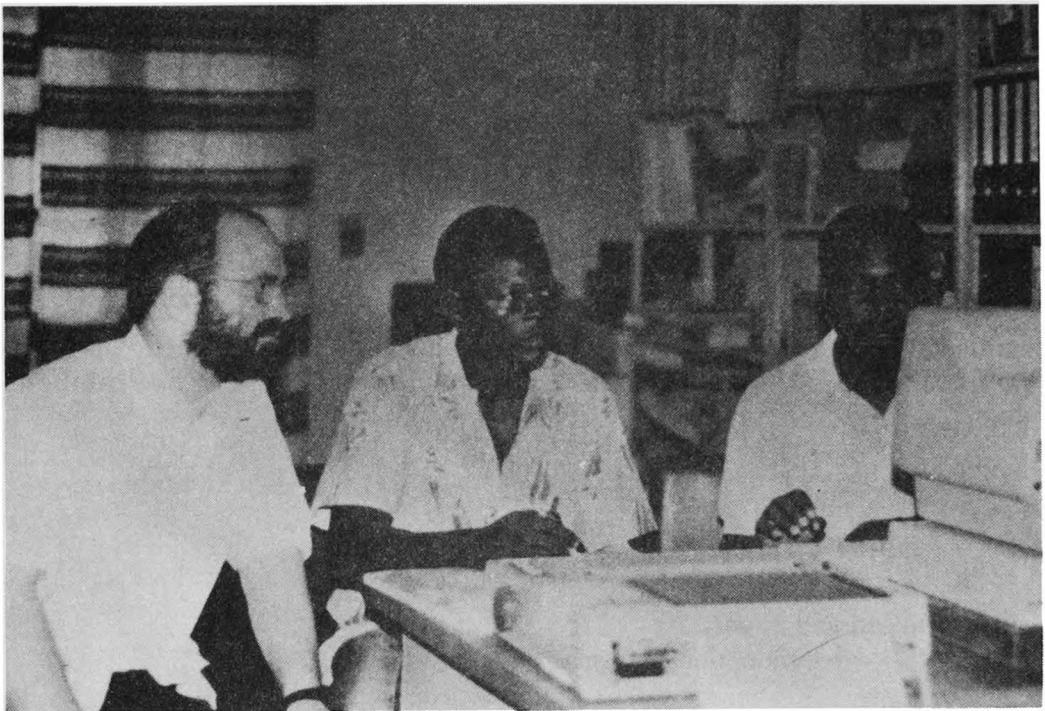


FIG. 2.— Directed practical work.

c) Instruments, systems for measuring and collecting data (27 hours of lessons, 40 hours of guided work, 8 hours of practical work).

— instruments for measuring angles, direction, distance:

- sextant, theodolite, levels and surveyors' rods, magnetic and gyroscopic compasses ...
- chains and tapes, tachymeters, telemeters

— port and coastal electronic positioning systems:

- short-range systems,
- medium-range system,
- precision, gauging and adjustment.

- acoustic systems:
 - echo sounders,
 - sonars,
 - various acoustic instruments,
 - transducers.
- current oceanographic instrumentation:
 - tide gauges, current meters, equipment for bottom sampling,
 - pressure gauges.
- marine geophysics equipment and measurement:
 - continual seismic,
 - geotechnical reconnaissance of bottom material.
- use of digitising and automatic data recording systems,
- use of semi-automated navigation systems in hydrographic sounding,
- integrated systems of processing and command,
- integrated systems for conducting port dredging operations.

MODULE 2 — PRACTICAL SURVEYING (8 WEEKS)

The trainees are received for eight weeks by EPSHOM at Brest (Fig. 3). Integrated into the group of Naval hydrographers, they are trained, under the supervision of EPSHOM's engineers, in carrying out surveys by traditional methods:

- land surveys:
 - geodesy,
 - geodetic lattices,
 - altimetric lattices.
- surveys at sea and in port:
 - determination of positions: optical methods,
electromagnetic methods.
 - determination of depth.
- hydrographic surveys:
 - sounding
 - hydrographic and sonar sweeping.
- basic plans, benchmarks, buoyage and beaconage, alignment marks,
- large-scale port surveys,
- cartography.

The practical project carried out at the end of this stage enables the students to actually make a survey, directly applying the methods taught, and to draw up the resulting plotting sheet.

MODULE 3 — PRACTICAL ON PORT SITE (10 WEEKS)

The final stage of this training takes place entirely at the Port Autonome de Bordeaux. The techniques and methods taught so far are then transposed and applied in the Gironde estuary. The highlights of this stage are:

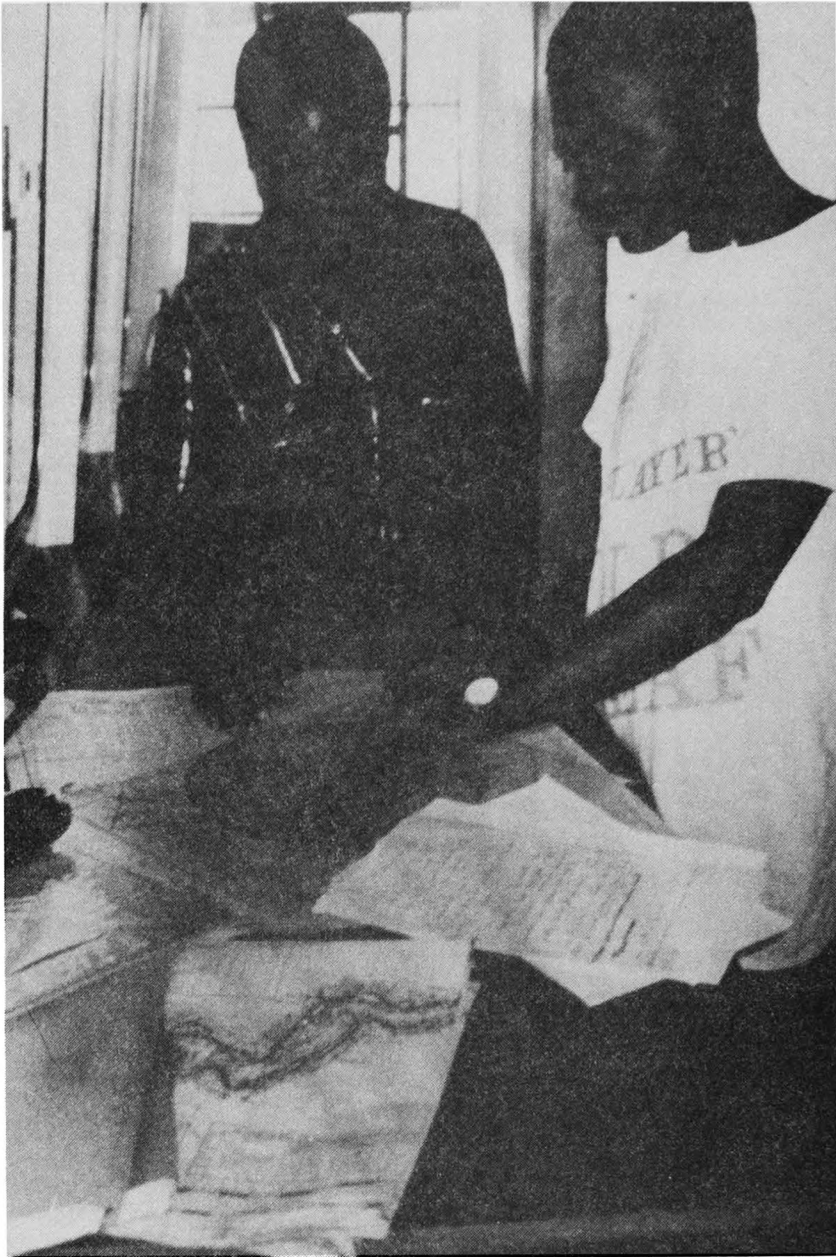


FIG. 3.— Lesson in navigation.

a) Embarking for two weeks aboard a survey launch of the Port Autonome de Bordeaux (Fig. 4).

Under the responsibility of an experienced hydrographer, the trainees prepare, organize, and carry out several port surveys themselves. The equipment used is that normally used in the Gironde, for example:

- SYLEDIS radio positioning system,
- ATLAS DESO 10 or DESO 20 echo sounder,
- acquisition calculator HP9000.

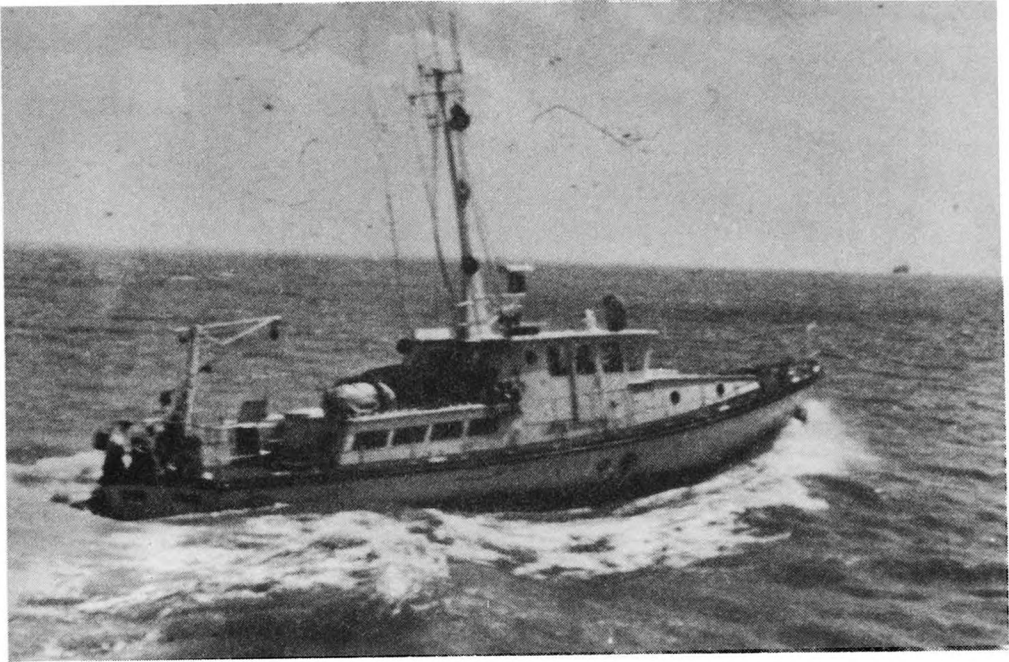


FIG. 4.— Survey launch BIGANON (PAB) used for training.

b) two weeks' training at the centre for automated processing of sounding data.

Detailed study of the various stages of the processing software DALI (Dessin Automatique des Lignes Isobathes) (or Automated tracing of isobath contours):

- tidal correction,
- smoothing of aberrant measurements,
- selection of summits,
- drawing of the plan,
- archiving of data,
- defining the clearance of a fairway (application, dredging),
- differential plans and calculation of volumes for :
 - monitoring the natural evolution of the bottom (erosion, silting),
 - monitoring the progress of dredging operations.

The students are capable, after these two weeks of instruction to process by themselves, the surveys carried out in stage a).

b) dredging (40 hours' lessons and training aboard a vessel)

- economics of a dredging project,
- geotechnical characteristics of dredgable materials,

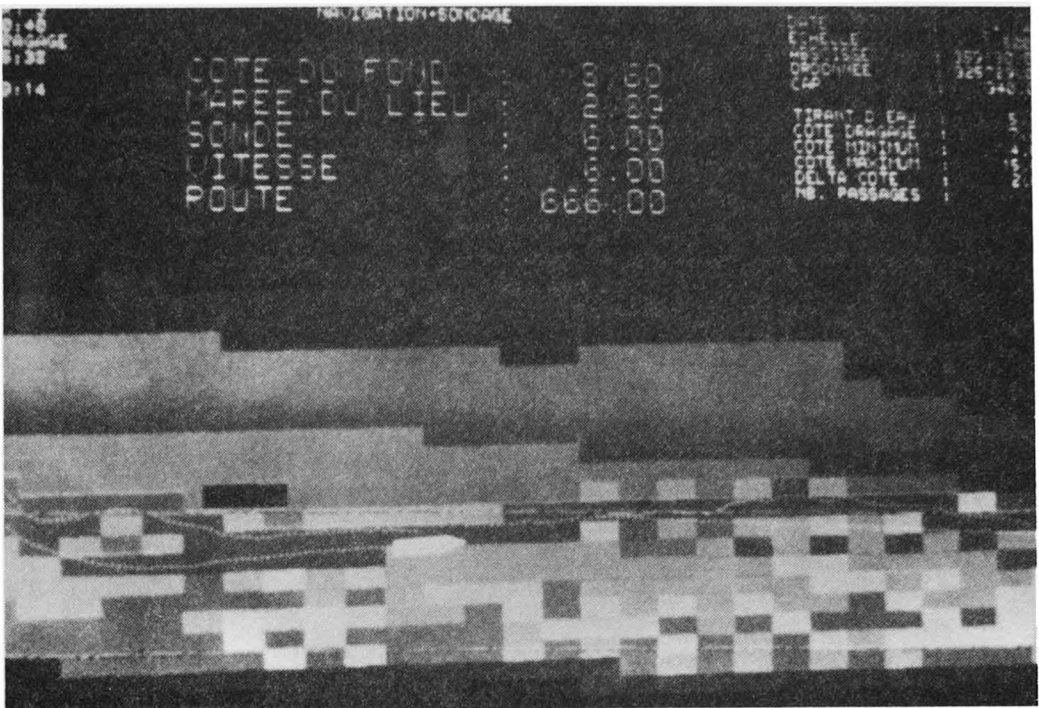


FIG. 5.— SYLEDREDGE System — Navigation aboard dredgers.

- different types of dredgers,
- computer and electronic equipment for monitoring the work,
- costs involved.

This theoretical training is backed up by several days spent aboard a dredger in action (suction dredge working) and visits to different types of dredgers (tipping dredger, dissolving dredger) (Fig. 5).

This stage is extremely important. It gives the students the possibility of appreciating the role and the impact of hydrographic activity in port economics and thus being fully aware of the amount of responsibility which they bear. This is particularly well brought out on the dredgers working in the Gironde, which use the data from the sounding plan on board. These, compared with the dredging camera make it possible to display on a screen, in colour, the zones to be dredged and the thickness of the material to be extracted. Equipped with positioning and navigation systems permanently supplying the exact position, the dredgers thus have at their disposal an efficient tool for real-time control of the execution of the dredging operations.

d) Navigation — Seamanship (20 hours lessons, 4 hours' practical work)

One week's lessons given by officers of the Bordeaux Harbour Master's office, completed by visits to the pilot service and the meteorological service.

e) Legal and economic aspects (12 hours)

- notions of the Law of the Sea,
- delimitation of port areas,
- safety of navigation in port areas,
- exploitation of surveys in port economics and logistics.

f) Final end-of-study practical project (two weeks)

During this project, the students work as a team to prepare, carry out and interpret a port or coastal sounding operation on a new site, including (Fig. 6):

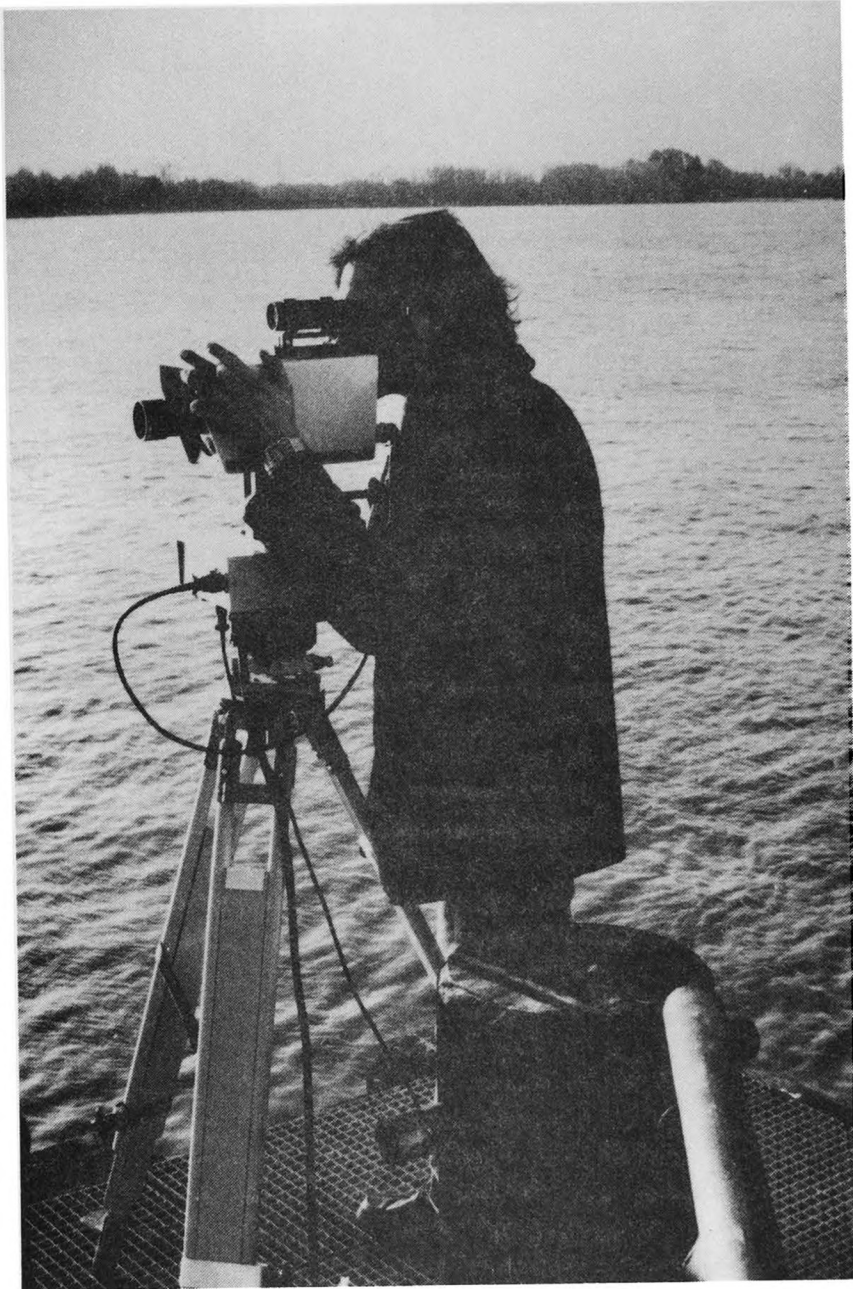


FIG. 6.— End of study practical mission.

- defining the equipment to be used,
- preparing the site (topography, tides),
- equipping the boat,
- carrying out the survey,
- scrutinizing the results — carrying them over,
- drawing up the report of the mission.

Each student has particular responsibility for one or more tasks, which makes it possible at the end of the project to give each an individual mark.

THE RESULTS SO FAR

Since its creation (in 1986) this course has trained 14 port hydrographers of French and foreign origin (from Senegal, Benin, Cameroon, Zaire, Madagascar) who have completed the full course.

Most of the students who have been sent to the course by the organization which employs them, now occupy posts where they are responsible for a hydrographic unit.

The final review carried out with the instructors and the students at the end of each session has made it possible each year to take their respective suggestions and impressions into consideration so as to arrive at the present organization, which is satisfactory to all. The latest adjustments made were adaptations of the syllabus as required by the FIG-IHO Advisory Board when the course was reviewed for accreditation.

The extensive syllabus obliges the participants to work hard and continuously, especially during the first 'module' which contains more theory than the subsequent ones. But, so far, all the trainees have participated with enthusiasm and shown a lively interest in all the techniques studied.

The rapid progression of requirements in the field of port and coastal hydrography, the constant evolution of techniques, the motivation and interest shown by all the participants in this course provide justification and encouragement for the continuation of this line of training. That is why thought is now being given to the idea of creating a real school in Bordeaux with a view to even greater improvement in the quality of the training offered.

DESCRIPTIVE SUMMARY OF THE COURSE

COURSE FOR TRAINING OF PORT HYDROGRAPHERS

- Length:
 - 1 university year (9 months)
- Language used:
 - French
 - English possible for a group of at least 6 students
- Entry conditions:
 - Must be holder of a university qualification corresponding to two years' university study after the French Baccalaureat, or equivalent.
- Fees
 - 60 000 FF in 1991.
- Level attained:
 - Category B
 - Award of a Diploma in advanced technical studies (DEST) in port hydrography.
- Course open to foreign students with a good knowledge of French.
- Course open to English-speaking students if a minimum group of 6 attend.
- Applications should be addressed to:

Université de Bordeaux I
 Institut Universitaire de Technologie 'A'
 Hydrographie Portuaire
 33405 TALENCE CEDEX — FRANCE.

or to Monsieur le Chef du service hydrographique
 Port autonome de Bordeaux
 152, quai de Bacalan
 33082 BORDEAUX CEDEX — FRANCE.

GENERAL INFORMATION AND REMARKS:

- AIM OF THE COURSE:** To train hydrographic surveyors specialising in port surveying so that they may successfully complete and coordinate all survey operations in port areas and integrate all the specific needs and constraints particular to such areas.
- COURSE SYLLABUS:** Conforms to the Standards of Competence for Hydrographic Surveyors, Category B.
- TESTING:**
 - Continuous testing of knowledge throughout university year

- Practical mission at the end of the training period.
- Examination of results by the 'Conseil de Perfectionnement et d'Organisation' meeting as a jury, which decides, on the basis of the results achieved, whether to award the Diploma of Advanced Technical Studies in Port Hydrography.

COURSE ORGANISED BY:

University Institute of Technology 'A' of the University of Bordeaux with the participation of:

- the Hydrographic and Oceanographic Service of the Navy
- the Port Autonome de Bordeaux
- the Institute of Geology of the Basin of Aquitaine.

INFORMATION:

The course begins on the first Monday in January of the current year. Applications for entry must be made before 30 September of the previous year.

The course is not organized if fewer than 6 students apply.