

John F. Riddell

The Role of Education and Training in Dredging

Abstract

The WODCON XIV held at Amsterdam in November 1995 included for the first time a full session on education and training for the dredging industry. The initiative for this session came from the Congress Organising Committee, and some ten speakers with a particular interest in the subject were invited to contribute short presentations. A lively discussion took place and a number of topics worthy of further consideration were raised. The speaker/panelists were: A.D. Bates, Consulting Engineer, United Kingdom; Professor W.J. Vlasblom, Delft University of Technology, The Netherlands; Professor Dr A. Welte, University of Karlsruhe, Germany; Dr. R. Randall, Texas A&M University, USA; Captain A. Kuruvilla, Dredging Consultant, India; J. Eygenraam, Royal Boskalis Westminster, The Netherlands; M. Harms, Maritime Institute "Willem Barentz", The Netherlands; Kenneth C. Wilson, Queen's University, Ontario, Canada; and Ronald de Heer, Institute for Hydraulic Engineering, Delft, The Netherlands.

This article is based on the contributions of members of the above panel to the Education Session of the XIVth World Dredging Congress and the subsequent discussion. As witnessed by the size and the participation of the audience, the subject of education and training for the dredging profession obviously generates a great deal of interest and is clearly of growing importance to the future success of the dredging industry. The full text of the presentations by the speakers is available in the WODCON Proceedings, *Dredging Benefits*, Volume 2 (pp. 973-1013), while one of the papers from this session, that of Mr J. Eygenraam, is reproduced elsewhere in this issue of *Terra et Aqua*.

Introduction

Education and training have not sat easily within the dredging industry. With dredging being historically considered perhaps more an art than a science, it is only in relatively recent years that the level of technology now available in dredging has resulted in the

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John Riddell chairing the Education Session at the WODCON.

realisation that a more formal approach to training than practical experience has become desirable. As dredging projects have become larger and dredging equipment more costly to purchase and operate, there has also been a realisation that the consequences of ignorance are now too great to be any longer acceptable to either employer or contractor.

But dredging is not a major industry. The employment opportunities within it are relatively insignificant, both in global terms and within the construction industry in general. The case for including its very varied interests as a standard element of formal university or college civil engineering education is not one easily made.



Figure 1. Operator at work on the cutter suction dredger simulator, with trainer supervising.

For education and training to succeed, there must first be a demand for knowledge and a willingness to participate in the learning process. Technology and the competition of the commercial world have ensured the demand. To have a healthy, flourishing world dredging industry is in the interest of everyone. Potential clients, their advisers and contractors must be aware of the possibilities which dredging can offer. Fortunately there are clear signs that the willingness to participate in the transfer and exchange of knowledge is steadily growing. The role of organisations such as World Organisation of Dredging Associations (WODA) and Central Dredging Association (CEDA) continues to expand, while initiatives by the International Association of Dredging Companies (IADC) in developing *Terra et Aqua* to a journal of professional standing, and in initiating various awards for students and young authors, are to be welcomed.

One of the difficulties of dredging education is the wide range of knowledge required. Many different categories of people are employed on the design and implementation of a dredging project. These include dredge designers and builders, contractors, operators, clients, consulting engineers, project developers, financial and legal advisers, and those with a particular concern about the environment. How can education and training meet the very disparate needs of these different groups? And how is knowledge to be gained, disseminated and preserved?

These were among some of the questions posed to the participants in the special WODCON XIV education session. To assist in providing possible answers, short presentations were made by distinguished speakers with specialist knowledge of or interest in dredging education and training.

OPERATOR TRAINING

The opening theme of the session was the training of dredge operators. Two presentations were made. The first was by Mr J. Eygenraam of Royal Boskalis Westminster and was followed by that of Mr M. Harms of the Maritime Institute "Willem Barentsz". Both speakers described highly sophisticated simulators for use in the training of those involved in operating modern dredging equipment. The Royal Boskalis Westminster simulator is able to reproduce all aspects of the behaviour of a cutter suction dredger. Its function is both to train new operators and to improve the efficiency of the more experienced crew members. No matter how good the dredger, a good operator will always maximise the production. The simulator allows many different variations in soil, weather and pumping characteristics to be reproduced.

The simulator has proved very popular with those who have used it, despite some initial misgivings by a few senior operators about "going back to school". The simulator is expensive, however, and required a considerable capital investment by Royal Boskalis Westminster in equipment, software, buildings and staff.

An alternative approach to simulator provision was described by Mr Harms. Pointing out that "dredging companies have for many years tended to recruit former merchant navy officers to operate trailing suction hopper dredgers", Mr Harms suggested that the "on the job" training traditionally used to develop both sailing and dredging skills was no longer appropriate. "There is now a strong demand for special officer training courses for the operational functions on

board trailing suction hopper dredgers”, he stated. This has resulted from changes in ship management practice and from the highly competitive economic situation in which contractors now operate.

Dredging companies and those who operate the dredgers have always appreciated the value of training and updating courses. For this reason a number of different parties joined forces to form the Foundation Fund for Dredging Training Courses. In 1992 this organisation supported the Maritime Institute “Willem Barentsz” at Terschelling to start HOPPERTECHNOLOGY, a new course to train maritime officers in the sailing and dredging techniques associated with hopper dredgers. The objectives of the course are to provide dredger officers with a proper understanding of shore organisation and shore business management, and to give them the skills needed to contribute to optimisation of the dredging cycle.

The “Willem Barentsz”

The Maritime Institute “Willem Barentsz” has a full-mission ship simulator to assist in achieving the foregoing objectives. The bridge simulator allows all aspects of hopper dredger sailing and dredging to be performed, including the pipeman position. The simulator has involved an investment of NGL 1 million and became operational in September 1995. It is intended both for the training of mariners new to dredging and for in-house company courses, including crew refresher and follow-up courses.

During the discussion about the two simulator presentations it was pointed out that the very high capital investment in such equipment would mean that its use must be confined to the larger dredging companies or company supported organisations. It was also mentioned that training of dredge operators was not confined to simulators, and reference was made to the specialist operator courses offered by IHC's Training Institute for Dredging.

CIVIL ENGINEERING TRAINING

Turning to the area of dredging education for civil engineers and others who may be engaged in the design or planning of a dredging project, Dr Robert E. Randall,

Director of the Center for Dredging Studies at Texas A&M University outlined the opportunities available in the United States. At Texas A&M University these included a BSc Degree course in Ocean and Coastal Engineering which has a significant dredging input. In addition a one-year postgraduate course is offered every three years, mainly for employees of the US Army Corps of Engineers, while the annual dredging short course attracts many participants from all sides of the industry. The short course includes hydraulics, dredge material disposal, and environmental and business topics. Dr Randall also mentioned in passing undergraduate programmes at the University of Florida, as well as at Maracaibo and Zulia universities in Venezuela.

Mr Ronald de Heer of the International Institute of Hydraulic Engineering at Delft, The Netherlands then described the one-year postgraduate hydraulic engineering course offered by IHE. The course is intended for graduate level students who already have some practical experience. Dredging is one of topics covered. According to Mr de Heer the programme has improved greatly because “in the last few years, the dredging course has been offered in co-operation with the International Association of Dredging Companies, and includes visits to dredging projects, shipyards building, dredgers and ports. Course tutors are brought in from the world of dredging with special attention being given to dredging contracts”.

The contribution by Professor A. Welte of the University of Karlsruhe, Germany emphasised that “during the early days of dredging, the development of equipment, machinery and procedures was based exclusively on the experience and observations of the dredger crews. It was their inventive talents and wealth of ideas which gave an essential developmental impulse to practical dredging operations”.

In Germany in the 1950s, initial modest approaches to dredging education emerged from job-oriented research mainly prompted by practical considerations. During the initial stages of co-operation between universities, polytechnics, specialist institutes and ports, together with equipment suppliers, a trend emerged for more scientifically-orientated basic research. As a general rule, the results of this research

Figure 2. Seated, left to right, panelist/speakers M. Harms, J.A. Eygenraam, K.C. Wilson, A.D. Bates, W.J. Vlasblom.



were only made available to the party which had provided the financial means for the project. Thus the educational effect derived from the research results was limited to a relatively small group of people.

Professor Welte continued: "The reason for this unsatisfactory development was frequently the fact that the companies involved, both dredger manufacturers and dredger operators, simply did not have suitably qualified executives with the personal and specialist skills to stimulate and guide their staff towards achieving the set corporate objectives".

This realisation led to the conclusion that education in dredging, in both theory and practice, was urgently required for all involved. In addition to the in-house training schemes of individual companies, overlapping solutions had to be found to allow all groups involved in dredging to work together. There thus arose a need for increasing attention to be paid to learning skills in staff management, project management, performance control and supervision, environmental protection and the appreciation of laws, regulations, directives and guidelines. As importantly, the knowledge of those involved on the commissioning side of a project must be advanced to match that of the contractors.

Professor Welte concluded by emphasising that each individual party must decide whether education and training are implemented in an organisation, and if so, at what speed and to what extent. Education and training are important, and it should be realised that "investment in good staff training is small as compared with the risks likely to be incurred by an inadequate level of knowledge among staff. Accordingly, the slogan must be 'education in dredging necesse est'".

Limited Market

Professor Kenneth C. Wilson of Queen's University in Ontario, Canada then described the specialist short courses with which he is involved. Noting first that "the dredging industry is a mature one, which makes large economic contributions to both developed and developing nations", Professor Wilson observed it was also one which required "only a limited number of specially trained engineers". Although this small group of engineers is vital to the success of the industry, the market for dredging education is not very large.

In Canada, some information on dredging is often presented as part of courses in coastal or river engineering. This type of presentation can hardly produce dredging professionals but does give a useful overview of the subject to engineers in related disciplines. It can also encourage those with a specific interest in dredging to take advanced training at one of the more specialised institutions such as Texas A&M and Delft universities.

Short Courses

"Practising engineers in the dredging field can keep abreast of the latest technology in venues other than conferences, specifically by attending short courses. Sometimes such courses are held before or after conferences", remarked Professor Wilson, but in his experience it is preferable to have a dedicated course of four or five days duration in which lectures can be complemented by laboratory and project work. Mention was made of the course on hydraulic transport offered at Augusta, Georgia in the United States and centred at the test facilities of the GIW Hydraulic Laboratory. This course has been run since 1978.

To encourage close interaction among the students and the teaching staff, each enrolment is limited to about thirty-six pupils. Engineers from the dredging industry form a significant proportion of the total number of students, drawn mainly from The Netherlands, the USA and Belgium. According to Professor Wilson, initially a marked difference in approach could be seen between the North American and European dredging engineers. The latter group tended towards greater technological sophistication combined with a reticence to discuss their own experiences. Over the years changes have occurred, however, with the North Americans seeing the need for greater sophistication and the Europeans becoming somewhat more forthcoming.

The discussion on these papers drew attention to a number of other dredging courses available, including the short courses run by the University of Strathclyde and those now offered by IADC, which are offered in different overseas locations to allow as much local participation as possible.

TRAINING NEEDS OF DEVELOPING COUNTRIES

Former Chairman of the Dredging Corporation of India (DCI) Captain Abraham Kuruvilla stated in his presentation that he once held the view that as "dredging is a part of a marine operations, any person with a marine background could pick up dredging skills without any special training". Following five and a half years experience with DCI and three years in a private dredging company, he had changed this view.

He now acknowledges "that one of the critical elements in successfully running a dredging operation is personnel trained in all the various aspects of dredging, be that dredge operation, maintenance of dredging machinery and electronic equipment, marine and civil survey, or contract and project management". As a developing country India now has a fairly strong dredging industry, with dredgers operated by the DCI, the ports, various state organisations and the

private sector. Until the 1970s there were no formal training programmes run for dredging personnel, and crews mostly received on the job training from their predecessors – who themselves may not have been very professional.

Captain Kuruvilla gave a brief run-down of the development of dredging education in India, starting with the first formal Indian training programme which was begun by DCI with the initiation of the All India Dredging Cadre in 1977. The programme was meant to train dredging officers both on the deck and engine room side. After about eighteen months of classes ashore, trainees were attached to different dredgers of DCI, while the final few months were spent in the University and the Nautical Engineering College, Bombay. This programme paved the way for creating a pool of well-qualified dredging officers certified by an independent examining authority. It was found that the trained cadets did very well on the dredgers, but for various reasons the training programme became restricted to meeting the particular requirements of DCI. In general the courses were well received, although there was some initial frustration on the part of the newly qualified cadets because of the resistance from the merchant navy officers who were then in senior positions on the dredgers. As time has gone by most of these problems have been resolved.

Dredging training in India has benefitted greatly from overseas assistance with numerous short courses being run with the help of both the British and Dutch governments, according to Captain Kuruvilla. Discussions have also been held to start a National Institute of Dredging Training to supply trained personnel for the Indian dredging industry, both private and government, but as yet the proposed institute has still not taken shape. This presents particular difficulties for the emerging private sector which does not have the resources to run its own training courses. The new private sector dredgers are operated mostly by people who have had some exposure to dredging in foreign dredgers, but the overall level of knowledge is not at present very high. This affects the operation and profitability of these companies. If the industry as a whole is to get the best out of the large investment in dredging equipment, it is imperative that there is some arrangement made to impart proper training to people already in the dredging industry and to those who want to join.

In concluding his presentation Captain Kuruvilla drew particular attention to the training needs of the smaller operators, both government and private, in developing countries. These operators do not have the financial resources to send staff for training overseas and find great difficulty in learning about the many aspects of dredging. The absence of low cost books and guides, written for such small organisations, also needs to be remedied.

COMBATTING IGNORANCE

The two final contributions were from Mr Anthony Bates, a UK dredging consultant, and Professor W.J. Vlasblom of Delft University of Technology. Mr Bates broached the subject of contracts, conflicts and education. He opened by stating that “it is a commonly held view that dredging contracts are particularly prone to conflict, but perhaps it is the case that conflict attracts attention, whereas harmonious contracts are more likely to pass unnoticed. Regardless of the statistics, two things are true – dredging usually is expensive and is accompanied by a substantial element of risk. Education and knowledge can do much to contain the former and reduce the latter”.

The dredging contract is in this context an important area. A contractor's tender price is based on information. If the information is inadequate, or misleading, such that the contractor underestimates the difficulty and cost of completion, it is likely that a claim will result. It is not uncommon to find deficiencies in the information provided to contractors due to a lack of understanding by the employer, or even by the consultant which the employer may use. Mr Bates outlined ten basic rules which should be followed if a dredging contract is to be completed to the satisfaction of all parties.

He concluded by strongly refuting, insofar as dredging is concerned, the saying that “ignorance is bliss”. Ignorance is not bliss in dredging – it is dangerous and potentially very expensive. “Unfortunately it is not uncommon for those arranging and supervising dredging works to be so lacking in knowledge of the processes that they are never aware that the work is less than satisfactory, and not been achieved at optimum cost”. Hence an unsatisfactory situation may be perpetuated in blissful ignorance, to the ultimate benefit of neither client nor contractor.

Professor Vlasblom opened his presentation by asking two questions: “Is dredging education necessary? Can the required knowledge be learned easily in the industry or in the field?” Before World War II and even into the 1960s, knowledge of the dredging equipment to be used on a project and the methods of dredging and reclamation were learned only in practice. Today, the dredging processes are much better understood, while dredgers have become larger, more productive and more expensive.

“These big changes in a relatively short period of time require a different approach to the question of education in the field of dredging”, Professor Vlasblom believes. “The new knowledge must be transferred to new personnel in order to avoid disappointment, prevent re-invention of already existing matters or, in the worst case, avoid the loss of knowledge freshly acquired”. He agrees with Mr Bates that “ignorance is



Figure 3. Speaking at the Educational Session, from left to right, Professors R. Randall, A. Welte, R. de Heer and Capt. Kuruvilla.

a main reason for dredging projects going wrong and it should be guarded against at all times. This applies not only to those persons working for a dredging contractor, but also for those working for the employers and their advisers”.

Everybody will agree that transfer of knowledge is of vital importance. Training is a very good and relatively cheap method to achieve this aim. The question is who is training whom and about what subjects?

But Professor Vlasblom pointed out the difficulties: “In addition to knowledge of the dredging process, transfer of practical experience is required. Although the latter would seem to be a simple exercise, it is not. The recent rapid changes in the dredging industry are still proceeding, which means that the knowledge of teachers who do not constantly relate to the subject is soon outdated.... All these developments mean that lectures concerned with these aspects of dredging have to be revised regularly – an important point which should be kept in mind by those responsible for organising training courses”.

In addition, “every branch of dredging activity should take its own responsibility for training their staff”. The contractor has to appreciate that exchange of knowledge can lead to growing knowledge, ultimately to the benefit of all.

Finally, Professor Vlasblom suggested that if the organisers of courses for clients and consultants sometimes have the feeling that their courses are not adequate or not up to date, they should take action to reach their goal, rather than complain about the small transfer of knowledge from the contractor.

THE DISCUSSION

After these brief presentations, the discussion was opened to the audience. One participant added to the list of courses mentioned that of The Training Institute for Dredging (TID) which provides short training courses at various levels. These are theoretical or practical

or combination and simulation is also used. Such courses are often designed for the crews of dredgers. Others mentioned the courses organised by CEDA as well as those offered by Hydraulics Wallingford and Oxford University. In addition, it was remarked that CEDA aims to publish state of the art reports on dredging and related issues.

Professor Emeritus de Koning (Delft University) pointed out that offering education at the engineering level is not possible in countries without a major dredging industry to support it. He suggested that for projects in such countries the establishment of Joint Ventures between international dredging and local companies is the only way forward.

In this context, various contributors expressed sympathy with Captain Kuruvilla’s remarks about the difficulties of developing nations. Solutions were not so easily found for organising courses in developing areas however, and essentially come down to the availability of funding. It was suggested that there could well be a role for associations such as CEDA to commission and distribute relatively simple guidance notes aimed at developing countries, and to organise trainers, including, for example, retired but highly experienced dredge operators from Europe to deliver on the job training in countries like India. As Ms Lorraine van Dam, recently retired Director of CEDA pointed out, organisations which utilise retired technical experts do exist, for instance, the PUM (Netherlands Management Cooperation Programme) and the British Executives Overseas.

The issue of funding dredging training was raised as well in a general context. It was noted with interest that the Western Dredging Association offered scholarships for the Texas A&M course, while the IADC courses usually had company scholarships available. Short course funding often came from government sources, especially in developing countries. However, there were several advocates in the audience, including several current students, that felt that increased financial

support for education and training should come from the dredging industry itself.

Educating the General Public

A concluding remark was made by Mr Peter Hamburger, Secretary General of the IADC, that "although technical advances are given a great deal of emphasis at dredging congresses worldwide and also at the WODCON, this amounts to dredgers speaking to themselves. Very little attention is spent to educating the general public about the economic and ecological benefits of dredging. This is an issue which is clearly of growing urgency in today's world where governments must often win public support for their dredging projects and policies. International associations should perhaps give more attention to how this could be done, possibly through publications, seminars and congresses which are directed to a broader public than that of the dredging fraternity".

Conclusion

In viewing the many contributions made by both the panelists and the audience, the wide variety of dredging education emerge.

Education by no means has the same meaning to all parties. To mention a few aspects:

- There are the needs of those who operated the dredgers. At one level these were being met by highly sophisticated and expensive simulators, at another they were not being met at all. How was basic training to be given to the operators employed by the many small dredging contractors, ports and government agencies throughout the world, and especially in developing countries?
- An increasing number of short courses are offered by both educational and trade organisations. If up to date and well presented these could be of great assistance to those employed by clients and consultants, as well as by smaller contractors. The problem appears to be accessibility to the courses. To save costs and allow the maximum participation, courses are best run in the demand countries. But costs still exist. How are they to be met? Is there a role for organisations such as WODA and IADC, or should it be left to sympathetic governments?
- Dredging education should include clients, consultants, contractors and regulators. Within each of these areas is a further range of knowledge requirements. Mariners, civil engineers, mechanical engineers, naval architects, surveyors, electronic engineers, accountants, managers, environmental scientists may all interact on a dredging project. Some knowledge areas are very specific – pipeline transport or pump performance, for example – while

subjects such as contract conditions and project management may be much less so.

- There is a growing necessity to educate non-dredging specialists and the public at large about dredging, because it has become a subject of more general interest but one which often receives damaging publicity. Environments are always impacted by dredging but not only negatively. Few people outside the dredging world realise that dredging, far from creating environmental problems, is frequently used to solve such problems arising from other human activity.

There was certainly very considerable benefit to the participants from the education session. Not every question was answered, and not every issue was addressed. There is much still to be done, and the proposal that a further education session should be included in WODCON XV in Las Vegas in 1998 was welcomed by all.