BY AN OLD HYDROGRAPHER

As it Was

In 1953 there appeared, amid a welter of underwater explosions, around the northern end of Das Island in the Persian Gulf a converted WWII surplus LCI(L) looking like some form of marine tram and still complete with fittings for personnel gangways on either side of the bow. Das Island was then an uninhabited, waterless, rocky piece of volcanic detritus, useful only as a shelter from the north-west Shamal wind. As a crew-member of a naval hydrographic survey ship working in the area I thus caught my first glimpse of the new marine seismic survey industry at work. Twelve years later I suddenly became an accredited â€˜oil industryâ€™ surveyor myself.

After the first successful drilling of a â€˜wildcatâ€™ well on 28th August 1859 by Edwin Drake in Pennsylvania and the western worldâ€™s discovery of a commercially viable source of fossil oil, the oil industry spent the following ninety-two years evolving its own particular breed of â€˜in-houseâ€™ land and engineering surveyor suited to the needs of geological explorers, in addition to drilling, construction and civil engineers. These people mapped remote wildernesses, tropical jungles and mountain ranges; pinpointed geological test sites; defined boundaries of land acquisitions; selected suitable routes for access roads and pipelines and set out all the associated construction works. Then, in 1947 in the Gulf of Mexico, a small American oil company, Kerr-McGee, drilled the first commercially productive offshore oil well, and the surveyorsâ€™ feet â€˜got wetâ€™.

The importance of many surveying technologies in modern exploration for and the development of hydrocarbon deposits was recently a subject for the â€˜Interviewâ€™ column in this publication. It was an educated exposition of the present state of offshore oil industry surveying and a tantalising look into the future; however, it is also useful to refer to our past, if only to seek lessons for that future.

The milestone Kerr-McGee well lay just over ten miles off the coast of Louisiana, surrounded by a hostile environment to which the industryâ€™s land surveyors had rapidly to adapt, although control of operations could still be effected using land survey techniques - triangulation from observing towers on the coast was one popular method. As long as the shore was within sight as, for instance, in Lake Maracaibo in Venezuela, work could proceed smoothly; however, when land became invisible a problem arose. Fortunately, early radio positioning, based upon wartime airborne and marine navigation systems, was then being developed for peacetime applications. Among the most frequently used of these were SHORAN, able to provide accurate two-range direct measurement positioning, and Deccaâ€™s 2RD (a version of its low frequency Main Chain system, to be followed in the late 1950s by medium frequency Hi-Fix), or the American system RAYDIST. Both used phase comparison principles to enable operation of more than one mobile receiver.

A very few commercial survey companies in the field of hydrography, mainly for the ports industry, extended their activities to offer services to oil companies: not only positioning, but also measurement of depths and tidal movement, essential parameters for the safe deployment of mobile marine drilling rigs. These were initially â€˜jack-upsâ€™ or â€˜sit-on-bottomâ€™ and, as operations moved into ever deeper water, column stabilised moored barges. New survey contractors gradually emerged to undertake this work reasonably efficiently, often using ships of convenience provided by a client either on-site or chartered locally, and portable equipment capable of being transported as air cargo. Some oil companies still used, and were proud of, their own in-house abilities but these were to prove insufficient for the tremendous pressure of work around the world as ever more offshore prospects were successfully tested. A shift of emphasis occurred in the expertise within operating companies towards supervisory duties, monitoring the quality of contracted work.

As one example of the situation, developments in Nigeria when I first arrived in 1965 provide an insight for industrial historians into the not always welcomed changes in managing surveying work. The major operating company in the area, Shell-BP Petroleum Development, was tentatively implementing a new policy which involved moving from in-house surveying to employing contracting companies to service operations in its numerous Oil Mining Leases (OMLs) on dry land and in the swamps of the Niger Delta and its Oil Prospecting Licences (OPLs) offshore. The companyâ€™s first test drilling on land in 1938 had proved positive but not commercially interesting; however, after oil and gas was found in worthwhile quantities in 1953 there occurred a huge surge in exploration activity until, by 1965, operations involved half a dozen seismic crews, eight land, swamp and offshore drilling strings, three full-time dredgers (grab and cutter/suction) and numerous major construction projects, including pipeline contractors. All of this was supported by some thirty survey crews on land and in the swamp - plus two hydrographic survey ships working offshore. Positioning at sea was provided by four of Decca Surveyâ€™s hyperbolic Hi-Fix chains, one covering each OPCO OPL.

Although the companyâ€™s training programme had ensured a useful core of Nigerian professional and technician surveyors for normal workloads, dozens more were needed and were recruited from many countries These reflected a variety of technical backgrounds: coal mines and quarries, government land mapping and nautical charting agencies, the ports industry, free-lance civil engineering assistants in private practice, and, most remarkable of all, two Hungarian ex-army artillery surveyors. Most of the survey personnel and equipment were directly contracted to work to Company specifications and under Company supervision, but it soon became clear to me that there was an anomaly in the end products. Good professional and environmental practices were being followed: horizontal accuracy criteria were carefully met, certainly as good as the technology of the day allowed, and perfectly adequate for locating lease boundaries, seismic shot-points and subsequent drilling at that time. However, the quality of â€˜verticalâ€™ data: water depths, heights, tidal data, currents - all vital for engineering and navigation applications - seemed to be regarded as secondary to the geodetic goal of centimetric horizontal closures.

Hyperbolic Hi-Fix chains along the coast of the Delta, with the master station located inshore in a mangrove swamp and two slave stations on a sandy beach, presented their own problems. Speed of propagation of terrestrial radio waves is greatly affected by variations in the terrain over which the signal has to pass. The mangrove swamp geomorphology of the Niger Delta is mud or fresh, brackish or salt water, depending on the height of tide and the level of the Niger seasonal flood. When it rains the terrain changes again, until the sun dries the mangrove tree leaves. In the middle of the swamp, isolated sandy islands distort radio signals. Chain calibration proved to be a nightmare for the surveyors, and frequent loss of accuracy caused by environmental conditions and/or plain, old-fashioned â€˜lane-slipâ€™ due to weak signals meant constant lane checks were needed (and much diplomacy when interfacing between hard-pressed chain commanders and seismic party chiefs). However, despite all problems, offshore seismic surveys were completed and interpreted, drilling locations were selected, rigs were placed on location, wells were drilled - and oil and gas were discovered in surprisingly large quantities. This until civil war brought all operations to a dead stop in 1967 as the threatened Biafran conflict became a reality, was fought and eventually won (or lost, depending upon which cause you favoured).

Re-starting work in the Mid-Western Region in 1968, before the end of the conflict in the East, was a massive task for surveyors. Those employed by one particular old-established survey company - one admirably endowed with â€˜know-howâ€™ - were quick off the mark. A cargo plane was chartered and, filled with aluminium dinghies, outboard motors, survey equipment and instruments, flown direct to Lagos. On arrival there, a fleet of â€˜Mammy Wagonsâ€™ was waiting to transport the gear to Warri - and the dedicated staff were able to set up shop at a temporary self-built river-side base in record time. Within a week, crews were on the job surveying a possible route for a pipeline from productive oil fields in the western Delta to the entrance of Forcados river, supplying a new terminal from which oil exports could resume. It was pioneering effort at its best on both sides: the client, having the advantage of years of practical expertise, appreciating the efforts being made and the survey companies responding by putting on a memorable performance. And it worked, showing a largely disinterested public just what can be achieved under adverse conditions.
That was â€˜As it Wasâ€™. Forty years have passed since operating companies began to abandon their own in-house surveying expertise and dispense with the services of countless staff surveyors working world wide. Although the purpose of surveying is the same - a sub-set of many pertinent activities - 21st century techniques are totally different. Indeed, they are as different as they possibly could be - but still, strangely, beset by the same old bugbears: ill-conceived specifications, mistaken emphasis, the wrong tools for the job, misunderstood objectives and shortage of the right sort of people. There is a new one as well: Political Correctness, and the reader can work that out for him/herself.

Above all, it remains essential that clients maintain a good level of practical expertise if these problems are to be avoided. But I have no suggestions as to how they may do so in the years to come.