A REVIEW OF CURRENT AND FUTURE TECHNOLOGIES

Digital Video Offshore

The advent of digital video introduces a new era for the offshore oil & gas industry. Digital methods of data acquisition have permeated most offshore survey techniques. The Offshore Survey and Remote Systems and ROV divisions of the International Marine Contractors Association (IMCA) have published a review of the field in Digital Video Offshore: A Review of Current and Future Technologies, for offshore contractors and their clients.

The adoption of digital encoding and recording of video data has gathered pace over recent years and many annual inspection campaigns now include digital video deliverables. This step has been dictated either by client specification or by sub-contractors seeking more efficient processing and delivery techniques than can be realised with analogue video. The Offshore Survey and Remote Systems and ROV divisions of IMCA have collated and published a wide-ranging review of the digital video field in Digital Video Offshore: A Review of Current and Future Technologies (IMCA S 008/IMCA R 012). Intended for the benefit of both offshore contractors and their clients, the publication provides an understanding of digital video technology, its potential benefits over existing analogue technology, practical applications, and issues relating to the development of standards within the survey industry. It aims to encourage the widespread use of digital video and to provide information on how data is captured, synchronised with traditional survey information and compiled into digital reports for delivery to the end client.

Quality Factors
The review includes discussion of factors affecting the quality of recorded digital video data, including the quality of hardware from camera through to recorder, the method of data transmission, and the environment in which the camera is used. The document also addresses the alternative approaches taken by different companies to the acquisition and use of digital video, including selection of media storage options and integration with GIS systems, providing a basis for further discussion of potential digital video standards within the offshore pipeline/structural inspection industry.

Background
Analogue videotapes have for many years been in widespread use for recording all forms of underwater visual inspection tasks. The technology is well proven and reliable. Standard-isation of VHS format has ensured widespread compatibility of recording/playback hardware and recording media, e.g. VHS VCR and tapes. VHS equipment and tapes are relatively cheap, widely accessible across the industry, both offshore and onshore, and picture quality is acceptable. However, storage of tapes is costly and takes up valuable space. In spite of the wide availability of VHS, it is not found on every desktop, and access to data can be slow and cumbersome.

Digital video brings with it some tremendous steps forward. Two examples being the massive reduction in size of storage media and greatly enhanced access to data. Data can be transferred easily between sites and reviewed in the modern desktop environment. As the new technology emerged, its very newness meant that some form of information on the technology would be needed for both contractors and their oil-company clients. In late 2003 IMCA established the Digital Video Workgroup to create such an information document. As the document emerged the focus changed from development of guidance to a review of available technology. Part of the driving force behind this change in emphasis was the speed with which the rapidly evolving technology was changing and spreading through the offshore industry. The objective of the workgroup remained the provision of information upon the basis of which all could plan their digital video strategy.

Offshore Applications
The technology review uses three broad categories, defined in terms of the complexity of the digital video system and potential users. The first is surveillance. This includes such work as drill support, diver support and construction. Generally, all that is required is a single camera with associated recording equipment. The data recorded have little intrinsic value and can be overwritten once every 24 hours or so. The primary use in diver safety would render the data of value only in the event of some form of accident requiring playback or checking of events after the fact.
The second is structure inspection. Platform inspection and viewing of other subsea equipment fall into this category. Requirements are a little more complex. A single camera/video stream is recorded and data logged from sensors. Video can be referenced to date and time using an alphanumeric video overlay so that it can be related later to other survey information. Image quality is important; the resultant data can have high intrinsic value and needs archiving appropriately. It may be necessary to dub a commentary and prepare edited highlights as a
client deliverable.

The third category is pipeline inspection. Pipeline inspection surveys are the most complex type of subsea inspection, demanding

integration of video and other data from a large variety of surveys/sensors. The implications of using digital video are thus much greater than if it were simply a case of recording video in a digital-video format. Typically, pipeline visual inspection tasks are performed using three ROV-mounted cameras to record coverage of the top and both sides of the pipeline onto VHS tape. Video is time-synchronised with the data collection of other survey-data sensors on the ROV, and generally an alphanumeric video overlay is recorded onto each camera video stream so the raw pictures are annotated with information defining the time/location of recording the video.

Storage Media
Our review covers the available technology for digital video recording, from the simpler equipment used for the 'domestic' market through to professional broadcast equipment. Detailed alongside DVD recorders are other methods of recording data, including the use of modern digital tape and hard-disk technology. There is discussion of the diverse range of available CD and DVD formats, as well as the pros and cons of newer technologies such as DVD Blu-Ray and HD-DVD. There is an explanation of a number of important technical issues, including different file formats available, digital-video compression techniques, and the resulting 'latency', the time delays that can be caused by temporal compression.

Integrating Data
A central advantage of digital video technology is the ease with which it can be merged with data streams from other sensors, adding value to the original video images. It is important when dealing with digital video to discard many concepts relating to analogue video. Digital video offers more direct control over acquisition, playback, storage and retrieval; control not possible with analogue video. This can result in more efficient surveys, as well as improving access to survey information and providing added value for the data acquired offshore. The integration of digital video files with other digital survey-data files allows the video camera to be treated as another sensor in the processing sequence, enabling digital video technology to become far more than just a replacement for the analogue video recording system.

New Technologies
Most video cameras that are used subsea are still analogue types. In the longer term, the demise of use of the analogue camera subsea will mean a completely digital data path from camera to client's chosen recording medium, with implications for the way data is transmitted up future ROV umbilicals. It is a complex matter to specify a complete 'digital throughout' system suitable for an ROV, such as one using digital cameras and digital transmission techniques and which digitally displays and stores images. There are many issues to consider, requiring extensive discussion and agreement between camera and ROV manufacturers, operators of this equipment and final users of digital video data.
Using geographical information systems (GIS), datasets obtained using different sensors from differing surveys in various years can all be viewed and analysed together with respect to their geographical position. Any particular event may be viewed by video for each successive year to see how it changes with time. This is true for other survey datasets, reinforcing the principle that digital video data can be treated in the same way as other digital survey data.

Conclusions
The introduction of digital video technology into the offshore inspection industry represents a significant step for clients and contractors alike. For clients, the access to video data can, with proper planning, be desktop PC-based, allowing rapid development of data review and remediation schedules. There is evidence that review time can be reduced by an order of magnitude based on the use of digital video techniques.

For contractors, the inclusion of video data as another survey sensor allows an enhanced data-flow to be developed, improving both the quality and timeliness of deliverables, benefits already being enjoyed in the industry by most parties. However, with the benefits comes a recent increase in misunderstandings and misinterpretation of specifications and client requirements. The new document details technical aspects that must be considered by both client and contractor when planning inspection campaigns. Given the rapid change in technology prevalent in the multi-media industry, it may be considered unwise at this stage to attempt standardisation. The leisure and media industries seem to be settling on DVD as the replacement for VHS tapes, and with new, high-volume DVDs such as Blu-ray becoming available with time, DVD would seem the medium with the longest lifespan. For now, however, the general consensus seems to be:

- log raw video data in an industry-recognised format, e.g. MPEG-2, MPEG-4 or Windows Media 9; Codecs for reading these formats are widely available
- archive full raw datasets to tape or external hard disk
- provide the video deliverable to the client on some form of hard disk-drive
- deliver summary datasets of inspection events/anomalies on DVD
- store and supply final processed survey datasets and events in CSV format or in databases.

Digital video is still a relatively new industry. There may be much more technological change and development before it reaches maturity, particularly with regard to its interface with the offshore oil industry. The IMCA publication has not attempted to specify the answers to all questions, but has attempted to provide information which readers may find useful in addressing some of these questions. Further standardisation of such criteria within the industry will require more extensive discussion between manufacturers, clients and contractors to ensure a solution acceptable to all.

Copies of the IMCA digital video review can be obtained from IMCA by emailing imca@imca-int.com. Members of the industry interested in contributing feedback or comment that will be useful for the updated version of the review in 2007 are invited to contact IMCA, the

international trade association representing offshore, marine and underwater engineering companies.