HOW DIGITAL VISUAL SYSTEMS LOWER COSTS AND IMPROVE EFFICIENCY

The Dawn of the Digital Age

Traditionally, Video Inspection surveys have been performed by ROV using analogue CCD colour cameras, with the video pictures recorded to S-VHS videotapes. This technology has served the industry well for more than twenty years but technology moves on: the world watches films on DVD, digital video movie trailers can be viewed over the internet and 3G mobile phones allow digital video clips to be viewed on the move. We are about to witness the same paradigm shift in the way we handle video information as occurred twelve years ago when CD audio replaced analogue vinyl recordings.

Digital video systems offer a complete replacement for VHS tapes for digitally recording, reviewing and reporting inspection surveys, speeding up the entire process and saving money at the same time. Clients can now view video in a completely new way, integrated with information recorded from many other data sensors. Since the late 1970s the entire offshore industry has universally adopted VHS tapes as the means for recording and playback of video data, enabling widespread sharing and access to video data. It has recently been announced that the leading manufacturers of professional S-VHS VCRs are planning to discontinue manufacture and support for this technology over the coming three years. Digital video systems are here and are being used by an increasing number of clients and operators: so why should a move to digital systems be considered?

Benefits of DVT

- significant cost savings due to improved operational efficiency e.g. no need for tape changes etc.
- playback video directly from desktop PC
- improved access to and distribution of video data - sharing of video via internet/email/CD/DVD
- radically improved data visualisation
- all survey data and video seen on one PC
- significant reduction in number and volume of storage media
- faster video eventing and report generation
- making of perfect video copies with no loss of quality.

How It Works
Essentially, the VHS tape recorder is replaced by a digital processor, typically a PC, which converts the analogue camera signal into a digital video stream which is then compressed into a file format for storage on hard disk. The benefit of this approach is that video recording is continuous, so we no longer need to stop the survey whenever tapes have to be changed. Changeover is instantaneous and a new header recorded: this significantly saves on wasted vessel time.
Dedicated hardware for playback of video is no longer required as this is achieved directly from the PC on your desktop, either from a hard disk, over a network or on CD/DVD. When we need to make copies of video for distribution this is now much quicker than copying a VHS tape and the copy will be of the same quality as the original no matter how many copies are made.

Not Just Video
One of the misconceptions about digital video is that it is simply a direct replacement of videotapes. Whereas VCRs and videotapes were a fixed technology, simply designed to record video pictures onto common tape media - separate from all the other information we commonly need to work with - Digital Video revolutionises the way we deal with video and other associated information. Because digital video systems simply create computer files containing video, as opposed to any other type of data, they should be considered as no different from any other files, whether Word document, spreadsheet or AutoCAD chart. All these files are stored on some form of digital media, be it hard disk, tape, CD or DVD, and are opened by a software programme which interprets the stored data into information in a format which we all understand. This fundamental change means that we can now truly integrate video information with any other type of data.

Integration and Visualisation
Data integration is the ability to link together information from related datasets. This may be data recorded simultaneously or at different times, all of which share a common link such as a time or a geo-reference i.e. position. This can include video recorded for the same area but at different times, so that changes in condition may be monitored by simultaneously playing several video streams.
Data integration also enables all relevant information to be displayed concurrently on one or more PC displays. Bringing all the data together in one place allows the end-user to visualise key information in a much more effective way. The user has control over what information is displayed and the exact way it is displayed: this makes for a powerful tool for data analysis and value is added to the clientâ€™s offshore inspection surveys.

Operational System Configuration

The successful implementation of Digital video involves far more than simply converting an analogue video input to digital and then storing it on disk or tape. To attain the maximum benefit from the medium a fully integrated approach is required throughout the process from data acquisition to final reporting. The key issues here are:

- automated video capture and archiving
- merging survey data and cross profiles with video data
- merging of video data with Online or Offline Eventing
- automated Data Management and Indexing of all data
- integrated Eventing and Video Review processes
- automated processes for final reporting and generation of easy-to-access Electronic Reports.

The Digital Video Concept

The aim of a digital video system should be to make the data acquisition, eventing, video reviewing and reporting process simpler, cheaper and more efficient than with current technology. This whilst also delivering significant additional benefits to the end client such as ease of access, faster reporting and higher quality electronic reports. There are three primary stages in this process: Data Acquisition/Online Eventing, Offline Processing/Eventing and Final Reporting. A successful digital video system (Figure 2) should offer a comprehensive set of tools which automates these functions to ensure higher productivity and reduce operator error.

Online Data Acquisition

An encoder module performs capture of Online video. It can capture video from a single camera for structural inspections, or three cameras for full pipeline inspection programmes. In addition to video capture, the system stores related survey data and all associated Events identified during the survey inspection.

Offline Video Review

Within minutes of video being captured, it may be viewed by any PC attached to the digital video server on the network. All raw data, including the video files, is automatically indexed and archived onto digital tape. Digital video also enables viewing of all the associated survey information, allowing the client to visualise all data as integrated and viewed on a single PC. This visualisation is controllable by the user, who can select to view pipeline track, longitudinal profile and cross-profile showing pipeline burial status and a 3D view of the pipeline (see Figure 4). The database is also fully searchable, allowing quick access to any information.

Data Storage Issues

One of the primary differences between digital storage and analogue tape storage is its versatility. Analogue video can only be stored on tape and copying/altering the media is restrictive and time-consuming. In contrast, digital video files can be stored on any type of digital storage media. The rapid increase in storage volume and decreasing cost over the last couple of years has lead to a bewildering choice of options when considering the best solution for digital video storage media. Figure 5 shows a useful matrix illustrating how differing media can be used depending on the requirements for accessibility, convenience and quantity of digital video data to be stored.

CD/DVDs offer the convenience of portability/accessibility and can be easily distributed to other users. Their storage capacity is rather small, so that they are best suited to sharing shorter video clips or electronic reports with video highlights. This type of media is not really suited to long-term video archiving, as they can be easily damaged and for all but the shortest surveys a very large number of discs will need to be accumulated to contain your survey.

Hard disks offer the fastest access to video and are a very compact storage medium: a 250GB disk will store 2.5 days of video survey for three cameras. External disks are very portable and can be plugged directly into a USB/Firewire port on most PCs. They are cheap and now come with varying capacities of up to 1TB, sufficient to store a typical two-week inspection survey. The only downside of hard disk storage is data loss in the event of HD failure and managing a large array of these disks if a survey expands.

The next logical step for reliable, secure large volume video storage is to use the latest generation of Network Attached Storage systems. These are basically an array of hard disks controlled by a storage server capable of providing a single volume with a capacity of 1 to 30TB or more. This solution also provides a very robust solution, since data is protected by a system that can automatically rebuild any individual HD that fails. These systems have traditionally been very expensive but the latest developments have seen prices drop to an affordable level, making this an excellent way of storing large databases of video inspection surveys.

Finally, there are the digital tape solutions that are used to create a back-up archive of video. These are not suited for instantaneous video playback, as the video files first have to be recovered from tape onto a hard disk. However, they do provide a highly robust/secure means of storing the complete archive of video data. These tapes are cheap and store data at a very high density: for example a single SDLT tape with a 300GB capacity will store three days of video from three cameras. This represents a reduction in storage volume of 1/144 and a reduction in the physical number of tapes by a factor of 72.

Final Reporting Deliverable

One of the drawbacks of traditional inspection survey reports has been the fragmented approach to the final reporting deliverable. For example, these might include a written survey report, spreadsheets containing lists of Events and anomalies, pipe sheets/charts/diagrams and a large number of videotapes. Digital video offers the delivery of all this information packaged in a single format i.e. on DVD, on external USB hard disks or on a network hard disk server. All data can then be accessed from a single location and viewed from a PC using a simple user interface. This allows the user to choose between viewing the data through the clients own database structure/GIS or using a separate viewer program bundled together with the data on a CD/DVD for automatic playback.

Summary

Clients realise that it is now possible to integrate digital video with their other database information, since video has become just another data file that can be stored digitally and linked seamlessly with other forms of geo-referenced information. Access to data is much simpler and faster, thus enlarging the user base able to make better use of and share this information.