EDUCATION AND TRAINING FOR AUTO CARTO

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ABSTRACT

The paper examines the needs for education and training for staff involved in Auto Carto generally; and draws attention to the requirement for operators, technologists and professionals; it examines in detail the training being given in the seven operations where Auto Carto is currently being practiced in the Ordnance Survey, this includes automatic drafting, computations, digital input from field survey instruments, the field update system, photogrammetric digital data capture, digital mapping and interactive editing; it attempts to look into the future with the introduction of new technology, to identify possible additional training needs; and it suggests some initiatives which could be taken to meet these forecast needs.

DEFINITION OF AUTO CARTO

Auto Carto is not a discrete discipline with well defined parameters, but is a generic term for a range of disparate functions which have a common purpose, namely the creation of digital data which can be used by the cartographer to aid map production and by other users to meet a variety of requirements in the field of Information Technology (IT). Auto Carto is considered to cover three main functions;

As a tool to aid map production, without necessarily creating a bank of digital data

As a means of creating, revising and enhancing databases of digital topographic and allied data for use in cartography

As a means of extracting data from such databases for use in map production or for providing such data to users in forms suitable for their requirements

THE EDUCATION AND TRAINING NEEDS

As with all technical disciplines, Auto Carto can make use of staff with varying skills and knowledge. At one extreme staff may require only simple manual skills to operate equipment without needing to know how it works; and at the other extreme staff may require extensive professional or technological knowledge and skills, which will enable them to manage, plan, develop, install, trouble shoot, maintain, and repair highly sophisticated electronic equipment operated by a multi-discipline staff. A production agency cannot decide on its training requirements until it has established the correct balance of staff needed to carry out its particular task. This balance may vary from agency to agency depending on both the task and the type of equipment used.

In broad terms, however, there will be a general need for broad based induction training for all the staff, and then varying levels of

technical training for the operators, and education and training for technicians, technologists and professionals, appropriate to their responsibilities.

HOW CURRENT TRAINING NEEDS ARE BEING MET IN THE ORDNANCE SURVEY

Fcr the purpose of this paper, seven operations have been grouped together under the broad umbrella of Auto Carto. The work is carried out in different divisions within the department and with different equipment. This has resulted in separate training needs in each area, and separate training programmes. These seven operations are:

Automatic Drafting using a Kongsberg 1216 four pen drafting table. The main task is the plotting of Instrumental Detail Surveys (IDS). Edit plots are drawn on paper and final plots directly on to plastic documents. Errors detected at the edit stage are corrected by amending the plot files before final plotting. Other plotting tasks include photogrammetric surveys, grids and graticules. The Kongsberg plotter is also used as a measuring device for checking lower order survey plots.

Computations The task is to compute minor control surveys and Instrumental Detail Surveys on a Vax 11/850 computer from digital data received on cassette tapes. Editing may be necessary.

Digital input from Instrumental Surveys The task of Instrumental Surveys is to provide horizontal, vertical, and detail control, and to present it in digital format on cassette tapes.

The Digital Field Update System (DFUS) The task is to pre-edit and digitise to current OS specification, detail surveyed at 1:1250 and 1:2500 scale on the Master Survey Drawings (MSD) and to replot the new detail on to the plastic MSD.

Photogrammetric digital data capture The task is to plot map detail photogrammetrically and at the same time collect digital data which is subsequently manipulated, coded and edited for input to a database.

Digital map production The task is the initial data capture and revision of digital maps using source material at 1:1250 and 1:2500 scale; including pre-editing and feature coding. For maps going forward for publication, additional text and symbols are required.

Interactive editing of digitised map data The task is to use interactive edit stations to correct errors which have arisen during the blind digitising process.

Continuation training in the Ordnance Survey

Apart from the appreciation training for managers, all the other courses are followed by a period of on-the-job practical experience. During this time the trainees will meet the range of problems which arise during normal working practices. Line managers and supervisors act as instructors and counsellors during this stage of the training.

The following tables list the range of in-house training courses which have been developed to train the staff in these seven operations.

TABLE No 1

Type of Course	Equipment	Level of Student	Course Objectives The student should be capable of:
AUTOMATIC DRAFTING COURSE Duration 20 Days spread over 3 months 75% practical	KONGSBERG 1216 4 pen drafting table VAX 11/750 Computer TEKTRONIX 4663 2 pen edit plotter	Basic Grade Surveyors or Draughtsmen (Operators) Higher Grade Surveyors or Draughtsmen (Supervisors)	Using the Tektronix plotter for production of a range of edit plots on paper Using the Kongsberg 1216 for plotting IDS and other forward or reverse reading work using etching ink on plastic documents Correcting computer files
COMPUTATIONS FOR MINOR CONTROL AND INSTRUMENTAL DETAIL SURVEYS Duration 27 days spread over 3 months 65% practical	VAX 11/850 Computer with 440 megabytes of permanent disc store LINE PRINTER DOT MATRIX PRINTER TAPE DECK INTERACTIVE TERMINALS	Basic Grade Surveyors or Draughtsmen Higher Grade Surveyors or Draughtsmen	Using the Vax 11/850 computer Creating, amending and deleting edit files Carrying out traverse computations Carrying out Bearing and Distance computations
INSTRUMENTAL DETAIL CONTROL COURSE Duration 25 Days 60% practical	DIGITAL RECORDERS EDM SETS THEODOLITES TOTAL STATIONS	Basic Grade Surveyors Following basic survey training	Supplying and monitoring detail control using up to date equipment and modern booking procedures, including digital data capture
MINOR CONTROL COURSE	DIGITAL RECORDERS EDM SETS THEODOLITES	Basic Grade Surveyors Following IDC Course	Supplying and monitoring horizontal control using up to date equipment and modern booking procedures, including digital data capture

TABLE No 2

Type of Course	Equipment	Level of Student	Course Objectives The student should be capable of:
LEVELLING COURSE SECONDARY & TERTIARY Duration 25 days 60% practical	LEVELS DIGITAL RECORDERS	Basic Grade Surveyors Following IDC Course	Supplying and monitoring vertical control using up to date equipment and modern booking procedures, including digital data capture
CONTROL COURSE Duration 20 days 60% practical	DIGITAL RECORDERS EDM SETS THEODOLITES	Senior Grade Surveyors Higher Grade Surveyors	Supplying and monitoring horizontal, vertical and detail control using up to date equipment and modern booking procedures, including digital data capture
DFUS OPERATOR TRAINING Duration 7 days 45% practical	MICROCOMPUTER DIGITISING TABLET FLATBED PLOTTER CASSETTE TERMINAL	Basic grade Surveyors and Draughtsmen Higher Grade (Team managers)	Pre-editing a copy of an MSD for digitising by DFUS Using the DFUS facility to update MSDs Plotting the data and completing the MSD to current specification Downloading the digital data for subsequent archiving
DFUS FOR SURVEYORS WHO WILL INPUT TO THE SYSTEM Duration 2 days 20% practical	MICROCOMPUTER DIGITISING TABLET FLATBED PLOTTER CASSETTE TERMINAL	Basic Grade Surveyors Higher Grade Surveyors	Annotating detail Positioning names clearly A basic knowledge of the DFUS facilities A basic knowledge of feature coding Presenting fieldwork unambiguously for subsequent digitising by the operators
DFUS APPRECIATION FOR MANAGERS Duration 4 days 25% practical	AS ABOVE	Section Managers Senior grades Area Managers	A practical knowledge of digital mapping and DFUS procedures, and a limited experience on the equipment

TABLE No 3

Type of Course	Equipment	Level of Student	Course Objectives The student should be capable of:
COMPUTER AIDED PHOTOGRAMMETRIC MAPPING COURSE Duration 10 days 70% practical	PHOTOGRAMMETRIC PLOTTING INSTRUMENTS PDP 11/75 GRAPHIC EDIT STATIONS	Higher Grade Surveyors and Draughtsmen Following basic training in their own discipline	Understanding basic computer technology. Relative and absolute orientation, scaling and levelling a model Capturing data digitally Operating a graphic edit station
DIGITAL MAPPING COURSE Duration 13 days 73% practical	DIGITISING TABLES	Basic Grade Draughtsmen Following basic Carto training	Pre-editing large scale maps for digitising, colour coding, names collation, and preparation of the digitising documents. Digitising and feature coding large scale maps at 1:1250 and 1:2500 scale. Correcting digitised maps. Completing positives ready for publication.
DIGITAL MAPPING FOR CARTO ASSISTANTS Duration 13 days 73% practical	DIGITISING TABLES	Cartographic Assistants	Interpreting pre-edited documents. Digitising and feature coding large scale maps at 1:1250 and 1:2500 scale. Completing positives ready for publication.
INTERACTIVE EDIT STATION TRAINING COURSE Duration 10 days On-the-Job	INTERACTIVE EDIT STATIONS ARC INTERACTIVE EDIT STATION	Basic Grade Draughtsmen Following training and practical experience as digitisers	Correcting any digital map using either the MADES (LITES) or the ARC interactive edit stations

Validation of Training in the Ordnance Survey

Wherever possible, validation exercises are included in the training courses, to enable the instructors to monitor the progress of the trainees. It is standard practice for validation reports to be sent out six months after a formal training course, for the student to comment on his progress and to confirm that continuation work has taken place; and his line manager to assess the level of post course achievement.

Training patterns for the future in the Ordnance Survey

It has become quite evident that future training for Auto Carto must be in modular form. Students require a broad base which will prepare them for the ever changing technology they can expect to meet throughout their working lives, and to teach them to be computer literate. This background training will be followed by a series of specialist modules to train them specifically for the task they will be required to perform in their work area. As they move from area to area throughout their career, or as new technology is introduced into their own area, they will require further retraining modules.

Ordnance Survey has identified two different types of trainee. The first are the staff who have been with the department for many years, trained to the conventional mapping processes, who are not computer literate, and are somewhat reluctant to learn new concepts. The second type are the new young generation to whom computers are second nature, and who understand the jargon and are not frightened to use computer technology.

The immediate training requirement is to change the attitude of the older generation and to encourage them to be more willing to accept the new technology. The background training for these people will probably be provided by appreciation courses specifically tailored to their varying levels of skills and knowledge, whilst the follow up specialist modules could continue on similar lines to those already outlined above.

In the case of the younger generation who already have greater computer skills, it should be possible to consider new training patterns for the future.

FUTURE NEEDS FOR EDUCATION AND TRAINING IN AUTO CARTO

In the opinion of the author, there is a specific requirement for broad based education and training in Auto Carto which is currently not being met. Education establishments and user departments should get together to develop an education strategy for the future.

Education in Auto Carto should be included in foundation training, and be an integral part of cartographic, B TEC and Higher B TEC courses. It should be practicable to develop appropriate modules in computer science and Auto Carto covering such subjects as basic language - computer practice - computer graphics - handling spatially referenced data - file creation - interactive editing - database structuring etc.

It is doubtful whether external courses will be suitable for all specialist training modules, as each manufacturers equipment presents its own training requirements for the operators, and each organisation has its own specifications and working practices. It is probable that the larger organisations will run their own courses on lines similar to those at the Ordnance Survey. Smaller departments may continue to use education establishments, who will need to give both the students and their own staff, access to up-to-date systems, so that they will be aware of the latest developments.

SOME SUGGESTIONS FOR FUTURE TRAINING INITIATIVES

Central training facilities are expensive to run, and it may be possible for those with the facilities to offer courses on repayment to other organisations.

Distance learning is becoming more acceptable and it may be possible to encourage education establishments to consider developing courses for Auto Carto, or build specific Auto Carto modules into other carto related courses.

Manufacturers could be encouraged to work more closely with education establishments on the introduction of new hardware and software so that trainees and teachers are more aware of developments.

Manufacturers could be persuaded to offer more training facilities.

The staff of education establishments could make more effort to keep up-to-date by arranging attachments for staff to work in production departments, and the reverse.

Greater co-operation could be encouraged between education establishments to share resources and ensure viable numbers on specialist courses.

There is a need for standardisation in Auto Carto so that knowledge and skills can be used more widely.

The use of digital map data in schools could be encouraged so that youngsters are educated in IT.

Education and Training in Auto Carto is at a watershed, and there is a need for all the interested parties; users, education establishments, manufacturers, and schools to get together and develop a new education and training strategy for the future.

CONCLUSION

The pace of technological change demands flexibility and adaptability on the part of the workforce, and we need to develop and teach new training skills and techniques to meet the challenge.