THE ITC TRAINING PACKAGE FOR PHOTOGRAMMETRIC OPERATORS (TPPO)

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ABSTRACT

In 1983 the ITC started the production of an individualised, universally adaptable Training Package for Photogrammetric Operators (TPPO) that can be purchased, from 1985 on, by individual mapping organisations or educational institutes for internal needs. The objectives of the TPPO are to train photogrammetric operators in such a way that after training they should be able to carry out basic tasks concerned with the production of graphical-photographical-digital maps in mapping organisations.
The package is meant primarily for training in mapping organisations, but it is set up such that it can be used in educational institutes for training photogrammetric operators and as part of higher educational programmes in photogrammetry. The package is primarily meant for training skills but includes the required basic knowledge for those skills. It is composed of instruction manuals (theory and practice) which incorporate regular self-checks and different sets of training materials. While the training package has been prepared to be used with the therefore specially designed computer supported Stereo Plotting Simulator (SPS), it can also be used with normal stereoplotting instruments.
Although the training package can be used without any guidance it is advisable that the trainees will be assisted by supervisors from their own organisation with sufficient professional education and practical experience. Short special training programmes have therefore been developed at ITC to familiarize future training supervisors with the use of the training package.

1. INTRODUCTION

Since 1951 the ITC has organised courses in photogrammetry at M.Sc. degree level (specialisation in photogrammetry as a basis for future scientific and/or educational activities), at Post-Graduate and Technologist diploma level (all-round education in both the theory and practice of photogrammetry) and at Technician diploma level (training of well qualified operators with sufficient theoretical and practical background to fill posts at supervisory level). During the past 30 years some 1500 photogrammetrists, most of them from developing countries, have been educated/trained at the ITC.

It has until now more or less been taken for granted that training at levels below that of technician, i.e., photogrammetric operator, was carried out in the countries under their own responsibility. This training has been arranged through formal education or in-service training within mapping organisations. Though a number of developing countries have indeed set up their own training programmes (mostly of an in-service nature) investigations into the availa-

bility and quality of training facilities at photogrammetric operator level has proved that such training is lacking in many developing countries or, is evaluated as inadequate (training programmes not optimal and sytematic, conflict between the use of equipment for training or production).

In view of the urgent needs for well trained professionals at various levels in photogrammetry, ITC has developed plans to assist developing countries in setting up training programmes at the lowest professional levels (some 2000 operators/technicians to be trained world wide yearly) at a national and/or institutional basis. Training programmes at these levels are considered to be an indispensible supplement to the courses given at the ITC or at other international or regional educational institutes. The plan consists in an alternative training system names "Individualized Training Packages" [1]. These training packages prepared by specialized institutes like the ITC, and for use in mapping organisations and/or at educational institutes, are aiming at:

- improving the social-economic aspects of operator/technician training
- matching the requirements of employment and background of the target population
- enabling flexibility to meet the individual needs of trainees or employing establishments
- making available the necessary learning material and equipment to support the local instructors whose means are often limited.

In 1983, considering the very positive response from a world-wide mapping organisations oriented enquete organised in 1981 by the ITC [2], the Photogrammetric Department of the ITC started the preparation of an individualized, universally adaptable Training Package for Photogrammetric Operators (TPPO) that will be made available, from 1985 on, to mapping organisations and/or educational institutes to fulfil their particular needs of operators/technicians training. The ITC Training Package for Photogrammetric Operators is composed of:

- a training programme made of instruction manuals (theory, technical information and activity) which incorporate regular self-checks and different sets of training materials
- a specially designed computer supported Stereo Plotting Simulator (SPS)
- special training programmes for future training supervisors to enable them to introduce the training package in their organisations and ensure the continuation of the training.

With the aid of this training package (training programme and one SPS), 2 to 4 operators can be trained yearly, this being most probably sufficient for an average size mapping organisation.

The purpose of this paper is to present in details the different components of the ITC Training Package for Photogrammetric Operators. Another paper [1] will give to the interested reader more information on the Individualized Training Package system and on the methodology used to develop such training packages.

2. THE ITC TRAINING PACKAGE FOR PHOTOGRAMMETRIC OPERATORS (TPPO)

2.1. The training programme:

2.1.1. Objectives of the training programme and general remarks:

The general objectives of the training programme have been defined as follows: after training the photogrammetric operator should be able to carry out basic tasks concerned with the production of graphical-photographical-digital maps in mapping organisations.

The training is meant primarily as in-service training in mapping organisations, but it can also be used in educational institutes:
- for training of photogrammetric operators
- as a preparation for higher courses in photogrammetry
- as some basic elements for higher education in photogrammetry.

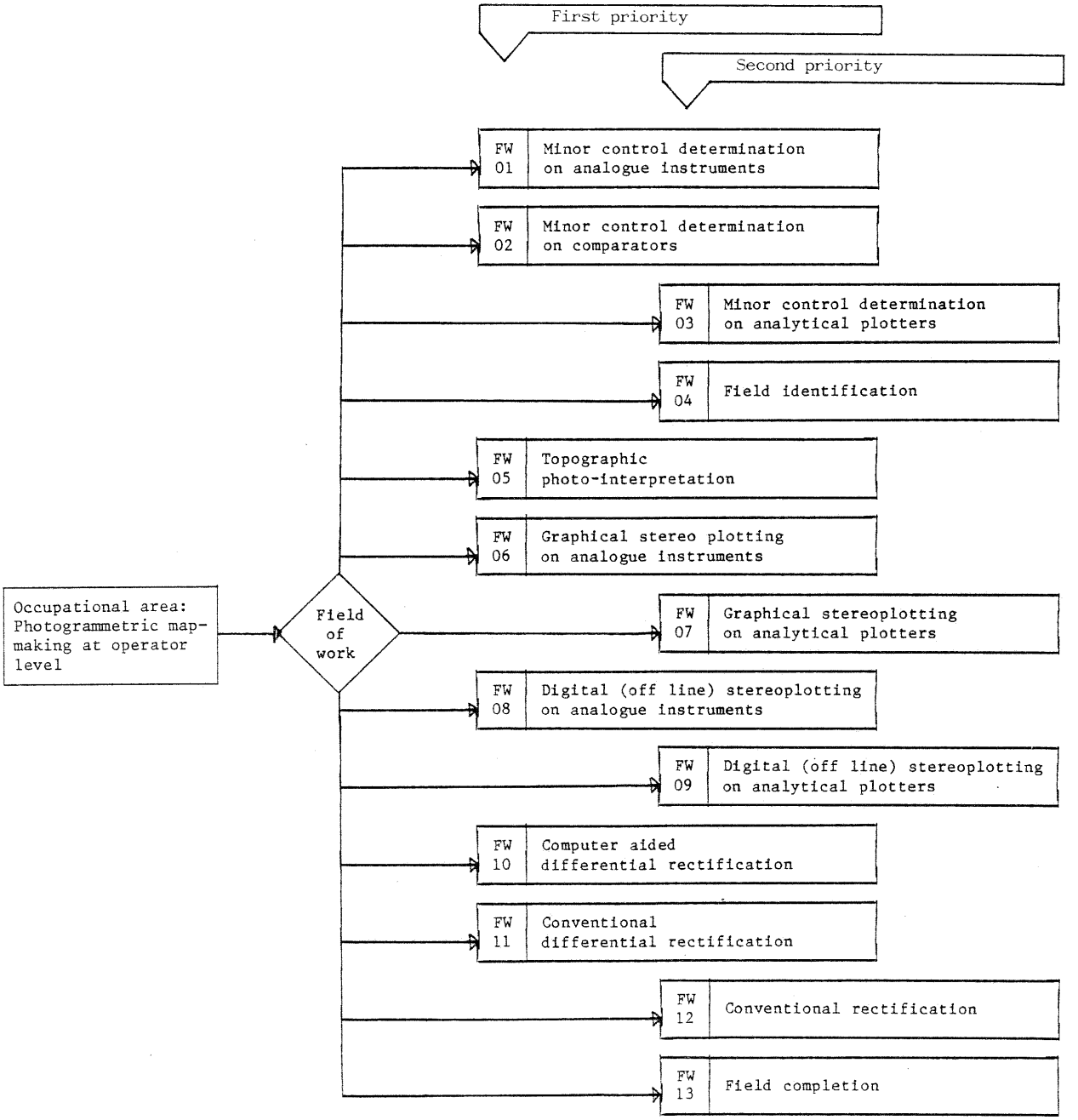
The training package is primarily meant for skill training but includes the required theory and technical information to master those skills.
The training package aims at a training period of 6 months, if the trainee works full-time with his training programme.
The training package is developed in English and will at a later stage, be translated at least into French.

2.1.2. Contents of the training programme:

A careful study of the specifications of the photogrammetric operator job, as defined in the general objectives of the training programme, has made it possible to further structure the content of this training programme in 13 basic tasks (further called Fields of Work) which an operator might have to execute.

These Fields of Work are presented below with an indication of a priority order for the sequential preparation of the learning material by the ITC. The choice of priorities has been influenced by the needs of the mapping organisations in the developing countries (most of whom still use analogue stereoplotters) and by some pure system design reasons.

It has to be mentioned that the system possesses such flexibility that each Field of Work is an entity, although it is composed of Learning Elements which are also used in other Fields of Work. Therefore, a mapping organisation is not obliged to purchase all 13 Fields of Work but only those which are geared towards its own needs.



Further studies of the specifications of these basic tasks (Fields of Work) have made it possible to further structure the content of each Field of Work into Modular Units (see an example in appendix 1) and the content of each Modular Unit in Learning Elements (see an example in appendix 2).
A bank of Learning Elements has then been created with which Learning Elements can be combined to form Modular Units. These can be particularly well adapted to the background of the trainee and to the specific employment criteria of a particular mapping organisation.

Several possible learning sequences, including a preferable one, have been introduced in the standard version of the training package to increase the flexibility and efficiency of the training process. Optional Learning Elements are also prepared for high level opera-

tors. Furthermore, the Learning Elements are prepared in such a way that the training programme can be used with the Stereo Plotting Simulator (SPS) or a normal stereoplotting instrument, and with the standard methods and procedures proposed in the package or with the particular methods and procedures of the mapping organisation. It is also obvious that the system is not limitative and that at any time one can produce, if necessary, a new Learning Element and introduce it into the system to fulfil a particular need.

2.1.3. Composition of the training programme:

The training programme will be composed of:
- a trainee guide which gives the trainee all necessary information to use the training programme, material and equipment.
- a training supervisor guide which gives the training supervisor all the necessary information to supervise the training.
- a series of Learning Elements corresponding to the choosen Field(s) of Work for each trainee. Learning Elements are self-contained instructional booklets, each covering a specific learning objective (theory, technical information or activity). The amount of learning that each Learning Element covers is small, significant and precisely matched to the learning objectives. Each Learning Element starts with a learning objective, a list of material and equipment needed, and a list of other Learning Elements related to it. The instructional pages contain short, concise texts and illustrations. Allowance is made for sufficient practice to master the skill concerned, self-checks by the trainee are made available and the element ends with a progress-check precisely matched to the learning objectives.
- a set of universally applicable training material prepared by the ITC and consisting of stereopairs of different types of terrain and area, examples of interpreted photographs, master sheets to check plottings, etc. As will be discussed in para. 2.2., the Stereo Plotting Simulator (SPS) which was specially designed for the Training Package for Photogrammetric Operators, uses rectified stereo-pairs. The standard material will be prepared for use with the SPS. Nevertheless, it will also be possible to obtain this standard material for use with any type of stereoplotting instrument. Furthermore, organisations purchasing a Training Package for Photogrammetric Operators with an SPS and willing to use their own photographic material can ask the ITC to process these photographs.

2.2. The Stereo Plotting Simulator (SPS)

2.2.1. Considerations for the design of a special training instrument:

Although the use of normal stereoplotting instruments for training photogrammetric practice is most usual, it has proved not to be the most efficient and/or effective [3] for the following reasons:
- the high degree of accuracy and the numerous application possibilities offered by commercial equipment is not needed for training basic skills.

- the training of the required skills at the actual production equipment is not effective from a didactical point of view, because the degree of complexity of the equipment implies that the trainee has to pay attention to too many different skills simultaneously.
- in the case of in-service training the use of production equipment for training creates conflicts between production and training needs.

Towards this background the ITC had already, at the end of the sixties, proposed the idea of a training simulator and produced the ITC Stereotrainer. At the ISPRS Congress in Hamburg an improved version of the ITC Stereotrainer was presented, the Mark II-1980. However, the fully mechanical simulation solutions limited the use of the simulator to the training of the pure plotting skills. By adding electronic components (encoders, motor-drives, micro-processor) to the Mark II-1980 version of the ITC Stereotrainer these limitations have been overcome.

2.2.2. Description of the Stereo Plotting Simulator (SPS) principle and capabilities:

The SPS looks like the ITC Stereotrainer Mark II-1980 (see appendix 3), the only visible differences is the addition of a microprocessor, a control panel and a (semi-automatic) drawing table. In fact it is a completely new design in which mechanical movements and transmissions have been replaced by motordrives, encoders and a micro-processor. The instrument has in fact become a low accuracy analytical plotter and, as such, has increased its capabilities enormously.

The introduction of these electronic components now permits not only the simulation of the elimination of parallaxes (training in stationary stereoscopic measurements) and the plotting of planimetry and heights (training in dynamic stereoscopic measurements), but also the following processes:
- relative and absolute orientations as executed on an analogue stereoplotter
- relative and absolute orientations as executed on an analytical plotter
- plotting in track or line mode with a semi-automatic drawing table
- profiling for orthophotography data acquisition
- by adding a simple registration device, digital off-line mapping

and of course all processes including, or derived from, those mentioned above.

For training purposes the stereopairs used in the SPS have been rectified at the ITC with the Wild OR1. This has the advantage that the orientation of the stereomodel is always well known (zero position) and can be recalled at any time.

The advantages envisaged of this training simulator are:
- it will simulate more or less the operations which can be executed on an analogue and analytical plotter
- it will be much cheaper than a production instrument
- it will be trainee-friendly thus speeding up training
- it will eliminate conflicts between training and production needs.

2.3. The special programme for the TPPO training supervisors

Although an Individualized Training Package has to be as much as possible learner-based, it has been shown [1] that provision should be made for the education of qualified training supervisors (setting-up, supervision and evaluation of training). The ITC has therefore developed a special programme for the TPPO training supervisors.

2.3.1. Organisation of special programmes for training supervisors and target group

It is planned to give 2 successive training supervisor courses of 2.5 months each at the ITC, starting mid 1985 and for the future training supervisors of the Training Package for Photogrammetric Operators, coming from mapping organisations and educational institutes which have purchased the training package. Ten fellowships have been allocated for each course by the dutch Ministry of Development Aid. Later on these special training programmes will most probably take place as a continuation of one of the standard ITC photogrammetry courses.

2.3.2. Objectives of the special programme for training supervisors and phases of activities

The general and detailed objectives of this special programme are given in the diagram on page 8.

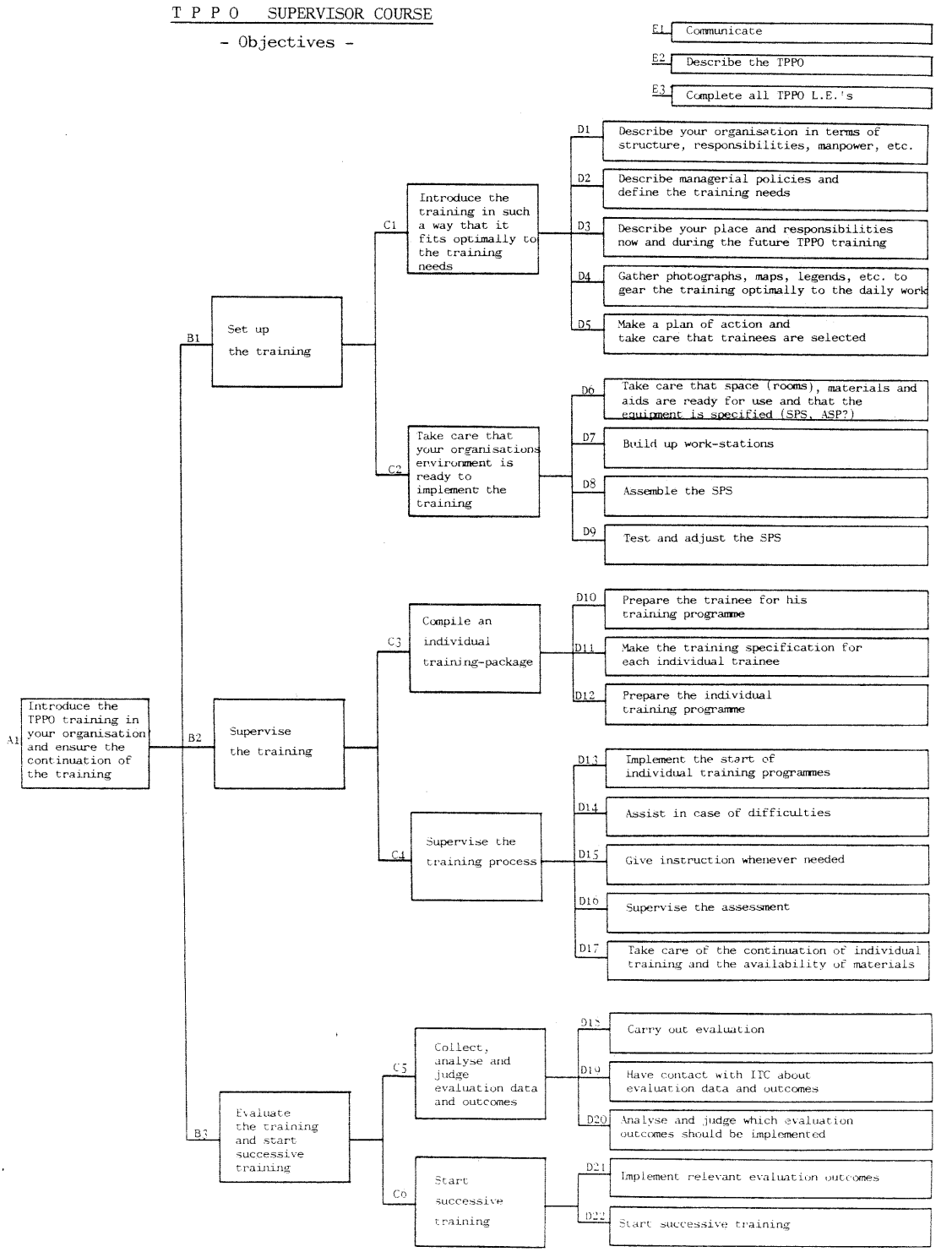
The learning activities needed to achieve these objectives will be divided in 3 phases:

Phase I
. Phase I is meant to prepare the student and to make him fully aware of what is going to happen.
. The ITC will send, before the training supervisor comes to ITC:
  - full explanations on the course objectives
  - instructions, guide lines, information materials and questions in order to enable the student to implement the activities as indicated in the objectives.

Phase II
. The problems encountered in phase I are discussed and solved.
. The activities started in phase I are completed as far as possible.
. The activities related to the indicated objectives are carried out and/or simulated.
. Learning takes place on the objectives with the help of lectures, workshops, written or oral instructions, guideslines, information, questions, simulation, etc.

Phase III

- The activities back home should now be a logical result of the preceeding phases I and II. The training should now become operational.
- The 'after care' should be guaranteed by objective D19. Of course, during phase III the ITC should continuously be ready for assistance.



2.3.3. Entrance requirements and certification

The training supervisor should be an experienced production supervisor in a mapping organisation and should preferably hold an ITC Technologist's Diploma in Photogrammetry. The candidate should further have a working knowledge of English.

Although this has not yet been definitely settled, most probably a Diploma or a Certificate will be awarded to those who attain a pass mark for the assessment of each unit of the training supervisor's programme.

2.4. Some data concerning the implementation of the Training Package for Photogrammetric Operators (TPPO)

2.4.1. Dead lines

The first series of 7 Fields of Work of the TPPO are expected to be ready by mid 1985, the second series of 6 Fields of Work by mid 1986.
It is planned to produce the first series of the Stereo Plotting Simulator (SPS) by mid 1985, the size of the series depends on the interest shown for this training instrument.
The 2 successive special courses for training supervisors at the ITC are planned for the second half of 1985.

2.4.2. Costs of the training package

At the time of writing this paper it is not yet possible to announce any definite prices, but these prices will be known at the time of the ISPRS Congress in Rio de Janeiro.
Nevertheless, it is already possible to mention how the costs will be divided. They will include:

- the costs of the standard training programme containing the standard learning material (trainee and instructor guides and learning elements) and the standard training material (stereopairs, interpreted photographs, examples of maps, master sheets for check of plotting, etc.).

  Any wish of a particular mapping organisation and/or educational institute concerning specific learning and/or training material will be considered by the ITC, and if possible realized with additional costs.
- the costs of the Stereo Plotting Simulator (SPS)
- the costs for the special 2.5 months course for training supervisors at the ITC
- on special request, the costs of introducing and making operational the Training Package for Photogrammetric Operators (including the assembly of the SPS) in a particular organisation.

3. CONCLUSION

The ITC is convinced that the alternative system of Individualized Training Packages, like the presented Training Package for Photogrammetric Operators, will be of great help to fulfil the urgent needs of well trained photogrammetrists at the lowest professional levels in mapping organisations particularly in the developing countries. It is also convinced that training at Technician level with such a package will be possible without any difficulties. The ITC also plans to upgrade the Training Package for Photogrammetric Operators with some optional Learning Elements and/or Modular Units to cover also the necessary level and content of Technician education. Finally, it is obvious that these types of Individualized Training Packages are not only applicable to photogrammetry but that other branches of our profession of survey and mapping would profit greatly by using the ideas which have been developed by the authors.

ACKNOWLEDGEMENTS

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REFERENCES

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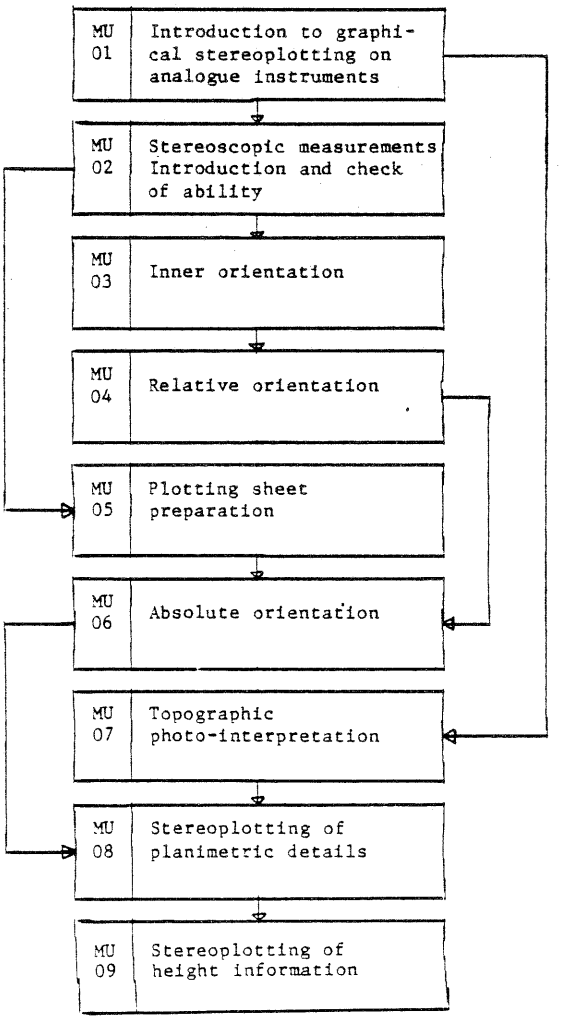
[2] J. Visser: Questionnaire for Photogrammetrists and Cartographers, ITC Journal 1981-3.

[3] H.G. Jerie: The new ITC exercise system. Presented paper at the XIth ISP Congress, Lausanne, 1968.

- **When you have completed this field of work you will be able to:**

  - plot planimetric details and height information at different scales, of different types of areas and terrain shapes.
  - perform the required preparatory activities including the orientation of the model, the preparation of the plotting sheet and the topographic photo-interpretation.

- **To achieve this, the following modular units are available:**

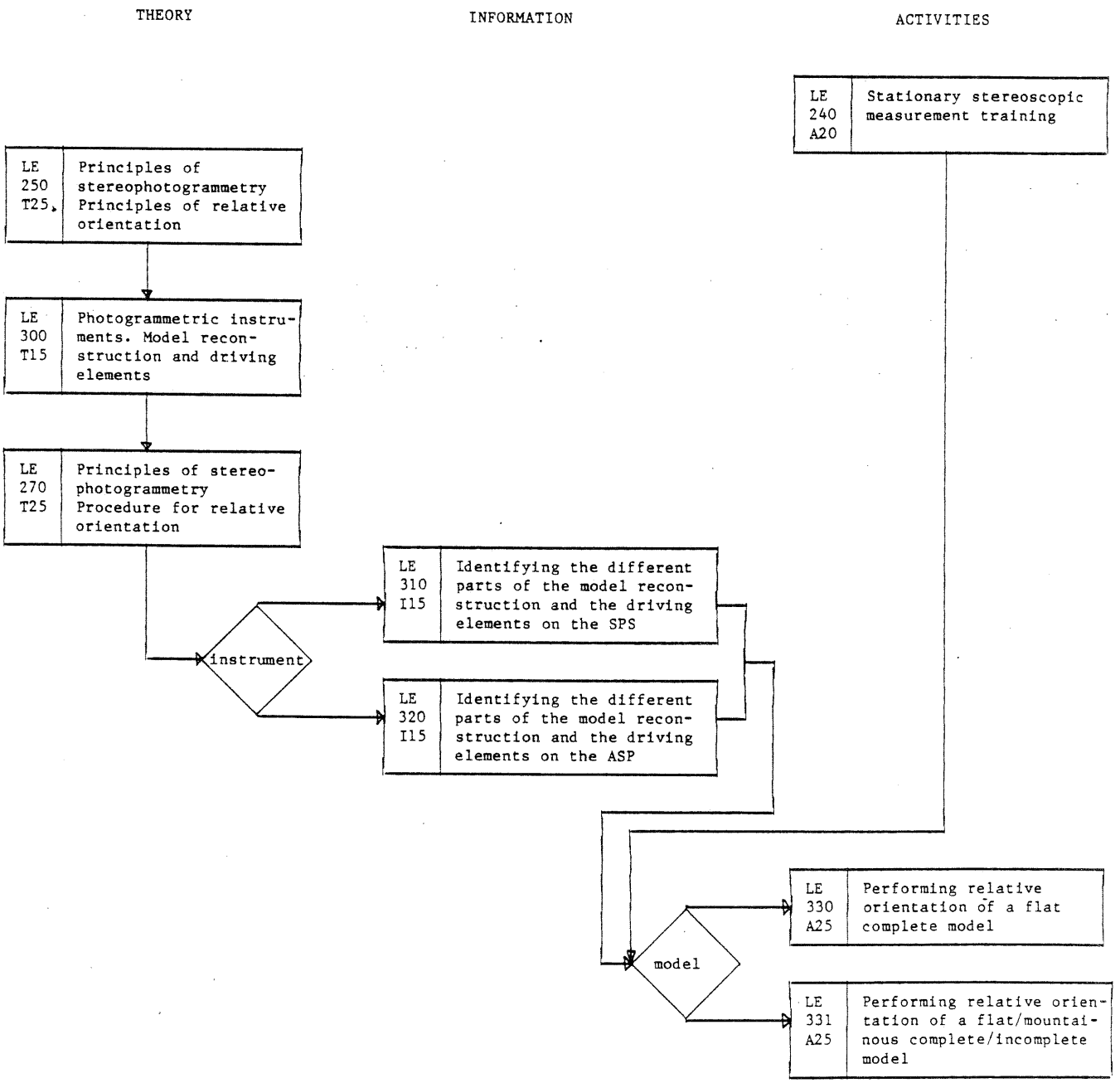


	MU 04	RELATIVE ORIENTATION	Appendix 2

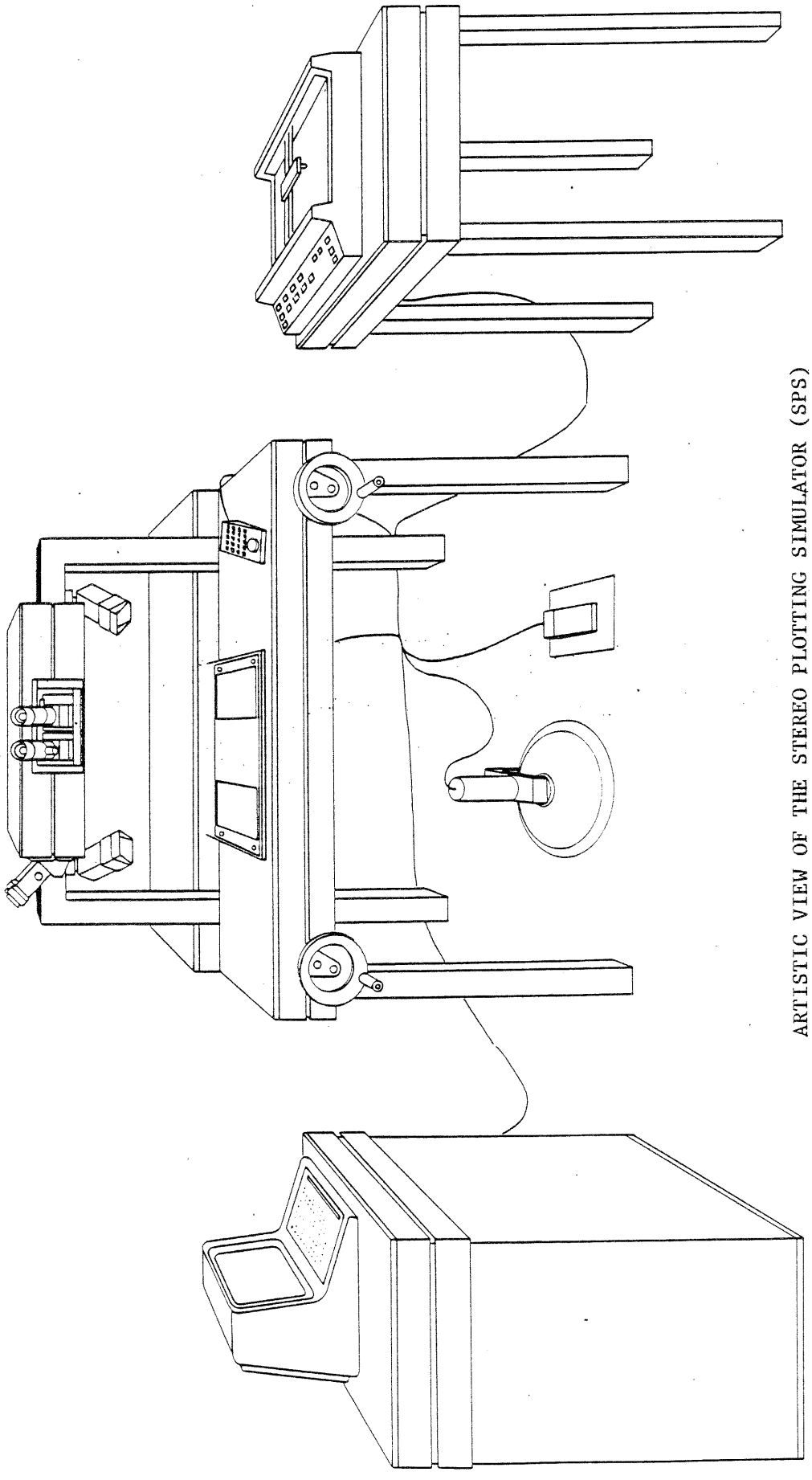
- **When you have completed this modular unit you will be able to:**

  - carry out stationary stereoscopic measurements
  - perform a relative orientation of any type of model on any type of instrument.

- **To achieve this, the following learning elements are available:**



Appendix 3



ARTISTIC VIEW OF THE STEREO PLOTTING SIMULATOR (SPS)