RECORDING TRADITIONAL SHIPS

T.Kokkas, Dr. A. Georgopoulos, Prof. J. Badekas
Laboratory of Photogrammetry, NTUA
Dr. K.Damianidis
Architect
V.Kostoulas
Naval Architect & Marine Engineer

GREECE

Commission V

ABSTRACT

Although Greece is a country with strong maritime tradition, old traditionally built wooden ships are threatened with extinction. A major project is underway in an effort to record, document and salvage the remaining examples of traditional shipbuilding. Simple traditional methods have been employed so far for this recording. In this paper modern Photogrammetry is considered as an alternative, as it provides more accurate and faster results and may also be used underwater. The results are shipbuilding plans of acceptable quality.

KEY WORDS: Analytical Photogrammetry, Terrestrial, Archiving, Low Cost System, Underwater

1. INTRODUCTION

The rapid development of new materials and technology stress our society to undertake sufficient care for the survey and the protection of old artifacts, which are significant parts of the history of techniques. Although the main effort has been given to conserve and restore buildings or other architectural elements, there are other objects, like ships and boats, which are equally significant structures. The necessity to conserve this kind of historic artifacts has also been mentioned and stressed in the Charter of Venice (ICOMOS 1964).

During the last years many historic craft are under conservation or restoration by various maritime institutions. The rapid abundance of many old traditional craft lead the maritime historians to undertake several projects for the conservation and restoration of as many historical craft as possible. These efforts are not always successful, because often the restoration of historical vessels appeared to be more complicated than that of the historical buildings.

During the first half of the 20th century, wooden shipbuilding was extensive throughout Greece. The types of wooden hull remained practically the same from the middle of the 19th until the middle of the 20th century, although the later built vessels tended to be smaller in size. By contrast, after the Second World War, wooden shipbuilding was drastically reduced and the last examples of some types of Greek traditional craft disappeared one after the other.

Unfortunately, research into these types of crafts has been very limited until today and some of these craft are very poorly documented, if at all. Drawings and good photographs are not available for some types and proper study of their lines and construction is inevitable.

Lines' plans of old crafts, which are based on tedious recording fieldwork are not only useful for the historians. They are often invaluable sources for new designs by Naval Architects, since several features of their geometry are still common. In this case accurate lines' plans are necessary for constructional purposes and advanced recording techniques, like Photogrammetry, are helpful.

Apart from the geometry, the history of a ship is of utmost importance for its documentation. Traditional shipbuilders used to add their own special personal touch to each ship, as all wooden ships used to be built individually and manually by a team of workers.

Old traditional shipyards, although rare, are still in existence in many parts of Greece. Their common methods of controlling the form of the crafts were either by applying some prefixed moulds or by the use of the lofting floor (Sala) The methods were not particularly associated to the types of hull and often additional fairness of the form of the vessel was applied after the completion of the skeleton. Thus the final shape of the vessel was often irrelevant to the method of controlling her form.

2. TRADITIONAL SHIP RECORDING METHODS

One of the critical parts of the documentation of a craft is her complete survey by an interdisciplinary group of experts, including the production of a full set of

accurate drawings. Adequate fieldwork must be undertaken and special techniques of recording and of taking lines of the hull of the craft must be developed. Several methods of recording the lines of historical ships were used by historians in the past (HABS 1988) and fine drawings based on recording fieldwork were published since the second half of the 19th century (Paris, EF. 1882). However, even until today it does not seem that a common and satisfactory method exists for recording all kinds of historical ship.

Common practice has shown that a simple drawing of the ship is not sufficient to reconstruct her geometry and construction, as it would be for a building. For a Naval Engineer to be in a position to study a certain ship, specific plans are necessary. These are called ship-lines plans. They represent sections of the ship's hull with planes parallel to those of a specific three dimensional cartesian system (Figure 1). This co-ordinate system is defined with the help of the ship's main axis and the vertical. The three sets of sections (waterlines, body plan lines, and bow and buttock lines) are related to each other in this drawing, in such a way that all intersectional points may be accurately interpolated with their help.

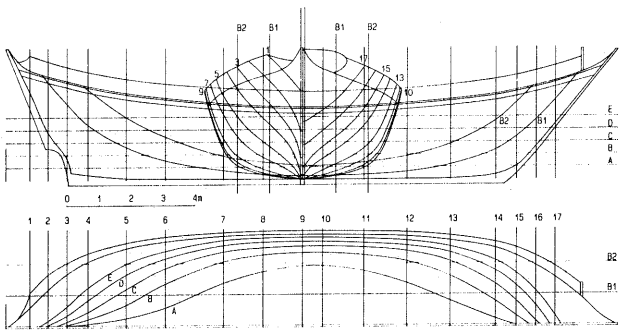

Figure 1

The accuracy required for this kind of documentation is not extremely high. A few centimetres are usually enough, considering that it is almost impossible to have access to the original wooden hull, after so many years and so many repairs. The form of the hull, as it is preserved today, is usually all it is asked for.

The usual method of recording a vessel is with the help of orthogonal co-ordinates. The various lines are materialised through plumb bobs and measuring tapes. Simple readings on the tapes determine the three dimensional position of the points observed (Figure 2). The main disadvantages of this method are the low accuracy achieved, the need for immediate access to the hull of the ship and the time necessary to complete the fieldwork.

As an alternative classical geodetic methodology has been tested (Papapolitou & Frangaki 1990). Although accuracy has been greatly improved, tediousness has increased, as every point had to be individually marked.

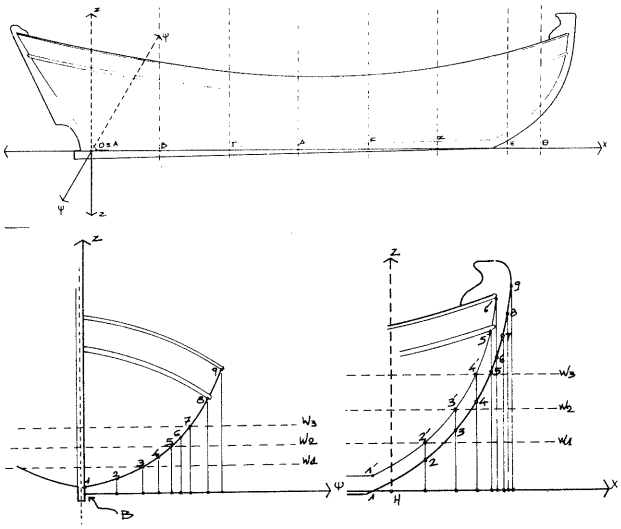

Figure 2

3. PHOTOGRAMMETRIC METHODOLOGIES

Photogrammetry is obviously a lucrative alternative. It should, however, be approached cautiously. Three different photogrammetric methodologies have been put to test in order to be extensively examined for their potential and for their usefulness.

The three methodologies are **analogue, analytical** and a **hybrid low cost** one. The instrumentation used and the procedure for each method is presented in Table 1. The relative merits and demerits for each one are quite clear from the above. A few control points are naturally needed for all methods. For the **analogue** method careful planning of the photography should be made, for the accommodation of the model on the specific instrument. The achievable accuracy lies within the centimetre boundary, considering the diameter of the measuring mark and the general capabilities of the instrument.

The **analytical** method needs no special reference. It has proved beneficial to use colour slides on the MPS-2 instead of B&W negative film, for obvious reasons of better detail recognition. The accuracies attained with this method are well within the specifications, although the calibration parameters of the camera were not taken into account and the scale of the photography was relatively small. As a by-product a side elevation of a traditional ship was produced (Figure 3).

The **low cost hybrid** method deserves perhaps a special mention, as it combined simple digitizer measurements on 3x enlarged P31 prints with a photogrammetric software developed by the Laboratory of Photogrammetry of NTUA (Georgopoulos & Spinou 1992) and a commercial DTM producing software (SURFER v.4.00). Thus the

METHOD	CAMERA	INSTRUMENT	PLOTTING	EDITING
ANALOGUE	Wild P31/100	Technocart D	Graphical	by hand
ANALYTICAL	Hasselblad/80	ADAM MPS-2	Automatic	AutoCAD
LOW COST-HYBRID	Wild P31/100	Digitizer+S/W	Automatic	AutoCAD

Table 1

DTM of the vessel's hull was produced and it was later interpolated along predefined lines in order to produce the final plots.

One of the main problems with all methods is the uncertainty with which the various lines of interest are being defined on the hull, in the photogrammetric stereomodel. With the analogue method, the instrument may be driven along specific planes, provided of course, that the coordinate system of the control is identical with that of the final shipbuilding plan. Even then a relatively experienced operator may be faced with difficulties. With the analytical method, things are theoretically more favourable. However, it proved equally difficult to drive the instrument along predefined planes, thus determining their section with the object. Special off-line interpolation stage was necessary for both methods, in order to achieve the required results, as described above. In addition the lack of detail points on the surface of the hull presents another problem to the observer. Since it is impossible to either paint or project onto the hull some kind of texture, the operator is required to proceed very carefully.

In all cases the lines produced needed some kind of smoothing. This may either be done graphically with special drawing aids, or computationally. A special CAD programme was developed for this purpose. As input it requires co-ordinates of observed points on the sections and it then determines the appropriate curve to fit (usually of third order). This is determined by the type of the vessel, its dimensions and the position of the section.

An interesting problem is to attempt the survey of such a vessel while it is in the water, when a portion of the ship's hull is underwater. Two are the obvious solutions. In the case of clear waters the photography could be taken from outside and special two-media algorithms should be employed. Alternatively underwater photography with specialised instrumentation should be employed. Both alternatives will be tested in the course of a major research project, which will, hopefully, start in the near future.

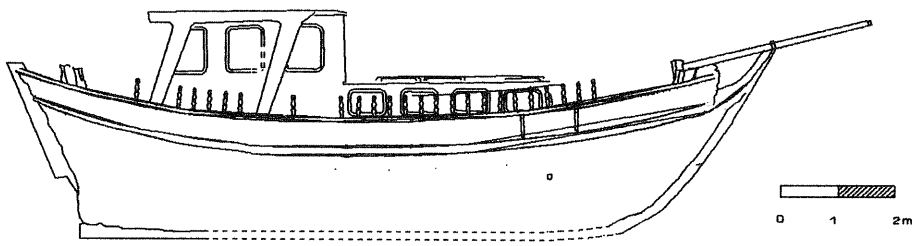

Figure 3

On the other hand, the final method, proved easier and faster in any respect. As the DTM could be produced in any coordinate system, no special care should be taken for the determination of the control. Hence simple distance measurements may be used for the analytical orientation of the stereopair, thus making the fieldwork easier, simpler and more accessible by a non-photogrammetrist. Careful specification of the plane parameters produces more reliable sections of the object. The only drawback of this method is the - temporary - lack of stereoscopy for the observations.

4. CONCLUDING WORDS

Since the main issue in this discussion is the photogrammetric methodology, it is proposed that simple instrumentation combined with simple measurements and simple software may lead to the required result. Of course it has been clear from the experiments that the best way to handle the problem is to produce a DTM of the vessel's hull and produce the required sections from it.

It is clear from the above presentation that the geodetic method was the most accurate, but the most time consuming and certainly the one less favoured by the non experts who would like a better tool for their surveys.

The main advantage of the photogrammetric method compared to the classical one is the photographic record, which is produced as a by product. Moreover, the DTM is also a very useful product, as one may come back to it at a later time and produce more cross-sections or extract other information about the construction. A comparison of the cost and time required is also favouring photogrammetry, as in less time it is capable of producing more and better results at a fraction of the cost.

Another important dimension of the capabilities of modern computing power is the possibility of archiving the acquired information in a Hypermedia System. It is feasible nowadays to integrate information in raster form (digitized images) and in vector form (CAD drawings) with text in a Relational Database (Cognivision 1991, Galileo 1991). Document Image Processing (DIP) and Optical Disk technology are the tools, which will aid this effort (Harvey 1991).

5. REFERENCES

1. Antoniou, A., 1969. Research on shipbuilding data of Greek vessels. PhD Thesis, National Technical University of Athens (in Greek).

2.Cognivision Research, S.A., 1991. Hypermap product information

3. Damianidis, K., 1989. Vernacular boats and boatbuilding in Greece. PhD Thesis, University of St. Andrews, Scotland.

4. Damianidis, K., Leontidis, A., 1992. Greek wooden sailing boats of the 20th century. Museum of Cretan Ethnology, Gavrielides Editions, Athens. p. 109.

5. Galileo Siscam, 1991. GART, product information

6. Georgopoulos A., Spinou, A., 1992. FotoCAD: A simple photogrammetric package for non-photogrammetrists. International Archives of Photogrammetry and Remote Sensing, Vol. 29, part 5.

7. Harvey, D.A., 1991. Catch the wave of DIP. BYTE Magazine, Vol. 16, No 4. April 1991, pp. 173-182.

8. Historic American Buildings Survey, 1988. Guidelines for Recording Historic Ships. (Historic American Engineering Record), Washington DC.

9. ICOMOS, 1964. International Charter for the conservation and restoration of Monuments and Sites (Charter of Venice).

10. Kokkas, T., 1991. Photogrammetric Survey of Traditional Ships. Diploma thesis (unpublished), Laboratory of Photogrammetry, NTUA.

11. Papapolitou, V., Frangaki, E., 1990. Modern applications of Geodesy - The survey of a caique. Diploma thesis (unpublished), Laboratory of General Geodesy, NTUA.

12. Pâris EF., 1882. Souvenirs de Marine. Collection de plans ou dessins de navires et des bateaux anciens ou modernes existans ou disparus. Paris, 1877-1882.