

## PHOTOGRAMMETRIC CONTROL CENTRE FOR MACHINE INDUSTRY

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### 1. HOW IT WAS STARTED

It was a great challenge for us to measure the dimensions of the tunnel digging machine head (figure 1) having approximately 5 m in diameter. The producer (Machine Factory Niš, Yugoslavia) was pressed by the licence contract and time available. The contractor (W. Germany) wanted the optical method to be used for the measurements.

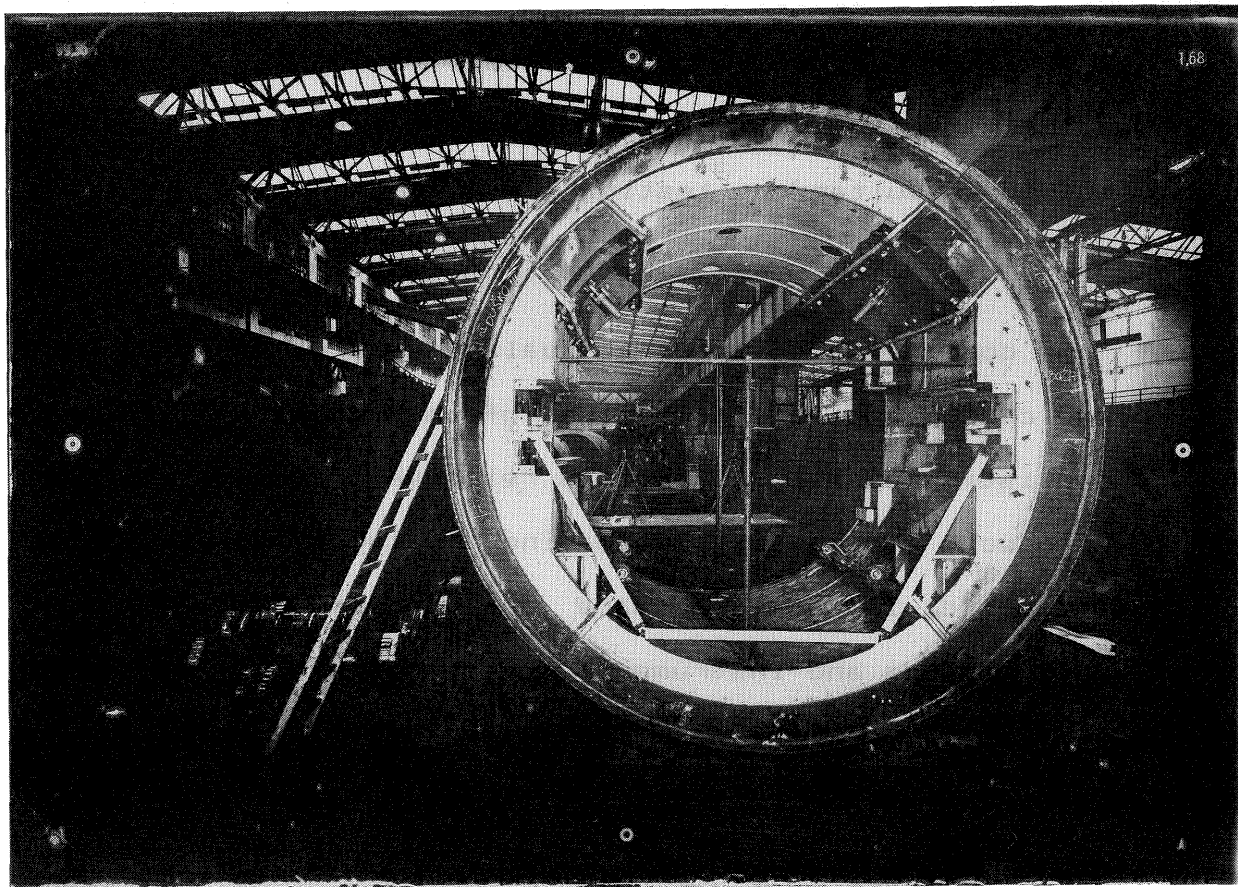


Figure 1

The photogrammetry seemed to be the only possible way to obtain the reliable dimensions. After the all necessary preparation, measurements and coputations the dimensions were in shortest possible time (2 days) delivered to the contractor. The accuracy of the measurements was satisfactory. Photogrammetric method was within the factory taken as the method which should be carefully examined for its use in the machine industry. It should be pointed out that the method was completely unknown to the machine factory representatives.

## 2. PREFACE

At the market succesful realisation of industrial products is overall quality (material, functionaly, perfomance, reliability, dimension, design) decisive factor. This is the reason the integral quality control is incorporated into the industrial procesess. This type of control consists of the set of procedures and methods for simultaneous testing serial or unique industrial products.

One of the components of integral quality control is also the testing and checking of the dimensions of the industrial products and its consisting parts. It becomes relatively complex problem when the products or objects are having greater dimensions (over 1 m), complicated in form and shape and heavy. Conventional metrological methods and instruments (three-coordinate measuring machines) usually need special fundaments, relevant climate and transport of measuring object on to the measuring place. Therefore these systems are to some extent non-flexible; this shows up in high transportation costs and discontinuity of working process.

Besides this the conventional measurements are limited only to a limited number of measuring points and are not repeatable.

Those facts and successful measurements of already described objects encouraged us to introduce geodetic and photogrammetric methods into the production processes of machine industry.

### 3. LOCATION OF INTERESTS AND GAIN OF EXPERIENCES

In spite of some successful examples of application of close range photogrammetry this method was not widely used in Yugoslavia. The reason is probably the fact that industry is bound to the conventional metrological methods, further the dimension control has the secondary meaning and finally non-organised approach to the measurements. In the industrial world at least some tenth of photogrammetric control centres are successfully operating in machine, aircraft, automobile and shipbuilding industry.

This was the challenge to realise the number of photogrammetric test measurements in shipbuilding and machine industry, robotics etc. We measured number of ship sections (figure 2) turbines and their models (figure 3), metal machine constructions (figure 4) and with open-shutter-technology also robot movement control.(figure 5)

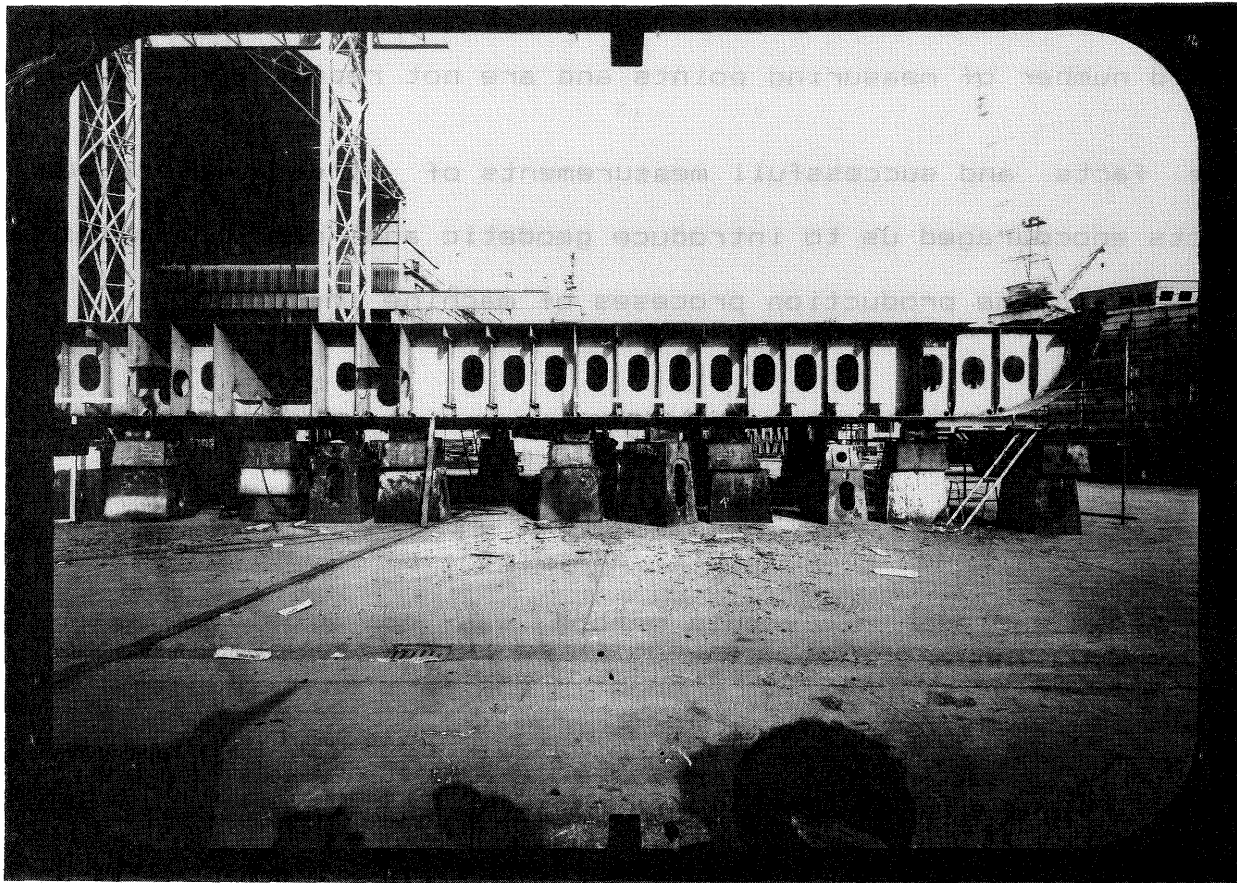


Figure 2

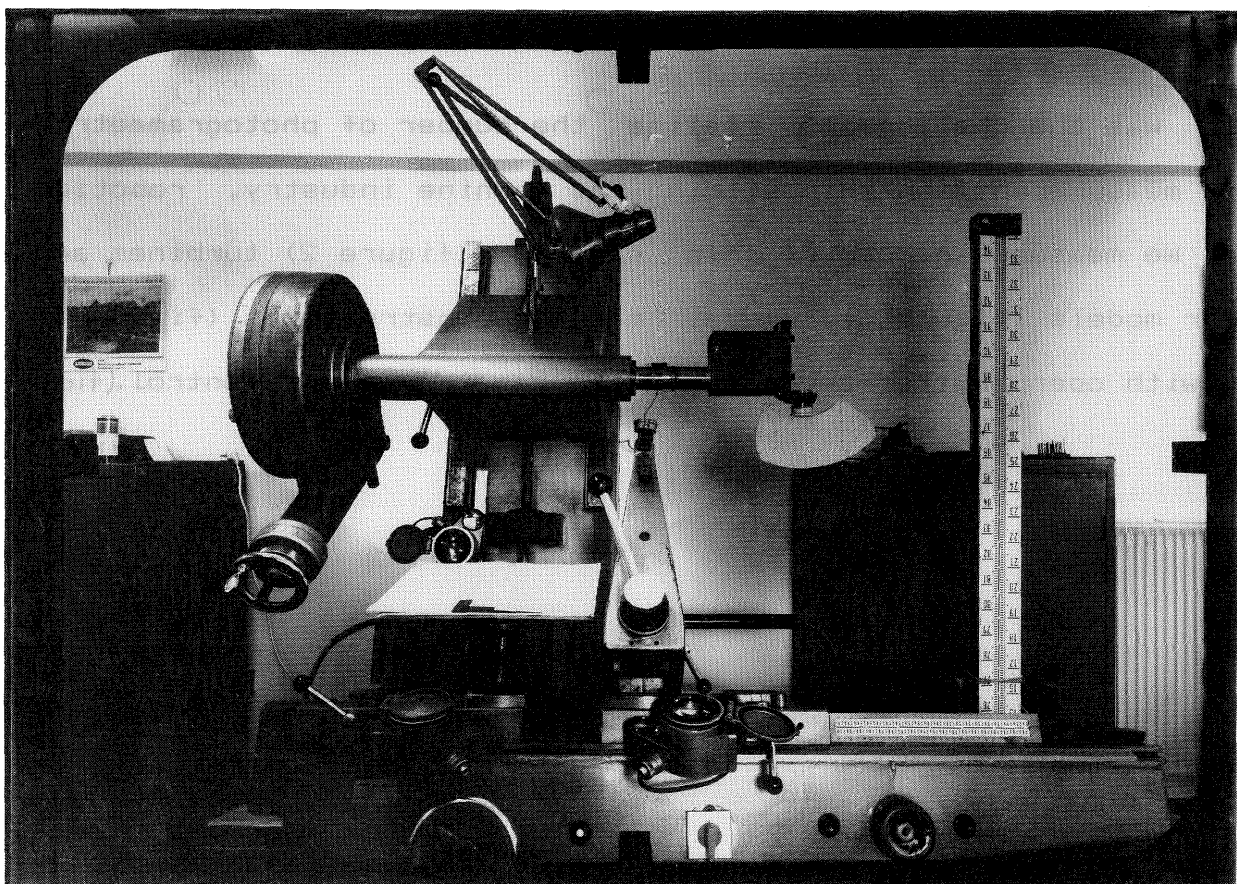


Figure 3

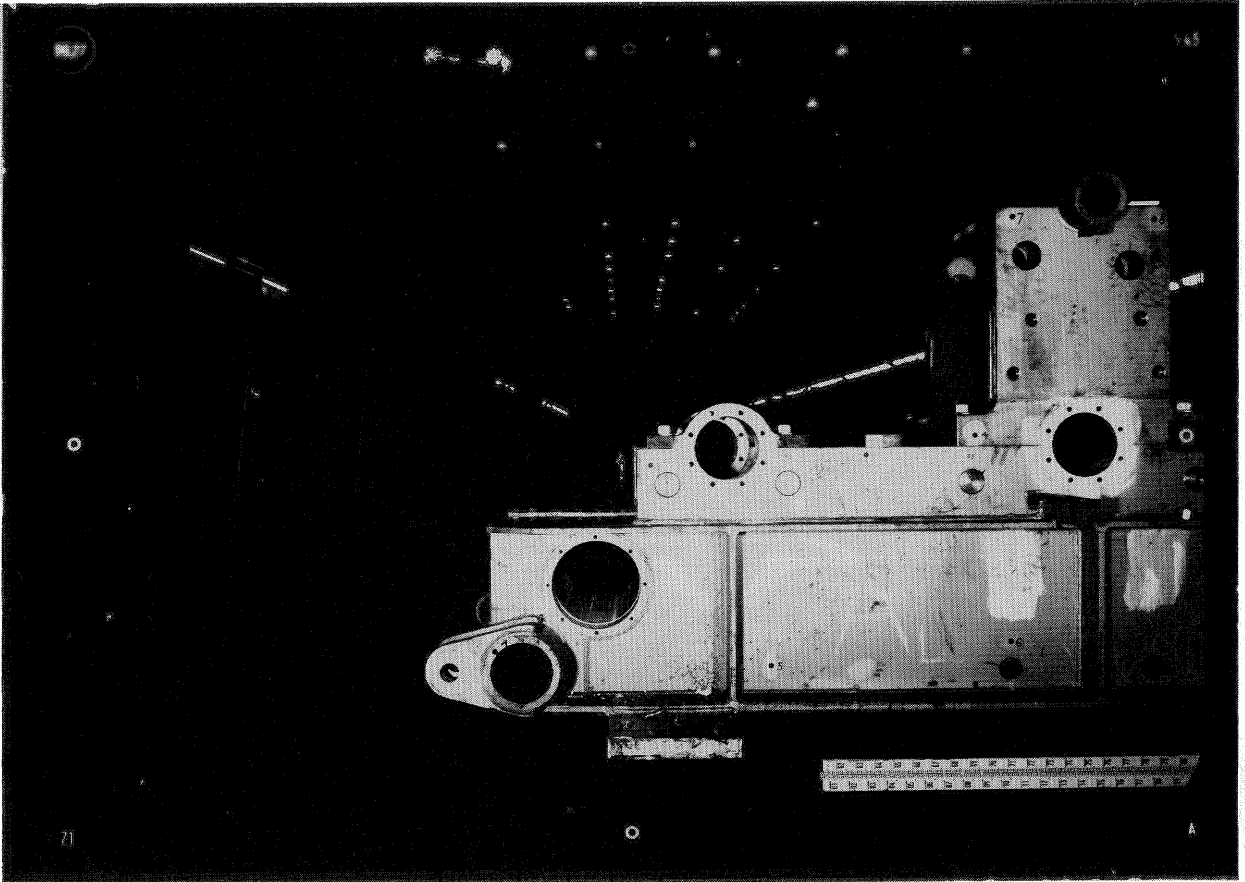


Figure 4

On the base of experiences it was proposed to realise first photogrammetric centre in Yugoslavia in Machine Industry Niš for the serial control of the motor housing (figure 5). The entire work was realised in one year in the frame of research project.

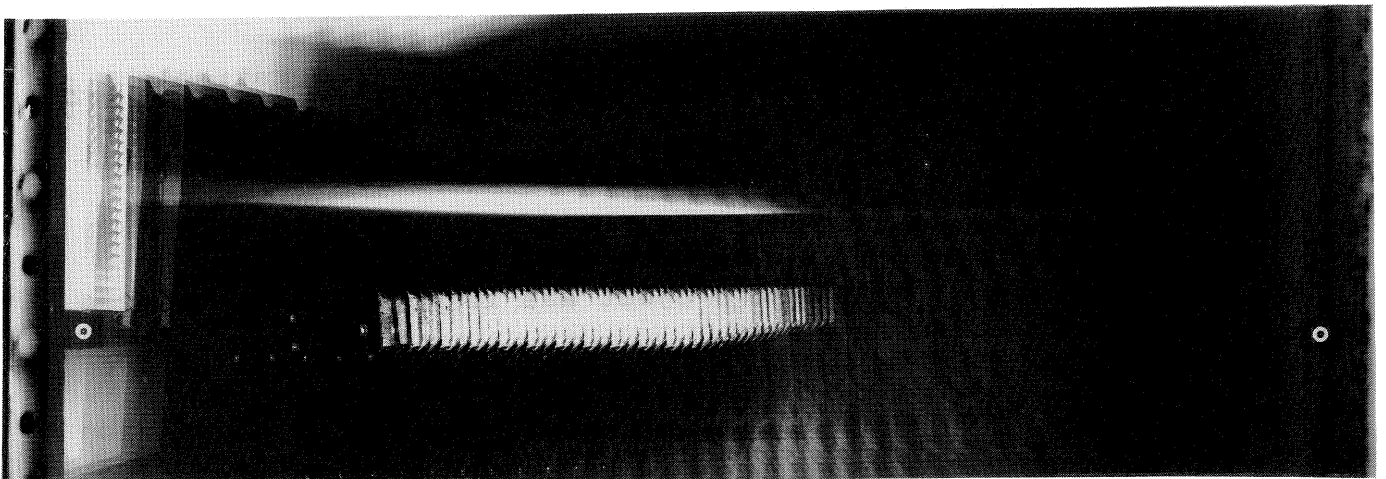


Figure 5.



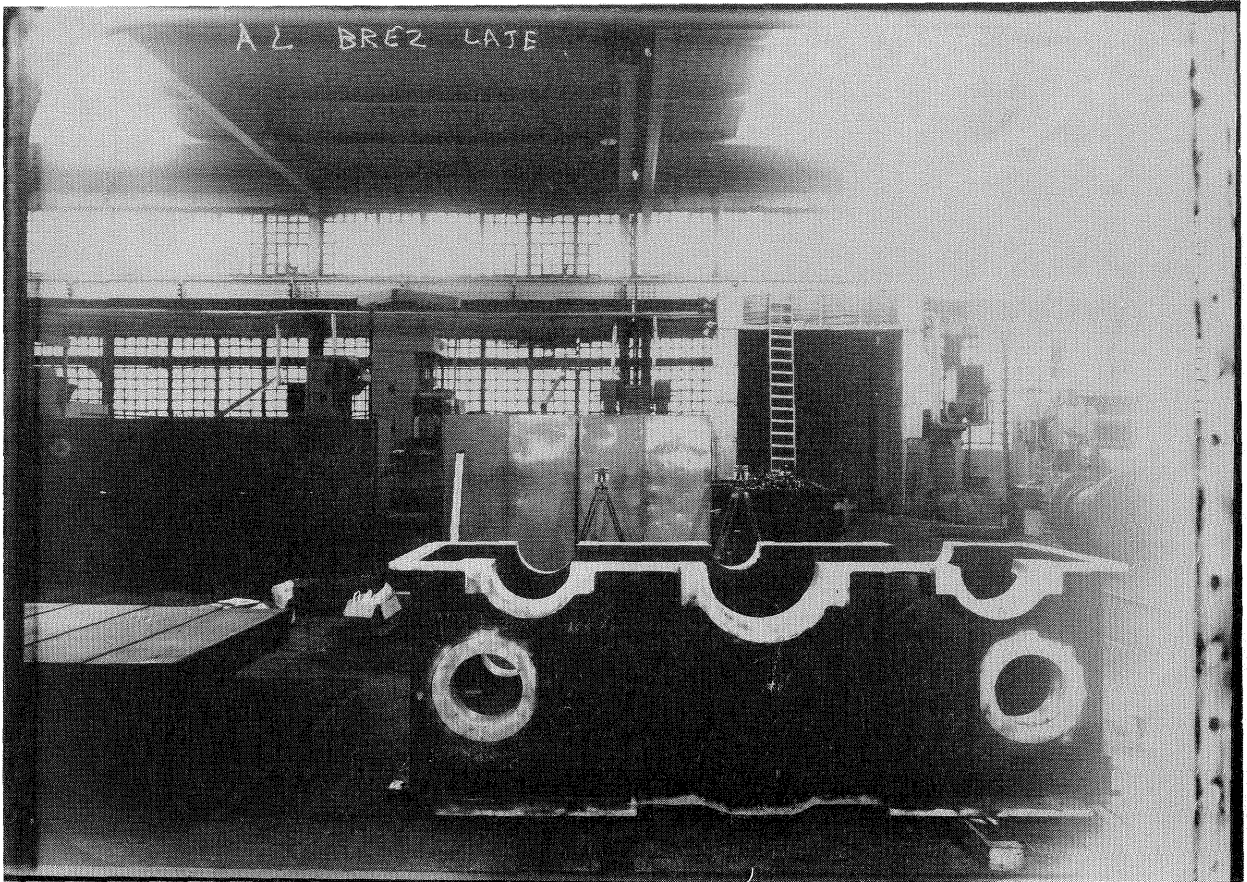


Figure 5

#### 4. PHOTOGRAMMETRIC CENTRE PROJECT

The project consisted of the following parts:

- organisation of the centre within the production process and location of the photogrammetric measuring equipment,
- transfer of technology (preparation, measuring computation),
- personnel,
- operationality of the center.

The most important part of the project was to allocate the places within the production process where photogrammetric measurements will take place. After careful study of the entire production line the places of measurements were located. Besides this also the necessary time for preparation and photographing of the serial objects ( housings ) was computed in order not to disturb

the production proces. After that the optimal times for measuring and computing were established in order to give necessary correction on-line.

The transfer of technology was taken together with the education seminars and work shops with the selected personnel. The geodetic and photogrammetric measurements are taken by Zeiss Jena equipment (theodolites, terrestrial cameras, stereocomporator). The computation of the spatial coordinates and applications (centers, axes, regression lines and planes, etc.) are computed by Industrial photogrammetry software package for IBM PC. The entire operational work of the center is shown on figure 6.

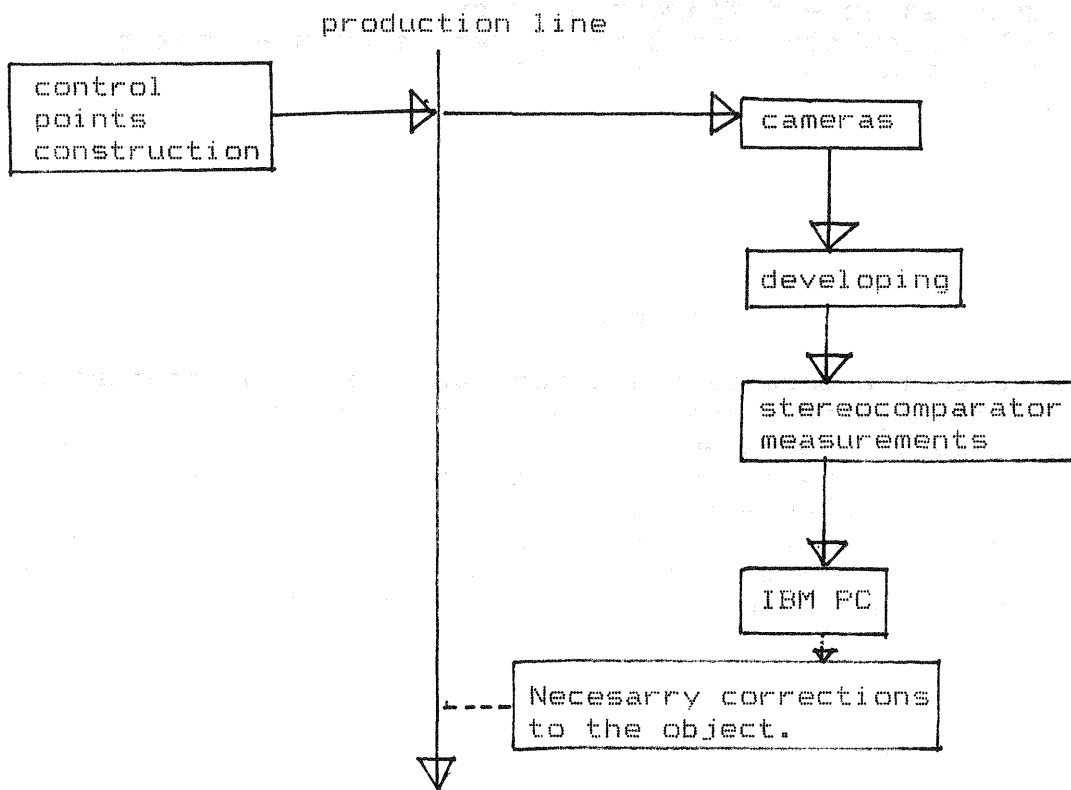


Figure 6

## 5. CONCLUSIONS AND PERSPECTIVES

The photogrammetric control centre is now one year operational and has drastically decreased the number of badly produced housings. The experiences are shown that with proper organisation of the measuring process the photogrammetry can play very important role in machine industry measurements. It is expected that very soon the second centre will be realised as mobile unit for different factories.

## 6. Literature

- 6.1. Jenaer Runschau - different editions
- 6.2. Die Industriephotogrammetrie in den Renault - werken  
Michel Wahl - Renault werke Paris

### Abstract

Paper deals with the organised approach of the photogrammetric methods in the machine industry metrology in Yugoslavia. It briefly describes the necessary steps taken in order to allocate the metrological interests and gaining the experiences. After that the main characteristics of the realisation of the operational photogrammetric center are shown in the details together with the schematic presentation of the centre within the production process. The paper wants to show the possibilities of operational incorporation of photogrammetry in metrology.