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UNITED NATIONS

FELLOWSHIPS SECTION

Name and Home Country: Mr. S. GIEMBICKI (POL/71/010) 1

Field of Study: time series analysis and short term prognosing

Country(ies of Study and Date of Award:

Sweden : 24.2.1977 - 28.5.1977



Stefan Giembicki

Central Statistical Office  
POLAND

## FINAL REPORT

on study in the Central Statistical Office of Sweden

from 28.02.1977 to 28.05.1977

### 1. My responsibility in the CSO of Poland

I am scientific-research worker of Statistical and Economic Research Centre, Central Statistical Office in Warsaw. In CSO I work for 11 years. In 1974 I received my Ph.D. degree. My Ph.D. thesis concerned "Problems of economic time series analysis".

Now I am head of the Time Series Analysis Projekt and work on the methods of decomposition (into trend, periodical and random components) time series, i.e. sets of monthly and quarterly data, collected year by year by the CSO.

More exactly, the sphere of my responsibility comprises:

- (a) Empirical works (1) decomposition of economic and social time series  
(2) estimation of measures of seasonality and seasonally adjusted series  
(3) publishing the results of these estimations in Statistical Bulletins and in informational publications.
- (b) Analytical works performed by myself and jointly with branch departments of the CSO: (1) analysis of trend/structure and changes in the periodical movements observed in monthly and quarterly data, (2) estimation of measures of rhythmicity in the economic processes, (3) short-term forecasts of periodical variation and trend (for the months and quarters in the current year).
- (c) Methodological works: (1) development and improvement methods for trend and periodical variation estimation, (2) developing statistical measures for assessing changes in the structure of periodical variation and rhythmicity.

Results of empirical and analytical works on the time series decomposition are useful tools for national economy management. For example:

- (1) Estimates of seasonal variation can be applied in constructing of short-



term (yearly) plans, for example planning distribution (on months of a year) of supplying raw materials for industry.

- (2) Analysis of discrepancy between current and prognosed trend may indicate that new tendency in development of considered phenomena is observed, caused for example by governmental intervention or by external events.
- (3) Short-term forecastings of trend and periodical variation can be used for establish measures useful in estimating the rhythmicity in implementation of economic plans and in prognosing a chance for successful implementation of these plans.

Though methods for time series decomposition are developed for forty years, one can not say that further methodological works on this subject are unnecessary. Particularly for economic time series there are some difficult theoretical and practical problems which need application of proper methods. These problems are as follows:

- (1) Nonstationarity of economic time series. Well developed statistical theory exists only for a stationary processes.
- (2) Statistical dependence of random disturbances in most economic time series.
- (3) A complex structure of seasonality: so called seasonal variation in the economic time series with monthly observations very often is generated by periodical variation with different periods from 2 to 12 or sometimes even to 24 months.

The first of the problems may be solved by bringing non stationary time series to stationarity by use of proper methods. The second and third problems need an application of some special methods and statistical tests. It seems that only few countries have computerized such systems in which nearly all listed above problems are solved.

In recent years fast development of methods for short-term forecastings is observed. Short-term forecastings are based on the same kind of statistical data like time series decomposition and seasonal adjusting procedures, but approach on which they are based is mostly different. However, these more advanced methods, especially Box-Jenkins method, are complex and need some experience and skillful. These methods are applied mainly in industry and it seems that possibility of their application in the macroeconomic time series analysis needs further examinations.



2. Statement of the problem which led my Government to nominate me for  
United Nations Fellowship

Problems of utilization of statistical and econometric analysis for national economy planning and management are difficult and complex. It seems, that base condition for their larger practical applicability is complexity. Estimation of relationships between economic and social processes, distribution of relations between these processes in time, estimation and forecasting statistical measures of dynamics, should be joined in one system. To obtain results significant from the point of view of their usefulness for national economy management we should not consider particular problems separately. A providing statistical information on the dynamics not connected mutually and from time to time may evoke only scepticism.

Therefore in Poland we want to realize a system "Statistical analysis of dynamics of social and economic processes" which will contain solvings for the following practical problems:

- (1) Statistical Estimation of a trend, periodical and random components and analysis of changes in these components
- (2) A construction of short-term forecastings (i.e. estimates of levels considered phenomena in the months or quarters of the current year).
- (3) An appreciation of rhythmicity in performance of annual plans and a forecasting of their implementation.
- (4) Testing turning points of a trend, i.e. a determining of probability that actually observed discrepancy from the values of a trend prognosed on the base of the past values of a time series is random.
- (5) Use of statistical data for the performance of optimal control of social and economic processes.

To elaborate a system which will accomplish the tasks listed above, some theoretical and methodological problems should be solved.

- (1) Testing statistical hypothesis in the case of nonstationary time series.
- (2) Examining usefulness of some approaches to forecasting and optimal control which are applied to technological processes and possibly modification this techniques.
- (3) A construction and examining models for estimating relations in time between different economic and social processes
- (4) A construction of the set of information and statistical measures concerning dynamics of economic and social processes.



It is a programme for many years of research work. So, to hasten the realisation of the programme my Government nominated me for a United Nations Fellowship. Of course, on account of short time of a study I receive limited tasks, related:

- (1) to elaborate of the method for time series decomposition,
- (2) to get acquainted with methods for testing hypotheses about changes in the trend of economic and social processes,
- (3) to get acquainted with new short-term forecasting methods.

### 3. Realisation of the programme of study

The programme of my study was accepted by host country. In the Swedish Central Bureau of Statistics (SCB) I received an excellent terms for my work. I received a room for work, possibility to use books and periodicals from library, computers and other technical devices and assistance of electronic computer's programmer.

The SCB made accessible all materials and publications concerning subjects in which I was interested, so, I had a possibility to get acquainted with works which were done in the SCB and other institutions in Sweden, for example in the Swedish Institute of Economic Research. I got access to descriptions of methods applied in other countries such as USA and United Kingdom.

The SCB is performing research works on the testing hypotheses about changes in a trend and is interested in the examining methods for time series decomposition. Therefore it was possible to discuss theoretical and practical problems at the working meetings.

Now I will give short description of my work.

#### (1) A method for time series decomposition

- (a) I got acquainted with methods for time series decomposition which are applied in the SCB in Sweden. The method and program were worked out jointly by the Swedish Institute of Economic Research and SCB.
- (b) I studied and tested, on the Swedish time series, the method and computer program which is applied by the Central Statistical Office in United Kingdom. The series which I used for testing are more complicated than those which we usually meet in Poland.



- (d) I worked out an algorithm for time series decomposition and seasonal adjusting.
- (e) The algorithm will be additionally tested on the Polish data. On the base of corrected algorithm the computer program will be worked out.

Description of the method and remarks concerning the results of its exploitation will be sent to the SCB in Sweden.

(2) The method for testing changes in the level of a trend of social and economic processes

It is a new problem for official statistics in Poland. Results of my study establish first and rough step to solving this problem. Further research works and more exact examination of the method are necessary.

- (a) I got acquainted with the theory of distribution-free statistical tests.
- (b) On the base of the theory of parametric and distribution-free statistical tests I worked out procedure in which statistical significance of the term  $r - z$  (where  $r$  is an arithmetic mean of absolute values of residuals in the past part of time series, and  $z$  is an arithmetic mean of the actual observed sequence of residuals with the same sign) is tested using classical t Student's test. This test is preceded by statistical tests for testing if the arithmetic means of absolute values of negative and positive residuals are equal, and by calculation probability of appearance of such long sequence of residuals with the same sign as this which actually appeared. This method was discussed on the seminar for workers of STM (Section of Statistical Methods in the SCB).
- (c) This procedure will be tested on the Polish time series. After testing it will be included to updating program, i.e. to the final part of the time series analysis decomposition computer program.
- (d) The corrected procedure with results of the tests will be published and will be sent to the SCB in Sweden.

As mentioned above the procedure is only a first step and further investigations on this subject will be continued.

(3) Study on the methods for short-term forecastings

- (a) I got acquainted with Box-Jenkins method for forecasting. No doubt that it is the best developed and the most exact method of forecasting. However this method is labour-consuming and is not fully automatic



so it can not be totally programmed on electronic computers. Besides, to use it successfully a prognoser should be experienced and highly skilled. The Box-Jenkins forecasting method will be introduced to statistical practice in the SCB as a method for prognosing of some important macroeconomic time series.

- (b) A new and very important problem which I met in time of my study on the forecasting and optimal control problems are methods for statistical testing of intervention effects. Analysis of intervention effects is based on statistical testing if a discrepancy between values of trend observed after an intervention and a trend prognose<sup>d</sup> for the same period is statistically significant or not. As an intervention we can understand governmental intervention into development of considered process (new laws, dispositions of central or local authorities, taxes, organisational changes, etc.). As an intervention may be considered another facts such as very strong random event, international event, unusual weather conditions etc. An intervention may cause either a change in a level or in a rate of growth of considered process. It may cause a change in both a level and a rate of growth simultaneously. As yet, analysis of intervention effects to economic and social processes was not applied often. In the statistical literature we can find examples of its application to marketing and to study on the effectiveness of environment prevention.

Analysis of intervention effects should be considered together with tasks of prognosing and control of social and economic processes.

- (c) The usefulness of new methods of forecasting and control for application to economic processes, particularly in the macroeconomic scale, should be investigated. We must take into consideration specific features of the economy in socialist countries. Maybe that economic and social processes are too complex and not always will it be possible to apply approaches presented above without their modification.
- (d) I completed an extensive bibliography on the subjects: time series forecastings, optimal control and analysis of intervention effects.



(4) Other works

- (a) A seminar for workers of STM, CUS, on the subject of testing hypothesis about changes in actually observed trend.
- (b) An information for workers of STM on the organisation and work of the Central Statistical Office in Poland and about scientific-research works of the Statistical and Economic Research Centre which I am worker.
- (c) Interviews with workers of SCB in Sweden on the subjects in which Research Centre is interested: investigations on the quality of statistical data and automatical coding of statistical data. Materials (papers, documentation etc.) on the questions mentioned above were completed.

4. Contribution my study can make to the advancement of my country in the field of study

My training abroad was very stimulating scientifically. I hope, that after working out of a new computer program, it will give fast practical effects. In this program some new ideas concerning methods of time series decomposition (for example statistical testing kind of association between a trend and periodical components, estimation of so called mixed models of seasonality and estimation of the changes in amplitudes and phases of periodical components) will be taken into consideration. Utilization of the new computer program will allow to increase considerably a number of processed time series.

Computations connected with analysis of dynamics should be less time-consuming and as a consequence it will be possible to destine more time for statistical and economic analysis. I hope that owing the new program interest with this kind of statistical analysis will increase. Results obtained from the new program, owing to more advanced dealing with connections between periodical components and trends and with outliers (effects of extreme random disturbances) should be more precise. It should increase confidence to results of time series decomposition.

An introduction (as a final part of computer program) the procedure for testing hypothesis about significance of changes in the current trend,



will give possibility for supplying the government with a signal information in the case when the probability of significant changes in a trend will be high.

In the future, this procedure should be combined with analysis of intervention effects and with elements of optimal control. An integrate consideration of this complicated and very important problems should give possibility for perfect and more complex analysis of dynamics of the social and economic processes. Therefore statistics will be fuller utilized in the process of management with national economy.

A supplement of the realized in the CSO in Poland project "Analysis of dynamics of social and economic processes" with new approach concerning testing of intervention effects, and advancement attained in problems connected with testing intervention effects, i.e. (1) in the new methods of forecasting and optimal control and (2) in the testing of changes in a trend, is the most important contribution of my training in Sweden. This approaches will be developed.

In the development of procedures for intervention effects and changes in a trend very important part determines forecasting, because in this two approaches differences are tested between a prognosed and real trends. Therefore an exact prognosing is base condition for a good performance of this procedures.

We know by experience that actually the Box-Jenkins method of forecasting gives the best results (the results obtained from this method are competitive to the results of prognoses obtained from complex econometric models). This method will be introduced in the CSO as a component of the set of methods for prognosing. The prognosing can very significantly contribute to improve national economy management. The methods of forecasting are utilized for constructing national economy plans and to management and control of their implementation.

The works on the extended project "Analysis of dynamics of social and economic processes" will be performed in the CSO in the next few years. Results of these works will be published.

Some results of my study abroad I will publish in the statistical periodicals in Poland.

Acknowledgements

I would like to express my gratitude to all institutions and persons who organized my training abroad and who helped me in the implementation the programme of my study.

First of all I am indebted to Fellowship Section of the United Nations Office at Geneva and to Swedish Institute for an excellent organization of my training. Especially I am indebted to Mrs Birgitta Carle from Swedish Institute for her assistance in solving my existencial problems and for her organizational work to make my study successful.

I would like to express my gratitude to Mr. Per Olof Olofsson, head of STM unit in the SCB, and to Mr. Per Gunnar Cassel, the worker of STM, who organized my scientific programme and helped me in its implementation.

*Stefan Grenbäck*





Mrs. M. Shoukletovich,

Fellowship Section  
Office of Technical Co-operation  
NEW YORK

*(E 323/1 POLA)*

Mr. J. SZWEYCER POL/72/004

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...Please find enclosed the final report submitted  
by Mr Szweycer, former UN Fellow who studied in Italy and  
Sweden from 7 September to 3 December 1976.

11.2.77

*TS 323 Country File*



Janusz SZWEYCER, M.Sc.  
architect  
Design Office "WAR-CENT"  
Warsaw, Wspólna street 72  
Ref.No. G.TE 134/1 Pol/3/FH

## F i n a l R e p o r t

concerning Fellowship awarded by UNDP  
in the field of:

"Planning of town centers and town  
agglomerations"

covering period of 3 months, in Italy and  
Sweden, 7 Sept. - 3 Dec. 1976.

### Data related to the work at home:

Type of institution: project office designing the centre of Warsaw  
supervised by Ministry of Municipal Economy  
and Protection of Environment.

Full name of the office: Design Office B.P.B. "WAR-CENT"

Place: Warsaw, Wspólna street 72, Poland

Post recently held: designer

Specialization: Problems of town planning:

- new housing areas in old parts of town
- renewal of old buildings, change of their functions
- town centers problems
- traffic system planning, green recreation areas, system of service net in cities.



1. Problems in my country which led my Government  
to nominate me for the United Nations Fellowship

As a result of the II<sup>nd</sup> world war, 5-years long foreign occupation of Poland and Warsaw uprising in 1944, Warsaw as a town in its structure was destroyed in nearly 90 %. After very fast, first period of rebuilding in the years 1945 - 55, further development of the capital returned to normal speed. To-day Warsaw has 1,3 mln inhabitants and this number is growing from year to year. New problems appear, connected more with " agglomeration" scale, than with " town" scale, as before. Traffic net problems, lack of underground and insufficiency of commercial services, have created the necessity of starting new phase of town development. As a consequence, a competition for the centre of Warsaw was organized in 1971, and one year later the second one - for the centre of "Praga"/part of Warsaw situated on the east bank of Vistula river/. The winners of the both competitions became starting group of the "WAR-CENT" /Warsaw-Centre/ design office. In view of big scale of the project and complexity of design problems, we have had to study many foreign examples of town centers and some contacts with foreign building firms have been done. As a result of investigation done, a close cooperation has been established with some Swedish firms /BPA/ and others, which realized some of Polish projects in the centre of Warsaw. It is evident that most helpful are direct contacts with foreign offices, their projects and realisations, especially with those who have gained wide experience and are real experts in the field of designing town centres.



Taking above into consideration, the Polish Government, on the initiative of the "WAR-CENT" office, submitted my candidature for the United Nations Fellowship, which creates possibilities for improvement of professional knowledge, both in theory and in practice and acquaintance with foreign achievements.

2. Description of training programme in Italy and in Sweden

The objective of training programme was to get acquaintance with all design problems connected with town centres. The particular attention was paid to the following aspects:

1. Renewal and restoration of old parts of town centres:

- a. change of functions of old houses for the new : public and commercial functions,
- b. Problems of traffic and public transport in old cities and central districts,
- c. rebuilding and complementing of old city structure,
- d. protection of existing old urban plans in town.

2. New commercial centres:

- a. functional programme,
- b. system of interior delivery of goods,
- c. architecture and construction of new centres.

3. Housing in central zone of town.

4. Traffic and public transport in town centres:

- a. underground
- b. parkings

5. Town centre as a centrum of agglomeration:

- a. location of public and commercial services in plans of town,
- b. inter-connection between different zones of town,



suburban centres and city.

The programme, as described above, was fully accomplished. Thanks to the most helpful attitude of I.N.I.P. / Istituto per l'Incremento della Produttività/ in Italy and the Swedish Institute in Sweden, training programme enabled an acquaintance with designing and urban and architectural problems of town centres, as a whole.

2. 1. My study programme in Italy

covering two month period / 7 Sept.- 7.Nov. 1976/.

My training programme in Italy was organized by I.N.I.P. technical assistance office, headed by dr Massimo Begani. The programme contained visits to several Italian towns and their local institutions, as well as to project offices, which were as following:

1. 13 - 19 Sept. Treviso

IACP / Istituto Autonomo Case Popolari - Autonomic Institute for Housing/

2. 20 - 22 Sept. Milano

ICITE / Istituto Centrale per l'Industrializzazione et la Tecnologia Edilizia - Institute for Industrialization and Building Technology/

3. 23 - 29 Sept. Torino

Technical University - Faculty of Architecture

4. 30 Sept. - 3 Oct. Firenze

XXIV Congress of International Union "Propriété Foncière Bâtie"

5. 4 - 6 Oct. Bologna - IACP / see point 1/

6. 7 - 20 Oct. Roma

Technical University, Faculty of Urban Planning



7. 21 - 26 Oct. Catania. IACP

8. 27 Oct. - 3 Nov. Napoli. IACP

Owing to that form of study programme I got acquainted with several urban and architectural problems in towns of different scale and character and in different climate conditions. The most conformable with aim of my training were visits to local IACP offices and design offices of Municipalities of Treviso, Bologna, Catania and Napoli. IACP are designing and realising mainly the housing areas. The urban and architectural solutions of their housing are simple and not very expensive, but we can note high standard of finishing works and quality of building materials used. IACP are interesting especially as an organisation and methods of activity for problems of transformation and remodeling of housing situation which is, very often, complicated.

The technical offices of Municipalities in Treviso and Bologna make very interesting projects for their town centres, dealing with problems of traffic, parkings and public transport in city and also plans for reconstruction and maintenance of historical structure of centre. As very good examples for those activities I can mention two big supermarkets "Coin" and "Standa", situated in the historical centre of Treviso, and church St. Lucia and school of St. Luigi in Bologna. Those ingerations in historical cities of new architecture have given as a result the new, commercial and cultural centres, without destruction of value and character of existing structure. In Torino I saw the actual plans for town development. I visited also a private urban planning office "Polis", in which I studied urban plans for small towns in Torino province. Those plans



were most interesting.

The big professional satisfaction gave me opportunity to participate in the XXIV Congress of International Union "Propriété Foncière Bâtie" in Firenze. The working sessions and reports presented by member countries representatives, who gave a general review of situation in architecture, housing and problems of building law in whole Europe, were extremely interesting.

My visits to ICITE in Milano and to Roma Technical University were less interesting, because were connected rather in small degree with main subject of programme, but for general professional orientation, certainly valuable.

Recapitulating, my studies in Italy were very interesting, particularly the materials and impressions received in Bologna and in Treviso connected directly with planning works of centres i.e. very similar to my actual work in Poland. In all institutions and project offices I was met with great hospitality, received all information needed and was welcome with friendship.

I should like to underline an excellent organisation of my study programme in Italy -thanks to personal assistance of dr Massimo Begani who enabled the most interesting professional contacts and knowledge of eminent works being done in the field of urban planning in Italy.

## 2.2. My study programme in Sweden

covering period of one month / 8 Nov.- 3 Dec.1976/

My study programme in Sweden was organized by the Swedish Institute, Scholarship Section, headed by Mrs Ingegard Grundstedt. During my stay in Sweden I got acquainted with



work being done in several design offices and I visited many objects and commercial centres in suburbs of Stockholm and in other towns.

The schedule of my stay was as follows:

1. 9 Nov. Stockholm  
visits to new suburbs in Stockholm area: Vallingby, Akkalla /Husby, Skarholmen;
2. 11 Nov. Stockholm. The City Planning Office;
3. 15 Nov. Uppsala. The Town Planning Office of Uppsala Municipality;
4. 16 Nov. Solna. The City Planning Office of Solna Municipality;
5. 17 Nov. Stockholm. Office building "Garnisonen", housing and commercial centre "Faltoversten";
6. 18 Nov. Vasteras ,The town Planning Office of Vasteras Municipality;
7. 22 Nov. Orebro. The Town Planning Office of Orebro Municipality;
8. 23 Nov. Gothenborg. The Town Planning Office of Gothenborg Municipality;
9. 24 Nov. Malmo. The Town Planning Office of Malmo Municipality;
10. 25 Nov. Lund. Technical University -Faculty of Architecture;
11. 30 Nov. Stockholm. KFAI, AB. The Architectural Office of the Cooperative Union and Wholesale Society;
12. 2 Dec. Stockholm. Koordinator AB. The architecture and interior designers' office.

I have seen many commercial centres in Swedish towns and suburbs of Stockholm. They are all characterized by very high technical standard, modern solutions in architecture, excellent service organisation. We can say, that Swedes have elaborated a "model" for commercial centre, which is , in various architectural expressions, repeated in different towns. Their common features are



extremely well working system of : goods delivery, park-story houses, pedestrian ways heating - as well as very good localisation in town plans. Good examples of those high standard, pilot centres are : the Stockholm one, Skarholmen and Taby near Stockholm and the commercial centre of Gothenborg. I have visited also centres of different type, which have been built in a more organic way in town city. The attention of designers was put there on the connection of " new - old" in architecture and structure of centre. Such examples I observed in Malmo, Lund, Orebro, Vasteras and in some fragments of centres in Stockholm and in Gothenborg. Everywhere modern technical solutions have been applied. During my visits to town planning offices in different parts of Sweden I could get information concerning their system of organisation, methods used in process of designing work and realisation. The managers of these offices, whom I had pleasure to meet, and also workers in Departments for Architecture and Urban Planning in Town Halls, have discussed the master plans and new ideas for towns development. Thanks to kindness of the Municipal Offices personnel, I have received everywhere detailed information about actual works carried out by particular design units and I could exchange opinions related to foreseen further development and tendencies in urban planning.

The programmes of studies in Sweden and in Italy included various problems and aspects in urban planning. I think this approach to subject of studies was the best one because it enabled a comprehensive study of all problems concerned, and personal evaluation of practical experience acquired.

### 3. Evaluation of the training programme

The training programme was very well organized and prepared. The foreign specialists in design offices and other institutions



I have visited in Italy and Sweden, as well as all staff members, received me with great kindness and tried to help me in my problems and studies, as only it was possible.

#### 4. Conclusions

The training was very useful and enabled me getting acquaintance with all problems, I have underlined in suggestions for study programme. Programme in Italy has given a lot of observations, especially related to methods of rebuilding and renewal of old town centres; in Sweden - bigger attention I put on studies of most modern solutions in to-day centres of town, suburbs and town agglomerations.

The knowledge and experience acquired thanks to UNDP fellowship will be used in my future work to the best profil of my country and my town when evaluation and preparing new projects and assumptions for modernization, the most efficient one, of Warsaw centre and city. Time spent in Italy and Sweden, visits to places of new realisations, have given a lot of experience and ideas which I would like to introduce into Polish conditions and local urban planning situation.

#### 5. Acknowledgment

May I acknowledge the assistance of Mr L.Bloch and Mr.Jean Coulondre, the representatives of UN Technical Assistance Office, whose attitude created possibilities to enlarge my professional knowledge and enabled contacts with foreign colleagues and their achievements - thanks to UNDP Fellowship.

I wish to underline very good elaboration and implementation of study programme by dr Massimo BEgani and Miss Rosalba Iavasile from I.N.I.P. in Rome, and by Mrs Ingegard Grundstedt and Mrs. Kerstin Nordlund-Malmegard from the Swedish Institute in Stockholm.



Thanks to their assistance, good will and engagement in their work , my study programme was so rich, interesting and giving wide information.

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*PE 323/1 POLA*



UNITED NATIONS

FELLOWSHIPS SECTION

Name and Home Country: Mr. J. CZAJKOWSKI (Poland) - POL/71/010

Field of Study: systems design for remote access time-sharing and real-time application methods of hardware evaluation and selection.

Country(ies) of Study and Date of Award: United Kingdom : 2.1.1976 - 13.3.1976

UNITED NATIONS FELLOWSHIP

FINAL REPORT

RECORDS CONTROL

17 AUG 1976

PREPARED BY: JÓZEF CZAJKOWSKI

LONDON - 8 MARCH 1976



Re: Józef Czajkowski

Country: Poland

Subject: Computer Systems

- Data Base Management Systems
- Computer Performance Analysis Systems

Place: London School of Economics,  
Houghton Street,  
LONDON WC2 2AE - U.K.

Term 2 January 1976 - 12 March 1976

## INTRODUCTION

This final report intends to give detailed information on my studies in the U.K. as an United Nations Fellowship. For that purpose it has been divided into four paragraphs that should give description of:

- Area of my activities in Poland
- Problems reasons for my nomination
- Realisation of the study programme in the U.K.
- Expected benefits from the study.

## AREA OF MY ACTIVITIES IN POLAND

I have been working in the data processing field for more than ten years.

In the course of that time I have passed a number of home country trainings mainly organised by Western Computer Manufactures and Data Processing Centres in Warsaw.

The topics of those trainings included:

- Computer systems analysis
- Computer systems design
- Programming languages
- Computer systems management.

The knowledge gained from the above studies, together with the years of computer practice allowed me to reach my current post in the Data Processing Research and Development Centre (DPRD Centre) - the organisation that I am working for in Warsaw.

The DPRD Centre has been established to promote implementation of an advanced computer systems technology among more than twenty other DP Centres, together creating the largest computer service - bureau organisation in Poland called The Unitedfield of Informatics (U.I.).

Being a manager of Quality Control and Computer Performance Evaluation Group, I am responsible for:

- development of data base management system (DBMS) in the part involved with data base performance analysis



- software aids design for programming testing and test data generating,
- implementing of software aids for programming testing and test data generating as the standards for software development in the DPRD Centre and consecutively in the whole U.I. organisation,
- consultancy service on DBMS problems and computer performance analysis for the rest of DP centres of U.I. and for outside users.

#### PROBLEMS REASONS FOR MY NOMINATION

During the recent two years it can be observed in Poland, like in many other countries in Europe, still increasing interest in DBMS approach for data processing systems development. Data base concept appears to many users as an advanced systems technology capacity of which can be used to implement more efficient and flexible computer systems applications. An increasing number of DBMS implementations in the U.S.A. together with users' experiences gathered from quite a large number of DP systems applications based on DBMS concepts have prompted the demand for DBMS implementation in Poland.

Because of generalised character of DBMS software and some research aspects of that approach, my organisation - The DPRD Centre - seemed to be the most suitable to undertake that project.

The lack of sufficient DBMS users' experience in Poland and a set of problems that DBMS implementation creates itself for an implementator to overcome, have resulted in my nomination for a United Nations Fellowship.

#### REALISATION OF THE STUDY PROGRAMME IN THE U.K.

The study programme has been carried out in the following forms:

- lectures attended at London School of Economics and talks to the staff of the Computing Department at L.S.E.
- the brief visits to users of DBMS.
- the brief visits to software manufacturers.

The lectures at L.S.E. have covered my study interests regarding the methodology of development of computer systems applications.

They have given me an idea of the current approach used in the U.K. to:

- systems analysis methodology
- computer systems design methodology.

In the course of my studies I visited a few DBMS users, software manufacturers and consultancy firms. This list includes such organisations as:

- The National Computing Centre in Manchester,
- Glaxo Holdings Ltd. in London (Robot system user),
- Bankers Trust Co. in London (IMS user),
- British Petroleum Co. in London (DMS - 1100 user),
- Water Data Unit in Reading (User of ICL - 1904's system currently investigating for DBMS),
- Software Sciences Ltd. in Macclesfield,
- Logica Ltd. in London,
- Hoskyns Systems Ltd. in London,
- C.A.C.I. Inc. International in London.

For obvious reasons the visits to DBMS users were concerned with practical experience rather than technical aspects of the systems.

The main subject areas covered by those visits were:

- method of approach to DBMS installation,
- DBMS software investigation and evaluation,
- development and implementation of DBMS,
- general description of Data Base applications,
- Data Base administration,
- DBMS manufacturers support.

The visits and talks to software manufacturers and consultants were concentrated on some technical aspects of software development.

An outline for these was DBMS and its software environment. The subjects discussed were:

- technical features of some DBMS implementations,
- the current state of Codasyl Committee's works for DBMS development, in particular those regarding the specification of tools for use of the Data Base Administrator to control efficiency and reliability of Data Base.
- software aids for programming phase of computer systems
- development (programming testing and test data generating aids)



- efficiency of Data Base systems and measurement problems,
- computer performance analysis - methods and techniques.

The above mentioned subjects of my study programme have been carried out on the base of discussions and talks rather than on training courses.

#### EXPECTED BENEFITS FROM THE STUDY

As I may expect my fellowship should contribute to the advancement of some software projects currently being developed by my organisation.

The country's wide scope of these projects should have an impact on some areas of computer systems applications in Poland.

Directly, my studies in the U.K. is seen to have influence on:

- development of software aids for use of the Data Base Administrator to control the Data Base system efficiency,
- development of computer performance analysis activities,
- implementation of software aids for programming testing and test data generating.

Apart from that the extra advantages supposed to be reached by my organisation are contacts with some software circles in the U.K. that should result in profitable co-operation for the future.

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TE 323/1 POLA

Name and Home Country: Mr. G. Gizycki (Poland) - POL/72/004

Field of Study: raising durability of machines for building industry

Country(ies) of Study and Date of Award: United Kingdom : 28.8.1975 - 27.3.1976-


FINAL REPORT

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- II The reasons for which my government nominated me for a  
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Fellow

GRZEGORZ GIZYCKI

POLAND  


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ROOM CM-2300 - EXT. 3218	
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The University of Aston in Birmingham,  
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Gosta Green.

Birmingham B4 7ET

*Dr. D. A. Mihner*



1. My responsibility in my country.

The training I have got and the work I have been doing there

In Poland I have been studying at the technical University named Warsaw Polytechnic. I finished my studies in 1968 and received the diploma of M.Sc. Eng. Mech. with the specialisation in designing heavy machines such as trucks, lifts, cranes and so on.

For nearly two years I was working in the lift's factory at the design office, then I was transferred to the Research Centre belonging to the big industrial corporation ZREMB where I am now employed. My job is to design machines for building industry. The specific nature of my work depends on the kind of machines we project. In most cases we have to do with highly specialised machines for special purposes. It can be e.g. to design the automatic transport in the big factory, large cranes for building power stations, special trucks to carry concrete elements to build motorway etc.

For that we are often in situation where previous experience can not help. So it is important to possess good general knowledge about designing, to learn about new techniques which involves the use of computers. This knowledge allows designers to go further, to design machines which are more reliable, lighter and lasting longer as compared with those were designed using old, project techniques.

As I have mentioned I finished my study eight years ago. In those days the knowledge of actual designing techniques

which we are using today were not very popular in my country. Therefore a refresher course in new techniques is very desirable. I learned something about the subjects such as RELIABILITY OPERATIONAL RESEARCH, MANAGEMENT TECHNIQUES, also in some small (but in most designers cases enough) degree how to write computer programs in FORTRAN and many other things. Of course during half a year I could not learn everything I wanted to. The full course at the University of Aston lasts a year and I was sent for half the course.



- 11 The reasons for which my government nominated me for a United Nations Fellowship

In the past few years the great effort was made in my country to produce more and better. So for that two problems concerning designing became extremely important:

- a) To save materials especially such as steel, wood, other metals.
- b) To design machines lasting longer or to put it in more modern way, more reliable and lasting not less than it was predicted.

In my country special courses on these subjects are organised and I have completed one Post Graduate Course on the subject "RAISING DURABILITY OF MACHINE PARTS". On this course I have learnt much about materials, calculating methods and technologies of renomination of work out parts but I was not quite satisfied. I have an idea that LIFE OF MACHINE can not be treated as a fully seperate problem. It must become the integral part of the design process so as when designing gear boxes, bearings etc. but at that stage of our knowledge it was not impossible but too complicated. To design a good machine one must do many calculations and to include the reliability calculations makes the design process too long. Using modern techniques involving computers allow us to design more precisely if we know what methods we can use and what LIFE & RELIABILITY really is.



### 111 The Programme of Observation and Study

#### 1. Introduction

I started my training in London at the Language Tuition Centre where for a month I was learning English. I have never been in England before so I think it was a very good idea to spend the first month in a language school. I joined the class grade 4 and after the training I received *mark 5 (very good)*

The according to the programme prepared by British Council I went to Birmingham where I have spent six months studying at the University of Aston. The program of study covered listening to the lectures and taking part in laboratory experiments..

The subjects I was reading were:

1. Industrial Engineering and Management
2. Computing
3. Control Theory
4. Digital Control
5. Hydraulic Control
6. Analogue Computation
7. Statistics
8. Quality Control
9. Operational Research
10. Production Control
11. Reliability.



In the same time I started to gather the materials about the subject LIFE AND RELIABILITY. Also after discussions with my University supervisors the subject matter of the project was choosen. The intention of making this project was to connect my previous experience as a designer with the new knowledge I have obtained at the University. With the help of my supervisor this work was completed and because results are interesting and of a practical importance we intend to publish it in England. In my opinion to do this project was the most interesting and valuable part of my training it is included in this report as the point 3 of this chapter.

The materials gathered about the LIFE AND RELIABILITY are quite interesting. To avoid any misunderstanding I must explain that in all English speaking countries Durability is called LIFE and this word is now used in my work instead of previous terminology.

## 2. New Material I have learned about Life and Reliability of Machines

### a. Basic Definitions

The modern, concept of life and reliability is related to failures and from the mathematician point of view are statistic problems.

The machine can be introduced as the set of items. These items are taken as systems if they are reparable and as components if they are not.

Shorter than expected life of some components can cause a total failure of the machine failure of others will cause a drop in performance. We say:

Unreliability may manifest itself as a quasi-random instantaneous total loss of function or the machine can still operate but errors can be found during work.

In general these errors can be observed as:

1. Initial faults design or manufacturing
2. Short time cycle influences - vibrations, load fluctuation.
3. Medium time cycles such as different kind of deformation, quick wear of some parts as bolts, wheels etc.
4. Long time cycle influences due to wear or electric, electronic or hydraulic equipment.

For that it is difficult to talk about life of a machine



without defining the RELIABILITY.

RELIABILITY is a probability of the system to work satisfactorily, under specified conditions for a given time.

$$R = f(t)$$

If we consider any machine we can expect and predict how long it will live without failure with estimated probability.

So as we can see from above one can not design a machine and say that it will work satisfactorily for some period, without considering what kind of relationships are between its parts. Even then we can still only say that the probabilities of life without failure (small or total) is R.

The programme of my study at the University of Aston in the Production Engineering Department contains the subjects: Statistics, quality Control and Reliability and the training on this field was given to me.

#### B. MATHEMATICAL TECHNIQUES

The use of FORTRAN (and other High Level computer Languages) allows us to design machines more precisely but it is not all. If we are able to define the criteria and to write the programme the computer will choose the best solution. Special techniques e.g. DECISION TABLES can be used.

These subjects are also lectured at Aston University.

C. Design Against Corrosion, Wear, Fatigue.

These subject were not lectured so the only way to learn about them was to make use of the big and well equiped library in Aston. The best found position about the problem was the book DESIGN FOR STRENGTH & PRODUCTION by Rutz & Koeingsberger, London 1970.

This book shows the modern look on the problem of design against different kinds of deformation and can be highly recommended for designers.



# COMPUTER DESIGN OF MAST & REFLECTOR UNIT

This paper illustrates, given the specification, the design principles involved in obtaining the buckling load for a telescopic mast and reflector unit. The mathematics and associated flowchart for the computer calculation is given, these basic ideas can be useful for a variety of problems, examples of which are given here.

Dr D A Milner

Department of Production Engineering

University of Aston

Birmingham

G Gizycki, MSc

The Design Office

Zremb

Warsaw

## INTRODUCTION

The design procedure may be regarded as the processing of information via objectives, relationships and data in order to determine the system specifications, Figure 1. The concept of design which involves a process of optimisation is a relatively recent one and its emergence as a maxim is due largely to the increasing use of digital computers and modern calculators. The process towards good design is achieved largely by experience built up gradually in specialised fields over a long period of time. The way of organising the effective application of existing knowledge is, in fact, by acquisition of the appropriate experience and to use data tables, computer programmes, etc. However when designing a new machine there are some problems for which past experience and literature survey give relatively little help.

It is now necessary to:-

- a) change the conception of the equipment
- b) solve the problem in a simplified form
- c) try to create the theory necessary to solve the problem.

Usually designers choose the first two solutions but sometimes the problem is such that an accurate determination is necessary, especially in a situation when the method of attack may in future be used for design of similar machines. This paper intends to introduce such a technique.

## DESIGN CONSIDERATIONS

The mast carrying a reflector at the top of the unit had to be 15 metres high, the reflector being of weight approximately equal to 150 kg. The device had to be easy to convey from one site to another and then to stand for the period of working at the site. The designed mast carrying the reflector unit was to give illumination for digging operations. The height



beam of the reflector was examined carefully and 15 metres was found to be the lowest and still efficient.

The other restrictions were that:

- a) no crane or other equipment was available to support the mast and reflector.
- b) maximum staff available would not be more than two persons
- c) the longest time, available to erect the unit would be one working day.

The shortest time to stay in one place was estimated as two weeks and the longest six months. Obviously this time factor was important as too much time spent in erection would be not economical.

#### MAIN SPECIFICATION OF THE UNIT

The unit Figure 2 consists of four main assemblies, namely:

- a) the mast
- b) the frame with four supports
- c) the chasis with the two tyres
- d) the basic reflector.

The mast was made of telescopic form consisting of three tubes; the frame was to be welded with steel box section. Finally the reflector is a standard part, weight of approximately 150 kg and maximum area 2 sq metres.

#### FUNCTIONING OPERATION

In order to transport the unit from one site to another the mast is folded as shown in Figure 3. To prepare the mast in its working position the mast is placed on the supports by means of the built-in screw jack. The chasis is first removed than the first telescopic member of the mast is lifted and

assembled into position with the second tube. Similarly the second member is assembled into position with the third member. Finally the last action is to pull the rope R tight for tensioning purposes.

#### BUCKLING FORCE CALCULATION

The force of the wind may be obtained by using a standard procedural handbook which gives the only allowable way of calculating this force for all devices which are to be used or built on public ground.

$$\text{The total force } P = \sum_{i=1}^n S_i q_i C_i$$

where  $S_i$  is the area of the object

$q_i$  is the wind pressure depending upon the height (above ground level) and where about the unit is located.

$C_i$  is the shape factor obtained from tables.

In this case the total wind force was calculated to be about 300 kg and it is then a simple geometric exercise to find the forces pulling the ropes and stressing the mast during stormy weather, as shown in Figure 4.

The maximum vertical force on the telescopic mast unit was found to be 2500 kg.

The initial idea in calculating the diameters of the tubes was to assume that the strength of all the mast is the same as that of the thinnest pipe.

During high winds this mast must bear the buckling load generated from the ropes of 2500 kg.



From the basic Euler equation

$$P = \frac{E I}{l_x^2}$$
$$I = \frac{P l_x^2}{E}$$

where  $P = 2500$  kg, the buckling force

$l = 1250$  cm, the total length

$X = 2$ , the factor of safety for steel

$E = 2.1 \cdot 10^6$  kg/cm<sup>2</sup>

hence  $I_{\min} = 377$  cm<sup>4</sup>

This giving the diameter of the first section tube as 13.0 outside diameter 12.0 cm inside diameter. Similarly the second tube measurements must be 17.5 cm outside and 16.5 cm inside diameter. Then the third telescopic member must be 22.0 cm outside and 20.8 cm inside diameter. It was not wanted to use tubes with wall thickness thinner than 0.5 cm because of corrosion and possibility of damage during transport. Tubes above 20.0 cm diameter with the wall thinner than 0.6 cm were only obtainable on special request and entailed a more expensive product.

In this case the total weight of the three telescopic members was approximately 350 kg and the design of the unit was then impossible to realise. Especially for the case of using the standard parts for the wheels, tyres, springs and brakes.

It was then decided to calculate the dimensions more precisely as obviously the unit is too strong and heavy.

The calculation of the buckling force for the situation of several different diameters of tube was then undertaken and the appropriate theory developed and a computer solution is given.

### CONCLUSIONS

This approach is an aspect of design that can be useful in practice for many cases. Very often one has to deal with buckling loads and it is rare that the diameter is constant. Some years ago it would have been helpful to calculate many similar examples for different diameter tubes and collorate in a tabular form. Nowadays with the facility of the digital computer a program may be developed (Figure 5) to calculate the load for three different cross sections. This program could therefore be easily adapted for the case of the three examples shown in Figure 6, the calculation of the telescopic tubes buckling load being the same.

### SYSTEM MATHEMATICS

The system shown in Figure 6 may be analysed as follows. The differential equation of the loaded beam is

$$EI\ddot{y} = -Py \quad \text{where } y = f(x)$$

The solution of this equation is

$$y = A \cos wx + B \sin wx$$

$$\text{where } w^2 = \frac{P}{EI} \quad \text{and } A \text{ and } B \text{ are unknown constants determined from the boundary conditions.}$$

Consider the three sections and in the first  $x_1 \leq \ell_1$  and  $w = w_1$

$$\text{when } x_1 = 0 \quad y_1 = 0 \quad \text{giving } A_1 = 0$$

$$\text{thus } y_1 = B_1 \sin w_1 x_1$$

$$\text{and } \dot{y}_1 = w_1 B_1 \cos w_1 x_1$$

In the second section  $\ell_1 \leq x_2 \leq \ell_2$  and  $w = w_2$

$$\text{when } x_2 = 0$$

$$y_2 = A_2 \quad \text{and } \dot{y}_2 = w_2 B_2$$



At this point, however,  $x_1 = \ell_1$  and because the function is continuous

$$y_1 = y_2 \quad \text{and} \quad \dot{y}_1 = \dot{y}_2$$

$$\text{therefore } B_1 \sin w_1 \ell_1 = A_2 \quad (1)$$

$$w_1 B_1 \cos w_1 \ell_1 = w_2 B_2 \quad (2)$$

At the end of this section  $x_2 = \ell_2 - \ell_1$

$$y_2 = A_2 \cos w_2 (\ell_2 - \ell_1) + B_2 \sin w_2 (\ell_2 - \ell_1)$$

$$\dot{y}_2 = -w_2 A_2 \sin w_2 (\ell_2 - \ell_1) + w_2 B_2 \cos w_2 (\ell_2 - \ell_1)$$

In the third section  $\ell_2 \leq x \leq \ell_3$  and  $w = w_3$  when  $x_3 = 0$

$$y_3 = A_3 \quad \text{and} \quad \dot{y}_3 = w_3 B_3$$

so as before

$$A_2 \cos w_2 (\ell_2 - \ell_1) + B_2 \sin w_2 (\ell_2 - \ell_1) = A_3 \quad (3)$$

$$\text{and } -w_2 A_2 \sin w_2 (\ell_2 - \ell_1) + w_2 B_2 \cos w_2 (\ell_2 - \ell_1) = w_3 B_3 \quad (4)$$

$$\text{when } x_3 = \ell_3 - \ell_2 \quad y_3 = 0$$

$$0 = A_3 \cos w_3 (\ell_3 - \ell_2) + B_3 \sin w_3 (\ell_3 - \ell_2) \quad (5)$$

$$\text{Now letting } w_1 \ell_1 = \alpha_1$$

$$w_2 \ell_2 = \alpha_2$$

$$w_3 \ell_3 = \alpha_3$$

$$B_1 \sin \alpha_1 - A_2 = 0$$

$$B_1 w_1 \cot \alpha_1 - w_2 B_2 = 0$$

$$B_1 \cos \alpha_2 + A_2 \cos \alpha_2 + B_2 \sin \alpha_2 - A_3 = 0$$

$$-B_1 w_2 \cos \alpha_2 - A_2 w_2 \sin \alpha_2 - B_2 w_2 \cos \alpha_2 - B_3 w_3 = 0$$

$$-B_1 w_2 \sin \alpha_2 + B_2 w_2 \cos \alpha_2 + A_3 w_3 \cot \alpha_3 - B_3 \sin \alpha_3 = 0$$

The matrix may now be constructed

$B_1$	$A_2$	$B_2$	$A_3$	$B_3$	
$\sin \alpha_1$	-1				
$w_1 \cot \alpha_1$		$-w_2$			
$\cos \alpha_2$	$\cos \alpha_2$	$\sin \alpha_2$	-1		= 0
$-w_2 \cos \alpha_2$	$w_2 \sin \alpha_2$	$w_2 \cos \alpha_2$		$-w_3$	
$-w_2 \sin \alpha_2$		$w_2 \cos \alpha_2$	$w_3 \cot \alpha_3$	$\sin \alpha_3$	

thus

$w_1 \cot \alpha_1$	$-w_2$	0	
$\cos \alpha_2$	$\sin \alpha_2$	-1	= 0
$-w_2 \sin \alpha_2$	$w_2 \cos \alpha_2$	$w_3 \cot \alpha_3$	

expanding

$$w_1 \cot \alpha_1 (w_3 \sin \alpha_2 \cot \alpha_3 + w_2 \cot \alpha_2) + w_2 (w_3 \cos \alpha_2 \cot \alpha_3 - w_2 \sin \alpha_2) = 0$$

finally

$$\frac{w_1}{w_2} \cot \alpha_1 \left( \frac{w_3}{w_2} \cot \alpha_3 + \cot \alpha_2 \right) + \left( \frac{w_3}{w_2} \cot \alpha_2 \cot \alpha_3 - 1 \right) = 0$$

This must now be solved by a trial and error technique.

#### REFERENCES

Timoshenko, S. Theory of Elastic Stability, McGraw Hill, 1936.



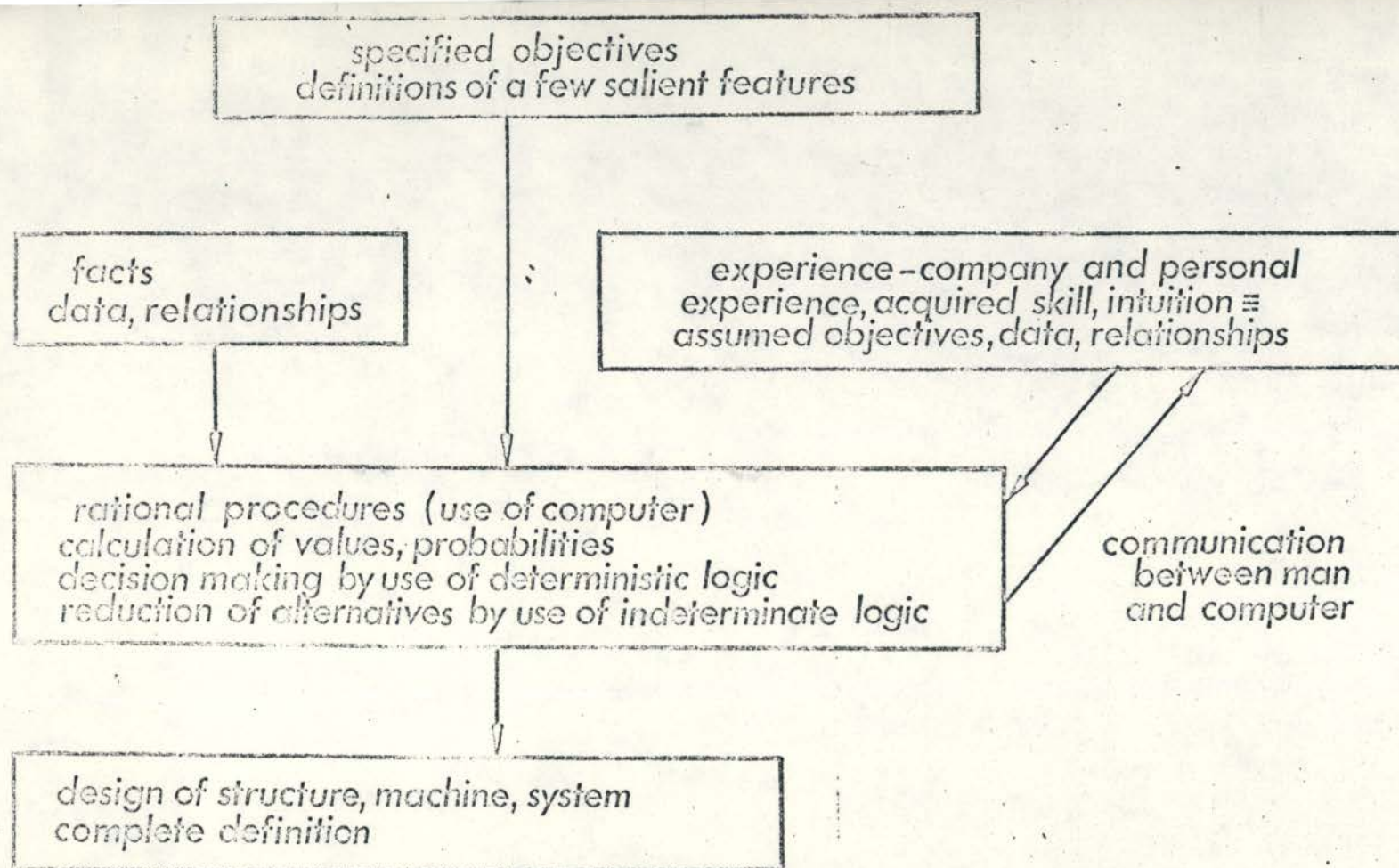


FIGURE 1. A graphic representation of the design process

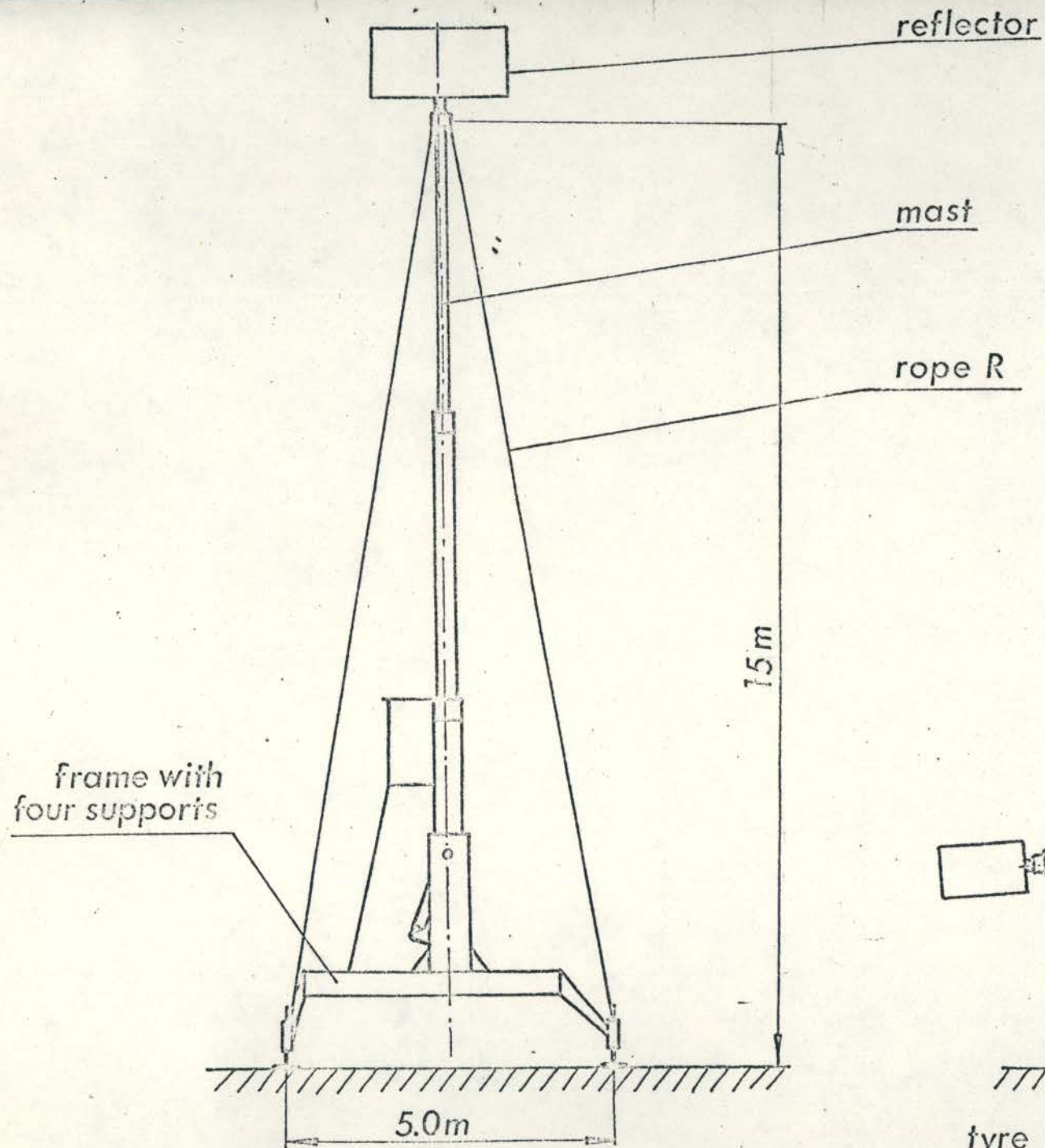


FIGURE 2

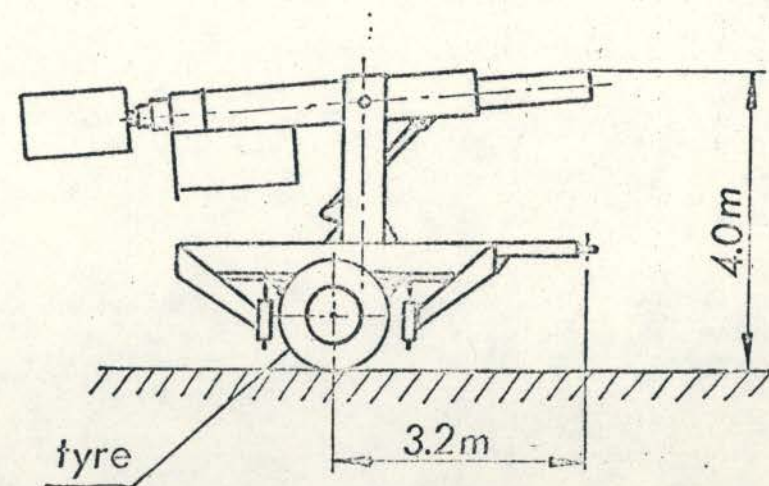


FIGURE 3 Folded Unit



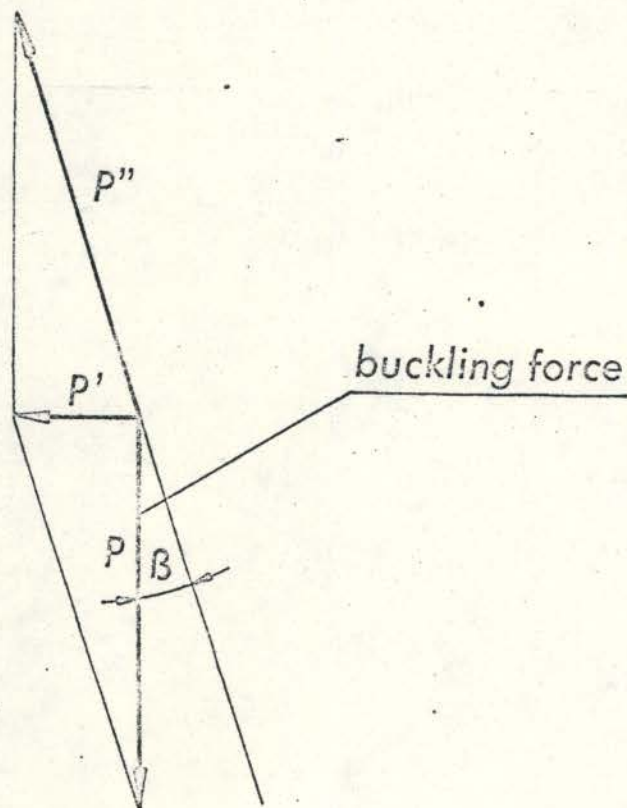
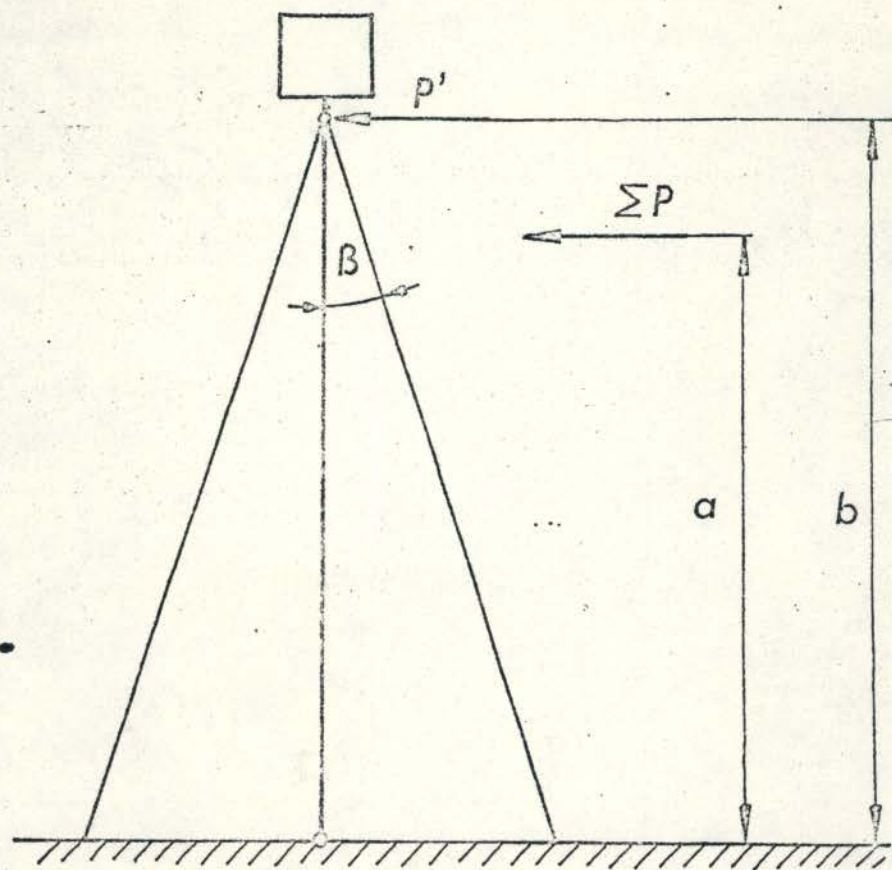


FIGURE 4

Force Diagram

START

K=0

READ:D1,D2,D3,G1,G2,G3,DELTA,L1,L2,L3,R,E,S,B,X

I=0

$D1 = D1 + K \cdot \text{DELTA}$   
 $D2 = D2 + K \cdot \text{DELTA}$   
 $D3 = D3 + K \cdot \text{DELTA}$

$$J1 = \frac{D1^4 - (D1 - 2G1)^4}{64} \pi$$
$$J2 = \frac{D2^4 - (D2 - 2G2)^4}{64} \pi$$
$$J3 = \frac{D3^4 - (D3 - 2G3)^4}{64} \pi$$

$$P_{\text{MIN}} = \frac{\pi^2 E J1}{(L1 + L2 + L3)^2 X}$$
$$P_{\text{MAX}} = \frac{\pi^2 E J3}{(L1 + L2 + L3)^2 X}$$
$$P_{\text{JUMP}} = \frac{P_{\text{MAX}} - P_{\text{MIN}}}{S}$$

I=I+1

I ≤ S

a

b

c



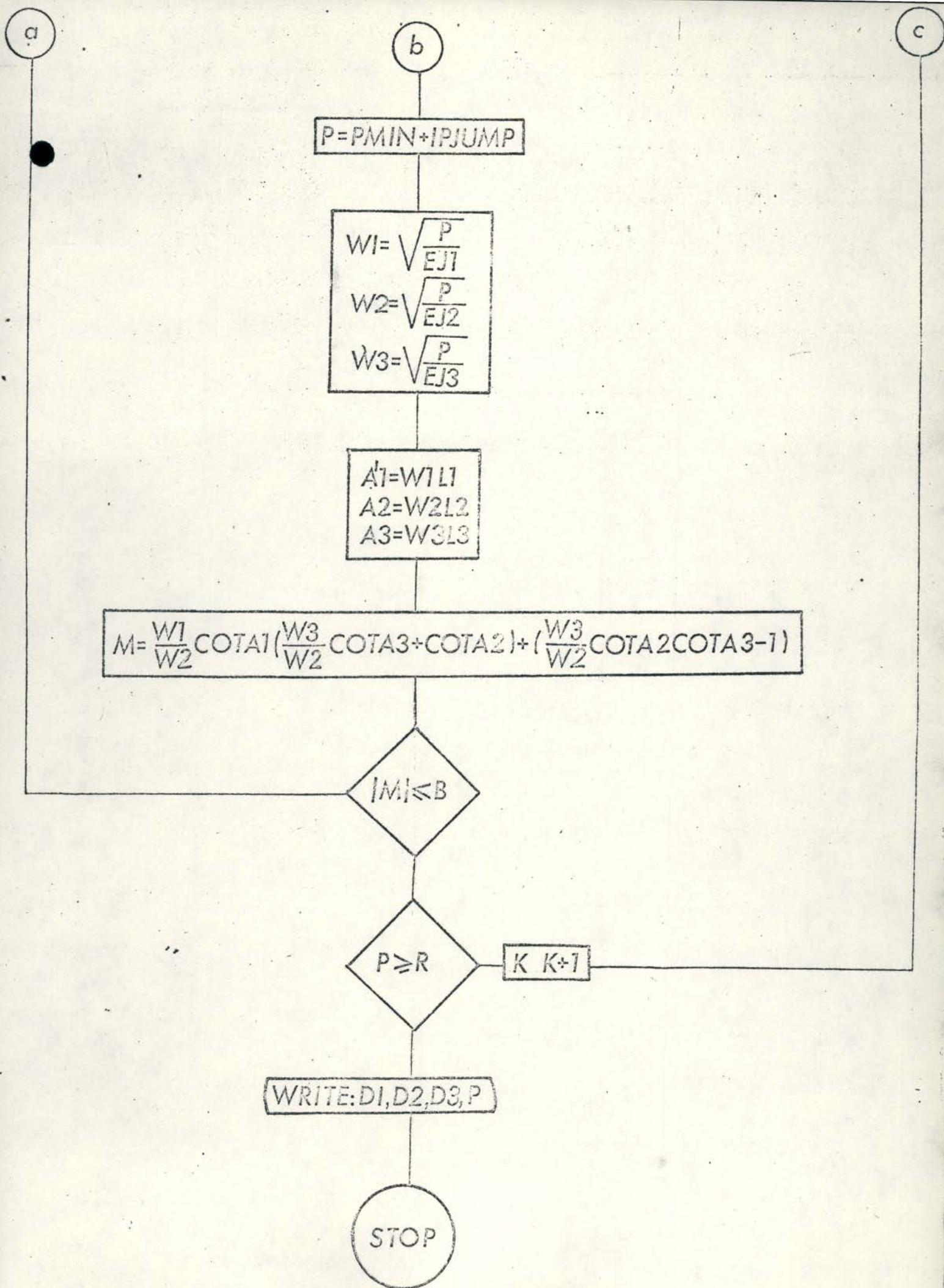


FIGURE 5



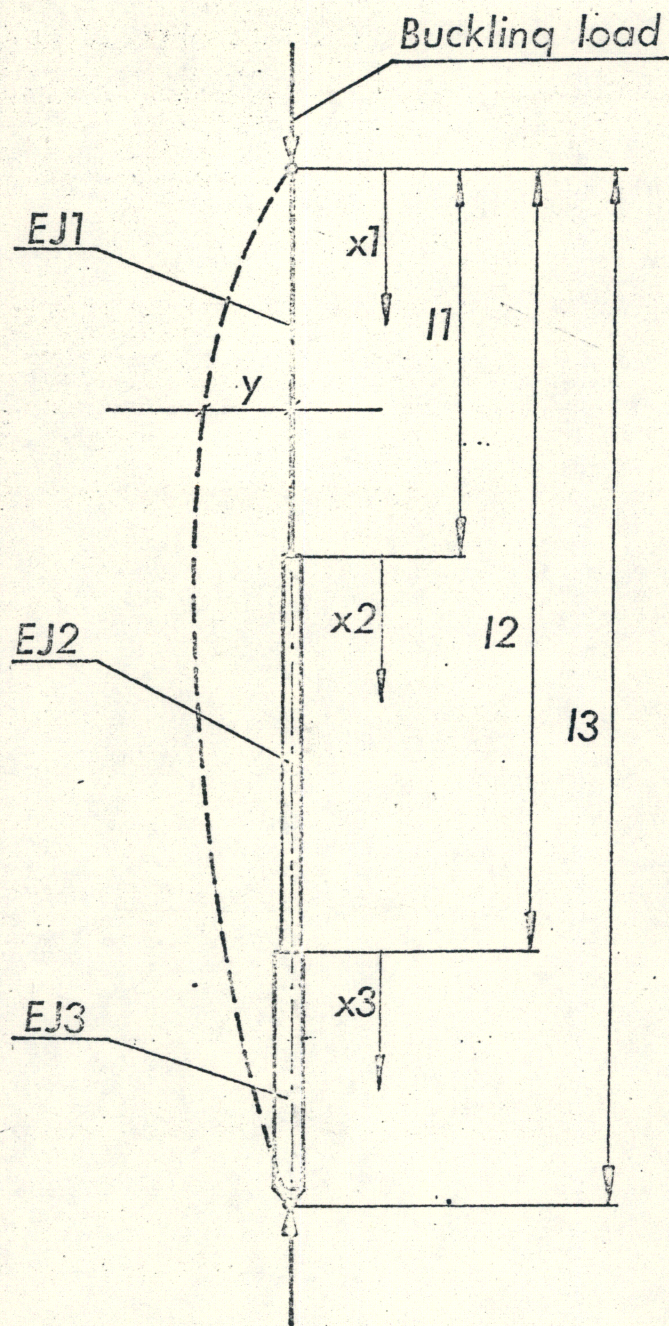
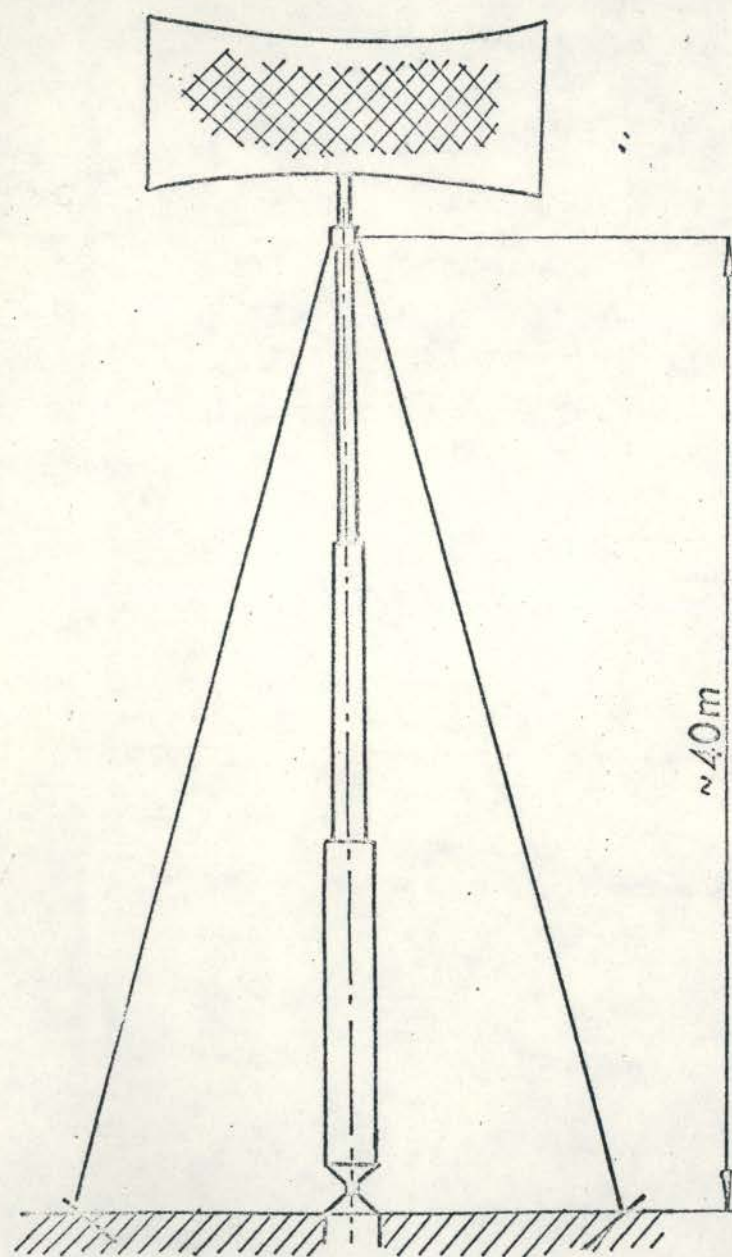
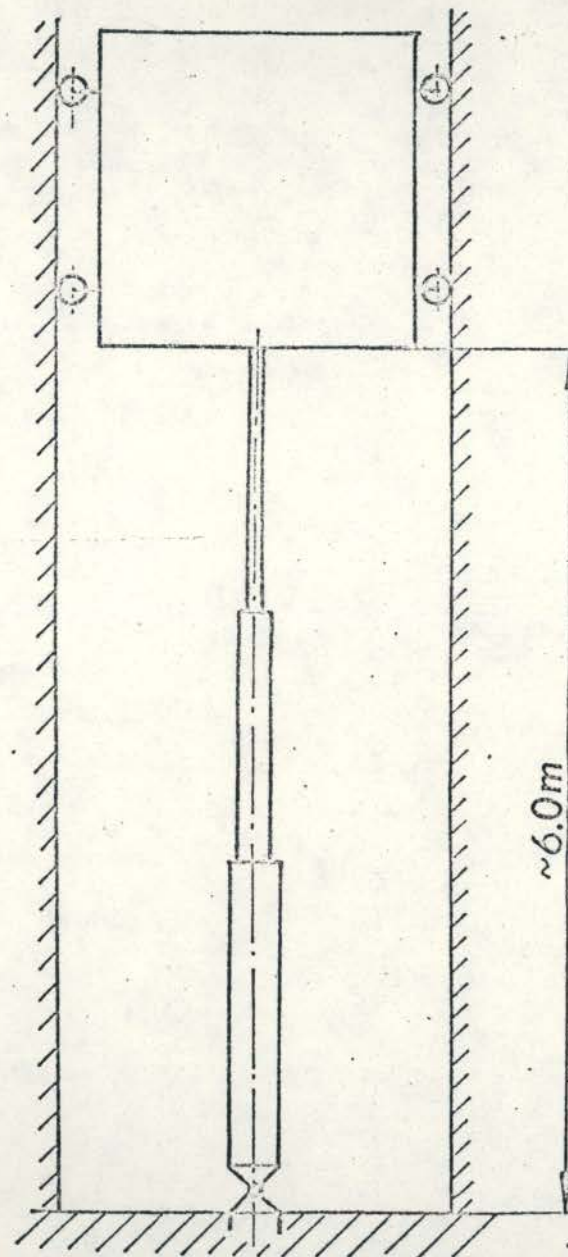


FIGURE 7

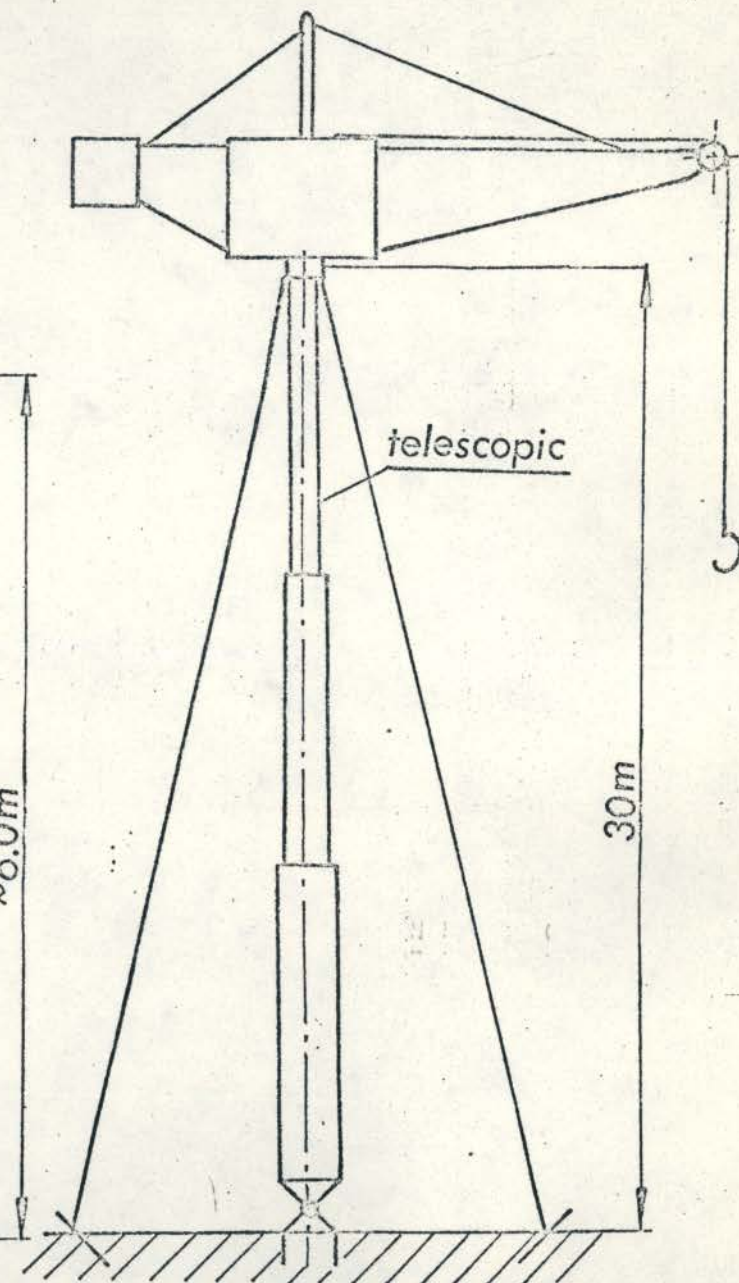




VHF ariel



Lift Unit



Derrick Crane

FIGURE 5

#### IV My View to the Contribution of the Training Abroad

There are several advantages of studying abroad. Especially study in Great Britain gives the fellow an opportunity to learn or to improve his English, this being the most popular language of science and technology for the past few years. This knowledge can be obtained only studying abroad in one of the English speaking countries.

The second important thing is that United Nations fellowship gives the possibility to learn what are the actual tendencies in technology and science in other countries. Also the fact that for some time one can work on the subject he is interested in, has a great importance. After some years of everyday's work one can always find problems which were not solved in satisfactory degree because of lack of time, knowledge or experience. Study organised by United Nations gives the possibility to finish this work. In my particular case study in England at the University of Aston gave me the opportunity to complete the work I have started some years ago and which I did not finish for the reasons mentioned above. With the help of University supervisors the problem was solved and the solution can be used in future, allowing me to design similar machines better, which means they will



be more reliable and more efficient. More detailed description of problems I was studying is given in chapter III of this report but here I want to say that the benefit for my country of sending their specialists to study in Britain is bigger than just to solve one particular problem. In my case not only the knowledge about the subject "Life and Reliability" was widened but I also revised my previous point of view on terminology and a methods which are used.

Nowadays the computer techniques allow us to solve plenty of problems in quite another way than in the past. Every country which wants to go forward must pay much attention to train their scientists and engineers on that field. In Great Britain the computers are being used for a long time and for that British Universities have great experience in teaching computing. Also all technical subjects are taught assuming the use of computers.

Working at the field of Machine's Life has a very specific nature. The main point is that if we want to do some experiments we must be prepared to spend long time on research. The situation is even more difficult for a designer, who in most cases has to do with a project and not with the machine itself. It is very desirable then to know more about the life of the machine before it is built, because very often the mototype will be the only one example to be manufactured. The modern simulation

techniques allow us very often to examine the machine without making it.

It would be too good to say that six months training will allow me at once to design in quite opposite way I was doing for eight years, but I can say that the new knowledge I have got will alter my work in a big degree. I believe that now I shall be able to design quicker and in the same time precisely, and machines designed by me will be more modern. Also the knowledge I got here can be helpful for Polish specialists working on the same field because an adequate report for my company will be given.

The University of Aston in Birmingham,  
Department of Production Engineering,  
Gosta Green.  
Birmingham B4 7ET

Dr. D. A. Milner

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Date of award:

28.8 - 26.11.1975

Name and home country:

Mr. S. PIOTROWSKI (Poland) POL/72/008

Field of study:

Computer systems

Country of study:

United Kingdom

TROL

TE 323/1 POLA



Stanisław W. Piotrowski

United Nations Development Programme Fellow  
from Poland

## R E P O R T

on studies in the United Kingdom

I studied in the United Kingdom as an UNDP fellow from 28<sup>th</sup> August until 26<sup>th</sup> November 1975. The programme of studies included:

- a) 4-weeks training in the English language at the Language Tuition Centre, School of English and Foreign Languages in London,
- b) 8-weeks studies in computer based Total Operations Processing System (TOPS) at the British Railways Board in London.

In my country I work in the Ministry of Transport, Department of Railway Traffic as a senior adviser. I specialize in the implementation of computer systems in the Polish Railways.

I graduated in mathematics at the University of Warsaw, Poland. For over five years I have worked in the designing and programming of computer systems. Previously I worked in the Civil Engineering Computer Centre, where I had planned, designed and written various programs which were applied in structure analysis. For the last three and half years I have worked for

the Polish State Railways. My section is occupied with planning, designing, programming and implementing computer based reporting systems on our railways.

The Polish State Railways are one of the biggest in Europe. The volume of information sent from stations and yards to Divisional and Regional Headquarters, and afterwards to the Ministry of Transport, is very large. The information should be checked and processed on each level of management. Verified and up-to-date information is of fundamental importance for railway administration on each level and is the basis for making accurate decisions concerning train, wagon and locomotives movement.

For the past years the freight movement on Polish State Railways has increased by about 7 % annually. The present system of collecting, processing and distributing information should be modernized to keep up with the increase of volume of input and output data. Freight railway movement is an important factor to our government and special attention is taken about its development.

The problems of processing information in real time were solved by the Total Operations Processing System - TOPS. The system was planned, designed and fully examined in practice by Southern Pacific Railroads in the USA before 1970. In Europe, a number of railway administrations have been developing their own computer systems over the past ten years. By developing TOPS, the British Railways have now overtaken them and have one of the most comprehensive freight control systems of its kind in the world. Therefore not only the Polish State Railways, but also a number of other rail administrations have shown interest in TOPS.



TOPS is an on-line real time computer information and control system. It was designed to provide a real time control over the movement of freight equipment (mainly wagons and locomotives) and to supply up-to-minute information to various user departments of rail administration.

The system uses two IBM Model 370/168 computers located in London. One of these is on-line at all times and is in constant communication with approximately 450 input/output terminals located throughout the rail network. The other computer has been installed to serve as an emergency standby in the event of failure of the other one. It is also used for back-up purposes, off-line processing of data, producing management statistics and carrying out program testing work.

The data input/output terminals have been located in every Area Freight Centre, in Regional and Divisional Headquarters and in the British Railways Board. The main field reporting terminal is the Ventek 9200, consists of a card reader/punch, a visual display unit with keyboard and a printer, operating at 134 and 600 baud transmission speeds. The Ventek 9200 terminal includes a mini computer which has considerable opportunity for remote processing of work associated with the local area without reference to the central computer. The smaller field locations and some offices are equipped with IBM 2740 or Texas Instruments 710 keyboard/printer terminals and the main offices with IBM 2260 video screens operating at 2400 baud line speed.

The component linking the central computer with the terminals is the data transmission network. The focal point of that network is the Communication Data Centre. The flow of data to and from the computer is through the Centre.



The information required by the system is essentially the 'status' and location of each wagon. By 'status' is meant in transit, in position with the customer, held for operational or commercial reasons, crippled or stored. Location can be a train, or at a stand in a yard or depot. A complete up-to-date picture of the freight railway is thus maintained by the computer - the composition of every train, the state of every yard, the standage at every terminal, the state of each wagon.

Information for the central computer is input through terminals in any of 155 Area Freight Centres which have been established at marshalling yards and some freight depots. On these same terminals output from computer is received, some of it automatically, some by specific enquiry.

Various enquiries are used to give up-to-date detail information about trains, wagons and locomotives to the yard managers and Area Managers. For example, yard managers can get several hours notice of the volume and type of traffic with which they will have to deal.

The TOPS software was originally developed by the Southern Pacific Railroads of the United States. Since Southern Pacific is in most respects very different to British Railways, most of the programs had to be adapted or rewritten. However, many ~~of the~~ original system programs, which took 600 man-years of intensive work, were used. Other programs were devised by British Rail's planners, e.g. the group of programs assigning a destination to a wagon which has been reported as empty.

There are plans to extend the system by introducing a comprehensive locomotive movement and maintenance coverage from TOPS and by adding parcel trains to the system. The British Railways expect to accrue substantial financial benefits from a reduction



in wagon fleet, from lower train movement costs, from giving a better service to the customers and from the improved control and distribution of empty wagons.

The programme of my studies on TOPS included:

- visit to Area Freight Centres in Toton and Warrington,
- the hardware and operating system,
- the Communication Data Centre and communication network,
- data bank organisation,
- data collection,
- application programming, including training in TOPSTRAN - specific programming language for updating information stored in the system data bank.

The results of my observation and study have been described above.

I had the possibility to become acquainted with planning, designing, implementation and utilization of a big on-line real time computer system. Such a system does not exist in my country yet, but I expect that Polish State Railways will initiate works on a similar system in the next few years and my knowledge will be used. I think a computer based information and control system will be essential for developing freight movement in Poland. Although my experience in designing a real time system is poor, since my studies lasted 8 weeks only, nevertheless I hope to be useful in future in works on that project.

I wish to thank the Technical Assistance Office of Economic Commission for Europe, the British Railways Board and the British Council for giving me the possibility to study such an interesting problem.



London, in November 1975

UNITED NATIONS  
Fellowships Section

Date of award:

28.8 to 26.11.75

Name and home country:

Mrs. K. CIESLAK (Poland) POL/72/008

Field of study:

Computer systems

Country of study:

United Kingdom



Krystyna Cieślak

London 26.11.1975

ul. Marchlewskiego 26/522

Warsaw, Poland

REPORT FOR UNITED NATIONS

My fellowship stay in England was from 28.08.1975 to 26.11.1975. The Programme of my study can be divided into two periods . First month was devoted to improving my English in Language Titution Centre School in London . The remaining two months were devoted to study my subject i.e. the British Railways computer system . My tranining in British Railways Company took 8 weeks and was strictly concerned with the newly installed computer system . My task in home country is to design and introduce computer systems to be used for the organization of transportation in railways . J have been dealing with this problems since J graduated from The Technical University / Departament of Railway Transportation / in 1970 . When J took up the job in Polish Railways in 1970, J was first engaged in computer programming . Then J was transferred to work for the Ministry of Transportation where, J was dealing with analyzing and designing computer systems most suitable for the Polish Railways Company . J have been working on this problems for three years now . J am specially interested in systems concerned both computer and work operation on stations and efficient management off the whole fleet as well as the whole railways network .



In Poland , Railways are the main carrier of goods and people .  
The tasks of Railways Company and its importance still increase .  
To raise the efficiency of Railways many essential problems  
will have to be solved in first instance :

- a/ to improve and speed up transfer of information for  
the management .
- b/ to improve the organization of wagons supply as far as  
their number and the proper type are concerned.
- c/ fast and efficient intervention on the part of dispatcher  
offices in case of wagons shortages.
- d/ to improve working conditions of railwayman and others  
employees.

Most of these problems can be solved by introduction of computer  
systems which have a complex , reliable and dynamic database,  
and quick , easy access to all kinds of information at any  
management level . The computer systems should serve both  
railway operating practice and customers' requirements .  
The Government fully realizes the present difficulties in  
transportation and necessity of subsidizing the Railways in  
the first instance because of its basic importance for national  
economy .

My fellowship stay / granted to me by United Nations / ,  
made it possible for me to get acquainted with organization of  
work in the British Railways, based on newly installed computer  
system . Great Britain is now the leading country as far as  
the railway technology and management are concerned .

British Railways Company was able to bring the computer



control wagon system fully into operation as the first country in Europe , by adapting the Southern Pacific's Total Operations System / TOPS /. TOPS was bought from Southern Pacifics and modified to suit British Railways practice .

Designing and implementation of TOPS took about 5 years / from 1971 to 1976 / . TOPS is an on-line real time computer information and control system . It was designed to provide a real time control over the movement of equipment and to supply up to the minute information to various users departments including Operating, Transportation, Accounting and Marketing .

The main characteristic of TOPS is that if an accident occurs in the field , it is reported to the computer which updates the appropriate files and makes the information therefrom available either upon request or automatically . It includes a high set of monitoring logic to insure a high degree of database reliability . Computers system which British Railways has managed to implement allows management control over both wagons and motive power at all levels in the real-time . It is the first computer system in Europe which embraces complexity of all problems connected with railway transportation.

Polish Railways Company is in most respects very similar to the British Railways. However there are simultaneously some differences between the Polish and British Railways .

First of all , the Polish Railways are extremely busy because of enormous freight train traffic which 50 % small in British Railways whereas the number of wagons is almost equal in each country .

Another differences are connected with interchange between British and Polish Railways System and also the fact that the British Rail-



ways do not demand the waybill for every wagon consignment which is demanded with the Polish Railways.

Apart from such differenceis operations connected with wagon movement, schemes of management are very similar both in Poland and Britain . For that reason, it seems reasonable to underline that similar features of both companies allow to adopt this modern computer system in a relatively easy way .

The programme of my training prepared by British Railways was connected only with TOPS.

One of the most important aspects of my training was getting to know computer system in which the high technique and modern equipment with real time computer application was successfully applied to the whole freight operating activity .

During my stay in Britain, I managed to improve my knowledge in many fields which are connected with designing , implementation, and introduction of on-line system . First of all, I was interested in and managed to investigate problems of : Data Bank , Data Transmission , File Organization , Wagon Distribution and the transfer and utilization of TOPS informations on marshaling yards .

During my observation and study on British Railways the programme of my activities was as follows :

- 1/ General configuration and operating system.
- 2/ Communication equipment and network.
- 3/ TOPS on-line control .
- 4/ Methods of Data Collection .
- 5/ Data Bank organization .
- 6/ Applications programming .
- 7/ Study of computer language TOPSTRAN .
- 8/ Station's computer programmes .



The first two weeks was concerned with getting acquainted with TOPS system in general and communication . The main subjects of my study was concerned with wagon cycle, file organization ,hardware and organization of computer functions concerning tele-processing , edit and processing of messages , the guarantees of information recovery in case of need .

The subject is so vast that I had only possibility to concentrate on its main problems .

Next part of my practical training concerned of telecommunication, data collections, access to computer and constant communication with input/output terminals ,updating of the records storage on discs , checking both a content and a form messages .

The basic feature of the system is fast and easy access to and from every terminal . An extensive and reliable data transmitting network and quick means of diagnosing the precise area of a failure make it possible for TOPS to transfer information which an essential activity in running the railway .

Some days which were devoted to these problems only showed me the importance of communication task and its significance .

It was instructive and beneficial for me to see both the way how many problems connected with this task are solved and how the on-line system works on adequate channels of communication .

Next about three weeks I spend in Applications Depatment .

I investigated there the the Data Specification ,Data Bank organization , application programming and general study of TOPSTRAN , which is the main language used in system .

My only objection as far as the practical traing is concerned is that the time devoted to these very important problems was



absolutely too short to get acquainted with them even in general outlines .

The last but one week I spend at the station in Dover . During my stay there, I was interested in manual applying of essential procedures, measurement time and application of computer .

I had a look at the equipment and how the staff made use of the computer and numerous possibilities offered by the system / especially in the field of enquiry /. Staying in the station, I could watch exactly the daily ,usual routine work on-line system. Last week was devoted to collecting materials and discussion over more difficult and complicated professional problems .

I would like here to emphasize the most helpful assistance on the part of the British Railways that helped me to enlarge my knowledge as well as my experience in the field computer techniques. That is why I am very grateful to British Railways and I would like here to thank British Railways employees for their kindness and instructions .

I was only sorry that the study in ITC School proved not to be so valuable to me as I had expected .

I enclose also many thanks to United Nations for making it possible to me to benefit so much in my professional field, and to make use of my experience in future to the advancement of my country e.i. in in modernisation the Polish Railways activities by introducing computer system I had to possibility to study in Britain .