OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

19411

69p
graphs
diagrams
illus.

SPECIALIZED WORKSHOP (MEETING OF EXPERTS)

CONCRETE SHIPBUILDING AND OTHER FLOATING STRUCTURES

UD/UC/INT/90/250

Bourgas, Bulgaria

22 to 24 October 1991

FINAL REPORT

Mr. Fedor Gouriev, Consultant,
Engineering Industries Branch, UNIDO

January 1992

Backstopping Officer: Mr. Beppu

5/45

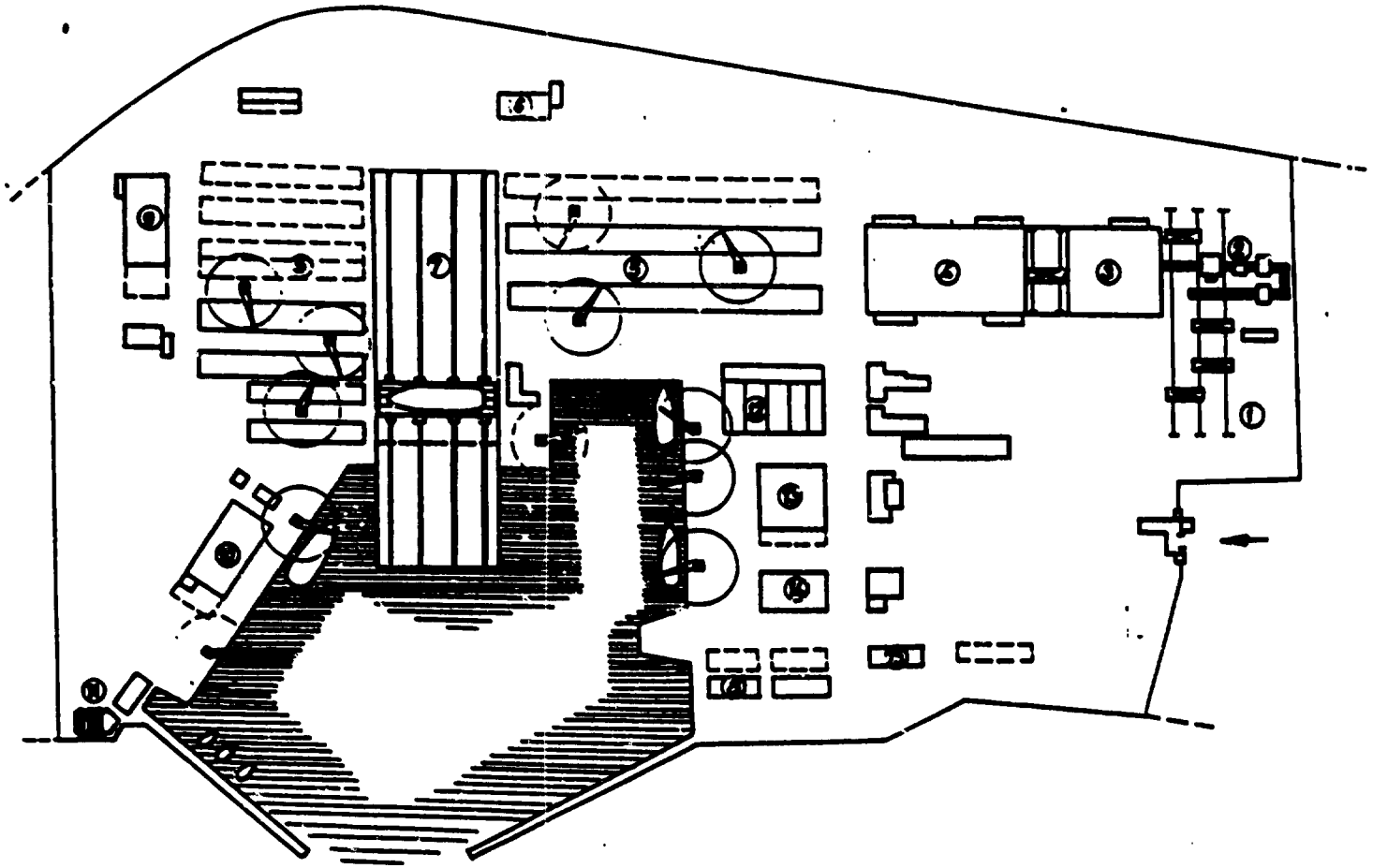
PREFACE

Application of ferro-concrete technology for construction of ships and other floating structures has been known long ago and practically used by boat builders since the last century. However, a limited number of shipbuilders maintain nowadays this experience which might be of particular interest to the developing countries.

Bulgarian shipyard in Bourgas, which is presently known as KORBSO Shipbuilding and Shiprepair Corporation, developed specific skills in application of this material for construction of specialized floating units. They elaborated a multipurpose design of ferro-concrete hull and widely use it now for construction of floating shiprepair workshops. Dozens of units were delivered to foreign shipowners. This hull is also proposed for establishing floating power stations, hospitals, hotels, restaurants, desalination plants, etc.

In view of simplicity of ferro-concrete technology and availability of major materials in various regions, construction of ferro-concrete vessels can be easily introduced in a number of developing countries with appropriate geographic location and adequate needs of local communities. Specialized Workshop on Concrete Shipbuilding and other Floating Structures was conducted at KORBSO Shipyard in Bourgas with a view to facilitate transfer of this technology to interested developing countries and to assist them in establishing appropriate facilities.

KORBSO, Shipbuilding & Shiprepair Co



LEGEND:

① Open/outdoor/Storage Complex
② Zero line
③ Steel Shop
④ Assembly-welding Shop
⑤ Open Slipways
⑥ Transport Shop
⑦ Hoisting-Launching Complex
⑧ Electro-assembly Shop
⑨ Block of Shiprepairing Shops
⑩ Erecting Shiprepairing Shops
⑪ Jaught Club
⑫ Erecting Shops and Stores
⑬ Erecting Block
⑭ Electroplating Shop
⑮ Ship's Outfitting Shop

Contents

INTRODUCTION

The Meeting of Experts (Workshop) on Concrete Shipbuilding and other Floating Structures was held in Bourgas, Bulgaria, from 22 to 24 October 1991. It was jointly organized and financed by the Government of Bulgaria and by the United Nations Industrial Development Organization (UNIDO), and conducted by the Bulgarian Shipbuilding and Shiprepair Corporation KORBSO in co-operation with the Engineering Industries Branch of UNIDO.

Bourgas is one of the three major marine engineering and shipbuilding centres in Bulgaria, two others include Varna and Russe. KORBSO shipyard was approved for the above UNIDO/Bulgaria Workshop in view of its specialized experience in application of ferro-cement material and ferro-cement technology for construction of vessels and other floating structures.

Maritime organizations in Varna were also closely involved in the programme of the Workshop. Varna is the biggest centre of the maritime activity in Bulgaria. The country's largest shipyard with a dry dock for construction of vessels up to 100,000 dwt is located at Varna.

Participants from seven developing countries of various geographical regions attended the Workshop on Ferro-Concrete Shipbuilding at KORBSO Shipyard. They submitted their country papers and took part in the discussions. Thirteen national experts spoke on various aspects of ferro-concrete technology and design of vessels and provided technical explanations.

General Director of KORBSO, Mr. D. Terziev, officially opened the meeting and welcomed the participants and organizers.

Mr. D. Demirev, Marketing Manager, KORBSO took full responsibility of a national organizer and a counterpart to UNIDO organizers.

Mr. Vasil Genkov was elected Chairman of the sessions.

The programme, elaborated for the Workshop, included lectures and discussions followed by visits to the engineering and production facilities in Bourgas and Varna as well as visits to the major research and design centres in Varna.

PROGRAMME OF WORK

The following programme for the Workshop was adopted by the participants:

Day 1

1. Presentation of country papers by the participants
2. What is KORBSO (a brief historical review)
3. Constructive and technological peculiarities in designing and building of ferro-concrete vessels (a lecture)
4. Discussions
5. Visit to the shipyard of KORBSO

Day 2

1. Ferro-concrete floating crafts for public services and for plants (a lecture)
2. Practical design of ferro-concrete floating structures (a lecture)
3. Discussions
4. Elaborations of the conclusions and recommendations

Day 3

1. Visit to the Shipbuilding Equipment Works
2. Visit to the Shipbuilding Cybernetic Centre
3. Visit to the Bulgarian Ship Hydrodynamics Centre

FERRO-CONCRETE SHIPBUILDING IN BULGARIA

Bulgarian shipbuilders have long experience and maintain skills in construction of ferro-concrete floating crafts. A ferro-concrete hull of a monolithic type was developed and widely used by Bulgarian shipyards in Bourgas for construction of floating workshops. Dozens of such workshops were delivered to many shipowners in a number of countries.

Now this design with some modifications and improvements is being considered for multipurpose application. Based on the excellent quality of the ferro-concrete hulls, the Ship Research and Design Institute in Varna, Bulgaria, has developed the idea of module construction of a wide range of crafts on the hull of a ship repair workshop.

hull length	62.00 m
breadth o.a.	13.40 m
hull breadth	13.00 m
depth o.a.	12.75 m
depth	03.70 m
draught	01.90 m

The structure of the ferro-concrete hull is monolithic. The framing of the deck and bottom is longitudinal, the side framing is transverse. There are eight watertight transverse bulkheads. The hull is to be made of concrete M300 with metal superstructure of conventional carbon steel.

This multipurpose hull is now proposed for construction of floating units, designed for establishing a variety of industrial and public services. Their range and purpose is quite extensive:

- in offshore industry;
- in processing industry;
- in energy supply;
- in shiprepair;
- in agriculture;
- in tourist commerce;
- in exploration and extraction;
- in development of underdeveloped areas.

Ferro-concrete technology and its application in the construction of special types of vessels has a number of advantages, such as simplicity of this method, lower labour cost, lower steel consumption, minor maintenance requirements and long life of a floating unit.

Owing to the dead weight of the concrete structures which is relatively high compared to conventional floating structures, the motion behaviour of the offered modules is as a rule much better than that of other pontoon structures because of their large mass.

Concrete was used as the construction material because of its special advantage regarding resistance to seawater and fire. The assertions that concrete is heavy, brittle and permeable belong in the past. The qualities of concrete have evolved beyond recognition and offer many advantages. So, although structures themselves have to be built of light materials, their weight gives them good motion behaviour.

By correct selection and development, the concrete can be made, and indeed has been made, watertight and resistant to seawater, thus reducing maintenance to almost nothing and eliminating the need for regular dock inspections.

Some advantages which make the ferro-concrete floating structures especially desirable relate to ecology and possibility of an increase in financial returns.

Basic design of a ferro-concrete hull and major particulars are shown in the attachment (Annex 3). This material also contains information on major areas of application of this design for such services as floating repair workshop, floating power plant, floating desalination plant, floating hospital, floating public utilities center, etc.

a. Floating workshop

Serial type of the floating workshop constructed at Bourgas shipyard comprises the following technological sections:

- forge tinsmiths section
- electric repair section, battery section;
- painting section;
- section for mechanical treatment;
- section for hull-mechanical and piping work;
- woodcarving section;
- mechanical section;
- radio repair section;
- section for repair of refrigeration equipment provided with vacuum pump; repair of all kinds of ship equipment is performed;
- section for repair of fuel apparatus;
- laboratory for test of metal hardness and chemical composition.

For the operational purposes and the security of the floating structure, the design includes:

- anchor gear;
- mooring and towing gear;
- swinging davit;
- platform for approach of the electric truck to the deck, it is handled by an electric-driven winch;
- draining system;
- water anti-fire system;

- a system for additional air-mechanical foam extinguishing;
- a system for procuring water for daily domestic and technological use;
- a system for sewage water;
- a provision-cooling system.

The engine-boiler compartment is equipped with the following machinery:

- two sets of main diesel generators of 180 - 200 kW (300 hp);
- one stand by diesel generator of 50 kW;
- auxiliary boiler unit, steam output 1,000 kg/h;
- two sets of water heating boiler unit, heat output 200,000 kcal/h.

Sources of electric power:

- two generators x 200 kW;
- one standby generator of 50 kW.

Accumulator batteries and charging devices:

- one battery 180 Ah.

Supply from the shore:

- one 630A station in a set with automatic switch, phase indicator and signal lamps.

Inter-craft communication and signalling:

- automatic telephone station;
- fire-warning station;
- all hands (average) signalling;
- radio transmitting.

Cargo arrangements are provided: aft hoisting crane, console cranes, lifts, according to the purpose of each floating structure and features of the module.

b. Floating power plant

This floating unit is proposed for autonomous supply with electricity in remote inland waterways where other sources of electric power are not available temporarily or not sufficient or, if the building of land electric stations is expensive, inefficient and slow. The 3MW floating power plant is a non-propelled vessel based on reinforced concrete hull designed to be located (or to voyage in non-working condition) on inland waterways.

Proper spaces with the necessary accommodation conveniently for 16 persons are also available. The power plant consists of a steam boiler, two main steam electric power units, auxiliary diesel generator and associated equipment.

c. Floating desalination plant

A ferro-concrete hull of a standard design can be equipped to produce desalinated water from sea water. Steam and electricity consumption is available from onboard sources. The floating desalination plant is a non-propelled vessel on steel reinforced concrete hull, designed to float moored or anchored in coastal sea waters protected from waves. The floating structure has all the necessary systems providing safety and self-sufficiency, as well as proper accommodation spaces.

d. Floating hospital

This type of floating service can be of particular interest to communities located in coastal areas, island regions or river basins. The proposed floating structure with a ferro-concrete hull has sufficient space to be equipped for various types of medical services, including therapeutic rooms, surgery space, isolation ward, polyclinic, pharmacy, laboratories, etc. Other services can also be secured.

e. Floating public utilities center

The proposed center is a non-self-propelled floating craft on a ferro-concrete hull. It can be designed and equipped for providing a large number of services depending on the local conditions and requirements of the population. Establishing of new services will not require considerable changes in respect of operational systems and basic equipment.

TECHNICAL SESSIONS

1. In the course of technical sessions, qualified experts from KORBSO and from Bulgarian research organizations delivered technical lectures on various aspects of ferro-concrete shipbuilding technology and organization. This technology and KORBSO's experience in construction of ferro-concrete vessels were considered and discussed from the point of view of its applicability to the prevailing conditions in developing countries and to the needs of their communities.

The lecture materials are briefly summarized below and the full texts are available in the attachment to this report (Annex 4).

a. Short history of KORBSO Co. (by D. Terziev, General Director, KORBSO)

Initially established as a small shiprepair shop in 1903, Bourgas shipyard, through a number of modernization and development efforts, was re-established in its present position with assuring prospects for further development. It is a significant shipbuilding and shiprepair company with steadily upgrading facilities and technology, favourably located at the Black Sea coast of Bulgaria.

Now KORBSO is building 12,500-dwt product carriers, 5,000-dwt tankers, 650-dwt and 1,240-dwt bunkering tankers, marine dump barges, barges for bulk and general cargoes, river boats and push tug boats, ferries, platforms and floating ferro-concrete workshops.

Also, a wide range of shiprepair work is done: changing of hull plates, docks, double bottom, gears, repairs of main engines and auxiliary engines, accommodation, pipe lines, electrical systems and others.

Considerable experience was gained and specialized facility was developed for construction of ferro-concrete vessels. Floating shiprepair workshops, established on ferro-concrete hulls, represent the largest number of vessels delivered by the company to foreign shipowners.

b. Constructive and technological peculiarities in designing of the ferro-concrete vessels (by H. Naidenov, Shipbuilding Institute, Varna)

It is well known that the building of specialized types of ferro-concrete vessels is economic and reasonable. More than 60 per cent of steel can be saved. The lifetime of ferro-concrete hull 2 to 3 times exceeds operational period of wooden and steel vessels and the maintenance cost of ferro-concrete vessel is 6 to 8 times lower.

Bulgaria keeps a leading part in the world list of ferro-concrete shipbuilders.

Among the most important problems of ferro-concrete shipbuilding are technology and method of preparation of the ferro-concrete. It is based on the monolithic method, which today remains the basic method for building of vessels. This method does not require expensive and complicated equipment and has simple building organization. Many disadvantages of the monolithic method are eliminated by applying of prefabrication and prefabrication-monolithic method. The material, used for ferro-concrete shipbuilding does not differ considerably from the one required for high civil buildings, but there are some specific quality features that should be considered depending on the application conditions. Advantages and disadvantages of ferro-concrete vessels when compared with the steel ones are analyzed. In the report enclosed are some diagrams and descriptions of ferro-concrete hull construction.

Among the disadvantages of this method are substantial dependence on the climate and season conditions, long period of the berth stage of construction, considerable labour consumption in building berth works.

c. Ferro-concrete floating crafts for public services and for plants (by S. Petrov, architect, Shipbuilding Institute, Varna)

Ferro-concrete vessels can be applied in various environments and conditions. These floating crafts have such characteristics, which make them attractive for solving more specific regional, social, economic, communication, urbanization and other problems.

There are two groups of floating ferro-concrete crafts--for public services and for plants. For the first group, there are designs for a hotel, hospital, hostel, restaurant, public services and garages. The second group is illustrated by a dairy plant, bakery, soft-drink plant, desalination plant, power station, mechanical shop, etc.

To improve technical and economic properties of floating crafts, it is reasonable to build special vessels with the hull structure of the same type, i.e. dimensions, forms, longitudinal and transverse elements, bulkheads, etc.

Another important question is the strength characteristic of the hull and the superstructure.

Design of the floating ferro-concrete crafts requires application of the normal shipbuilding practice what concerns the local and total strength, loading, hull draft, cargo distribution, wind loading, etc.

Extremely precise co-ordination is required between the elements, fixed on the ferro-concrete hull and the ones built in it.

d. Practical design of ferro-concrete structures (by M. Deneva, Engineer, Institute of Shipbuilding)

KORBSO has long experience in the field of design and construction of floating crafts with ferro-concrete hull of 62-meter length, 13.40-meter width, 3.70-meter board height and draft range from 1.90 to 2.25 meters. Its bottom and deck frame set is longitudinal and transverse on boards. It is divided into eight watertight compartments which provide single-compartment floodability. The pick compartments are with strengthened frame and plating. This design flexibility allows quick changes of the location and easy solving communication problems between the hull itself and the superstructure in any of the alternatives. The superstructures are made of steel and constitute typical structures with mixed system of the frame set or pillar deck structures with walls of corrugated sheet metal. They are completely welded. Depending on the client's requirements for the classification some part of designs is done according to the river register of the USSR Class "P" for inland waterways or to Lloyd's register - rules and regulations for the classification of inland waterways ships - zone 2. Such vessels can work in moderate climate areas as well as in the north and south geographical regions.

2. All the participants from developing countries submitted their country papers, which reflect specific conditions in their respective countries. The level of development in the maritime field differs considerably from country to country, but there are also the problems of common interest.

Mr. U. Akoguz from Turkey, Turkish Shipbuilding Industry Inc., presented country shipbuilding industry. Shipbuilding activity accounts for many years in Turkey, but major developments took place in the last two decades. In Turkey there are 42 shipyards; four of them are state owned and the others are private. There are facilities and capabilities to build different types of vessels, and ferro-concrete ships can also find their demand.

Mr. Ali J. Ghabban from Saudi Arabia, Sea Transport, Ministry of Communications, submitted considerations on shipbuilding activities. They have modern facilities for vessel maintenance and assuring prospects for the future shipbuilding activities. According to Mr. Ghabban, there are possibilities to organize the production of ferro-concrete vessels in Saudi Arabia, but they need assistance from UNIDO and from KORBSO.

Mr. A.M. Kunghalo from Tanzania, Tanzania Harbour Authorities, described his country's present economic conditions. There are possibilities to develop shipbuilding including ferro-concrete boatbuilding in Tanzania. They need financial assistance as well as trained specialists, technology and modern facilities.

Mr. Ramiro G. Yegros from Paraguay, Arsenal De Marina, presented the country industrial and shipbuilding activities. Due to specific geographic location of the country and big waterway systems, ferro-concrete vessels could particularly be suitable to this environment. The shipyards in Paraguay are not large. They cannot produce large vessels and they use old-fashioned methods and simple technology. So, if they find the adequate assistance, they could develop ferro-concrete shipbuilding and in this way contribute to the country's economy.

Mr. R. Ramli from Malaysia, Malaysia Shipyard & Engineering Co. (MSE), presented his company as the biggest and most important shipbuilding facility in the country, as the well as in the whole region. The company is specialized in building of clean petroleum product tankers, methanol carriers, commercial fishing trawlers, dredgers, ferries and patrol boats. Mr. Ramli made a brief estimation of ferro-concrete vessels--their merits and disadvantages.

Mr. Sindi Hebura from Zaire, Omatra's Shipyard, presented his company and economic conditions in his country. Because of the specific geographic and economic conditions in this country, there are good possibilities for operation of ferro-concrete vessels in Zaire and they may satisfy economic and social needs of the population. They need assistance from UNIDO and from KORBSO.

Mr. M.F. Hammad Walid from Egypt, Alexandria Shipyard, presented his company. Alexandria Shipyard "Egypt" is one of the most significant modern shipbuilding and shiprepair yards in the Mediterranean. Organized in 1959, the yard develops and increases its production capacity. They build dry-cargo vessels, small replenishment tankers, multipurpose cargo vessels, Ro-Ro vessels, service boats, etc. If they have know-how and technology of ferro-concrete shipbuilding, they can organize the production of such vessels.

3. Technical discussions centered on the features of ferro-concrete shipbuilding technology, both technical and economic aspects, and on its applicability to the needs of developing countries. Economic and geographic position of individual countries were analyzed in this respect. General trends and specific problems of common interest for groups of participating countries were among the subjects of the discussions.

With appreciation of KORBSO experience in building vessels of ferro-concrete, the majority of participants extended their interest to specific details of ferro-concrete vessels design and to practical construction works. The way and the programme of discussions were adjusted to the participants' basic knowledge and experience in ferro-concrete shipbuilding, which unfortunately were very limited. As a matter of fact, only a few developing communities nowadays develop or maintain skills in ferro-cement boatbuilding. In the course of technical discussions, the participants received informative explanation on design approaches and technological matters. Technical discussions were also followed by visits to the production facilities.

Another important topic of common interest in the discussions was connected with the cost comparisons of ferro-concrete method in relation to other technologies and materials, i.e. steel and wood. Unfortunately, detailed comparison information, suitably subdivided in an internationally acceptable form, was not immediately available. Therefore, cost evaluation discussions were confined to general considerations and expert's estimates, whereby economic advantages of ferro-concrete method were proved. Finally KORBSO and UNIDO were requested to include such information in the future study, which is among recommendations of this Workshop.

Some participants of the meeting made remarks on possibilities of utilization of ferro-concrete method or ferro-concrete floating units in their countries.

According to the participant from Turkey, there might be some interest in his country to floating garages which are most suitable for the intensive car traffic in Istanbul, where there is a lack of parking places. Another area of application of floating structures are the floating docks.

In the case of Saudi Arabia, as the participant indicates, most suitable there might be floating restaurants, hotels, hospitals, docks and especially desalination plants.

The participant from Tanzania mentioned eventual needs of his country in pontoons, oil storage, floating hostels and other facilities for offshore oil exploration. There is interest in transfer of this technology and know-how and in training courses.

According to the participant from Paraguay, his country has long waterway routes and developed cement industry, but they import steel profile and plate materials. Depending on the cost analysis, they might be interested in know-how and technical assistance.

The participant from Malaysia expressed his opinion that ferro-concrete vessels are very prospective, because they are cheap and have long life. The most suitable applications for his region are floating hospitals, schools, hotels, restaurants. Malaysia needs assistance to organize design work and transfer of technology.

The participant from Zaire referred to a specific geographic location of his country and necessity to organize their own production of ferro-concrete structures. Because of limited internal communications, most suitable for them are floating hospitals, schools, workshops. They need a preliminary study for different areas of application of ferro-concrete structures. They need assistance of UNIDO and KORBSO.

Egyptian participants stated that Egypt need such floating structures as hotels, stores and accommodation for offshore activities. All floating structures should be self-propelled, because of specific navigational conditions of the Nile River. They expressed their particular interest in a comparison study for steel and ferro-concrete structures to be prepared for the next seminar. They suggested another seminar for the next year.

At the conclusion of the meeting, KORBSO made a practically-oriented statement, submitted in the form of a letter, which is attached to this report in Annex 5. It is indicated in the statement that KORBSO is prepared to provide to interested countries practical assistance in this field through co-operation with UNIDO. Qualified experts from KORBSO could assist in establishing a pilot production unit for construction of fishing boats or undertake a study for construction of bigger ferro-cement units.

This assistance may specifically include for a country or a region such topics as assessment of the market demand and existing infrastructure, elaboration of the layout of a production facility and the design of a floating unit, selection of the equipment and instrumentation, elaboration of a training programme.

RECOMMENDATIONS OF THE MEETING

The participants expressed their great appreciation to the organizers from UNIDO and KORBSO for their efforts to make the meeting on Ferro-Concrete Shipbuilding informative and useful. The following recommendations have been adopted by the participants:

(1) Application of ferro-cement shipbuilding technology and design to the construction of self-propelled vessels (fishing vessels, yachts) and non-self propelled structures (workshop, hospital, garage, hotel, restaurant, etc.) deserve particular attention to meet the needs of developing countries.

(2) It is recommended that a study should be undertaken on the applicability of this technology to the specific needs of developing countries because of a number of advantages of this technology such as:

(a) lower labour cost;

(b) simplicity of technology;

(c) minor maintenance requirements;

(d) lower steel consumption;

(e) long life.

(3) As concerns regional approach, particular attention should be given to the countries located around lakes and on rivers of Africa, Latin America and Asia and to the Gulf countries. UNIDO is required to place priority to those countries on their request.

(4) Training opportunity should be provided to the developing countries according to their needs.

(5) Similar meeting is recommended to be organized with a special emphasis such as ferro-cement fishing boats and other applications.

CONCLUSIONS

1. KORBSO shipyard in Bourgas has appropriate facilities, qualified personnel and valuable experience to successfully demonstrate the application of ferro-concrete technology for construction of ships and other floating structures.

2. The Workshop was properly prepared and successfully conducted and thereby met professional interest of the participants and received their appreciation.

3. Discussions on development problems in the maritime field, including inland water transportation, were informative and mutually useful for all the parties involved hence possibilities for further co-operation were identified and considered.

4. A programme for the future meeting or a training programme in ferro-concrete shipbuilding should envisage discussions on diversified application of this technology and include alternative designs, and at least a few participants with some basic experience in ferro-cement boatbuilding should also be selected for such event from developing countries.

5. The meeting in Bulgaria was used as an opportunity to discuss other problems of the shipbuilding sector with a view to expanding UNIDO activities in this field, including eventual assistance to Bulgarian shipyards.

UNIDO TECHNICAL ASSISTANCE PROPOSALS

(Discussions in Bulgaria Related to the Shipbuilding Sector)

a. During the meeting in Bourgas and in the course of visits to major research centres in Varna, a number of discussions took place. The present position of Bulgarian shipyards and problems induced by the transition period in the national economy was discussed in Varna and Bourgas with high-level specialists from Bulgarian shipbuilding industry.

For the few past decades, Bulgarian shipbuilding industry maintained a sound level of development and operations. However, in the latest period of political and economic changes in Bulgaria, when the country is moving towards the market economy, this industry encounters great difficulty. The shipyards are not well prepared to compete on the world market.

The above problems of this industry were discussed with general consideration of ways and means needed to be undertaken in order to overcome the difficulties of the transition period and to improve shipyards operations and their competitiveness on the world market. Possibility and a need for UNIDO assistance in this field was also under consideration.

Content of the discussions on a need and possibility to initiate a joint action by Bulgarian shipyards (Varna, Bourgas and Ruse) and by UNIDO for a policy-making programme on shipyards rehabilitation is reflected in the note for the file attached to the report in Annex 1.

b. Another subject of the discussions was a project proposal Transfer of Modern Technology in Ship Hydrodynamics forwarded to UNIDO. The participant of the discussions was also Mr. Dong Shitong, Director of the China Ship Scientific Research Centre (CSSRC), who was on mission to Bulgaria.

Bulgarian and Chinese ship research centres co-operate in their field of activities. Now they jointly elaborated a proposal for a regional project. This project proposal was submitted to UNIDO a few months ago and, according to Mr. Dong Shitong, it was also sent to the Chinese representative in New York for submission to UNDP. However, this project proposal did not appear in the UNDP draft list of projects for the regional programme 1992-1996. Mr. Dong Shitong reconfirmed interest of the CSSRC in establishing and implementing the proposed regional project. The BSHC is willing to co-operate in developing the project.

The participants of the discussions agreed to undertake a prompt action with a view to revive the project proposal within the limited period of time left, through direct contacts with UNDP/ New York and UNDP office in Beijing. It is reflected in Annex 2.

LIST OF PARTICIPANTS

1.	Mr. Ustuner AKOGUZ Assistant General Manager	Turkish Shipbuilding Ind. Inc.
2.	Mr. Fumio BEPPU (Associate Industrial Development Officer)	United Nations Industrial Development Organization (UNIDO)
3.	Mr. Ali Jabra GHABBAN (Director General for Marine Trans.)	Ministry of Communications Saudi Arabia
4.	Mr. Doymo DEMIREV (Marketing Manager)	KORBSO, (Bourgas, Bulgaria)
5.	Mrs. M. DINEVA (Senior Designer)	KORBSO
6.	Mr. Fathy Abdalla ESSAM (Assistant Director of Design Department)	Alexandria Shipyard, Egypt
7.	Mr. Vasil GENROV (Expert)	KORBSO
8.	Mr. Christo GODJUKOV (Vice General Director)	KORBSO
9.	Mr. Fedor GOURIEV (Consultant)	UNIDO
10.	Mr. D. KLINKOV (Expert)	KORBSO
11.	Mrs. R. KLINKOVA (Designer)	KORBSO
12.	Mr. Toma KUDEV (Director)	KORBSO
13.	Mr. Anicet Manita KUNGHALO (Assistant Port Manager)	Tanzania Harbour Authority
14.	Mr. George LAZAROV (Senior Researcher, Head of) Department)	Bulgarian Ship Hydrodynamics Centre (Varna, Bulgaria)

15. Mr. Toshko MARINOV (Vice General Director)	KORBSO
16. Mrs. Milka MILANOVA (Marketing Expert)	KORBSO
17. Mr. Christo NAIDENOV (Expert)	Shipbuilding Institute (Varna, Bulgaria)
18. Mr. Petar PETROV (Head of Department of Technology)	KORBSO
19. Mr. Stefan PETROV (Chief Designer)	Shipbuilding Institute
20. Mrs. Sonja POPTADJAN (Marketing Expert)	KORBSO
21. Mr. Roslin RAMLI (Marine Engineer, Technical) Executive)	Malaysian Shipyard and Engineering SDN. BHD.
22. Mr. Hebura SINDI (Assistant Director)	ONATRA Shipyard, Zaire
23. Mr. Dimitar TERZIEV (General Director)	KORBSO
24. Mr. M.F. Hammad WALID (Design Department)	Alexandria Shipyard, Egypt
25. Mr. Ramiro Gutierrez YEGROS (Captain, Naval Engineer)	Arsenal De Marina, Paraguay

Annex 1

Note for the File

Subject: Bulgaria - Symposium on Rehabilitation of Shipyards and Capital Investment Policies.

The present position of Bulgarian shipyards and problems induced by the transition period in the national economy of the country was discussed in Varna and Bourgas with high-level specialists from Bulgarian shipbuilding industry, in connexion with the UNIDO Meeting on Ferro-cement Shipbuilding, held in Bourgas from 22-24 October 1991.

For the few past decades, Bulgarian shipbuilding industry maintained a sound level of development and operations. This industry significantly contributed to the national economy in terms of foreign exchange incomes, as well as with its upgrading effect given to other engineering activities. Major Bulgarian shipyards located at Varna, Bourgas and Russe constructed cargo vessels, tankers and specialized floating units for export to a number of countries.

However, in the latest period of political and economic changes in Bulgaria, when the country is moving towards the market economy, this industry encounters great difficulty. The shipyards are not well prepared to compete on the world market, both technologically and operationally. They cannot successfully meet requirements of the world market which implies construction of modern ships with high quality and short time of delivery.

The above problems of this industry were discussed in Varna and Bourgas with general consideration of ways and means needed to be undertaken in order to overcome the difficulties of the transition period and to improve shipyards operations and their competitiveness on the world market. Possibility and a need for UNIDO assistance in this field was also under consideration.

The necessity of upgrading of Bulgarian shipyards is evident and generally recognized. To approach the programme of shipyards rehabilitation, co-ordinated action and considerable preparatory work is needed and should start immediately. The participants of the discussions agreed that the first promotional action might be a meeting/symposium and a study on Rehabilitation of Shipyards and Capital Investment Policies to be conducted jointly by UNIDO and the Bulgarian shipyards and research organizations with participation of foreign partners. This meeting could attract international expertise and induce eventual interest of potential investors and thereby contribute to the Shipyards Rehabilitation Programme.

The following action-oriented decision was commonly agreed upon:

(a) KORBSO Shipyards and Bulgarian Ship Hydrodynamics Centre are requested to co-ordinate a proposal for the UNIDO/Bulgaria project - Symposium on Rehabilitation of Shipyards and Capital Investment Policies - with other interested organizations and respective authorities. An official request for UNIDO assistance, with basic information available, will be submitted to UNIDO within a month.

(b) As soon as an official request is received by UNIDO, Mr. F. Gouriev, expert in marine engineering, will co-ordinate this project proposal for UNIDO and prepare a Project Document, in consultations with interested Bulgarian organizations.

Below is the list of those who participated in the discussions:

Mr. G. Georgiev, Chairman of the Board of Directors, KORBSO
Mr. P. Bogdanov, Director, Bulgarian Ship Hydrodynamics Centre (BSHC)
Mr. C. Gudjukov, Vice General-Director, KORBSO
Mr. D. Demirev, Marketing Manager, KORBSO
Mr. G. Lazarov, Head of Department, BSHC
Mr. F. Gouriev, UNIDO consultant.

Annex 2

Note for the File

Subject: Draft Project Proposal - Transfer of Modern Technology in Ship Hydrodynamics and Development in Marine Engineering - Regional Project

The above project proposal was discussed in Varna with interested partners from Bulgaria and China, in connexion with the UNIDO Meeting on Ferro-Cement Shipbuilding, held in Bourgas in October 1991. The participants of the discussions were Mr. Dong Shitong, Director of the China Ship Scientific Research Centre (CSSRC), who was on mission to Bulgaria, Mr. P. Bogdanov, Director of the Bulgarian Ship Hydrodynamics Centre (BSHC), Mr. G. Lazarov, Head of Department, BSHC, and Mr. F. Gouriev, UNIDO consultant.

Both centres, Bulgarian and Chinese, co-operate in their field of activities. BSHC was established with assistance of UNIDO. Now they jointly elaborated a proposal for a regional project on Transfer of Modern Technology in Ship Hydrodynamics and Development in Marine Engineering, for China (host country), India, Indonesia, DPR of Korea and Vietnam.

This project proposal was submitted to UNIDO a few months ago and, according to Mr. Dong Shitong, it was also sent to the Chinese representative in New York for submission to UNDP. However, this project proposal did not appear in the UNDP draft list of projects for the regional programme 1992-1996, available at UNIDO.

The conclusions of the discussions could be summarized as follows:

(a) Mr. Dong Shitong reconfirmed interest of the CSSRC in establishing and implementing the proposed regional project. The BSHC is willing to co-operate in developing the project.

(b) To revive the project proposal within the limited period of time left, urgent action by the relevant national authorities of China is needed with a view to proceed with the request through direct contacts with UNDP N.Y. and UNDP Beijing, as well as to receive support from participating countries. Mr. Shitong will take prompt action upon his arrival in Beijing.

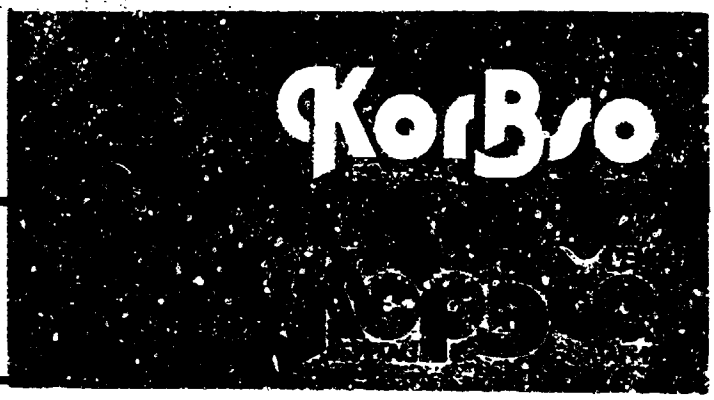
(c) The draft project document submitted so far to UNIDO requires considerable redrafting and is to be discussed in detail with competent partners from all participating countries. Preparatory assistance in this case will be needed to finalize the project document. Participation of an expert from BSHC at this stage will be useful and desirable.

(d) UNIDO has already expressed its positive attitude to the project proposal and is prepared to consider an eventual request for preparatory assistance provided this request is supported by UNDP.

(e) As soon as an official request for preparatory assistance is received in UNIDO, Mr. Gouriev, UNIDO expert in marine engineering, will provide supporting and co-ordinating action for its due consideration.

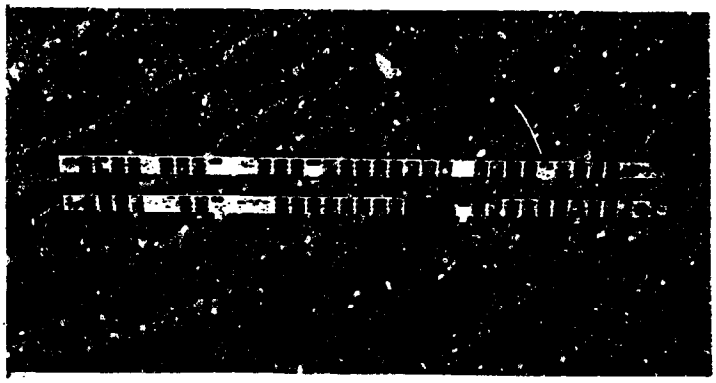
SHIPBUILDING KorBso SHIPREPAIR
BOURGAS BULGARIA

СУДОСТРОЕНИЕ КорБсо СУДОРЕМОНТ
БУРГАС БОЛГАРИЯ



FLOATING REINFORCED CONCRETE WORKSHOP

ПЛАВУЧАЯ СУДОРЕМОНТНАЯ МАСТЕРСКАЯ



Main characteristics

Length oa	67,5 m
Breadth mod	13,4 m
Depth	3,7 m
Depth oa (above waterline)	10,0 m
Draught (with 100% provisions and load 30 t on stern crane)	1,95 m
Personnel	96 persons
Self – sufficiency in operation fuel	7 days
water	3 days

Основные характеристики

Длина габаритная	67,5 м
Ширина габаритная	13,4 м
Высота борта	3,7 м
Высота над ватерлинией	10 м
Осадка (100% запас и груз 30 т на кормоподъемном кране)	1,95 т
Административно-производственный персонал	96 человек
Автономность — по горючему	7 суток
— по воде	3 суток

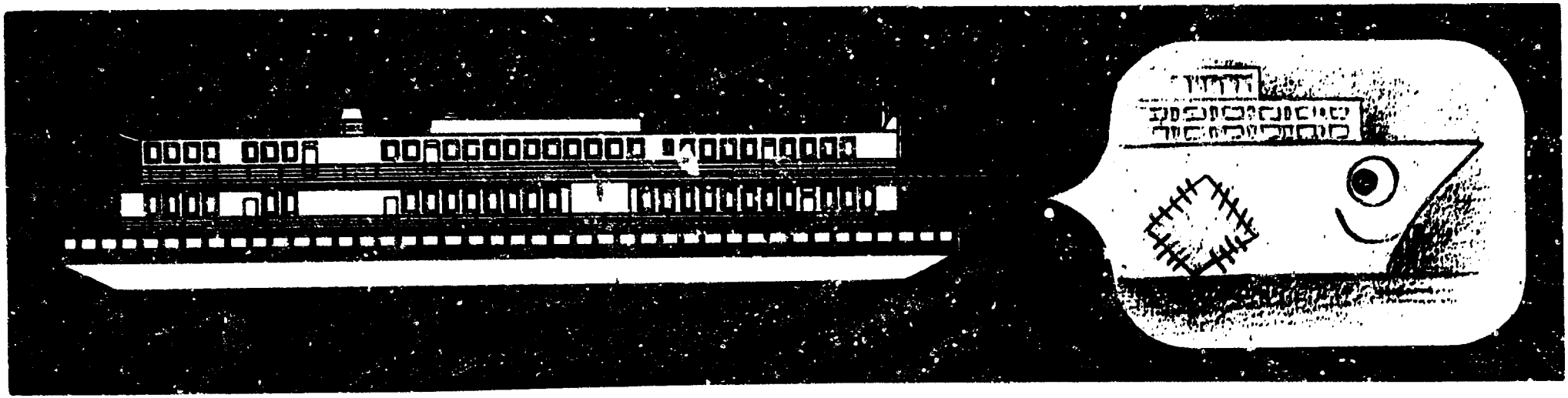
TELEPHONES:	General Director	4-31-57
	Deputy Director on technical matters	4-25-66
	Deputy Director on economic matters	4-59-78
	Commercial department	4-66-82
	TELEX 83511	
ТЕЛЕФОНЫ:	Главный директор	4-31-57
	Зам.-директора по ТВ	4-25-66
	Зам.-директора по ИВ	4-59-78
	Торговый отдел	4-66-82
	ТЕЛЕКС 83511	

Destination

Not self-propelled, built on an iron concrete hull with two floor steel superstructure under the Rules of the River Register of USSR with class "R", the floating concrete workshop is designed for repairs and maintenance of vessels and floating crafts as well as various types of machines.

Техническая характеристика

Несамоходное, двухярусное судно, построено на железобетонном корпусе класса „Р" по Правилам Речного Регистра РСФСР, предназначено для ремонта и поддержки плавучих сооружений и технологических машин.



FLOATING REINFORCED CONCRETE WORKSHOP

Wherever maintenance of vessels and floating crafts is needed before adequate facilities for repair and maintenance are built, the most appropriate solution is the floating reinforced workshop.

Its dimensions and purpose make it the right design for areas where the exploration and extracting activities precede the building of repair and maintenance facilities.

Its advantages place it far beyond comparison: low cost, high operational efficiency, full autonomy, considerable capacity and easy movement.

The only standard part is the hull. All the rest is designed and produced according to the buyer's wish.

Its technical characteristics are as follows:

- length o.a. - 67.5 m
- breadth - o.a. - 13.4 m
- depth o.a. - 13.4 m
- depth - 3.7 m
- draught - (at 100% provisions, with workers and load 30 t of stern crane) - 1.95 m
- staff - 96 people

Autonomy on operation:

- fuel - 7 days
- water - 3 days
- sewage water - 5 days

The workshop is designed and built under the rules of the River Register of the Russian Soviet Federated Republic with class "P" for inland river basins or under the rules of other classification socioties. With relevant rearrangement it can perform single passages by towing at unlimited area of navigation.

The hull is of monolithic reinforced concrete structure with longitudinal framing of the bottom and the deck, and transverse framing of the sides. The hull is divided into eight watertight compartments. The peeks are with strengthened framing and thickened outer plating. In places where heavier machines are fitted the deck is also strengthened.

The superstructure is two-deck steel structure with a mixed system of framing.

It has:

- two main diesel generators with output of 150 kW each
- one steam boiler with capacity 1000 kg/h and two water boilers (for heating) with capacity of 200 000 kkal each
- compressors - one with capacity of 5 m³/min at pressure 8 kg/cm²

The following production sections are located in the concrete hull:

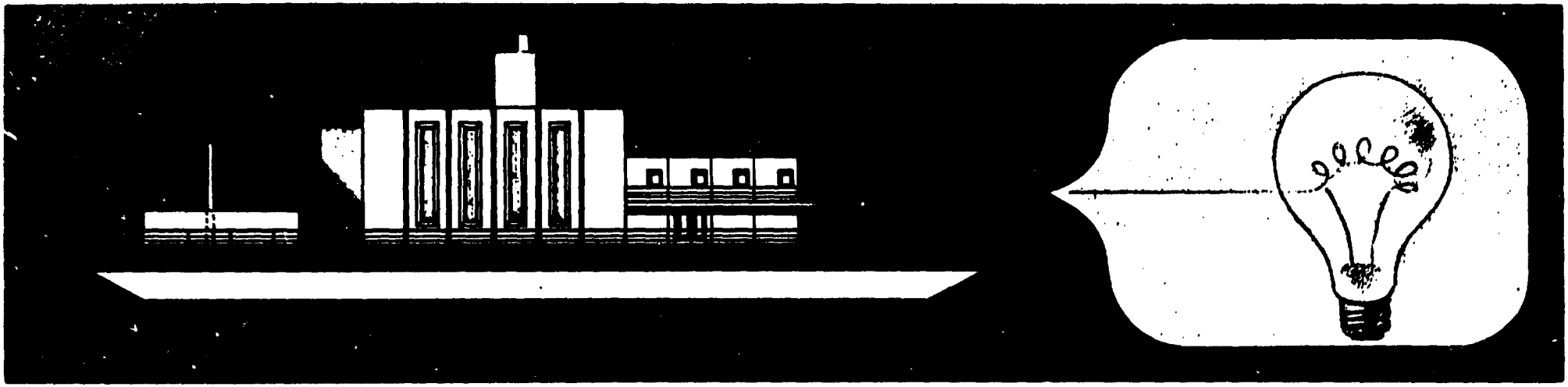
- forge-tinsmith section
- electric repair section
- battery section
- painting section

On the main deck are located two basic sections:

- section for fitters and mechanical treatment
- section for plate-mechanic and piping works

On the main deck are located the following production sections:

- carpenter's shop



FLOATING POWER PLANT

A floating plant proves to go together with shipbuilding.
Experts place it very high!
And that is only natural.
Because it can use offshore energy resources.
By doing so you avoid expensive pipelaying.
The design is unique for application by countries abounding in water basins and oil sources.
Particularly so , if the building of land electric stations is expensive, inefficient and slow.
The 3 MW floating power plant is a non-propelled vessel based on reinforced concrete hull designed to be located (or to voyage in non-working condition) on inland waterways, equivalent to class "P" according to the rules of the Russian Soviet Federated Republic Register of Shipping for river ships or to other classification organizations and societies.
The following figures give an idea of the principal dimensions and particulars of the structure:

- hull length - 62.00 m
- length o.a. - 62.40 m
- hull breadth - 13.00 m
- breadth o. a.- 13.40 m
- depth o. a. - 12.50 m
- depth - 3.70 m
- draught during voyage - 1.80 m
- full draught (in working conditions) - 2.10 m

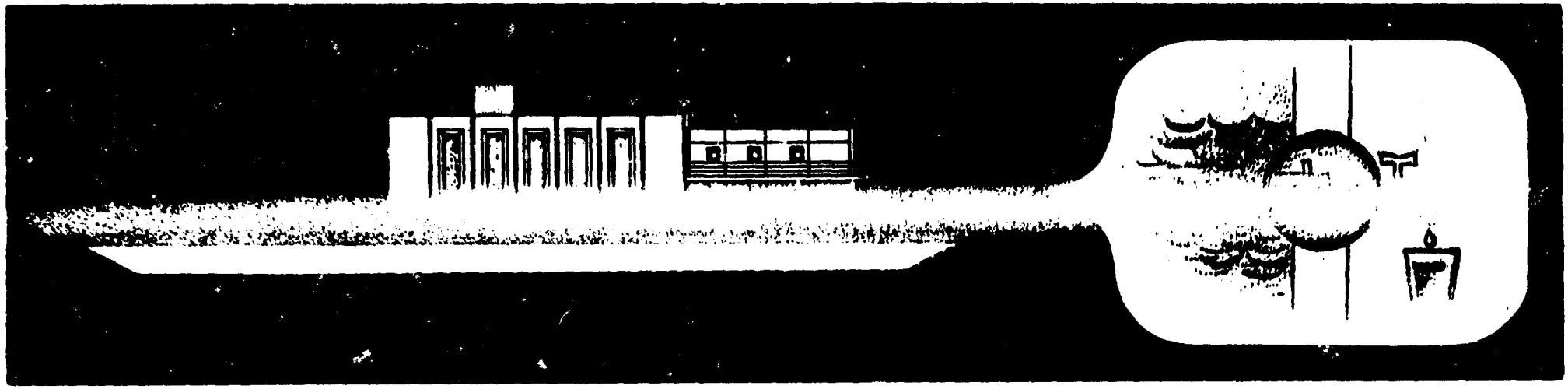
The vessel's hull is made of sulphate-resistant concrete of brand M300 with cold resistant properties for particularly severe climate conditions with more than 150 freezing cycles at average monthly temperatures lower than -20°C.
The reinforcement consists of common carbon steel and high tensile manganese steel.
The metal superstructure is made of conventional carbon steel plates and weldable sections.
The floating structure is provided with the necessary systems for safety and autonomy:

- anchoring and mooring electric capstans - 3 pcs
- Hall's anchors weighing 600 kgs each - 3 pcs
- mooring bollards, dia. 219 mm - 6 pcs
- towing bollards, dia. 299 mm - 4 pcs
- deck electrohydraulic crane, 10-12 t, adapted to operate with coal grabs - 1 pc

Ship systems:

- drain system
- ballast system
- water and fire-proof system
- foam fire-proof apparatus
- water supply system
- sewage system

Proper spaces with the necessary accommodation convenience for 16 persons are also available.
The power plant consists of a steam boiler, two main steam electric power units, auxiliary diesel generator and associated equipment. The boiler plant consists of one steam boiler with steam generation capacity of 14 t/ h, working pressur of 38 bars, output pressure of 35 bars,



FLOATING DESALINATION PLANT

Desalinating water!
Using sea water when there is no fresh water!
For years man has dreamed of that!
Under certain conditions anybody can welcome it. And enjoy it.
The floating desalination plant is a non-propelled vessel on steel reinforced concrete hull, designed to float moored or anchored in coastal sea waters protected from waves.
Its class is equivalent to class "P" of the Register of Shipping of the Russian Soviet Federated Republic for river ships or under the rules of some other classification societies.
It is designed to produce desalinated water from sea water. Steam and electricity consumption - from onboard sources.
Storage tank capacity - desalinated water - for 24 hours; fuel - for 7 days.

The main dimensions are:
- hull length - 62.00 m
- length o.a. - 62.40 m
- hull breadth - 13.00 m
- breadth o.a. - 13.40 m
- height - 3,70 m
- draught - 1.90 m

The hull of the desalination plant is of concrete M300, reinforced with carbon and manganese steel; the metal superstructure is of conventional carbon steel plates.

Capacity: about 630 m³/24 hours.
Tanks for desalinated water - 640 m³ in the hull.
Output of the boiler plant: about 8.5 t/h, saturated steam P=0.7 MPa, sufficient for the needs of the vessel.

One main diesel generator set of about 280 kW, 1000 RPM.
One emergency diesel generator set of about 100 kW, 1500 RPM.

The floating structure has the necessary [illegible] ing the safety and the self-sufficiency:
- anchoring and mooring electric capstans - 3 pcs
- mooring bollards, dia. 299 mm - 6 pcs
- towing bollards, dia.299 mm - 4 pcs

The floating plant has the proper accommodation spaces and the following systems:
- bilge water system
- water fire proof system
- foam fire-proof apparatus
- system for hot and cold sanitary water
- sewage system of closed type for waters from toilets
- forced ventilation
- air conditioning of the office, cabins, messrooms and central control room
- electric equipment comprising of:
  - 3 x 380 V, 50 Hz for power consumers
  - 220 V, 50 Hz for lighting
  - 12 V, 50 Hz for portable lights
  - 24 V DC for important signalling

FLOATING HOSPITAL

In remote areas where ambulances can not arrive on time or where there are no roads, a floating hospital is a real necessity.
The floating hospital is a non-propelled craft on a ferro-concrete hull.
It is designed to sail in inner waterways and is built under the rules of the River Register of the Russian Soviet Federated Republic with class "P", or under the rules of other classification societies.
Its hull length is 62.00 m.
- breadth o.a. - 13.40 m
- hull breadth - 13.00 m
- depth o.a. - 12.75 m
- depth - 3.70 m
- draught - 1.90 m

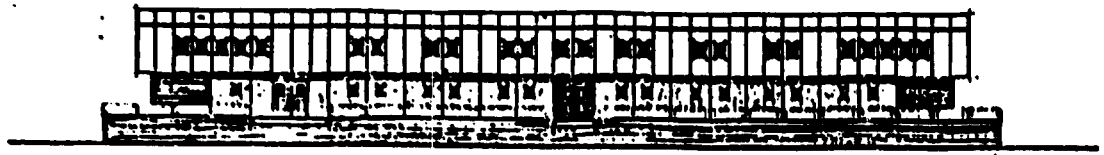
In respect to fuel and provisions its autonomy is 7 days.
- drinking water - 3 days
- sewage water - 5 days

The hull is made of concrete M300. The structure of the ferroconcrete hull is monolithic.
The deck and bottom framing is longitudinal; the side framing is transverse. There are 8 watertight transverse bulkheads.
The material of the superstructure is conventional carbon steel. The floating hospital consists of a polyclinic, isolation ward, therapeutic room, surgery and service spaces. The first deck accommodates:
- the polyclinic and the reception office
- pharmacy
- isolation ward with separate entrance
- large lift for garbage, which also links the first deck and the surgery
- lift between the lower and the upper deck
- pathological cases room which is linked with the second deck by the lift

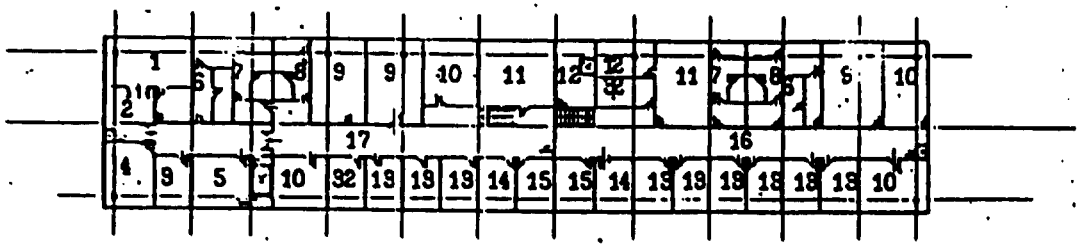
Two links are available for shore communication:
- one for the central entrance
- one for emergency cases

The therapeutical ward is for 23 persons.
The surgery is for 14 persons.
If a third deck is designed and constructed the numbers can be increased to about 50.
There are several more rooms:
- chief physician's consulting office
- office
- laundry and sterilizing room
- galley with refrigerator stores
- store room
- engine room

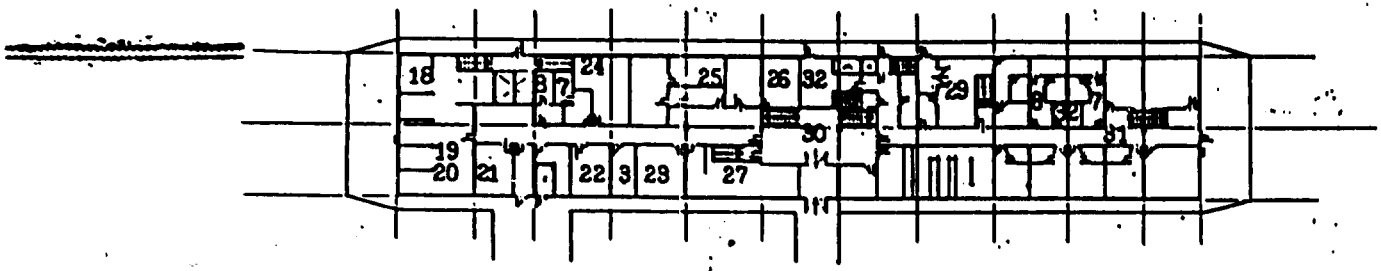
For the normal operation and the safety the designers have provided:
- anchor gear
- mooring and towing gear
- draining system
- water fire-proof system
- foam fire-proof apparatus
- water providing system for everyday needs



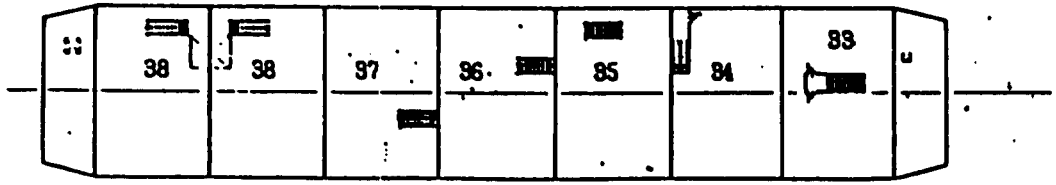
II Tier



I Tier



Hold



FLOATING HOSPITAL

Principal particulars:

Hull length	71,00 m
Hull breadth	13,50 m
Hull depth	4,00 m
Draught	2,00 m
Hull overall	12,75 m

The floating hospital is a nonself-propelled vessel on a reinforced concrete hull with a carbon steel superstructure. It is intended for inner waterways of "P" class with sea endurance for 7 days.

The floating hospital consists of surgery roo with 24 beds, therapeutics room with 22 beds and isol ting ward with 3 beds. There are also a polyclinic, pharmacy and accomodation spaces for 9 persons.

Power consumers on board are supplied by diesel-generators: 2x150 kW and 1x50 kW. Heating is provided by two steam boilers with a capacity of 1000 kg/h.

Principal spaces

1 - operating room
2 - pre-operating room
3 - dressing - room
4 - plaster room
5 - reanimation room
6 - personned sanitary block
7 - sanitary block (E)
8 - sanitary block E (D)
9 - hospital ward for 6 persons
10- Hospital ward for 3 persons
11 -Mess room
12 - Pantry
13 - Hospital ward for 2 persons
14 - Nurse room
15 - Physician consulting room
16 - Lobby in front of therapeutics room
17 - Lobby in front of surgery
18 - Paraffin room
19 - Physiotherapy room
20 - Rehabilitation room
21 - Dental surge
22 - Surgery
23 - Gynaecologica room
24- Hospital labo ratory
25 - X-ray room
26 - Therapeutic r
27 - Reception off
28 - Pharmacy
29 - Isolating war
30 - Central lobby
31- Personned acc modation spaces
32 - Stores
33- Sports facili
34 - Air-conditioni station
35 - Galley
36 - Provision sto
37 - Domestic store
38 - Engine room

FLOATING PUBLIC UTILITIES CENTER

No matter where research or construction works are performed - there are ubiquitous necessities for normal living conditions. Before any company could cope with the urgent daily problems or instead of creating expensive temporary centers on land it can use the floating craft.

The floating public utilities center is a craft on a ferroconcrete hull, designed to navigate in inner waterways and built under the rules of the River Register of the Russian Soviet Federated Republic with class "P", or under the rules of other classification societies.

Main particulars:

- hull length - 62.00 m
- breadth o. a. -13.40 m
- hull breadth - 13.00 m
- depth o.a. - 12.75 m
- depth - 3.70 m
- draught - 1.90 m

In respect to fuel and provisions its autonomy is 7 days.

- drinking water - 3 days
- sewage water - 5 days

The hull is made of concrete M300.

The structure of the ferroconcrete hull is monolithic. The deck and bottom framing is longitudinal, the side framing is transverse. There are 8 watertight transverse bulkheads.

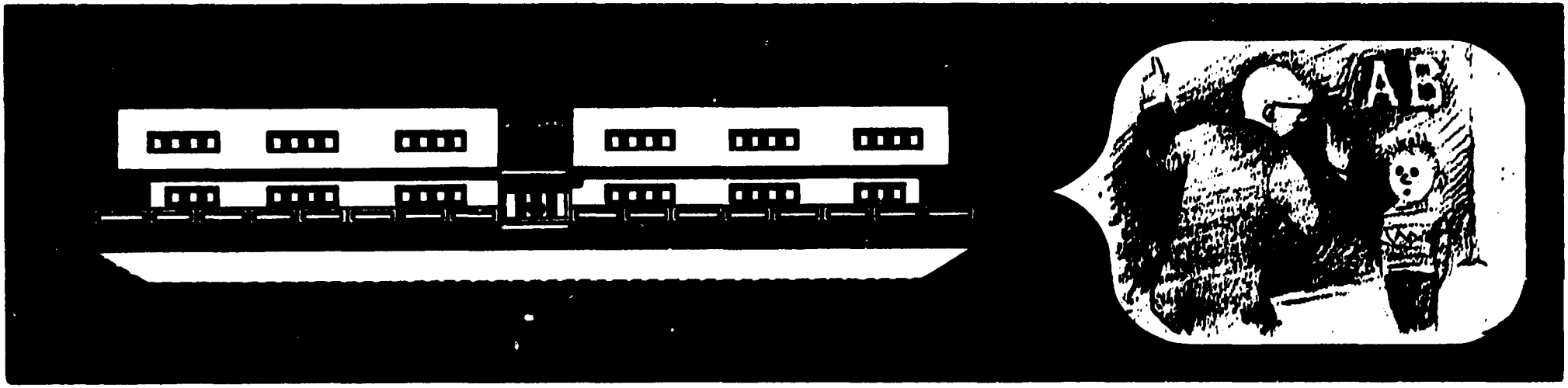
The material of the metal superstructure is conventional carbon steel. In the floating public utilities center the following services are available:

- laundry with washing capacity of 200 kg per working shift
- dry cleaning
- making to measure and repair of clothes, leather articles, knitwear and hairdressing - 23 working places
- shoe and leatherwear mending - 6 working places
- watch and jewelry repair - 4 working places
- repair of small electrical appliances - 4 places
- radio and TV sets repair - 4 working places
- photographic studio comprising of: a reception room, a room for taking photographs, a room for photo development, a store room and two cabins for amateurs and non-resident photographers
- a hairdresser's - 9 working places
- a cafe with a refreshment bar

The necessary administration and public places are provided as well as double cabins for temporary stay of non-resident skilled workers or for the crew.

For the normal operation and for the safety of the floating craft the designer has provided:

- anchor gear
- mooring and towing gear
- swinging davit of 0.5 t cargo lifting capacity
- draining system
- water fire-proof system
- foam fire-proof apparatus
- water providing system for daily needs
- sewage water system
- ventilation system



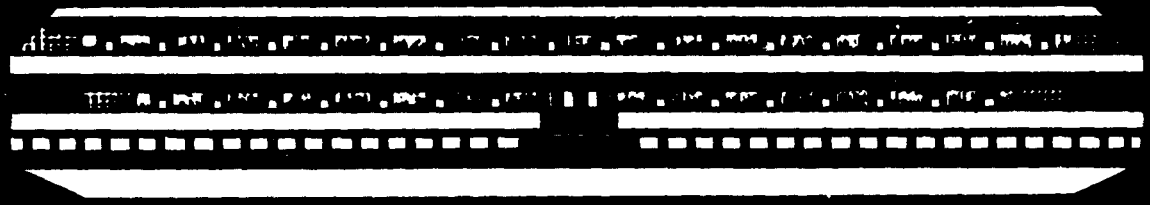
FLOATING SCHOOL

Main Dimensions:
- length - 62.00 m
- breadth - 13.00 m
- depth - 3.70 m
- draught - 1.90 m

Principal spaces:
1. Classroom (10)
2. Multipurpose hall
3. Teachers' room
5. Office
6. Library
7. Natural history study
8. Fan room
9. Provision store
10.Galley
11.Messroom
12.Engine room
13 Equipment store
14.Store
15.Ladies W.C
16.Gents W.C.

The floating school is a non-propelled vessel with steel concrete hull designed for inland water service. The necessary conditions are provided for elementary education of pupils from 1st to 7th class - two classes for each of the first 3 years and one for the remaining. The classrooms floor area (54 m²) permits the instruction of up to 35 pupils in every room. Catering accommodation is provided for the pupils as well as rooms for the teachers and the other personnel.
The floating school is provided with its own power sources - diesel generators and storage batteries. It can also be supplied from the shore. It is equipped with water heating and forced ventilation system.

Endurance:
- fuel and provisions - 7 days
- drink water tanks - 3 days
- sewage and drain water - 5 days



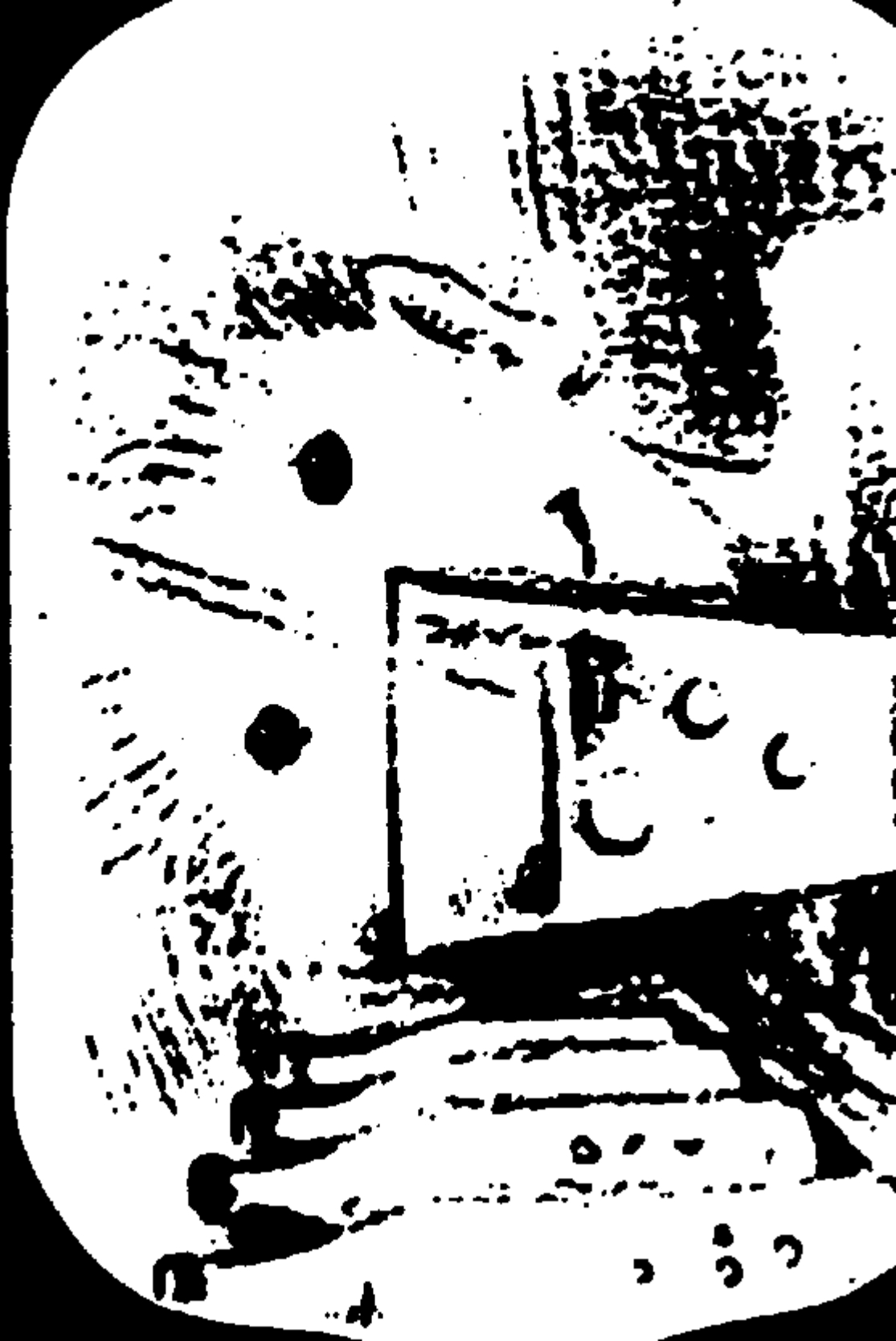
FLOATING HOSTEL

In faraway areas lacking in necessary initial infrastructures a floating hostel is the key. It is the key to the solution of service and social problems in undeveloped areas.
The units are to be moored in calm waters as sea bays, ports, harbors, lakes, dams, rivers, river mouths, etc., where the only resort is a floating hostel.
If the idea of a standard hostel is not acceptable to some, there is an extremely attractive feature; the only standard and fixed integral part is the hull while the rest is designed and produced after the buyer's wish.
The floating hostel is a non-propelled craft on a ferroconcrete hull.
It is designed to sail in inner waterways and is built under the rules of the River Register of the Russian Soviet Federated Republic with class "P" or under the rules of other classification societies.
Its length is 62.00 m.
- breadth o.a. 13.40 m
- hull breadth - 13.00 m
- depth o. a. - 12.75 m
- depth - 3.70 m
- draught - 1.90 m

In respect to fuel and provisions its autonomy is 7 days;
- drinking water - 3 days
- sewage water - 5 days

The hull is made of concrete M300.
The structure of the ferroconcrete hull is monolithic.
The deck and bottom framing is longitudinal.
The side framing is transverse. There are eight watertight transverse bulkheads.
The material of the metal superstructure is conventional carbon steel.
The floating hostel is designed in two decks for 74 persons, accommodated in 37 double cabins - 11 on the lower deck and 26 on the upper deck.
The cabins are provided with furniture, necessary for good living conditions. On the first deck is a messroom for 80 persons and a galley.
The messroom can be used as a place for meetings and as a cinema hall.
The saloon on the second deck accommodates the staff.
The lower and the upper deck are connected by two companion ladders in the alleyway.
The holds contain:
- provision store
- equipment store
- laundry

Heat insulation is secured by suitable padding in conformance with the constructive features and fire rules.
For the normal operation and the safety of the floating craft the designer provides:
- anchor gear
- mooring and towing gear
- swinging davit of 0.5 t cargo lifting capacity
- draining system
- water and fire-proof system
- foam fire-proof apparatus



FLOATING SOFT DRINK PLANT

In faraway areas while research or construction activities are going on everyday needs may be satisfied quite easily and at a low price. A floating soft drink plant may be essential in high temperature zones under development.

The floating soft drink plant is a craft on a ferroconcrete hull designed to navigate on inner waterways and built under the rules of the River Register of the Russian Soviet Federated Republic with class "P" or under the rules of other classification societies.
The main characteristics of the craft are:
- hull length - 62.00 m
- breadth o.a. - 13.40 m
- hull breadth - 13.00 m
- depth o.a. - 3.70 m
- draught - 1.90 m

The hull of that non-propelled craft is made of concrete M300.
The structure of the ferroconcrete hull is monolithic.
The deck framing is longitudinal, the side framing is transverse.
The watertight transverse bulkheads of the hull are eight.
The material of the metal superstructure is conventional carbon steel.
The designed floating plant produces sweetscented fruit and refreshing soft drinks.

The technical and production features are as follows:
- nominal output - 6000 bottles/h
- general power of the equipment - 120 kW
- drinking water consumption - 10 m^3/h at 0.5 MPa
- water consumption 6H - 5.5 m^3/h
- steam consumption - 1800 kg/h at 0.5 MPa
- necessary cold output -152 000 kkal/h.

Personnel in shifts - 15 people.
The necessary accommodation spaces are provided including 3 cabins, a physicochemical and a microbiological laboratory and other service rooms.
For the normal operation and for the safety of the floating plant the designer has provided:
- anchor gear
- mooring and towing gear
- swinging davit of 0.5 t cargo lifting capacity
- platform for approach of the electric truck to the deck, 4.0 x 2.0 m, with electrically driven winch
- draining system
- water fire-proof system
- foam fire-proof apparatus
- water providing system for daily and technological needs
- sewage water system
- ventilation system
- heating system
- provision cooling system

The engine boiler room is equipped with:
- two sets of main diesel generators of 180 - 200 kW (300 HP)

FLOATING RESTAURANT

While research and production goes in remote areas the workers require normal living conditions and convenience. The floating restaurant is just one of the remedies! The floating restaurant is a non-propelled craft on a ferroconcrete hull designed to sail in inner waterways and built under the rules of the River Register of the Russian Soviet Federated Republic with class "P", or under the rules of other classification societies.

Its hull length is 62.00 m.

- breadth o. a. - 13.40 m
- hull breadth - 13.00 m
- depth o.a. -12.75 m
- depth - 3.70 m
- draught - 1.90 m

Its self-sufficiency for fuel and provisions is 7 days.

- drinking water - 3 days
- sewage water - 5 days

The hull is made of concrete M300.

The structure of the ferroconcrete hull is monolithic.

The deck and bottom framing is longitudinal, the side framing - transverse.

The craft has 8 watertight transverse bulkheads.

The material of the metal superstructure is conventional carbon steel. That first class floating restaurant is designed for 200 visitors.

A refreshment room, a cafe and a discotheque are also available on board.

Places for public catering are served by a cooking section, comprising of a galley for hot food with appropriate spaces for preparing meat, fish and fruit, a galley for sweets and a bakery.

Refrigerated and fresh food can be stored for 7 days.

The architectural arrangement secures a pleasant atmosphere. The walls and the ceilings will be covered by appropriate materials. The floor cover may be linoleum or terra-cotta.

The fire insulation meets the existing requirements.

For the normal operation and for the safety of the restaurant are provided:

- anchor gear
- mooring and towing gear
- swinging davit of 0.5 t lifting capacity
- draining system
- foam fire-proof apparatus
- water providing system for everyday use
- sewage water system
- ventilation system
- heating system
- provision cooling system

At the temperature sustained in the chambers provisions can be preserved for ten days.

The engine boiler room is equipped with:

- two sets of diesel generators of 150 kW (225 HP) each
- one standby diesel generator of 50 kW (69 HP) nominal output
- packaged steam boiler, steam output - 1000 kg/h
- two water heating automated packaged boilers, heat output - 200 000 kkal/h

FLOATING DAIRY

In remote areas where milk is abundant and transport is not handy, or where, for climate or any other reasons, the processing of the products has to be performed in the vicinity of calm waters as sea bays, port or harbor areas, lakes, dams, rivers, river mouths, etc., a floating dairy comes to solve a lot of problems.

The floating dairy is a non-propelled craft on a ferroconcrete hull, designed to navigate in inner waterways and built under the rules of the River Register of the Russian Soviet Federated Republic with class "P" or under the rules of other classification societies.
The main characteristics of the craft are:
- hull length - 62 m
- breadth o.a. - 13.40 m
- hull breadth - 13.00 m
- depth o.a. - 12.60 m
- depth - 3.70 m
- draught - 1.90 m

The hull is made of concrete M300.
The structure of the ferroconcrete hull is monolithic.
The deck and bottom framing is longitudinal; the side framing is transverse. There are 8 watertight transverse bulkheads.
The material of the metal superstructure is conventional carbon steel.
The floating dairy can process daily 32 000 liters cow milk into the following products:
- pasteurized milk - up to 8000 liters
- Bulgarian yoghurt with normal (solid) coagulant and/or whey - to 12000 liters

The equipment also secures:
- the circulation washing of the technological equipment and the milk tubes
- the inner transport

The milk is cooled, if that has not been done on the farm and is kept in a heat insulated tank with 59% of the capacity of the dairy.

The production line performs the packing of the following products:
- pasteurized milk and yoghurt with whipped coagulant in polythene packs of 0.5 and 1 liter
- Bulgarian yoghurt with normal coagulant, whey and cream in plastic cups of 0.2 and 0.5 liter
- milk champagne - in aluminium drums of 20 liters

Equipment for brined cheese production can be also added thus increasing the capacity to 40 tons.
The necessary accommodation and service spaces are provided, including 4 cabins, 2 laboratories, cooling chambers, etc.
For the normal operation and the safety of the floating dairy the designer has provided:
- anchor gear
- mooring and towing gear
- swinging davit of 0.5 t cargo lifting capacity
- platform for approach of the electric truck to the deck, 4.0 x 2.0 m, with electrically driven winch
- deck electric elevator - 100 kg

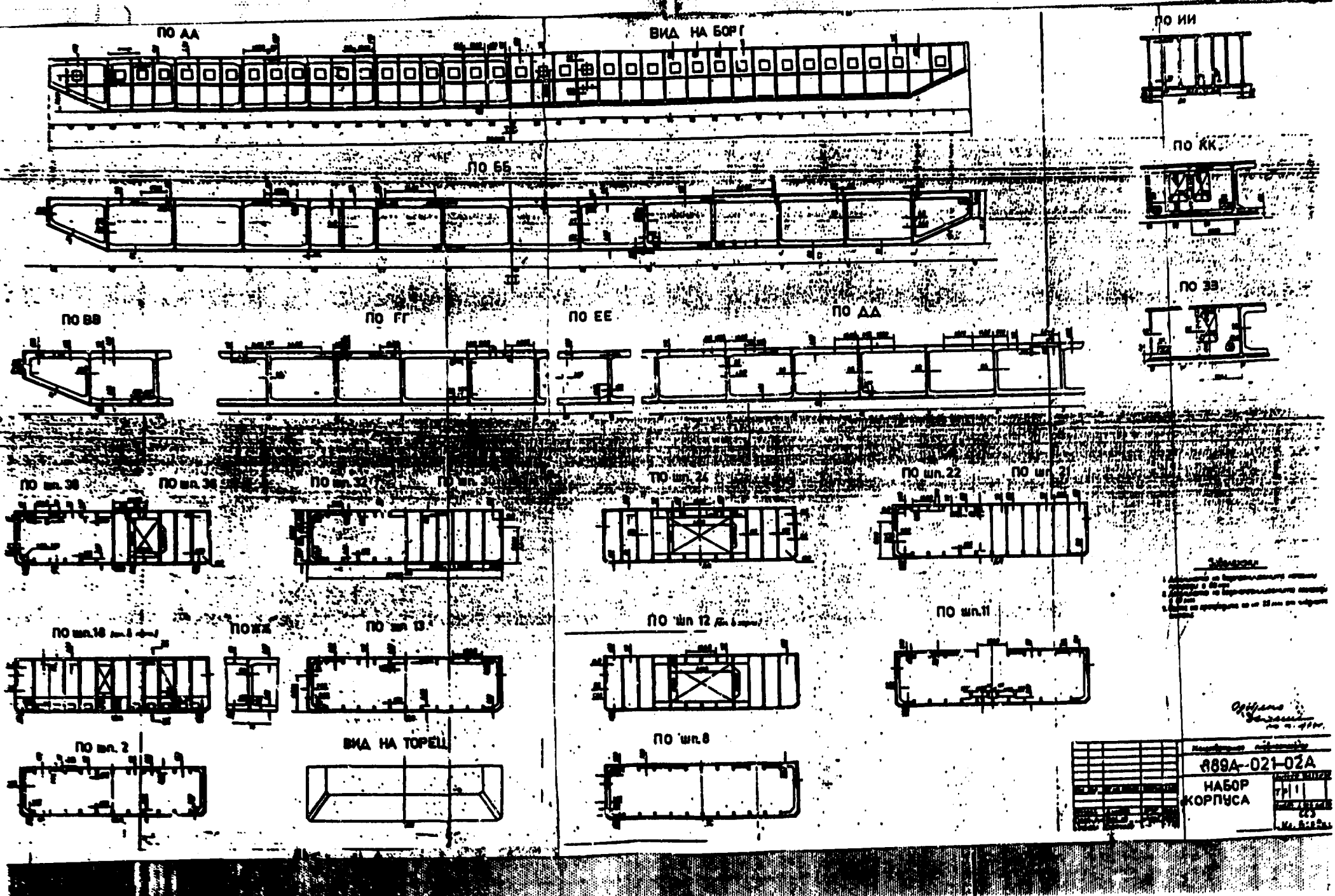
FLOATING BAKERY

With a floating bakery you can have your batch of freshly made bread anytime wherever you are!
The floating bakery is designed to navigate in inner waterways and is built under the rules of the River Register of the Russian Soviet Federated Republic with class "P" or under the rules of other classification societies.
Its hull length is 62.00 m.
- breadth o.a. - 13.40 m
- hull breadth - 13.00 m
- depth o.a. - 12.60 m
- depth - 3.70 m
- draught - 1.90 m

It is made of concrete M300. The concrete hull is monolithic.
The deck and bottom framing is longitudinal, the side framing is transverse. The watertight transverse bulkheads of the ferroconcrete hull are eight. The material of the metal superstructure is conventional carbon steel.
The line secures the production of 6 tons of bread in 16 hours, including various kinds of buns, ranging from 0.250 to 1 kg.
Customer's programme can be best satisfied if the desired articles are brought to the designer's knowledge. Thus an optimal number of shapes and carts for the bread can be provided. At customer's wish the production rate can be increased to 7.5 t/16 hours or to 10 t/16 hours which is achieved by increasing the number of the kneading machines, the fermentation chambers, the ovens, the shapes and the carts.
The technological line comprises all the necessary machines, equipment and spaces, including space for the product storage, the flour and dough processing till bread is baked, and its preservation in roller stacks.
The workers needed are about 25.
The needed accommodation spaces are provided, including 4 cabins.

The vessel's equipment is specifically designed for the purpose.
For the normal operation and the safety of the floating bakery the designer has provided:
- anchor gear
- mooring and towing gear
- swinging davit of 0.5 t cargo lifting capacity
- platform for approach of the electric truck to the deck, 40 x 2.0 m, with electrically driven winch
- draining system
- water fire-proof system
- foam fire-proof apparatus
- water providing system for everyday and technological needs
- sewage water system
- ventilation system
- heating system
- provision cooling system

The engine boiler room is equipped with:
- two sets of main diesel generators of 180 - 200 kW (300 HP)



989А-021-02А

НАБОР КОРПУСА

SHORT HISTORY OF KORBSO CO.,
TOWN OF BOURGAS
PAST – PRESENT – FUTURE

THE FAVOURABLE LOCATION OF THE TOWN OF BOURGAS ON THE BLACK SEA COAST CREATES ADEQUATE CONDITIONS FOR SHIPBUILDING, SHIP-MAINTENANCE AND NAVIGATION.

JOHN STAINBECK SAID: 'NEARLY FOR EVERY HUMAN BEING THE SHIP IS MUCH MORE VALUABLE THAN ANY TOOL MADE BY HIM. IT IS INCARNATION OF HIS DREAM WHICH OBSESSED THE MEN SO MUCH THAT THERE IS NOTHING ELSE IN THIS WORLD CREATED WITH SUCH CLEANLINESS OF THE THOUGHTS. THE RIBS RIGIDITY, KEEL STABILITY, CORRECT SELECTION AND BOARD STRENGTHING DEPENDS ON THE HEART HE PUTS IN HIS OWN WORK'.

SHIPBUILDING IS ONE OF THE OLDEST OCCUPATIONS IN BOURGAS WELL KNOWN FOR MANY YEARS. AT THE END OF THE LAST CENTURY THE REQUIRE-MENTS OF THE COASTAL NAVIGATION AND FISHING WERE SATISFIED BY SMALL SHIPBUIDING COMPANIES. THEY PRODUCED MAINLY SMALL BOATS BECAUSE OF THE MANUAL PRODUCTION ACTIVITIES. THE FIRST SHIP-REPAIR SHOP WAS ESTABLISHED IN 1903. THE EQUIPMENT THERE WAS VERY PRIMITIVE AND LIMITED SHIP-REPAIR AND SHIPBUILDING ACTIVITIES WERE CARRIED OUT. MANY PRIVATE SHOPS FOR BUILDING OF WOODEN BOATS WERE ESTABLISHED IN THE FOLLOWING 35 YEARS.

IN 1938 A COOPERATIVE SOCIETY FOR SHIPBUILDING AND NAVIGATION 'BULGARIAN LLOYD' WAS ESTABLISHED. THIS WAS A GREAT STEP FORWARD THE SHIPBUILDING INDUSTRY.

IN 1948 A MAINTENANCE SHOP WAS ESTABLISHED AND IT CAN BE CONSI-DERED AS FOUNDATION OF THE FUTURE SHIPBUILING COMPANY IN THE TOWN OF BOURGAS. BUILDING OF 80 TONS FISHING SHIPS, BOATS FOR THE EDU-CATIONAL PURPOSES, ROW SAILING BOATS, YACHTS AND SHIP REPAIRS ACCOR DING TO THE RULES OF THE BULGARIAN REGISTER WAS STARTED THERE. IN THIS PERIOD OF TIME THE PLANT IS EQUIPED WITH A LOT OF NEW MACHINES AND FACILITIES. ALL THE SPECIAL DEPARTMENTS REQUIRED FOR PROPER SHIPBUILDING AND SHIP MAINTENANCE WERE CREATED. PROCESS AND DESIGN DEPARTMENTS WERE ESTABLISHED ON A LATER STAGE AND THEIR DUTY IS TO COVER COMPLETELY THE PRODUCTION ACTIVITIES, MATERIALS AND PARTS PROVISION, NEW BUILDING METHODS IMPLEMENTA-TION, DOCUMENTATION ISSUE FOR MORE COMPLICATED AND BIG REPAIR WORKS. THIS IS CONSIDERED AS A BEGINING OF THE DESIGN WORK.

A REMARKABLE EVENT IN THE HISTORY OF THE STATE SHIPBUILDING COMPANY IS BUILDING OF THE FIRST SHIP WITH A METAL STRUCTURE IN 1960. THIS WAS A RIVER TUGBOAT 200 H.P. AND THEN THE FIRST FISHING VESSEL WAS BUILT ALSO.

THE PRODUCTION LIST OF THE COMPANY COVERS MAINLY TUGBOATS 135, 300 AND 360 H.P.,NOT-SELF MOVING DREDGER BARGES OF 200,300,500 AND 1500 TONS, HYDROBUSES WITH 150 SEATS,SELF-MOVING DREDGER BARGES DREDGES, FLOATING PUMP STATIONS, BARGES AND OTHERS.

IMPLEMENTATION OF THE MODERN SECTION SHIPBUILDING METHOD CAN BE CONSIDERED AS THE BIGGEST SUCCESS. THIS METHOD ALLOWS CREATION OF CORRECT SHIPBUILDING PLANS BASED ON THE AVAILABLE DESIGN

DOCUMENTATION. IN THIS WAY ALL DEPARTMENTS CAN PLAN AND COORDINATE THE OUTSTANDING WORK.

IN ORDER TO ENLARGE THE PRODUCTION ABILITIES FOR BUILDING OF FISHING AND TECHNICAL VESSELS IN 1969-1970 THE COMPANY IS MOVED TO THE NOWADAYS LOCATION OF 800 000 SQ.M. WHICH IS A GREAT CHANGE COMPARED TO THE OLD 15 000 SQ.M. AREA AVAILABLE IN THE PORT REGION.

THE YEARS FOLLOWING 1970 MARK NEW STAGE OF DEVELOPMENT OF THE SHIPBUILDING INDUSTRY. NEW, MODERN VESSELS ARE BUILT - 300 T FISHING VESSELS, 500M SELF-MOVING DREDGER BARGES, 1 500 T COAL-CARRIERS, PUSHERS WITH HIGH DEGREE OF MOBILITY AND FLOATING FERRO-CONCRETE WORK SHOPS WHICH IS THE BIGGEST NUMBER OF SHIPS BUILT IN THE YARD.

TWO NEW DESIGNS WERE IMPLEMENTED IN 1977 - 2 000 T SECTION AND MODIFIED FERRO-CONCRETE WORK SHOP. IN THE MEANTIME SELF-MOVING DREDGER BARGES, FERRY-BOAT, FLOATING CRANE, GRAPPLES WERE PRODUCED.

THE FIRST 5 000 TONS TANKER TYPE 'KASPIA' WAS BUILT IN 1980. THIS IS THE START OF NEW PRODUCTION BRAND - MEDIUM - TONNAGE VESSELS.

THE FIRST STAGE OF PLANT ERECTION AND MODERNIZATION IS NEARLY COMPLETED IN THE PERIOD OF 1981 - 1987. THE LETTER OF CREDIT FOR THE SECOND STAGE IS ALREADY OPENED.

THE BIGGEST ACHIVEMENT IS COMMISSIONING OF THE UNIQUE HOISTING-LAUNCHING SYNCHRO-LIFT UNIT WITH A CAPACITY OF 7300 T LAUNCHING WEIGHT OR 25 000 TONS DEAD-WEGHT. THOSE NEW UNITS AND EQUIPMENT ALLOWS BUILDING OF THE MEDIUM-TONNAGE VESSELS SUCH AS TANKERS, CARGO MULTIPURPOSE VESSELS, SHIPS TYPE 'RO-RO', CONTAINER CARRIERS AND SPECIAL SHIPS. A POSSIBILITY FOR VESSELS MAINTENANCE AND REPAIRS IS ALSO GIVEN. THIS INCLUDES REPAIR OF THE HULL, SHIP DEVICES, FURNITURE, MECHANICAL UNITS, PIPING SYSTEMS AND ELECTRICAL SYSTEM.

SPECIFITY AND DEVELOPMENT OF THE PRODUCTION PROCESSES IN KORBSO CO. DURING THE LAST TWENTY YEARS IS DETERMINED BY THE FOLLOWING CIRCUMSTANCES:

FIRST - BUILDING OF NEW PRODUCTION FACILITIES AND CONTINUOUS WORK OF THE EXISTING ONE WAS DONE SIMULTANEOUSLY;

SECOND - GREAT VARIETY OF THE VESSELS, FLOATING CRAFTS AND OTHER EQUIPMENT IN THIS PERIOD OF TIME;

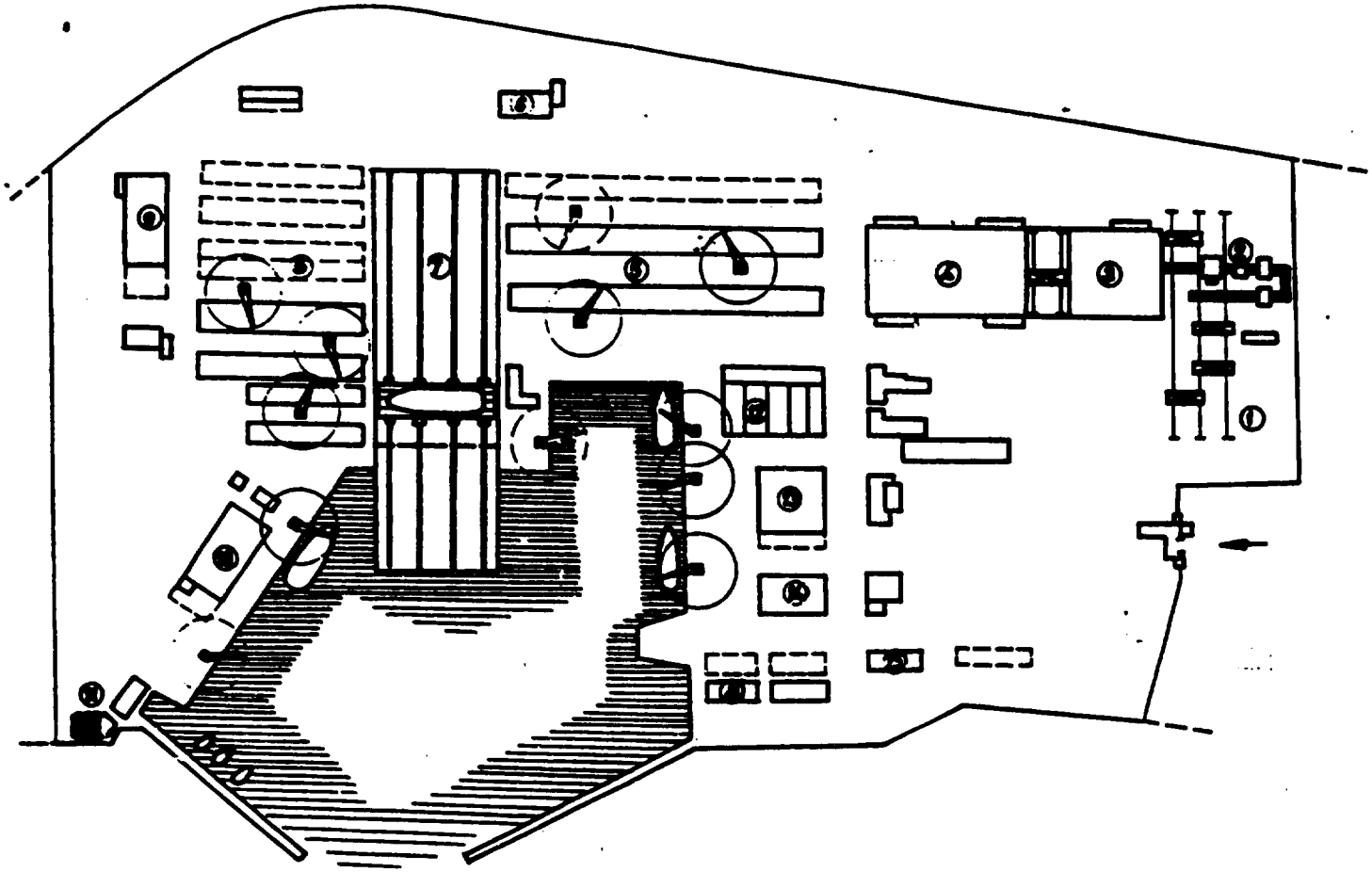
THIRD - DEVELOPMENT OF THE SHIPBUILDING TECHNOLOGY WORLDWIDE.

THE GREAT VARIETY OF THE PROCESS DECISIONS IS ESPECIALLY EVIDENT IN BUILDING OF THE HULL.

IN THE BEGINING TREATMENT OF THE MATERIAL FOR HULL'S BUILDING WAS DONE BY CHEMICAL CLEANING WITHOUT PRELIMINARY STRAIGHTENING. THEN BLAST SHOT CLEANING OF THE SHEET AND PROFILE STEEL WAS IMPLEMENTED TOGETHER WITH A PAINTING CHAMBER FOR SHOP PRIMING WITH A PURPOSE OF TEMPORARY PROTECTION, STRAIGHTENERS FOR SHEET MATERIAL.

THESE UNITS FORM A MODERN DEPARTMENT FOR PRELIMINARY TREATMENT OF THE HULL MATERIAL.
IN THE BEGINING THE SHEET MATERIAL WAS CUTTED MECHANICALLY BY GATE SHEARS AND MANUALLY BY OXYGEN CUTTING OF THE CURVED AREAS. CUTTING DATA WERE BASED ON HULL DRAWING IN ACTUAL SIZE ON A MOULD LOFT, BY MEANS OF WOODEN TEMPLETS. THE OXYGEN CUTTING MACHINE 'ODESA' WITH AN OPTIC CONTROL FROM THE CUTTING CHART IN A SCALE OF 1:10 WAS COMMISSIONED ON A LATER STAGE.
THIS WAS FOLLOWED BY IMPLEMENTATION OF OXYGEN CUTTING MACHINE 'KRISTAL'. THIS MACHINE ALLOWED USE OF 'FORAN' SYSTEM FOR DESIGN DRAWING OF THE HULL ON A COMPUTER. THE AVAILABLE MACHINES OF THE CENTRE FOR NAVIGATION CYBERNETICS IN THE TOWN OF VARNA ARE USED FOR THE ABOVEMENTIONED PURPOSES.
BENDING DEPARTMENT HAS A 315 T FLANGING PRESS, 500 T HYDRAULIC PRESS, THREE-ROLLERS MASHINE AND 'HU SMITH' PROFILE BENDING MACHINE. THESE EQUIPMENT TOGETHER WITH THE ACCEPTED METHOD OF ADDITIONAL ON-SITE BENDING THROUGH HEATING ALLOWS BENDING OF NEARLY ALL THE DETAILS OF THE HULL. ACTUALLY ONLY SOME SPECIFIC DETAILS ARE BENT BY OTHER EQUIPMENT.
COMPARATIVELY INTENSIVE PROGRAM WITH HIGH QUALITY OF THE WORK IS REACHED IN FIELD WELDING SECTORS EVENTHOUGH THEY ARE NOT COMPLETED YET BECAUSE OF THE LACK OF THE MORE EXACT ERECTION LINES. AUTOMATIC FLUX WELDING AND SHIELDED ARC WELDING ARE THE WELDING METHODS APPLICABLE IN THESE SECTORS.
WE ARE COMMISSIONING NOW A STAND FOR SINGLE RUN WELDING OF THE PANELS.
THE SLIPWAY IS ONE OF THE SECTORS WITH ADVANCED DEVELOPMENT DURING THE PAST YEARS.
IN THE BEGINING THE SLIPWAY CAPACITY ALLOWED BUILDING OF VESSEL HULLS HAVING A LAUNCHING WEIGHT UP TO 400 TONS.
SECTION METHOD IS APPLIED WHEN THE HULLS ARE DRAWN ON THE TACKLE WAY UP TO THE LAUNCHING UNIT AND THEN LAUNCHED IN THE WATER BY MEANS OF SIDE UNCONTROLLABLE LAUNCHING. THE IMPLEMENTATION OF THE NEW LAUNCHING UNIT AND THE SLIPWAY N 1 CHANGED COMPLETELY THE PROCESS OF SLIPWAY ERECTION OF THE VESSEL.
THE LAUNCHING UNIT ALLOWS LAUNCHING AND TAKING OUT FOR MAINTENANCE OF THE VESSELS AND EQUIPMENT HAVING A LAUNCHING WEIGHT OF 7 200 T. THESE ARE THE LIMITATIONS FOR VESSELS BUILDING AND MAINTENANCE OF KORDSO CO. THE SLIPWAY EQUIPMENT INCLUDES SUPPORT BARS LIFTED BY HYDRAULIC TROLLEYS. THIS EQUIPMENT ALLOWS BLOCK METHOD APPLICATION IN BUILDING OF THE HULL. THE ABOVEMENTIONED METHOD TOGETHER WITH THE ON-LINE LABOUR ORGANIZATION WAS TESTED AND ADOPTED IN BUILDING OF 5 000 TONS TANKERS TYPE 'KASPIA'.
THE EXPERIENCE GAINED IN THE PERIOD OF MAINTENANCE OF THIS SLIPWAY

KORBSO, Shipbuilding & Shiprepair Co



LEGEND:

① Open/outdoor/Storage Complex
② Zero line
③ Steel Shop
④ Assembly-welding Shop
⑤ Open Slipways
⑥ Transport Shop
⑦ Hoisting-Launching Complex
⑧ Electro-assembly Shop
⑨ Block of Shiprepairing Shops
⑩ Erecting Shiprepairing Shops
⑪ Jaught Club
⑫ Erecting Shops and Stores
⑬ Erecting Block
⑭ Electroplating Shop
⑮ Ship's Outfitting Shop

CONSTRUCTIVE AND TECHNOLOGICAL PECULIARITIES IN DESIGNING AND BUILDING OF THE FERRRO-CONCRETE VESSELS, VESSELS FOR PUBLIC SERVICES AND VESSELS FOR PLANTS

ENG. H.NAIDENOV

IT IS WELL KNOWN THAT BUILDING OF THE FLOATING CRAFTS AND SOME TYPES OF THE TRANSPORT VESSELS OF FERRO-CONCRETE IS ECONOCMIC AND REASONABLE. MORE THAN 60% OF THE STEEL IS SAVED WHEN FERRO-CONCRETE IS USED AS CONSTRUCTION MATERIAL IN BUILDING THE VESSELS HULLS AND FLOATING DEVICES. FERRO-CONCRETE VESSELS LIFE TIME EXCEEDS THE ONE OF THE WOODEN AND STEEL VESSELS 2-3 TIMES AND THE MAINTENANCE EXPENSES OF THE FERRO-CONCRETE VESSELS ARE 6-8 TIMES SMALLER THAN THE ONE MADE FOR THE STEEL VESSELS.

BULGARIA IS ON ONE OF THE FIRST PLACES IN THE WORLD LIST OF THE MANUFACTURERS OF FERRO-CONCRETE FLOATING CRAFTS.

EVENTHOUGH THERE IS SOME SUCCESS IN THE FIELD OF THE TECHNOLOGY, MACHINES PROVISION AND ORGANIZATION OF THE PRODUCTION, THE PRODUCTION TECHNICAL LEVEL OF THE MANUFACTURERS OF THE FERRO-CONCRETE VESSELS, THEIR CULTURE AND ECONOMIC FEATURES ARE SERIOUSLY BEHIND THE INDUSTRIAL AND CIVIL FERRO-CONCRETE BUILDING.

IN TECHNOLOGICAL ASPECT THE FERRO-CONCRETE SHIPBUILDING HAS NUMEROUS SERIOUS OPEN PROBLEMS. THE BASIS FOR SHIPBUILDING DEVELOPMENT IS IMPROVEMENT OF THE TECHNOLOGY AND PRODUCTION ORGANIZATION, IMPLEMENTATION OF THE COMPLEX MACHINES, USE OF NEW EFFICIENT MATERIALS, DESIGN OF THE QUALITATIVE TECHNOLOGICAL STRUCTURES.

BUILDING OF THE FERRO-CONCRETE VESSELS AND FLOATING CRAFTS HAS MANY COMMON FEATURES WITH BUILDING OF THE INDUSTRIAL FERRO-CONCRETE UNITS THAT IS WHY IN THE BEGINING THE MONOLITHIC METHOD WAS APPLIED IN SHIPBUILDING AND ON A LATER STAGE WHEN PREFABRICATION AND PREFABRICATION-MONOLITHIC COMPLEX METHOD WERE APPLIED IN THE INDUSTRIAL AND CIVIL BUILDING THEY WERE ACCEPTED IN SHIPBUILDING AS WELL.

THE MONOLITHIC METHOD WAS APPLIED FOR BUILDING OF DIFFERENT VESSELS WORLDWIDE SUCH AS: TANKERS, SUBMARINES, PONTOON CRANES, LANDING STAGES, BARGES, FISH PLANTS, FLOATING HOTELS, FLOATING DOCKS WITH LIFTING ABILITIES IN THE RANGE OF 6 000 TO 8 000 TONS ETC.

WHEN THIS METHOD IS APPLIED ALL THE WORK STEPS CONNECTED WITH BUILDING OF THE FERRO-CONCRETE HULLS STARTING WITH BUILDING BERTH SUPPORTS, FLOOR COVERING, SHUTTERING, REINFORCEMENT INSTALLATION AND CONCRETE APPLICATION IS DONE AT THE BUILDING BERTH. THANKS TO THE SIMPLICITY OF THE MONOLITHIC METHOD BUILDING OF THE FERRO-CONCRETE VESSELS IS EASILY ADOPTED BY WORKERS WITH LOW DEGREE OF QUALIFICATION.

EVEN TODAY MONOLITHIC METHOD REMAINS THE BASIC METHOD FOR BUILDING A FEW NUMBER OF VESELS. THE MONOLITHIC METHOD DOES NOT REQUIRE EXPENSIVE AND COMPLICATED PROCESS EQUIPMENT, IT HAS COMPERATIVELY SIMPLE BUILDING ORGANIZATION. IT IS AN EFFICIENT METHOD AND HAS WIDE APPLICATION ALTHOUGH ITS BIG DISADVANTAGES ARE WELL KNOWN: LONG TERM OF THE BUILDING BERTH STAGE OF THE VESSEL, DEPENDANCE

FROM THE SEASON, GREAT LABOUR CONSUMPTION OF THE BUILDING BERTH WORKS, DIFFICULTIES IN MACHINES APPLICATION AT VARIOUS BUILDING STAGES.
AT THE END OF THE FIFTIES A TENDENCY TOWARDS ELIMINATION OF THE DISADVANTAGES OF THE MONOLITHIC METHOD BY MEANS OF THE PROCESS INDUSTRIALIZATION WAS EVIDENT. THIS PROBLEM WAS SOLVED APPLYING PREFABRICATION AND PREFABRICATION-MONOLITHIC METHOD. AT FIRST FRAMEWORKS, BARS (KEELSONS, CARLINGS AND LOCAL REINFORCEMENT) AND BULKHEADS WERE APPLIED.THESE OF COURSE WERE TRIALS TO IMPROVE THE MONOLITHIC METHOD. PREFABRICATION OF THE HULL INTERNAL ELEMENTS AND OF THE EXTERNAL ELEMENTS WAS IMPLEMENTED ON A LATER STAGE. AROUND SIXTIES PURE PREFABRICATION METHODS WERE APPLIED FOR SOME TYPES OF HULLS ALLOWING THIS - RIBLESS SECTIONS FOR SMALLER VESSELS WHICH BROUGHT TO 90-95% INDUSTRIALIZATION ESPECIALLY IN BATCH PRODUCTION.
PREPARATION AND PROVISION OF THE REQUIRED PROCESS EQUIPMENT AND UNITS SHOULD PRECEDE THE APPLICATION OF THE PREFABRICATION AND MONOLITHIC-PREFEBRICATION METHOD. THAT MEANS AVAILABILITY OF INERT MATERIALS TREATMENT UNIT, CONCRETE PRODUCTION UNIT, PREFABRICATION SHOP, MOULDING SHOP, STEAMING BOATS AND ADEQUATE CRANES PROVISION AT BUILDING BERTH STAGES AND HULL LAUNCHING DEVICES.
THE MATERIALS USED FOR FERFO-CONCRETE SHIPBUILDING DO NOT DIFFER CONSIDERABLY FROM THOSE REQUIRED FOR HIGH-RISE BUILDING BUT SOME SPECIAL QUALITY FEATURES SHOULD BE CONSIDERED DEPENDING ON THE HULLS APPLICATION LOCATION.
WATER TIGHTNESS AND FROST RESISTANCE SHOULD BE CONSIDERED FOR CONCRETE USED FOR SHIP HULLS WORKING IN LOW TEMPERATURE AREAS.SEA WATER RESISTANCE IS REACHED BY USING SULPHATE-RESISTANCE PORTLAND CEMENT.

SPECIAL REQUIREMENTS DO NOT EXIST FOR THE REINFORCEMENT EXEPT USING KILLED OR SEMI-KILLED STEEL DEPENDING ON THE AREA OF APPLICATION.
SMOOTH AND WELL TIGHTENED SHUTTERING IS STRICTLY REQUIRED FOR EACH OF THE CASES IN ORDER TO AVOID CEMENT OUTFLOW AND TO ENSURE SMOOTH CONCRETE SURFACE.
THE INERT MATERIALS SUCH AS GRAVEL AND SAND SHOULD BE WASHED WELL AND SHOULD COVER THE REQUIRED GRAIN SIZE. GRAVEL GRAIN SIZE SHOULD NOT EXCEED 1/5 UP TO 1/4 OF THE THICKNESS OF THE HULL CONSTRUCTION MATERIALS.
THE CONCRETE SHOULD BE DESIGNED FOR DOSING OF THE RELEVANT COMPOUND MATERIALS BY WEIGHT AND OF THE WATER IN LITRES AND THIS SHOULD BE STRICTLY FOLLOWED IN ORDER TO PROVIDE THE REQUIRED CONSISTENCY OF THE CONCRETE. THE CONSISTENCY OF THE CONCRETE USED FOR THE HORIZONTAL CONSTRUCTION ELEMENTS SHOULD BE IN THE LIMITS OF SL = 9-12 CM AND OF THE ONE USED FOR THE VERTICAL ELEMENTS - SL = 16-19 CM.

POTABLE WATER SHOULD BE USED FOR CONCRETE PREPARATION.
FERRO-CONCRETE SHIPBUILDING DEVELOPMENT DESCRIBES THE ADVANTAGES OF THE FERRO-CONCRETE VESSELS OVER THE STEEL ONE AS FOLLOWS:

1. METAL SAVING USING CONCRETE FOLLOWING THE RELEVANT POSITIONING OF THE STEEL IN THE VESSEL CONSTRUCTION ELEMENTS: FERRO-CONCRETE HULL BUILDING REQUIRES 1,5 - 3 TIMES LESS STEEL THAN THE ONE REQUIRED FOR THE SIMILAR STEEL VESSEL.
   REPAIR WORKS ALSO REQUIRE LESS STEEL. AS A RESULT OF THIS THE TOTAL STEEL CONSUMPTION IS 2 TO 4 TIMES LESS THAN THE ONE REQUIRED FOR THE STEEL VESSELS. FERRO-CONCRETE SHIP-BUILDING REQUIRES CHEAPER STEEL COMPARED TO THE NOT READILY AVAILABLE SHEET STEEL AND SHAPED IRON USED FOR THE STEEL VESSELS
2. THE CONCRETE USED IN THE SHIPBUILDING DURING THE SHIP LIFE IS NOT DESTRUCTED FROM THE CORROSION AS IT IS DONE WITH THE STEEL, THE STRENGHT AND THE OTHER PROPERTIES ARE NOT INFLUENCED ALSO. THANKS TO THIS THE FERRO-CONCRETE VESSELS DO NOT REQUIRE MAINTENANCE AT REGULAR INTERVALS, LONG STAY ON DOCKS, LIFTING OR SYNCHRONIZED LIFT FOR PAINTING WHICH IS REQUIRED FOR THE STEEL VESSELS.
3. THE LONG LIFE OF THE VESSELS (HULLS) WHICH IS 1,5 TO 2 TIMES LONGER AND THE ABOVEMENTIONED PROPERTIES AT NORMAL OPERATING CONDITIONS IS A GUARANTEE THAT THE VESSELS AGE MUCH MORE MORALLY THAN PHYSICALLY. IT IS ACCEPTED THAT THE LIFE OF THOSE VESSELS IS 70 - 80 YEARS I.E. 1,5 OR 2,5 TIMES LONGER THAN THE ONE OF THE STEEL VESSELS.
4. SIMPLICITY OF THE REPAIR WORKS. REPAIRS CAN BE EASILY DONE BY THE CREW ITSELF WHICH IS NOT ALWAYS POSSIBLE WITH THE STEEL VESSELS.
5. BUILDING ORGANIZATION OF THE FERRO-CONCRETE VESSELS IS COMPARATIVELY SIMPLE AND CHEAP ESPECIALLY IN CASE OF PRODUCTION IN SERIES.
6. HIGH HEATRESISTANCE WHICH IN THE MOST OF THE CASES IS BETTER THAN THE ONE OF THE STEEL VESSELS. IT IS IMPORTANT TO KNOW THAT THERE IS MUCH BETTER RESISTANCE AT THE INFLUENCE OF SOME OF THE HARMFUL CHEMICALS ALSO.

IN THE SAME TIME THE DISADVANTAGES OF THE FERRO-CONCRETE VESSELS OVER THE STEEL ONE ARE AS FOLLOWS:

1. THE 1,5 TO 2,5 TIMES BIGGER WEIGHT OF THE FERRO-CONCRETE VESSEL THAN THE ONE OF THE STEEL VESSEL RESULTS IN BIGGER DRAFT OR IN CASE OF EQUAL DRAFT IT RESULTS IN BIGGER OVERALL DIMENSIONS.
2. REDUCED RESISTANCE OF THE THIN WALLS OF THE FERRO-CONCRETE

STRUCTURES TO THE DYNAMIC AND ESPECIALLY CONCENTRATED CARGOS. THIS IS OF GREAT IMPORTANCE FOR PLATING OF THE VESSEL BOARD AND TRANSOM, FOR THE BOTTOM AND LOAD AREA DECKING WHICH ARE UNDER KNOCKS AND SHOCKS IN CASE OF SHEET-ANCHORING, ICE LOAD, SLUDGE STRANDING, DRIFT SHOCKS ETC. THOSE LOADS MAY CAUSE FORMING OF THE CRACKS, LOCAL DESTRUCTIONS AND BREACHES, WATER TIGHTNESS BREAKDOWN AND SOMETIMES IT WILL RESULT IN HULL STRENGHT LOSS. IN THIS CASE THE REQUIRED VESSEL' RELIABILITY WILL BE REACHED BY INCREASING THE WEIGHT OF THE HULL AND MAKING ITS STRUCTURE MORE COMPLICATED AND BY APPLYING THE REQUIRED ADDITIONAL PROTECTION DEVICES.

3. LACK OF ADAPTION ABILITIES FOR FUTURE MODERNIZATION OF THE HULL OR REINFORCEMENT AND CHANGING OF ITS PARTS. THIS IS BECAUSE SIMPLE AND RELIABLE METHODS OF ATTACHMENT OF NEW STRUCTURES TO THE FERRO-CONCRETE DO NOT EXIST.
4. RATHER HIGH CRITERIA FOR FLOODABILITY PROVISION SINCE THE STRENGHT OF THE OUTER SHEATHING IS LOWER THAN THE ONE OF THE STEEL HULL. PROVISION OF THE REQUIRED FLOODABILITY OFTEN RESULTS IN INCREASING OF THE WATERTIGHT BULKHEADS AND THEREFORE THE ROOMS USE IS DETERIORATED.
5. WEATHER CONDITIONS INFLUENCE ON THE PROGRESS OF BUILDING WORK. IN CASE OF TEMPERATURE BELOW 0°C THE WORK GETS VERY COMPLICATED AND SOMETIMES IT IS JUST IMPOSSIBLE TO WORK.

THE ABOVEMENTIONED PECULIARITIES OF THE FERRO-CONCRETE VESSELS DO HAVE GREAT INFLUENCE ON TAKING A DECISION FOR RESIONABLE IMPLEMENTATION OF THE FERRO-CONCRETE AS SHIPBUILDING MATERIAL.
SHIPBUILDING INDUSTRY NORMALLY USES NORMAL FERRO-CONCRETE CONSISTING OF NORMAL CONCRETE (WITH NATURAL FILLERS) AND REINFORCING STEEL BARS OF LOW AND AVERAGE STRENGHT AND AS A RESULT OF THIS THE HULLS ARE HEAVY AND STEEL CONSUMING. THE APPLICATION OF LIGHT CONCRETE MADE OF ARTIFICAIL FILLERS (SUCH AS EXPANDED CLAY AGGREGATE ETC) REDUCES THE HULL WEIGHT OF 15 - 20% AND USE OF HIGH RESISTANCE STEEL TOGETHER WITH PRESTRESSED REINFORCED CONCRETE REDUCES THE STEEL CONSUMPTION OF 30 - 35% AND CONCRETE CONSUMPTION OF 10 - 20% COMPARED TO THE NORMAL CONCRETE AND STEEL APPLICATION. ANOTHER ADVANTAGE OF THE PRESTRESSED REINFORCED CONCRETE IS THE INCREASED STRENGHT OF THE SHEATHING.
USE OF THE LIGHT CONCRETE AND ESPECIALLY PRESTRESSED REINFORCED CONCRETE INCREASES THE HULL COST.
APPLICATION OF THE FERROCEMENT AND FIBRECEMENT (WITH GLASS FIBRE) IS ESPECIALLY ADVANTEGEOUS IN SMALL VESSELS SUCH AS FISHING BOATS AND YACHTS BECAUSE THE STEEL CONSUMPTION IS REDUCED BUT THE COST OF THE HULL IS INCREASED.
EXCEPT FOR THE HULL BUILDING FERRO-CONCRETE CAN BE USED FOR THE SUPERSTRUCTURES WHERE THE REQUIREMENTS FOR FIRE RESISTANCE IS MUCH MORE STRICT.

FERRO-CONCRETE APPLICATION HELPS CREATING A PERFECT ARCHITECTURE AND LONG LIFE AND THE HULL DRAFT INCREASES WITH 5 TO 10 CM IN CASE OF SUPERSTRUCTURE OF 1 OR 2 FLOORS.
BUILDING OF SMALL NUMBER OF FERRO-CONCRETE HULLS IN THE COUNTRIES WHERE SPECIAL LAUNCHING DEVICES ARE MISSING CAN BE DONE IN BASINS DIGGED FOR THAT PURPOSE SURROUNDED BY DYKES. THE BASIN IS FILLED WITH WATER WHEN THE HULL IS READY AND THEN IT IS TAKEN OUT OF IT. ANCTHER ALTERNATIVE IS USING THE DRY PERIOD AND THE LOW RIVER LEVEL FOR BUILDING AND WHEN THE HIGH WATER COMES THE HULL IS TAKEN OUT.

THE VARIETY OF THE FERRO-CONCRETE VESSELS DEPENDING ON THEIR APPLICATION IS AS FOLLOWS:

1. VESSELS FOR PLANTS

1.1 SOFT DRINKS PRODUCTION PLANT
1.2 BREAD MAKING PLANT
1.3 PROCESSING DAIRY
1.4 MEAT PROCESSING PLANT
1.5 METAL ARTICLES PRODUCTION PLANT
1.6 WOOD PROCESSING PLANT
1.7 FLOATING POWER STATION
1.8 FLOATING PUMP STATION
1.9 FLOATING DOCKS
1.10FLOATING CRANES
1.11FLOATING PREFABRICATION SHOP FOR FERRO-CONCRETE ELEMENTS AND OTHERS.

2. VESSELS FOR PUBLIC SERVICES

2.1 FLOATING PARKING PLACES
2.2 FLOATING SCHOOL
2.3 FLOATING HOSPITAL
2.4 FLOATING HOTEL
2.5 FLOATING RESTAURANT
2.6 FLOATING HOSTEL
2.7 FLOATING SHOP
2.8 FLOATING ENTERTAINMENT ISLANDS
2.9 FLOATING STORAGES FOR INERT MATERIALS, CEMENT, CORN ETC.
2.10COMPRESSOR STATION AND OTHERS.

3. FLOATING EQUIPMENT

3.1 FLOATING PIERS
3.2 FLOATING BRIDGES
3.3 FLOATING TRANSPORT BRIDGES
3.4 FLOATING PORTS
3.5 FLOATING MOLES AND OTHERS.

LIST OF THE FERRO-CONCRETE HULLS FOR THE VESSELS AND EQUIPMENT BUILT FROM 1942 UP TO 1991

NO	DESCRIPTION	QUANTITY (PCS)	DIMENSIONS (METERS)		
1	3200 T TANKERS	3	L=96	B=14	H=8
2	BARGES	20	L=42	B=9,0	H=2,8
3	FISH PROCESSING PLANTS	15	L=42	B=9,0	H=2,8
4	FLOATING HOTELS(100 BEDS)	20	L=67	B=13	H=4,3
5	PANELS FOR PIERS WALLS	12	L=20	B=10	H=11,8
6	FLOATING REPAIR SHOPS	215	L=62	B=13	H=3,70
7	BATHY-WALL	2	L=44,0	B=10	H=11,5
			L=32	B=9	H=9,5
8	FLOATING PEDESTRIANS		L=63	B=5,5	H=2,10
	BRIDGE MADE OF 3 BLOCKS		L=58	B=5,5	H=2,10
			L=30	B=5,5	H=2,10
9	FLOATING PUMP STATION	1	L=44	B=13	H=3,70

TOTAL LENGHT OF 16,92 KILOMETERS OF 291 HULLS BUILT IN THE TOWN OF VARNA WILL BE REACHED IF THEY ARE PUTTED ONE AFTER THE OTHER. TECHNICAL PROPERTIES AND ECONOMIC INDEXES ARE ESPECIALLY VALUABLE AS DESIGN BASIS FOR CHOOSING THE MAIN DIMENSIONS (L B H) OF THE FERRO-CONCRETE HULLS:

1. WEIGHT MODULE FOR $1M^3$ LBH OF THE VESSEL – CONSUMPTION = 0,20 – 0,47 TONS
2. WEIGHT MODULE FOR $1M^3$ LBH OF THE HULL – CONSUMPTION = 0,19 – 0,28 TONS
3. CONSUMPTION OF CONCRETE FOR $1M^3$ LBH OF THE HULL – CONSUMPTION = 0,07 – 0,10 M
4. CONSUMPTION OF REINFORCEMENT STEEL FOR $1M^3$ LBH OF THE HULL – CONSUMPTION = 0,02 – 0,03 TONS
5. CONSUMPTION OF CEMENT FOR $1M^3$ LBH OF THE HULL – CONSUMPTION = 0,04 – 0,05 TONS

ATTACHMENTS

ATTACHMENT 1 - DIAGRAM OF THE FERRO-CONCRETE HULLS BUILT BY DIFFERENT METHODS IN THE WORLD UP TO 1983

ATTACHMENT 2 - DIAGRAM OF THE FERRO-CONCRETE HULLS DEFINED BY NUMBERS AND LENGHT UP TO 1983

ATTACHMENT 3 - LIST OF THE COUNTRIES BUILDING FERRO-CONCRETE VESSELS AND EQUIPMENT UP TO 1983

Fig.1 NUMBER OF BARGE/PONTOON HULLS BUILT IN THE PERIOD 1950 – 1982

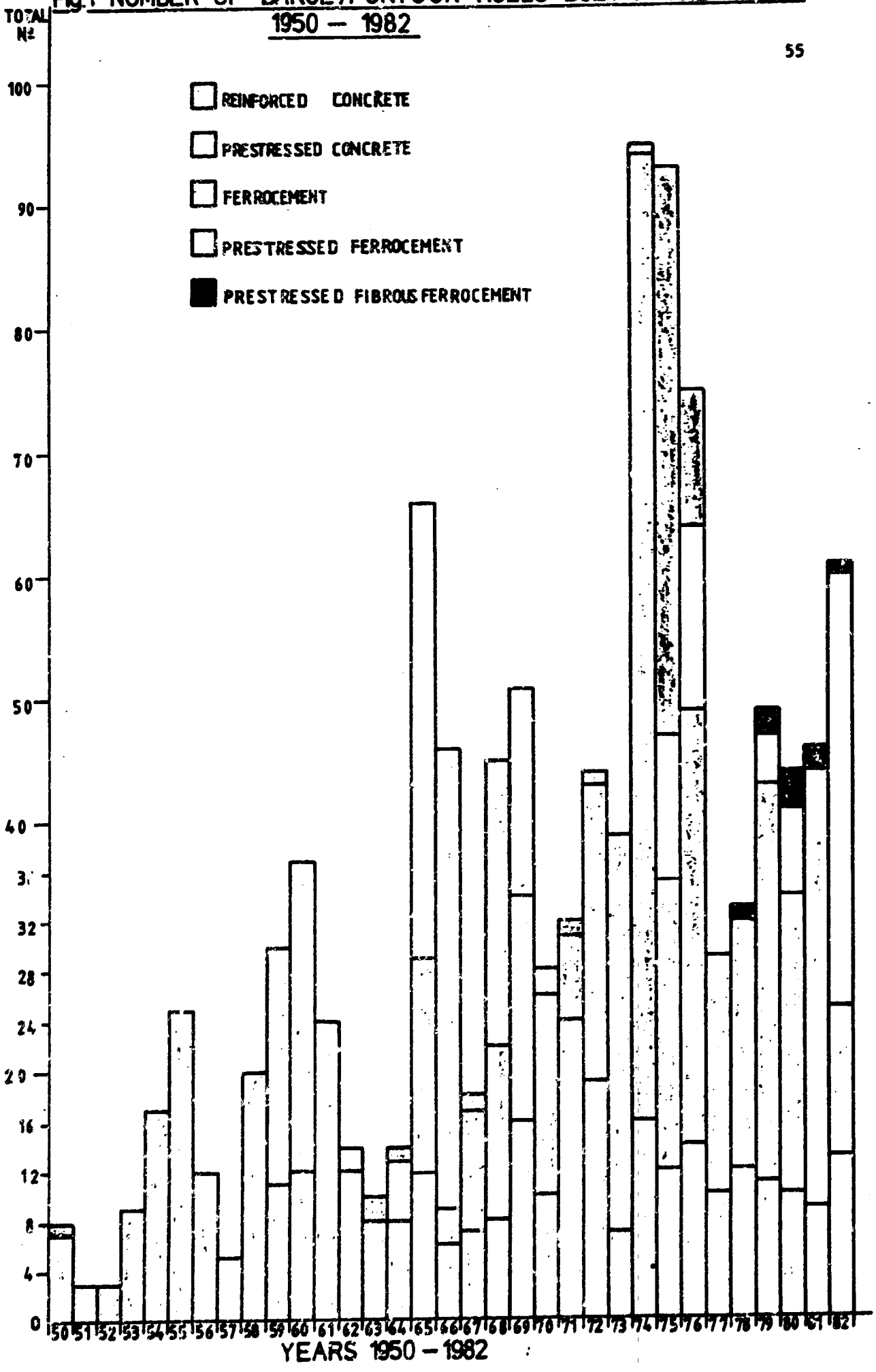


Fig.2 NUMBER OF BARGE/PONTOON HULLS OF A PARTICULAR LENGTH

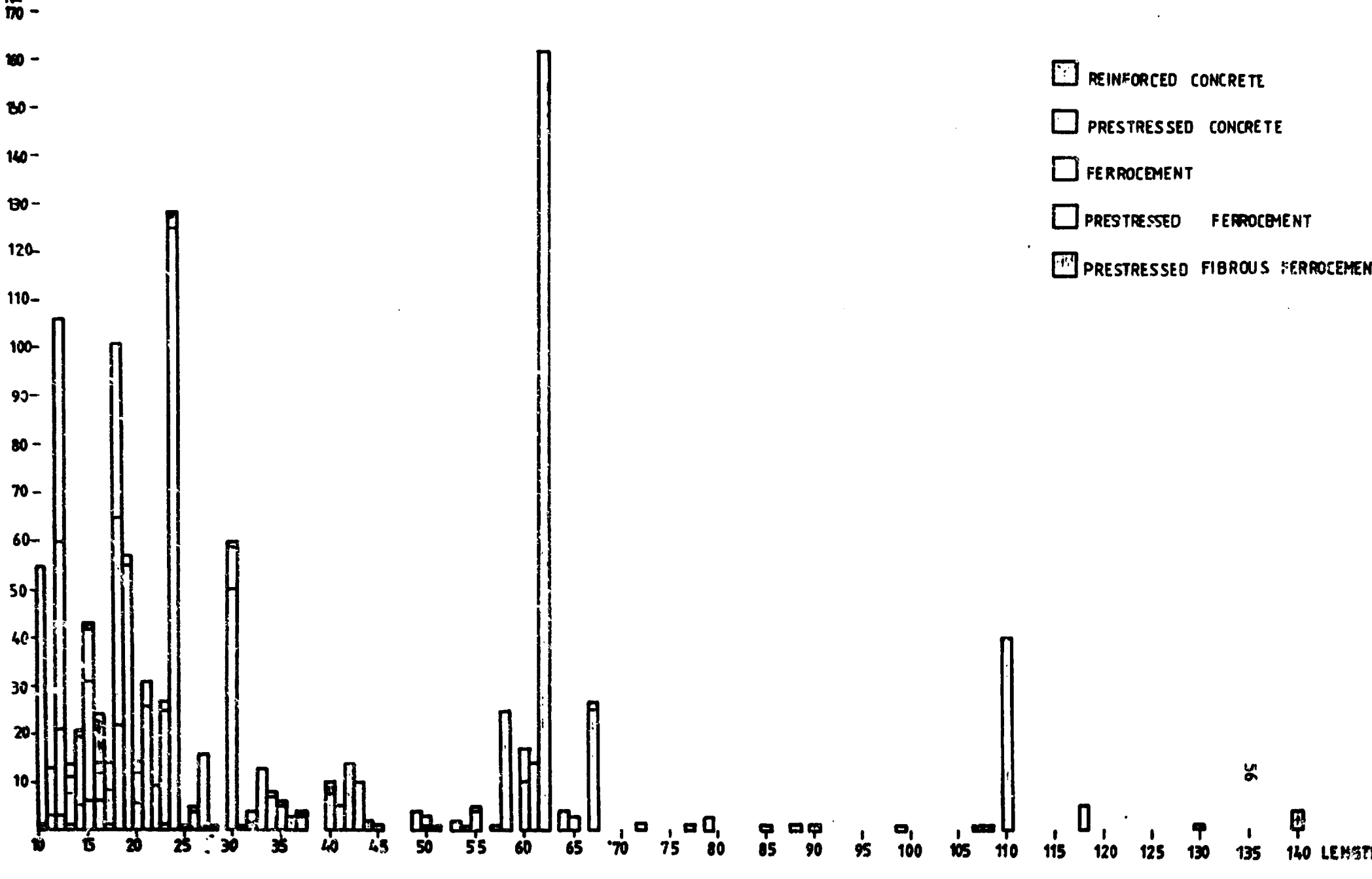
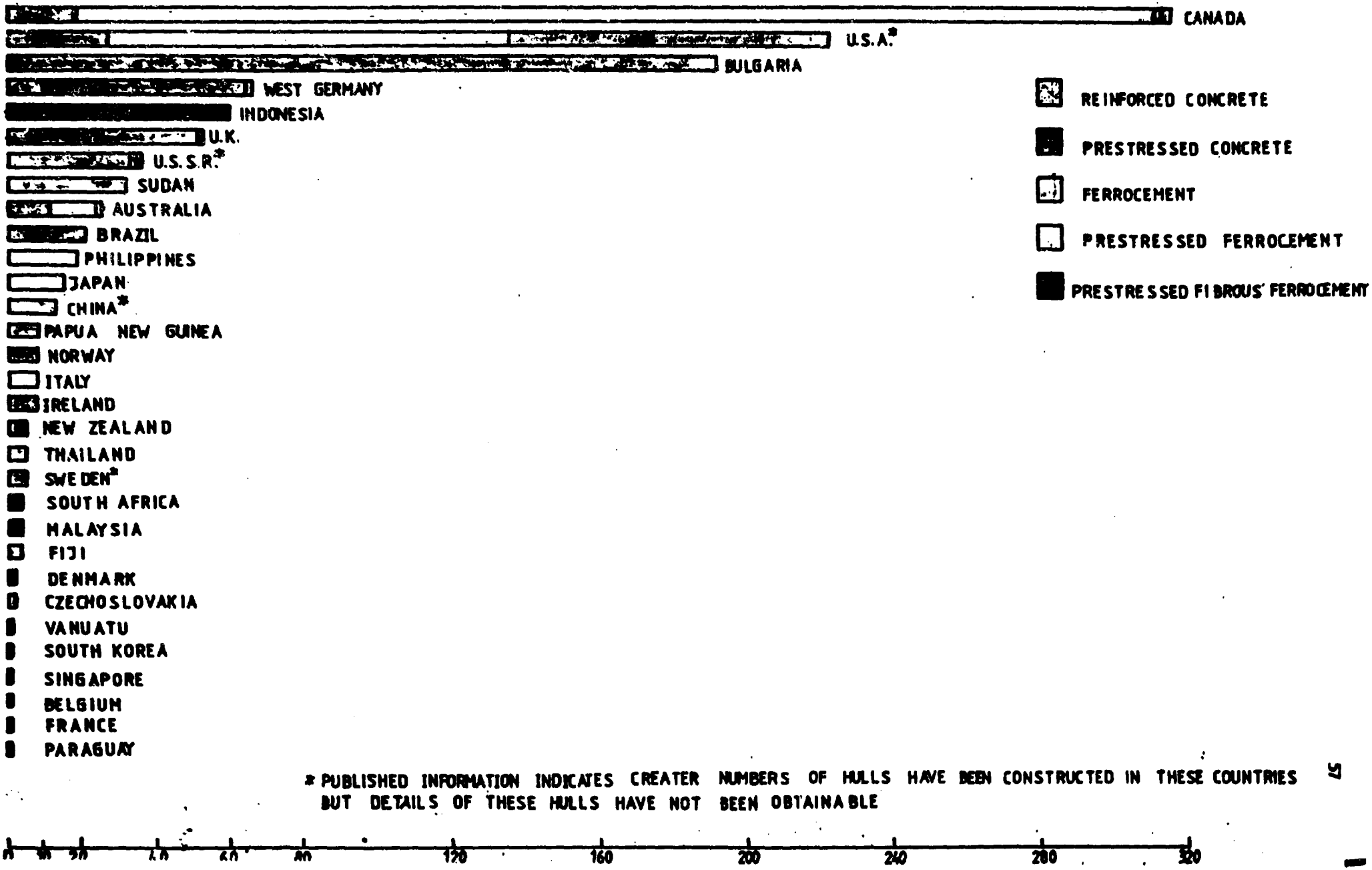


Fig3 TOTAL NUMBER OF BARGE/PONTOON HULLS OF VARIOUS MATERIALS BUILT IN EACH COUNTRY 1950-1982



* PUBLISHED INFORMATION INDICATES GREATER NUMBERS OF HULLS HAVE BEEN CONSTRUCTED IN THESE COUNTRIES BUT DETAILS OF THESE HULLS HAVE NOT BEEN OBTAINABLE

FERRO-CONCRETE FLOATING CRAFTS FOR PUBLIC SERVICES AND FOR PLANTS

ARCHITECT S.PETROV

THE FERRO-CONCRETE VESSELS ARE CONSIDERED SPECIFIC BECAUSE THEIR HULL IS NOT MADE OF THE CONVENTIONAL STEEL AND WOOD MATERIALS. THE SUBJECT OF THE PRESENT STUDY CONCERNS THE MORE SPECIFIC FERRO - CONCRETE VESSELS WHICH DURING THE MAINTENANCE PERIOD ARE FIXED, NOT SELF-MOVING.
THE ABOVEMENTIONED IS A GOOD REASON TO CALL THEM FLOATING CRAFTS IN ORDER TO DISTINGUISH THEM FROM THE WIDE CONCEPT 'VESSELS' AND TO BRING THE DISCUSSION TO ITS MORE SPECIFIC LIMITS.
THE FLOATING CRAFTS MAY HAVE VARIETY OF PROPERTIES DEPENDING ON FUNCTIONAL ABILITIES, SERVICE CONDITIONS, EQUIPMENT PROVISION, BUILDING METHODS, DESIGN SOLUTIONS ETC.
THE PRESENT STUDY OF THE FERRO-CONCRETE CRAFTS WILL COVER IN DETAILS SOME MORE SPECIFIC QUESTIONS.
WITHOUT CALLING IT CLASSIFICATION WE WILL ALLOW OURSELVS TO FORM TWO GROUPS OF FLOATING CRAFTS FOR WHICH WE HAVE DONE SOME STUDIES AND WE CAN ILLUSTRATE THEM. THE GROUPS ARE AS FOLLOWS:
- FLOATING FERRO-CONCRETE CRAFTS FOR PUBLIC SERVICES;
- FLOATING FERRO-CONCRETE CRAFTS FOR PLANTS.
REFERING TO THE FIRST GROUP HEREABOVE WE CAN PRESENT DESIGNS FOR A HOTEL, RESTAURANT, HOSPITAL, HOSTEL, PUBLIC SERVICES, GARAGES.
THE SECOND GROUP IS ILLUSTRATED BY DAIRY PLANT, BREAD MAKING PLANT, SOFT DRINKS MANUFACTURING PLANT, WATER DESALINATION PLANT, POWER STATION, MECHANICAL SHOP.
THE FLOATING CRAFTS OF BOTH GROUPS HAVE SUCH CHARACTERISTICS THAT MAKE THEM ATTRACTIVE FOR SOLVING MORE SPECIFIC REGIONAL, SOCIAL, ECONOMIC, COMMUNICATION, URBANIZATION, ENVIRONMENT AND OTHER PROBLEMS.
DIFFERENT REGIONS WORLDWIDE ARE CHARACTERIZED BY DIFFERENT NATURE SPOTS WHERE THE SOCIAL AND ECONOMIC NEEDS ARE IMPEDED BECAUSE OF THE LACK OF ACCESSABILITY.
OUR INTEREST IS DIRECTED TO THE REGIONS WHERE RIVERS, LAKES, CHANNELS EXIST AND THE EXPENSIVE DOCK EQUIPMENT IS NOT AVAILABLE.
WE ARE NOT GOING TO GO IN DETAILS WHERE AND HOW THE FLOATING CRAFTS CAN BE USED BUT WE WOULD LIKE TO MENTION THAT THE SPECIFIC CONDITIONS RAISE SPECIFIC PROBLEMS AND THAT THE COMMON PROBLEMS REFER TO THE AVAILABILITY OF SMALL OR BIG HUMAN SOCIETY, ECONOMIC AND SOCIAL STATE POLICY ETC. WHEN A REGION IS NOT ACCESSIBLE BY LAND OR GREAT INVESTMENT IS REQUIRED TO ESTABLISH SUCH AND IF WATER COMMUNICATION IS AVAILABLE IT IS JUST NATURAL TO USE IT FOR SOLVING THE COMMUNICATION PROBLEM EVEN IF IT IS A TEMPORARY SOLUTION.
A GOOD EXAMPLE OF THE ABOVEMENTIONED IS BRAZIL WHERE GREAT REGIONS INSIDE THE COUNTRY ARE ACCESSIBLE MAINLY BY WATER.
WHEN FERRO-CONCRETE FLOATING CRAFTS ARE USED THEN CERTAIN REGIONS BECOME NOT ONLY ACCESSIBLE AND WELL SERVICED BUT THEY CAN TURN INTO CENTRES FOR THE SURROUNDINGS.

THERE ARE UNLIMITED POSSIBILITIES FOR INSTALLING EQUIPMENT DIFFERENT BY SIZE, VOLUME AND TYPE ON THE FLOATING CRAFTS SINCE THIS CAN BE DONE IN THE INDUSTRIAL CONDITIONS WHERE HIGH INDUSTRIAL LEVEL AND HUMAN RESOURCES ARE AVAILABLE. THE IMPORTANT ADVANTAGE OF THE FLOATING FERRO-CONCRETE CRAFTS IS THAT WHEN THEIR SERVICES ARE NOT REQUIRED ANYMORE THEY CAN BE MOVED IN THE OTHER REGIONS WITHOUT CHANGING THE BASIC INVESTMENT AS IT IS REQUIRED WITH THE ON LAND DEVICES. THIS ALTERNATIVE FOR QUICK MOVE IN THE OTHER REGION CAN BE FOR LONG PERIOD OF TIME OR IN CASE OF DISASTER, EPIDEMIC, CREATING PROPER LIVING CONDITIONS ETC. THE AGGRESSIVE ENVIRONMENT CREATED BY THE WATER IS THE REASON FOR MAKING PERIODIC MAINTENANCE AND REPAIR WORKS OF THIS PART OF THE FLOATING CRAFT WHICH IS UNDER WATER. IT IS WELL KNOWN THAT THE FERRO-CONCRETE STRUCTURE DOES NOT NEED SUCH MAINTENANCE OPERATIONS WHICH MAKES IT VERY SUITABLE FOR THE QUOTED CASES.
FLOATING CRAFTS STUDY FROM THE TECHNICAL POINT OF VIEW DEPENDS ON THEIR SPECIFIC PECULIARITIES, FIELD OF APPLICATION, PROVISION OF EQUIPMENT, AREA AND MAINTENANCE CONDITIONS.
TECHNICAL AND ECONOMIC FACTORS ARE MUCH MORE COMPLEX BECAUSE THEY DEPEND ON DETAIL PROBLEM EVALUATION. THIS PROBLEM IS NOT A SUBJECT OF THE PRESENT STUDY.
WHAT ARE THE MORE IMPORTANT GENERAL TECHNICAL PECULIARITIES CONNECTED WITH THE DESIGN AND STRUCTURE OF THE FLOATING FERRO-CONCRETE CRAFTS.
THE QUESTIONS CONCERNING THE CHARACTERISTIC OF THE STRUCTURE AND MATERIALS OF THE FERRO-CONCRETE HULLS MAY BE STUDIED SEPARATELY BECAUSE OF THEIR SPECIFIC NATURE. BUT THEIR COUPLING TO THE REMAINING SECTIONS OF THE CRAFT BRINGS NUMEROUS QUESTIONS REQUIRING GENERAL SOLUTION OF THE PROBLEMS.
THE EXPERIENCE GAINED WITH THE ABOVEMENTIONED PRELIMINARY DESIGNS ALLOWS US MAKING THE FOLLOWING GENERAL SOLUTIONS:

- IN ORDER TO IMPROVE THE TECHNICAL AND ECONOMIC PROPERTIES WHEN SEVERAL FLOATING CRAFTS ARE BUILT IT IS REASONABLE THE HULLS STRUCTURE TO BE OF ONE AND THE SAME TYPE I.E. IN GENERAL THE SIMILARITY SHOULD BE IN DIMENSIONS, FORM, LONGITUDINAL AND TRANSVERSE ELEMENTS, BULKHEADS ETC. IT IS ACCEPTABLE TO HAVE DIFFERENT DECK OPENINGS, FOUNDATIONS FOR EQUIPMENT AND MACHINES AND OTHER BUILT-IN ERECTION MATERIALS ETC.
  ANOTHER IMPORTANT QUESTION IS THE DETAIL STUDY OF THE STRENGHT CHARACTERISTIC OF THE HULL AND THE SUPERSTRUCTURE. IN CASE OF SIMULTANEOUS WORK ON THE HULL AND SUPERSTRUCTURE IT IS VERY IMPORTANT TO REACH A MONOLITHIC CONNECTION BETWEEN THEM CONSIDERING THAT THIS IS DEFINETELY INFLUENCING THE TOTAL CONSTRUCTION STRENGHT. THE SUPERSTRUCTURE IN THIS CASE IS OF CONVENTIONAL TYPE

MADE OF STEEL. HERE WE SHALL ALLOW OURSELVES TO DISCUSS ANOTHER DESIGN SOLUTION WHERE THE STEEL HULL IS DESIGNED AS A SEPARATE CONSTRUCTION ELEMENT WHICH CARRIES THE SUPERSTRUCTURE.AS AN ADDITIONAL FACTOR WE HAVE TO CONSIDER THE METHOD OF TRANSPORT FROM THE MANUFACTURER TO THE PLACE OF WORK AND WHETHER THIS IS DONE BY TOWBOAT AND WHAT ARE SEA TRANSPORT LIMITATIONS.
IN ANY CASE THE ALTERNATIVE STUDIED HEREIN WILL BRING TO INCREASED BUILDING COST OF THE HULL. THEN IT IS NATURAL TO ASK WHY IT IS NECESSARY TO STUDY SUCH ALTERNATIVE.

AS IT IS WELL KNOWN THE TECHNICAL AND ECONOMIC CONDITIONS SOMETIMES REQUIRE THE APPLICATION OF THE COMPLEX INSTALLATION METHODS IN THE COMPLETION CONSTRUCTION WORKS. THEREFORE A POSSIBILITY FOR APPLICATION OF CONSTRUCTION AND VOLUMETRIC MODULES IN THE COMPLETION ERECTION WORKS IS AVAILABLE.
THE SOLUTION WHETHER MONOLITHIC METHOD /HULL WITH SUPERSTRUCTURE/ OR COMPLEX INSTALLATION METHOD IS CHOOSED DEPENDS ON MANY FACTORS. BUT THIS IS A SUBJECT OF THE SEPARATE STUDY WHERE THE COMMON FEATURES OF THE INDUSTRIAL BUILDING AND SHIPBUILDING CAN BE USED. WE CAN ONLY MENTION AN ESSENTIAL PECULIARITY WHICH DISTINGUISH THE FERRRO-CONCRETE CRAFTS FROM THE CONVENTIONAL SHIP STRUCTURES.
CONVENTIONAL SUPERSTRUCTURES COVER THE REQUIREMENTS OF THE CLASSIFICATION ORGANIZATIONS WHILE THE SUPERSTRUCTURE OF THE FLOATING FERRO-CONCRETE CRAFTS SHOULD BE IN ACCORDANCE WITH THE APPLICABLE CIVIL STANDARDS. THE EXPERIENCE GAINED IN SHIPBUILDING AND IN THE INDUSTRY IN GENERAL CAN HELP TO A GREAT EXTENT TO SUPERSTRUCTURE CONSTRUCTION AND BUILDING. THE POSSIBILITY FOR APPLICATION OF DIFFERENT BUILDING SYSTEMS AND TECHNOLOGIES RESULTS IN QUALITY IMPROVEMENT AND COST REDUCTION. THE MEANING OF 'BUILDING SYSTEMS' SHOULD NOT BE LIMITED TO ITS SIMPLIEST UNDERSTANDING BUT HAS TO INCLUDE THE SIGNIFICANT ACHIVMENTS OF THE INDUSTRIAL AND PUBLIC BUILDING. IN ORDER TO AVOID ANY MISUNDERSTANDING WE HAVE TO REMIND THE SPECIFIC AND COMMON FEATURES FOR ALL FLOATING CRAFTS. A REQUIREMENT FOR SHALL WEIGHT OF THE STRUCTURES AND MATERIALS USED FOR COMPLETION WORKS CAN BE CONSIDERED AS A GENERAL SHIP RULE. THE ABOVE MENTIONED CAN APPLY TO THE SAME EXTENT TO THE FLOATING FERRO-CONCRETE CRAFTS.
DESIGN OF THE FLOATING FERRO-CONCRETE CRAFTS REQUIRES APPLICATION OF THE NORMAL SHIPBUILDING PRACTICE WHAT CONCERNS THE LOCAL AND TOTAL STRENGHT, LOADING,HULL DRAFT, CARGOS DISTRIBUTION, WIND LOADING ETC.
EXTREMELY PRECISE COORDINATION IS REQUIRED BETWEEN THE ELEMENTS FIXED ON THE FERRO-CONCRETE HULL AND THE ONE BUILT-IN IT.
THE DESIGN COORDINATION ON VERY HIGH LEVEL IS THE BEST GUARANTEE FOR HIGH QUALITY AND FAULTLESS BUILDING OF THE FLOATING CRAFT.

THIS IS ESPECIALLY VALID WHEN DIFFERENT ELEMENTS, SYSTEMS, FURNISHING IS BUILD-IN THE HULL.
THE BEST RESULT IS ATTAINED BY EXPERIENCED ENGINEERS AND THEIR WORK TOGETHER, UNIFICATION OF THE DESIGN SOLUTIONS, APPLICATION OF THE STANSARD ARTICLES, AVAILABILITY OF MANY MACHINES AND EQUIPMENT AND HIGH DEGREE OF BUIDING METHODS INDUSTRIALIZATION. WE CAN ALSO ADD THE USE OF MODULES PREFABRICATED IN THE RELEVANT SHOPS.

PRACTICAL DESIGN

OF FERRO-CONCRETE STRUCTURES

ENG. M.DINEVA

KORBSO CO. IN THE TOWN OF BOURGAS HAS LONG EXPERIENCE IN THE FIELD OF DESIGN AND BUILDING OF THE FLOATING CRAFTS ON FERRO-CONCRETE MODULE WITH THE DIMENSIONS OF: 62 M LENGHT, 13.40 M WIDTH, 3.70 M BOARD HEIGHT AND DRAFT IN THE RANGE OF 1.90 - 2.25 M. THIS REPORT GIVES BRIEF EXPLANATION OF SOME OF THE BASIC ARCHITECTURAL CHARACTERISTICS OF THE CRAFT ALREADY BUILT OR TO BE BUILD ON THE FERRO-CONCRETE MODULE.

THE PLANTS AND SERVICES LISTED HEREABOVE /MECHANICAL SHOP, HOSPITAL, HOSTEL, HOTEL, RESTAURANT, SHOPS, BREAD MAKING PLANT, FISH PLANT, SOFT DRINKS MANUFACTURING PLANT ETC./ ARE INTENDED FOR INLAND WATERWAYS OR LOCATION IN CLOSED LAKES OR SEA AREAS. AFTER ADEQUATE PREPARATION THEY CAN BE MOVED BY TOWBOATS IN CASE OF UNLIMITED SAILING AREA OR TO BE CARRIED BY SUITABLE SHIP TO THE RELEVANT POINT OF THE WORLD.

THE STRUCTURE OF THE HULL LISTED ABOVE IS MONOLITHIC, FERRO-CONCRETE AND THE TYPE OF THE CONCRETE IS M300 AND THE REINFORCEMENT BARS TYPE IS BCT 3Cп 4, 25Г 2C, 35Г C. THIS MATERIAL ALLOWS VERY LONG /NEARLY UNLIMITED/ LIFE WITHOUT DOCK MAINTENANCE AND EASY DECK SERVICE. BOTTOM AND DECK SYSTEM SET IS LONGITUDINAL AND TRANSVERSE ON BOARDS. IT IS DIVIDED IN 8 WATERTIGHT COMPARTMENTS WHICH PROVIDE SINGLE-COMPARTMENT FLOODABILITY. THE PICK COMPARTMENTS ARE WITH STRENGHTENED SET AND INTENSIFIED OUTER SHEATHING. THE HULL FLEXIBILITY ALLOWS QUICK CHANGE OF THE LOCATION AND EASY SOLVING OF THE COMMUNICATION PROBLEMS BETWEEN THE HULL ITSELF AND THE SUPERSTRUCTURE IN ANY OF THE ALTERNATIVES. THE SUPERSTRUCTURES ARE MADE OF STEEL AND AS ARCHITECTURAL TYPE THEY ARE TYPICAL SHIP STRUCTURES WITH MIXED SYSTEM OF THE SET OR PILLAR DECK STRUCTURES WITH WALLS OF CORRUGATED SHEET METAL. THEY ARE COMPLETELY WELDED. DEPENDING ON THE CLIENT'S REQUIREMENTS FOR THE CLASSIFICATION SOME PART OF THE DESIGNS IS ACCORDING TO THE RIVER REGISTER OF THE USSR CLASS 'P' FOR INLAND WATERWAYS OR TO LLOYD'S REGISTER - RULES AND REGULATIONS FOR THE CLASSIFICATION OF INLAND WATERWAYS SHIPS - ZONE 2.

THEY CAN WORK IN MODERATE CLIMATE AREAS AS WELL AS AT THE NORTH AND SOUTH GEOGRAPHICAL LATITUDE. THE FIELD OF APPLICATION DEFINES THE DEGREE OF INDEPENDANCE OF THE FLOATING CRAFT. FOR EXAMPLE, A HOTEL OF 140 BEDS AND A RESTAURANT WITH 60 AVAILABLE SEATS HAS SPARE FUEL, SEWAGE AND POTABLE WATER FOR 3 DAYS AND FOOD STOCK FOR 2 DAYS.

INLAND POWER SUPPLY IS CONSIDERED FOR ALL ALTERNATIVES AND CAN BE USED IF THAT IS FEASIBLE.

WE BRING TO YOUR ATTENTION SOME OF THE PROPERTIES OF THE FLOATING CRAFTS:

FLOATING FERRO-CONCRETE WORK SHOP

FIELD OF APPLICATION OF THIS SHOP IS REPAIR AND MAINTENANCE OF THE SHIPS, FLOATING CRAFTS AND DIFFERENT MACHINES /TRANSPORT, WOOD PROCESSING, MINE MACHIENS AND OTHERS/ IN AREAS WHERE RESEARCH AND PRODUCTION ACTIVITIES PRECEDE THE PROVISION OF REPAIR AND MAINTENANCE MACHINES. SHOP HIGH EFFICIENCY IS DEFINED BY ITS COMPLETE INDEPENDANCE, HIGH PRODUCTION CAPACITY AND EASY MOVE. IT IS EQUIPED WITH TWO DISEL GENERATORS OF 150 KW /380V, 50HZ/ EACH AND WITH A FIXED GENERATOR OF 25 KW /380V, 50HZ/, A STEAM BOILER WITH A CAPACITY OF 1 000 KG/H, TWO WATER BOILERS /USED FOR HEATING/ WITH A CAPACITY OF 200 000 KKAL/H, COMPRESSORS.
THE FOLLOWING PRODUCTION FACILITIES ARE LOCATED IN THE TWO-STORY SUPERSTRUCTURE AND IN THE HOLD:

- IN THE HOLD - A FORGERY, ELECTRICAL REPAIR FACILITIES, BATTERY AND PAINTING FACILITIES;
- ON THE MAIN DECK - MECHANICAL FACILITIES AND PIPE FITTING FACILITIES;
- ON THE UPPER DECK - WOODPROCESSING AREA, RADIO REPAIR SHOP, REFRIGERATION EQUIPMENT REPAIR SHOP, FUEL SYSTEM REPAIR AREA AND A MECHANICAL LABORATORY;

THE ADMINISTRATION AND LIVING PREMISES INCLUDE: OFFICES, STORES, ONE SINGLE AND TWO DOUBLE CABINS, A DINING-ROOM, BATHROOMS, DOCTOR'S CABIN ETC.
ALL OF THE REQUIRED SHIP SYSTEMS AND DEVICES ARE AVAILABLE AND SOME MORE SPECIFIC ARE PROVIDED AS WELL.

A FLOATING HOSTEL

THE FLOATING HOSTEL ON A FERRO-CONCRETE HULL PROVIDES THE REQUIRED LIVING CONDITIONS IN DISTANT PLACES OR IN AREAS WHERE POWER SUPPLY, WATER SUPPLY AND SEWAGE SYSTEMS ARE PROVIDED. ITS INDEPENDANCE IS ENSURED BY FUEL AND FOOD STOCK FOR 7 DAYS AND POTABLE, WASH AND SEWAGE WATERS FOR 1 DAY OR UNLIMITED WATER SUPPLY IF WATER TREATMENT UNIT IS PROVIDED. THERE ARE THREE DECKS WITH ADEQUATE LIVING PREMISES. THE AVAILABLE SEATS ON THE MAIN DECK ARE 29 AND ON THE UPPER TWO DECKS - 67 EACH. THE LIVING PREMISES ARE AS FOLLOWS: AN APARTMENT FOR 4 PERSONS CONSISTING OF A BEDROOM, A NURSERY, A HALL AND A BATHROOM AND AN APARTMENT FOR 3 PERSONS CONSISTING OF A HALL, THREE-BED CABIN AND A BATHROOM. THE FOLLOWING ROOMS ARE CONSIDERED ON THE DECKS: A MEDICAL ISOLATION ROOM, OFFICE, ADMINISTRATION OFFICE, CONTROL OFFICE, KITCHEN, CANTEEN FOR 80 PERSONS, LAUNDRY, IRONING ROOM, STORE, BREAD MAKING SHOP AND FOOD PREPARATION ROOM.

THERE ARE TWO DISEL GENERATORS WITH A CAPACITY OF 249 KW EACH AND A FIXED GENERATOR WITH A CAPACITY OF 48 KW.
THE REQUIRED SHIP DEVICES AND SYSTEMS ARE PROVIDED.

FLOATING HOSPITAL

THE FLOATING HOSPITAL ON A FERRO-CONCRETE HULL PROVIDES MEDICAL SERVICES IN THE DISTANT AREAS, COVERS THE LACK OF MEDICAL SUPPLIES, PROVIDES HIGHLY QUALIFIED PERSONNEL AND SPECIFIC DEVICES IN THOSE AREAS AND HELPS DEVELOPING THE INFRASTRUCTURE IN OTHER DISTRICTS.
THE HOSPITAL HAS A CREW OF 10 PERSONS. NO BEDS ARE PROVIDED FOR THE CREW. THE HOSPITAL BEDS ARE AS FOLLOWS: 3 BEDS IN THE ISOLATION WARD, REANIMATION ROOM BEDS FOR 5 PERSONS, SURGICAL DEPARTMENT FOR 14 PERSONS, THERAPEUTICAL DEPARTMENT FOR 21 PERSONS. THE SPARE SUPPLIES OF FUEL CAN LAST FOR 7 DAYS, POTABLE WATER FOR 3 DAYS, WASH AND SEWAGE WATER FOR 5 DAYS.
THERE ARE TWO MAIN DISEL GENERATORS OF 264 KW EACH, A FIXED DISEL GENERATOR WITH A CAPACITY OF 50 KW AND A STEAM BOILER WITH A PRODUCTION CAPACITY OF 630 KG/H. THE AIR CONDITIONING SYSTEM COVERS 30% OF THE PREMISES INCLUDING THE STERILITY WARDS. IT OPERATES AT 40 C AMBIENT TEMPERATURE AND A RELATIVE HUMIDITY OF 70%.
THE HEIGHT OF THE ROOMS IS 2.8 METRES AND THE METAL SUPERSTRUCTURE IS LOCATED ON THE FOLLOWING AREAS: MAIN DECK 45 X 10.55 M, FIRST DECK 37 X 11.55 M, SECOND DECK 39 X 10.55 M. LIFTS ARE PROVIDED FOR THE CREW AND FOR THE PATIENTS.
SOME OF THE BASIC CHARACTERISTICS OF THE DEPARTMENTS ARE LISTED HERE BELOW:

- ISOLATION WARD - PATIENTS REQUIRING SPECIAL LIVING AND HYGIENIC CONDITIONS ARE ACCOMODATED HERE. CONDITIONS FOR AVOIDING THE MIXED INFECTIONS, SPECIAL FOOD AND TREATMENT, PREPARATION AND STORAGE OF THE DISINFECTION MEDICINES ARE ALSO PROVIDED.
- BLOOD TRANSFUSION SECTOR - IT IS USED FOR BLOOD TRANSFUSION TO THE PATIENTS IN LABORATORY OR HOSPITAL CONDITIONS.
- HOSPITAL - CONSISTS OF SURGICAL AND THERAPEUTICAL DEPARTMENTS WHERE THE REQUIRED LIVING CONDITIONS AND PROPER TREATMENT IS PROVIDED. ALL THE CONDITIONS FOR GENERAL CASES TREATMENT AND FOR PLANNED OR URGENT SURGICAL INTERVENTION ARE ENSURED. THERE IS A RECEPTION HALL AS WELL.
- POLYCLINIC - THE FOLLOWING CONSULTING ROOMS ARE PROVIDED: RECEPTION HALL, ADMINISTRATION, DENTISTRY, OBSTETRICIAN'S ROOM, DERMATOLOGY, OPHTHALMIC ROOM, THRAPEUTIC ROOM, SURGICAL ROOM FOR URGENT INTERVENTION AND SURGICAL ROOM, MORTUARY, PATHOLOGY, X-RAY DIAGNOSTICS, LABORATORY FOR CLINIC, BIOCHEMICAL AND PARASITOLOGICAL TESTS, PHARMACY AND THE RELEVANT STORES, BLOOD AND BLOOD PRODUCTS STORE.
- MEDICAL SERVICE INCLUDE KITCHEN, LAUNDRY, STERILIZATION SECTOR, REPAIR SHOPS AND STORES.

MODERN MEDICAL FACILITIES ARE PROVIDED FOR ALL OF THE CONSULTING ROOMS AND SERVICE AREAS.

ALL THE ALTERNATIVES OF FERRO-CONCRETE HULL LISTED ABOVE COVER THE REQUIREMENTS FOR FIRE PROTECTION. THERE ARE HORIZONTAL FIRE PROTECTION AREAS, FIREPROOF STRUCTURES ARE SELECTED AND ALL INTERNAL BULKHEADS ARE FIRE RETARDANT TYPE. THE FLOATING CRAFT LOCATION WILL DEFINE THE TYPE OF THE HEAT INSULATION, THE FIRE PROTECTION, ANTIVIBRATION AND OTHER INSULATION ON SOME SPOTS OF THE CRAFT CLIENT'S REQUIREMENTS, PROBLEMS DETAIL STUDY AND MAINTENANCE CONDITIONS DEFINE THE SPECIFIC FEATURES OF EACH OF THE ALTERNATIVES LISTED ABOVE.

IT IS ILLUSTRATED THAT DESIGN SOLUTION FOR DIFFERENT TYPES OF THE FERRO-CONCRETE CRAFTS CAN BE FOUND. IT IS EVIDENT THAT ONE AND THE SAME HULL IS USED. SPACE DISTRIBUTION BY THE HULL TRANSVERSE BEAMS IS ONE AND THE SAME FOR ALL THE DESIGNS. THIS PROVES THE POSSIBILITY FOR HIGH DEGREE OF UNIFICATION OF THE HULLS OF THE FLOATING CRAFTS. HULL'S AREA IS MAINLY USED FOR SERVICE DEVICES, TANKS, STORES AND OTHER SIMILAR FACILITIES.

THE ACCESSIBILITY TO THE COMPARTMENTS THROUGH THE FERRO-CONCRETE DECK IS A SUBJECT OF THE DETAIL DESIGN CONSIDERING THAT COMMUNICATION PASSAGES IN THE MAIN HULL BULKHEADS ARE NOT ALLOWED. THE PASSAGES THROUGH THE FERRO-CONCRETE DECK HAS TO BE STUDIED SEPARETELY. SOLUTION FOR THE DECK STRUCTURE HAS TO BE MADE BY CALCULATION METHODS WHEN IT IS REQUIRED.

SMALLER OR BIGGER NUMBER OF FACILITIES , WORKSHOPS AND TANKS ON THE DECK DEPENDS ON FLOATING CRAFT DEGREE OF INDEPENDANCE.

THE AIM OF THE DESIGN ENGINEER IS TO REVEAL THE NATURE OF THE RELEVANT CRAFT, ITS PROPERTIES AND FIELD OF APPLICATION THROUGH THE ARCHITECTURE.

THE ARCHITECTURE CAN BE ENRICHED BY ADDITIONAL PLASTIC SHAPING BRINGING THE VIVID STYLE AND REMARKABLE ARCHITECTURAL DETAILS.

THE FLOATING CRAFTS TOGETHER WITH THE WATER AREAS, LAND FACILITIES AND COMMUNICATION ARE GIVING A GOOD CHANCE FOR UNIQUE SOLUTIONS MATCHING TO THE NATURAL AND URBAN CHARACTER OF THE DISTRICT.

* K O R B S O * BURGAS

BULGARIA
BURGAS 8000

fax /056/ 4 53 84
tel./056/ 4 54 85
tlx. 83 511

We are happy with the organization of this meeting and that the representatives of the countries from Asia,Africa and South America show their interest to our experience on ferro-concrete technology. Our contribution to this meeting is that we were the housts country and together with you to assist developing countries in this field. This meeting is our first,but not the last one and we can maintain our activity in this field.This is just the first step of these bilateral activities.

We understood that not all of the participant's countries are interested in this technology but from offered speeches we just bette understand local conditions in these countries.Although there are specific conditions and environment in every country,we believe that this technology could be beneficial and practically introduced in a country,concerned with the benefit of its population.In this respect we would be happy and fully prepared to provide further assistance in cooperation with UNIDO or on some bilateral basis.We feel that the activity of the participants is going to do the best,so to understand needs of their countries.Our good will is to help the countries and to contribute our high technological achievements to them.

Also we are fully prepared to send our experts and to provide the following:

1.To study the local market,the demands and applicability of ferroconcrete structure.

2.To advise on the location of proposed facilities.

3.To advise a type of floating unit most suitable for the local condition and to prepare design of such floating units.

4.To assist introduction of our technology.

5.To recommend the equipment and instrumentation for this technology and we are ready to deliver this equipment.

6.To provide in plant training for the local personel.

7.To accept your specialists at KORBSO for training.

So,why did we organise this meeting,what is its purpose? It is not only to meet each other,which is also a pleasure for us, but to give also a practical assistance.This meeting must have some results - a cooperation between our countries,exchange of technology, know-how,training of specialists and so on.

Perhaps we should organize another meeting too - it is also the opinion of the participants,and we think that this cooperation between us under the guidance of UNIDO,the international supporting organization,will be salutary for us both.

If you desire you can send some written recommendations for future cooperation to UNIDO as a joint venture,transfer of technology,know-how or specialists.

D.TERZIEV
GEN.DIRECTOR