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RURAL SETTLEMENTS IN DEVELOPING COUNTRIES

1. - Conditions of housing in rural areas in developing countries are far from being satisfactory. Universal consciousness of these conditions has become among the dominant traits of our epoch. Several governments and international organizations are paying laudable attention to this problem, but the problem seems to be desperately intractable due to the very low income of the people to be housed.

2. - Estimates made by U.N.O. show that the annual income per capita among the people in the Third World to be 20-30 pounds and some other estimates made about 15 years ago, showed that there were 800 million of these people who are doomed to a premature death because of the bad conditions of housing-- not to mention nutrition. This figure must have surpassed the billion by now.

3. - Several governments and international organizations have interested themselves in the problem, carrying out projects, but unfortunately all their efforts were shipwrecked on the rock of high cost of building relative to the low income of the people to be housed or to what their governments can afford to give them in cash as a loan, for one reason; they all have come up with the same technical solutions -- employing industrialized materials that need to be bought in cash.

4. - U.N.O. had fostered the system known as "Aided-Self-Help," providing the peasants with concrete shakers and vibrators for making prefabricated building elements to reduce the cost. But this system didn't work either, as the reduction did not bring the cost down to the level of the financial capacity of the people to be aided. In fact, the problem does not lie in the labour, which the peasant can provide, but in the material to shake or vibrate

that needed to be bought in cash which doesn't exist.

5. - After some 10 years of trial and error, organizations admitted the unworkability of this system as confessed in the report by the E.C.A., from which I quote:

"...But the fact is a practically unsurmountable obstacle where the policy is that housing must normally be paid for. Between the limits imposed by the financial profitability of buildings and the solvency of the occupants; the few thousand dwellings built in all Africa are finally inhabited by the privileged minority of the country. The rest of the population continues to swell in the shanty towns of the suburbs.

"...It is without a doubt time to say that there is no chance of finding a satisfactory technical or financial solution to this situation before the African states have attained a certain level of economic development."*

7.- From the financial point of view there are two reasons for this situation; firstly, most architects are not acquainted with the use of local materials, that does not exist in the curricula of the technical universities and schools of architecture. It is true there is the science of soil-mechanics, but as taught in these schools, it deals almost exclusively with problems of foundations and not earth as a building material. Secondly, most people in developing countries associate progress and modernity with the use of industrialized materials such as reinforced concrete and cement block,

* United Nations: E.C.A. How/Working paper No. 2, p.32, 21 August 1963.

because they are costly and because the natives see the professional architect use them exclusively. In fact, the building material is amorphous, and the question of quality depends on what the architect can do with it. You give a Rodin half a cubic metre of clay and he will make you The Thinker, radiating energy and costing millions.

In the town, the economy has been almost completely integrated in the monetary system and the provision of housing became a profitable business. It has become an investment, while in the countryside of a poor country the necessary conditions for investment in housing do not exist. Most peasants are extremely poor, in fact there is no explanation how this peasant can satisfy his basic needs to keep alive other than his living outside the cash economy. He cannot buy a house nor pay rent for one. There is no house market in a village.

8. - But if the peasant cannot provide cash, he might produce labour. We have existing examples to show that he can easily convert available materials into housing. From historical times he was forced to find the right solution to this seemingly intractable problem in many places, in which he depended solely on the available materials, such as stone, mud, straw, bamboo and reeds, etc.

9. - In hot arid zones where earth is the material there was no problem in putting up walls in mud-brick. Nature herself suggested this material to man by seeing, how after harvest, earth mixed with straw formed solid big lumps that were not cracked. Mud brick takes well the compressive stresses to which it is normally exposed in peasant houses. Laboratory tests showed ordinary hand-made bricks to take 15 to 25 kgs/cm² compression, while the maximum it is exposed to does not exceed 3 kgs/cm², giving a large margin of safety. But mud-brick is a lively material, it doesn't set once for all after drying and keeps changing with humidity that it can absorb from the air.

This is why some architects are shy to use it. We know that water and moisture are the greatest enemies of mud-brick, but the modern science of soil mechanics had solved the problems arising by using stabilizers such as bitumin and paraffin imulsions and cement, in the outside rendering to protect the structures from rain water and dew, and by using asphalt for damp-proof courses to stop moisture seeping up by cappillarity from the ground.

10 - But if peasants could manage to put up walls, they were in general defeated by the roof. The roof needs materials that take up bending and tensile stresses such as wood, steel, reinforced concrete, etc., which materials have to be paid for in cash. To meet the situation, the ancients had devised an ingenious method for roofing with mud-brick, solving the problems of the resistance of materials and stresses by the geometrical form. They made the roof in the shape of a vault with the profile of a catenary curve in which the tensile stresses are annulated, working only under compression as in the wall.

11. - More than that, these ancients had devised a simple method for the construction of a vault right out in space, without the need for any centering of support during the construction. This, they achieved by building the vault in successive rings with bricks laid end to end in a plane slightly inclined to the vertical, leaning against an end wall (fig 1). To increase the sticking surface relative to the weight of the brick they used special bricks for vaulting; 25x15x5 cms. made with two grooves running diagonally from corner to corner which would work by suction in keeping the brick in place until one course is completed. Calculations showed the cohesion stresses for the brick at the most precarious position at the crown to be 0.01 Kgs/cm^2 , which the earth mortar can take easily, even without the suction grooves.

12. - In this way, and by using mud-brick for roofing, the peasant can have an unlimited supply of free roofing material, removing the major

technical and the financial obstacles.

Ranges and Limits for Vaulting

13. - The use of vaulted roofs imposes more limitations on the architect than when using flat roofs. Firstly, vaulted roofs exert lateral thrusts on the bearing walls, which need to be considered in the design. In peasant houses in Nubia, the vaulted rooms are set side by side in a row to take up the thrust (fig 2) what affects articulation of the plan. Secondly, the rise of the vault depends on the span, affecting the height of the room and introducing a new dimension in the design. Thirdly, when the dome is to be used, it has to sit on a square plan which is not agreeable for a living space.

14. - However, in the past, the architect wasn't hampered by these limitations and devised means and ways for roofing large spaces without excessive height, by subdividing the area to be covered and articulating the space using combinations of vaults and domes to cover the same room. The aesthetic effect is always pleasing as witnessed in the various examples that we have in Iran--in Sarvistan, Yazd and Kerman (Fig 3); in Egypt -- in Numbia and Bagwat at Kharga Oasis (fig. 4); and in Iraq -- Ukhaier Palace and others (fig.5)

15. - As a matter of fact, these structural impositions saved the architect from the pit-falls of futile superficiality if he were completely free to do whatever he liked. In a way, they play a similar role to the classical orders in the architectural design, as safeguard from the aesthetic point of view.

16. - In a vaulted room, stresses are almost continuous in wall and roof, which has an aesthetically pleasing effect on the feeling of man for man-made space. In such structures as shown above, the lines flow harmoniously up and down with no abrupt change or break as in the case of a flat roof, and

form will be found forcibly consilient with the forces acting on it, giving it truth which is a precondition for beauty.

17. - In using earth and vaulted roofs resides the only probable solution to the problem of peasant housing in the hot arid zones where the majority of inhabitants of the Third World live. In this way we shall have subjected the technology to the economy of the people, and not the other way round. To do this we have to secure the collaboration of three technicians, the soil mechanics, the structural engineer specialized in shell structures and the architect acquainted with the exigencies imposed by these techniques on the design.

18. - But to secure the services of these technicians we need to set up a comprehensive policy for the implementation of what we may call the "aided-owner-builder" system or the "corrected-aided-self-help" one, which by necessity would be different from the architect-contractor one prevailing in the current practice.

19. - To start with, we have to form the specialized architect who is fully acquainted with the snags of design in mud-brick which would need to include mud-brick architecture in the curricula of the technical universities and schools of architecture and to produce the necessary educational material such as text books, manuals, audio-visual means, etc.

The need for such documentation is expressed by the demand of 40 colleges and community colleges in the U.S.A. who have shown interest in developing a multi-media package of materials based on my project of Gournia discussed in my book, "Architecture for the Poor," who are interested in building the materials into their Humanities, Engineering and Architecture courses.

20. - The definition and dissemination of the information at the present stage requires the formation of an institute to assume the responsibility of

conducting research in both the technical and human fields to be carried out on active projects. Because of the world-wide significance of the work to be undertaken by the institute and because the procedure in the owner-builder systems is quite different from the orthodox bureaucratic systems prevailing in official administration which is based on the architect-contractor system, it is proper that the framework of the organization be supported by an international body in cooperation with national authorities.

21. - Fortunately, the Ministry of Housing in Egypt has recently decided to sponsor implementing this policy by carrying out several pilot projects in the different regions of the country with different specific conditions; alluvium, sandy, or rocky as to the use of local building materials. The ministry's program will include taking over anew the work in two old projects; The New-Gourna Village in Upper Egypt (started in 1946) and the village of Bariz - from the Ptolemaic name Pairs- at Kharga Oasis in the Western Desert (which was started in 1964). These will help in including the time factor and cost of maintenance in the research.

22. - Now we have also the possibility of conducting research in two private projects to be carried out in Egypt and of implementing the policy advocated here: One in Guiza and the other in Luxor, both of which may serve as pilot projects for the institute.

These projects are conceived as a seat for the institute, where architects, masons and craftsmen may come together to exchange knowledge and techniques and to participate together in the specific disciplines discussed here. This experience will be complimented by studies in related indigenous architectural traditions as the Nubian in Egypt, Yazd and Kerman in Iran and the oases in the Western Desert.

23.- As one of the early functions of this institute, there is in preparation a manual of mud-brick architecture dealing with the problems of soil-

mechanics, structural engineering and architectural design, to complement the already existing "Architecture for the Poor".

24. - With regard to hot-wet regions, science and artistic creativity can take care of using the existing local materials in improving housing conditions by developing on what the peasants have been doing up to now. Already, some new ideas have been tried to engineer such materials as bamboo, reeds, and straw for use in housing which should open a new vista in architecture for the tropics, pending more research to be done in this field before launching them into the current practice.

Earth Quarrying

25. - The main sources of earth for mud-brick making are: the silt already sedimented on the agricultural land, and that which collected in the dry water-courses in the desert land. The latter doesn't present any problem, it is the quarrying of the first that presents a problem for peasants and even for some architects and engineers. In Egypt, some of them repeat now and then that after the High Dam, the river Nile will not carry silt any more and therefore there will be no earth for making mud-brick. But this is quite naive, as there are billions of cubic meters that have sedimented in the valley along the millenia since the valley started to be formed. This statement is based on the idea that there are no other means for earth quarrying than what the peasants do, which are either:

a) to dig borrow pits by the villages and

b) to scrape the top layer of soil of the fields,

which both have nothing to do with the High Dams, but incidentally are both unsatisfactory. The borrow-pit leaves the village with a mosquito breeding stagnant water-surface and the scraping removes the top layer of the soil that contains the nitrates and the fermented organic matter that is necessary for the plants. So the only possible way of catering with so many factors is to

transform the borrow-pit into an artificial lake with running water, which can be easily achieved by integrating the lakes into the irrigation system, connecting the lake with the irrigation canal on one side and the drain on the other side, allowing for a periodical change of water. Thus we shall have concentrated the earth quarrying in a limited and controlled area, and removed the source of mosquito-breeding.

26. - For a new village, the main factors to determine the size of a lake are: The volume of earth needed for brick-making, and the second; the minimum quantity of water that can remain relatively clean between the changes of its water when bathed in by such numbers of peoples and cows as may be expected to use it.

A village with about 200 houses together with the public service buildings needs about 50,000 m³. For a lake with a mean depth of 3mts, we shall need 4 acres, which is enough to satisfy the second conditions.

Bilharziasis Control

27. - More and above the artificial lake catering for the problem of earth quarrying, it will cope with the more vital problem of bilharziasis control.

27. - Bilharziasis can be said to be the greatest single cause of degeneration that pulls down the peasantry in so many countries. It is a doom that no peasant can escape. All irrigation water in most tropical and subtropical countries is infested with the circania, and all peasants work and bathe in this infested water.*

* Bilharziasis - The W.H.O. Report. "Because of the intensities of its morbid symptoms, its socio-economic aspects and its very wide distribution throughout the world, bilharziasis is one of the most important helminthiascs. It is estimated that there are about 150,000,000 infested people in the world suffering from this disease...."

If he is cured, he must inevitably go back to the fatal canals again. So, the solution to the problem is not exclusively medical, it is a complex one involving the work of the pathologist, the hygienist, the irrigation engineer, the educator, the planner and the administrator.

28. - To exterminate the parasite from the whole body of water in all the rivers and the canals is almost impossible. If it is impracticable to decontaminate the whole rivers, we might be able to decontaminate just part of it and keep it permanently safe. Eventually, the artificial lake idea is indicated to provide for this function.

The worm as it is discharged from the human body is not contagious. It has to harbour first in a snail where it undergoes some sort of metamorphoses and comes out as a cercaria which is the dangerous thing. If the worm doesn't find the snail in 48 hours it will die. So, it is at this point that we can intervene, by exterminating the snails which, incidentally is easy to do. Copper sulphates held in a bag attached to the end of a stick when waved all along the banks of the canal will kill all the snails and keep the banks free of them to a considerable distance after the shores are sulphated.

So, all we have to do to make the artificial lake to provide for a bilharzia-free swimming water, is to hold the water in a side canal or ante-lake for 48 hours before being admitted into the lake by lock-gates set at the intake and the outlet. This will ensure that all the floating cercaria are dead. When this water is run off into the lake, the surplus will rush over a sluice-gate at the drain end of the lake, which will eventually remove the mosquito larvae.

Protective Clothing

29. - To protect the peasants working in the fields from infection, some sort of protective clothing would be needed. Rubber boots catered for 40% of infection in Japan, but would be too dear for the majority of peasants all over

the world. An equally appropriate solution could be had if we lengthened the ordinary cotton trousers that the peasants wear to enclose the legs and feet completely, and impregnated them to the height of the thigh with linseed oil, and hung them to dry. When this operation is repeated twice, these trousers will become water and cercaria-proof. It is comprehensible that protective clothing for peasants working in water infested with germs is just as essential as protective masks, goggles and gloves for workers or welders dealing with poisonous materials.

Co-operation is the basis of all development activity in peasant housing

30. - The technical solutions prescribed here-before- will work only if the owner built his house. This would need cooperation.

Building by nature is a collective activity. In the past, peasants used to cooperate in building within well established traditions that ensured that anyone building a house will be assisted by his neighbours. The snag in cooperative building is that one man cannot build a house, but ten can build ten houses easily.

31. - The use of the cooperative system and mud-brick architecture had reached a remarkable scale in recent years, when the villages in Nubia were to be flooded in consequence of raising the water level of the river after the second elevation of the Aswan Dam in 1934. The Nubians had to build 35000 new houses above the new water level. The indemnity they were offered by the government amounted to 750,000 pounds which the Nubians quite understandably rejected because it was very small. They went on negotiating until there was only one year before their houses were submerged, then they started building their houses which they did using mud-brick for walls and roofs which were vaulted.

Though the time limit was very short, the people managed to reorganize the construction work and collect sufficient materials and labour in such a way that construction in one village did not slow the rate of progress in another. In addition to that, the cost of labour did not rise above the normal in spite of the rush. This could not have been achieved unless the peasants were accustomed to depending entirely on local building materials, and mastered the technique of vaulting for roofing, and unless some social traditions of self-help and mutual aid had already existed.

32. - It was remarkable how beautiful these villages came out, each one with its own character and each house different from the other. The houses were spacious, beautiful, clean and roofed neatly with brick vaults. The design of these houses was very simple, invariably composed of a number of vaulted rooms set side by side in a row, having a large courtyard in front with the various service rooms to one side. Each house had its guest room directly going onto the outside (fig)

Setting the rooms side by side is dictated by structural exigencies, to take up the lateral thrust of the vaults. But in spite of these restrictions, the Nubians managed to compensate for the similarity of the plan by variegating the design of the facades and the doorways. These were exquisitely decorated with claustra work, tracery and mouldings in mud. (fig)

33. - So, 35,000 were planned and executed entirely in one year by the peasants without the assistance of a single architect or engineer for the sum of 75,000 pounds. Whereas, when this region was to be reflooded in 1965, as a result of the High Dam, and the whole population had to move North to Kom Ombo, the architects were called upon to build the new villages. They came up with one house type in stone and concrete, repeated identically all over the region (fig.)

To build just half of the houses in this way cost 28 million pounds, and

the building activities were held up in the rest of the country during the construction, because of the shortage of materials and labour provoked by this project.

34. - Another example in which the people managed to undertake the construction of a whole village without access to government assistance and depending entirely on local materials and resources, may be given by the case of the village of "Genah" in Kharga Oasis in the Western Desert in Egypt.

This village was buried in 1956 by the moving sand dunes so frequent in this desert. The mayor of this village told me that the inhabitants have built an entirely new one which he pointed out, into which they all had moved except one old man, who, for sentimental reasons did not want to depart with his house, though it was almost buried and he had only two rooms left to live in. When I asked the mayor about what this poor old man will do when these two rooms will be gone too, his answer simply was, "don't worry, we have already built him a new house down there."

This story shows how the cooperative system works automatically when the peasants are dealing with communal affairs, and where building is not to be paid for in cash.

These two examples show that there exists a great potential building-activity among the peasants. If it is to be released, then the architects enter into the field and work with peasants, subjecting their modern technology to their economy, guiding them how to develop their technique.

35. - The basic motive in the voluntary donation of time and labour in the traditional cooperative system is the desire to receive a similar help oneself. Every neighbour by helping build a house, establishes a right to receive help himself which was guaranteed by tradition.

As we know that there exists a perfectly adequate technique by which to

build a house of a standard, outside the cash economy by engineering the local materials, it is sure that there also exists a method of organizing the work in a peasant community by which the traditional customs in building can be made to work under the non-traditional conditions prevailing in rural communities nowadays. The way is; as we engineered the local materials we have to systematize the traditional customs.

36. - The longing of each private person for a house that will take place of honour in his community, and his eagerness to accomodate his family in the best way he can, is the guarantee to the workability of the cooperative system in building, if it were made clear in his mind that it will work, and if he were shown how to build.

37. - If this principle were recognized in the policy, and a program of action is set up including training and recording the exact amount of work to a man's credit, then the cooperative system will begin to appeal to the most commercially minded. Such programs will include the procuring of and preparation of all materials and necessary equipment for the building.

By necessity this program will embrace the human and social problems as well as the technical ones.

Whenever the government needs to extend its services into any rural district it has to reckon on the human resources and the natural social order existing.

38. - Releasing the productive potential of the peasants by cooperation would give the answer to the economic obstacle while the social benefits are great. Indeed the communal adventure of building by cooperative work should raise the morale, the self-respect of the society and give it a sense of purpose that will be of immense spiritual benefit to its members.

39. - First and foremost, a village built by its own inhabitants will be a living organism, capable of growth and continuing life. Secondly, a

cooperatively built village will be cheap enough to make the cost fit into the budget of the peasant and the government. In fact, it will be the only kind of village any developing country can afford.

40. - In the past, peasants had age-old traditions that guided them in the design and the construction. They made the decisions in these matters almost intuitively as if by reflex. Today these traditions do not exist any more in most peasant societies, and it would be unsafe to leave them alone in this field. It is implicit that we secure the assistance of the aware architect specialized in mud-brick architecture, by his knowledge and artistic sensitivity until a new tradition is established.

In-Service Training for Building

41. - The best way of training the villagers in construction is to train them while they are working on the project as helpers, usually called in-service training.

A training course has been devised and actually tried in the Gournia Village Project. By this system, one master mason had trained 46 boys from among these mason helpers who mastered all the operations that go into the construction of every element in the house; walls, arches, vaults, domes, stairs etc.

The Quality of life: The psycho-aesthetic factor

42. - In rural planning we need the greatest care to satisfy the psychological needs of the peasant, translate them into spatial terms and determine objectively the sort of space that is most beneficial to him.

43. - In agricultural regions with cash crops growing such as the plains of the Nile Delta, Iraq, and Guegira in Sudan, the landscape is shaped by the demands of the market, from the pattern of the field to the system of work.

The fields are flat and unvariegated with almost no natural features to break the dullness of the landscape. One crosses canal after canal, narrow straight, dug with utmost economy for watering the crops and never allowed to waver for a moment from this duty, canals that insist on being canals and

never pretend to be streams.

44.- The villages are dull and uninspiring. Cotton has flattened the countryside and put into uniform, can we doubt that it has done the same to the minds of the people?

As architects, we cannot propose changes in the economy of the countryside. It is therefore our duty to alleviate as far as possible the deadening effect of economic pattern by the structural pattern of the village. We must try to create in the village an environment as different as possible from that of the fields. We must give the villages a change: give them instead of the rectangularities of the fields a winding pattern in their streets, and a free patterning of buildings to suit best the requisits of climate and social grouping, and to shut off the view on the fields which are the peasants work place.

45. - We have to create opportunities for entertainment, festivity and public life. When the peasant comes back into the village after hard working in the fields, he should come into a relaxed environment where he can begin to live as a social being (fig).

Quality of life

46. - If the village is to be a centre of variety and interest in an otherwise dull landscape, then the variety must be reflected in its social composition as well as in its architecture. A thousand labourers living in even the most inspired architecture will have nothing to talk about but their labour in the land. Their society will not have that internal liveliness and imaginative fertility that comes from the interactions of different kinds of experience when the members come from various trades and professions, at best, the village will be like a holiday camp full of workers from the same factory.

47. - We know that a settlement consisting only of farmers is not enough to constitute an organic community. The stability of a farming settlement

will depend on the existence of well mixed occupational groups which will bring the social life to the standard sufficient to keep the people on the land and stop the drift to towns.

48. - Rural districts in the third world have a very limited variety of occupations in general, consequently the conditions of life are not up to the standard. They are inadequate especially for the younger people. A variety of trade would make a boy need not suppose that he has no escape from the cotton and rice fields.

49. - To variegate the social composition of the villages will become ever more important as the population grows. For comprehensive planning we have to evaluate the services to be provided and the goods to be supplied in the village and work out the corresponding number of professionals, tradesmen, and artisans of all the trades and professions necessary to fulfil these services from among its inhabitants.

There exists an optimum ecological balance between the land, the plant life, the animal life and the human life that any geographical area can sustain at a given standard. Some sort of balance was automatically achieved in the past, when the village community was dependent on its own resources and labour; when tilling the land was done by man and cow, allowing for a certain amount of chances for labour, and when the provision for services catered for the surplus that the fields chased.

This balance is seen to be upset nowadays by the machine and industrializations in almost all rural areas in the world. The tractor and the mechanical plough has reduced the already limited chances for human labour, to almost one tenth. One man and a cow would cater for 4 acres, while one man and a tractor can cater for 40; -and the importation of industrialized goods from the town, had taken the jobs from the village craftsman and artisan, and we talk about the drift from rural areas to towns.

50. - An empirical way of working out a balanced occupational distribution scheme, is to go through a list of all the recognized occupations and sort out the ones judged necessary to exist in the village and the region. For this, it is indicated to use the "International Standard Classification of Occupations" published by the I.L.O. in Geneva in 1958.

We have first to sort out the professions needed by kind, then work out how many of each and after that, work out a scheme for distributing them over the geographical area of the region we want to serve.

The Policy

51. - In the policy of rural housing and village rehabilitation we should merge the technology of building with the aims of philosophy in the planning of the new settlements and the old, where men will be able to realize their true potentials. Just as each village in Nubia, when the people were given the chance in 1934 has developed its own personality and flavor, and made its distinctive contribution to the understanding of the nature of culture, so we may expect each one of the modern villages to develop its own flavor of cultural life, starting with the very buildings that make it, and thus enrich the lives of its inhabitants and of the country. And, just as we have brought down the physical planning to the level of the brick, we have to bring down our socio-economic planning to the level of the family and the individual man.

Above all, we have to avoid the attitude taken by some planners, who take the easy way out and try to transplant the town into village, succeeding only in creating a sub-urban environment instead of creating a super-rural one.

52. - For action, we have an age-old technique of building that is proved by properly conducted scientific experiment to give an answer to the

technical and financial problems in housing the great numbers.

- We have a system of organization by which the traditional co-operative building can be made to work under the non-traditional conditions prevailing nowadays. We have a system of training by which to obtain the masons by the numbers wanted from among the youth, that can take up the skilled labour.

53. - In spite of that, we still see projects avowed to be not working that are repeated everywhere. The reason is that the problem is not purely technical, but administrative as well and the procedure for the co-operative building or architect-owner builder system does not fit into the existing bureaucratic administrative system.

54. - To bring remedy to this situation we have to bring the information about the possibilities that are there to the knowledge of the official technicians and the authorities responsible for housing the great numbers.

- It is only for a conference like Habitat, bringing together the responsible authorities and the eminent technicians that there exists hope for saving the situation.