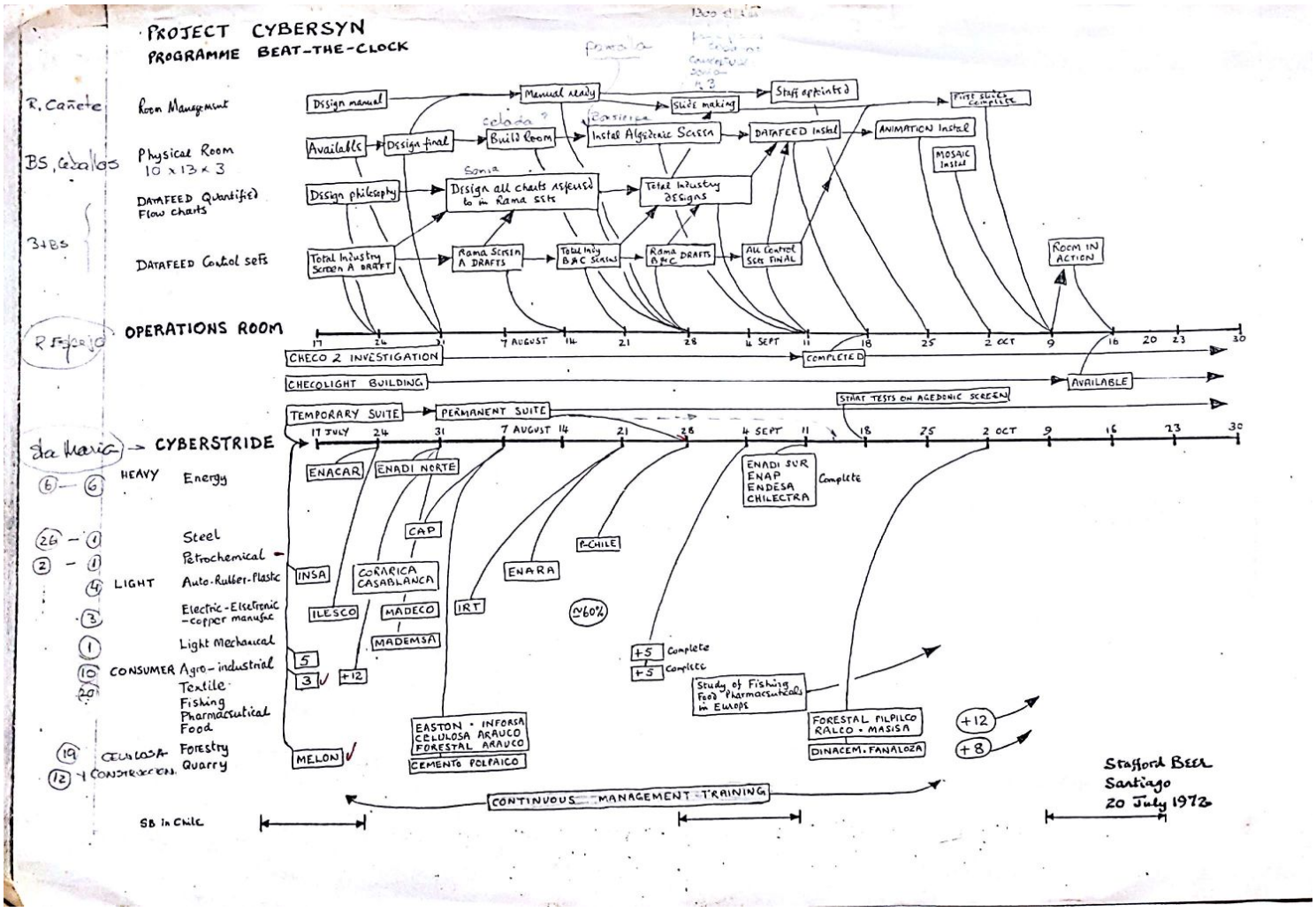

System One: Divisional Control

For reasons which will soon become apparent I shall call the assembly so far discussed System One (see Figure 1). It consists firstly, al level (a), of the basic set of "doing" machines with which we are industrially familiar already - which include their own intrinsic controls. Secondly, at level (b), are the computer controls needed for the sequiencing types of activity which make the doing-machine flexible. Thirdly, al level (c), are the computer controls capable of sequencing the sequencers. System One is, in the scheme of things expounded here, a basic component of what will shortly become modern industrial organization. It is already a three-level command hierarchy, but it is itself only the first level of another five-tier hierarchy which is needed to run a business.

System Two: Integral Control

This will perturb the equilibrium of the "X" and "Y" solutions, which will themselves alter, once again perturbing the central unit "M". In short the entire system will go into oscillation.

When this happens inside a machine-tool we call it hunting. When it happens in the human being, as it sometimes does owing to a defect in the cerebellum, it is called purpose tremor or ataxia. The defect is also sean frequently in managerial situations: stocks, for example, may go out of control for precisely similar reasons. To control this kind of oscillation we need a higher-order command structure - and this is System Two. It is a unifying controller capable of damping-down the oscillation of all the Systems One within an overall strategy (see Figure 4).

The divisional units are concerned, quite properly, to do the best they can, within the constraints of good order imposed by System Two. Thus they reach a homeostatic equilibrium.

System Three: Internal Homeostasis

Homeostat (1). Means a control existing to hold the critical variables of a system within physiological limits.

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(1) Ashby, W. Ross, Design for a Brain, Chapman and Hall, London, 1954.

It should be noted here that control in large systems turns out to be mainly about stability - rather than the obsessional pursuit of high profits or any other maxima. But the top management of the firm, despite its commitment to some kind of stability, is none the less interested in particular goals. Its method of interfering with the homeostat is already visible in Figure 4 - as a line descending from the clouds. But these instructions, together with a superior view of the world environment in which the firm is set, must be interpreted downward - and this is the function of System Three, which is shown in Figure 5.

The function of System Three is to reassemble relevant data about the firm's operations into an input-output matrix which can be studied and optimized anew in the light of the firm's overall objectives.

The scientific techniques available to System Three are primarily the modern forms of input-output analysis which began with linear programming. At this level we can for the first time compute with the firm as a whole.

From the computation should emerge a homeostatic strategy for the firm as a whole.

In particular, such worrisome problems as the allocation of total resources between divisional units, and the transfer prices to be used in internal dealings, are here solved. These and similar issues ought to cohere the company in integral activity - but they are normally divisive.

System Four: External Homeostasis

The information available to System Three is of three kinds. There are data rising from below about the internal company homeostat. These are derived either through the filter of System Two, or, where special performance is concerned, from System Three's own antennae. There is descending information from the top management, using what we shall soon call System Five, being filtered down through a staff function- which is now nominated as System Four. And thirdly there is corporate information about the outside world which it is specifically the job of System Four to collect and to distil.

System Four sits squarely on the central command axis of the firm. One of the consequences of the model we are constructing is the view that what management has always thought of as "the staff function"is really not the so-called advisory activity in which its occupants sometimes take refuge. Consider: "Course A is ruinous, I think, and Course B highly profitable. But take your choice. It is not for me to arrogate to myself the role of manager". This can surely not be called "advice", when it contains an implicit decision (unless you think the man is mad). A great deal of professional service is of this kind, although it is not presented so

crudely; and it should be recognized as the contribution to actual management that it truly is.

System Five: Foresight

The Board is served by System Five - as well as by its dependet systems One to Four. For the Board must consider policies which are almost philosophies, or at least superior in some sense to the practical strategies considered by System Four. And System Four itself will assuredly pose problems upward to the Board - which it may inform but not usurp.

The kind of computer control theory appropriate to System Five is based on yet a third kind of model of the firm, and a new set of operational research techniques. Recapitulating: System Three includes a model of cost-effectiveness, and System Four models of marketing and finance. The model for System Five should incorporate every feature of the company in its environment which seems relevant to a consideration of the firm's long term future. It must be capable of reflecting on totally new departures in policy.

The technique for running such a model is ultra-rapid simulation.

In fact System Five has often been designed and used - not indeed in the role of a System Five, but as a distinctive piece of research. The same is true of System Four and System Three. What has not been properly explored is either the interaction of these three types of models of the firm (see the dotted lines in Figure 6) or their response to real-life inputs - as provided for by this whole theory. The normal practice in operational research work is to use synthetic data to activate models, by regenerating historical data according to statistical sampling routines. But in a five-tier hierarchy of control systems of the kind described, the models would be continuously activited by real data - namely the information flowing throughout the firm.

The company divisions are the body's major organs (the liver, heart, lungs and so on). System Two is the spinal cord; and the Systems One are its vertebral segments, working through reflex arcs. System Three is the autonomic nervous system, and the special-purpose inputs and outputs described are the sympathetic and parasympathetic trunks. The control centre of System Three in the body is the hind-part of the brain (pons, medulla, cerebellum). System Four is the middle part of the brain, through which pass all sensory data on their routes from the sense organs. System Five is the cerebral cortex itself.

TO: STAFFORD BEER

FROM: GUI BONSIEPE

DATE: June 16, 1972

REFERENCE: Operation Room

Dear Stafford Beer,

Attached you will find several drawings of the subsystems for the operation room.

1
Control chair
New version with slightly inclined control panel in the right arm-rest.

2
Control panel with keys for DATAFEED
You will observe that we had to change the position of the push button "HOLD". In the original proposal this key was located at the right edge vertically. But this would have required to much space. Thus, the keys for operation "HOLD" and for the operation "Block" (lozenger shape) (including a warning light) are located at the lower edge of the square form panel. The drawings contain measures of push button keys and distances between centres.
Please consult people of ELECTROSONIC whether this proposal is adequate for them. The space below the key board can be adapted to the requirements for the electronic hardware. The difference between the key in normal position and in pressed-down position is about 20 mm.

3
Datafeed
New version of fibreglass housings
Individual mounted units will be carried by vertical panels. The exact size of the cut-out in the front side of the housings can be determined once we have the specifications from ELECTROSONIC. I do not know whether the indicated dimensions of the screens refer to the surface which can be utilized or whether we have to take into account a small edge needed for mounting and fixing the screen in the interior part of the housing.

4
Room for prototype testing
Finally, after several changes there has been assigned to the team a room which measures about 8 by 4 meters (approximately 24 feet by 12 feet). This is not optimal, because the equipment has to be crammed into the available space. But anyhow, we have reached a good compromise. The panel of the 5 levels will have to be mounted on a rail so that it can be moved from the wall for reasons of access and maintenance.
The definite position of the chairs will be decided once the room is equipped.
It will be difficult to put more than four control chairs into the room.
I am afraid that we have to sacrifice the bar; but we can arrange for a storage unit (refrigerator) and facility for preparing coffee in the maintenance area of DATAFEED that is behind the screens where is a lot of space. This area has to be used also for having access to the toilette facilities. The room has air conditioning.

5
Implementation fase
Once we have finished the technical drawings, these will be handled to Mr. Jorge Ceballos who was in charge of the organization of Chile-Expo. He will take care of the implementation.

6
Information on control screen of DATAFEED
The industry will be divided into four great divisions:
Heavy Industry with 38 enterprises.
Light Industry with 30 enterprises
Basic Consume Industry with 45 enterprises
Building Materials and Wood Industry with 30 enterprises.

In total almost 150 enterprises. According to a report of Raúl Espejo and H. Gavella there will be needed around 20 slides per enterprise with indices, photographs, diagrams of processes, geographical location, future plans and so on.
This means that at LEVEL ONE it is impossible (and unnecessary) to present the 3.000 different slides.
Indices and other information would have to be bundled if the room is going to be used at SYSTEM one level. If the room is going to operate on the level of one of the above mentioned general 4 divisions, the maximum number of lines would be 45, which we cannot press onto one slide.
Suppose, we press button A, there will show up enterprises from number 1 to 23 in alphabetical order.
If the searched/for enterprise is not in this group, we press button B and get the remaining 22 enterprises. Dividing 240 by 23 we get around 10 slides per firm. If we need more slides per firm, we divide the group of 45 over the buttons A, B and C in equal manner. This means, we have 240 divided by 15 slides per firm, that is 16 different informations. This is in the estimated case for having 45 enterprises.
With less enterprises per general divisions we get to the proposed number of 20 slides per firm which Raúl had in mind. So I think there will be no problems of legibility, since we will use a maximum 15 lines. At any rate, if necessary we can provide a layout for up to 20 lines.

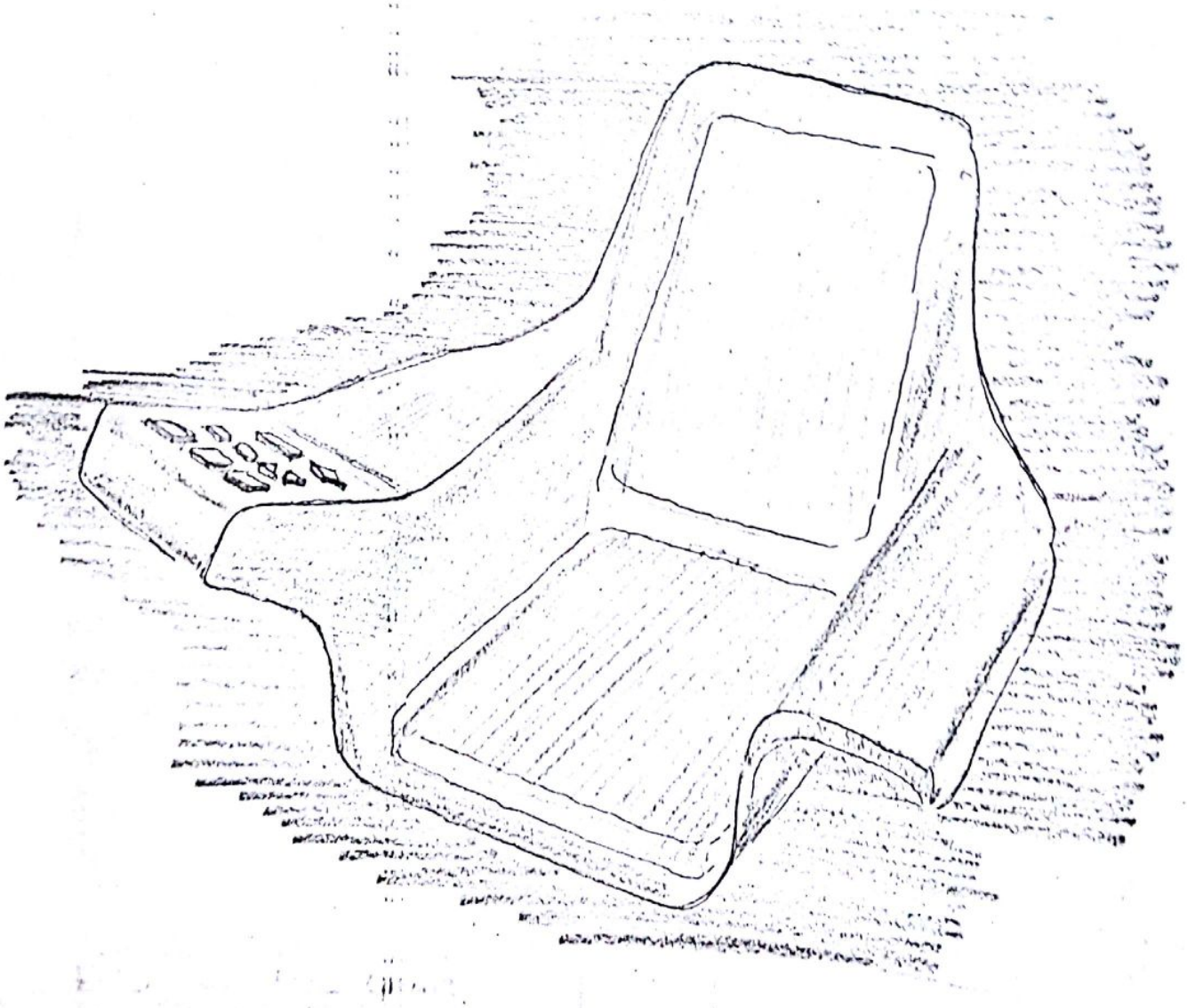
Questions
Is it possible that ELECTROSONIC provides the push button keys with its mechanical and electronical hardware structure? This would simplify the work for us, since we will have to prepare only the perforated metal sheet which will be mounted then as a block into the arm rest of the control chair.

Sincerely yours,

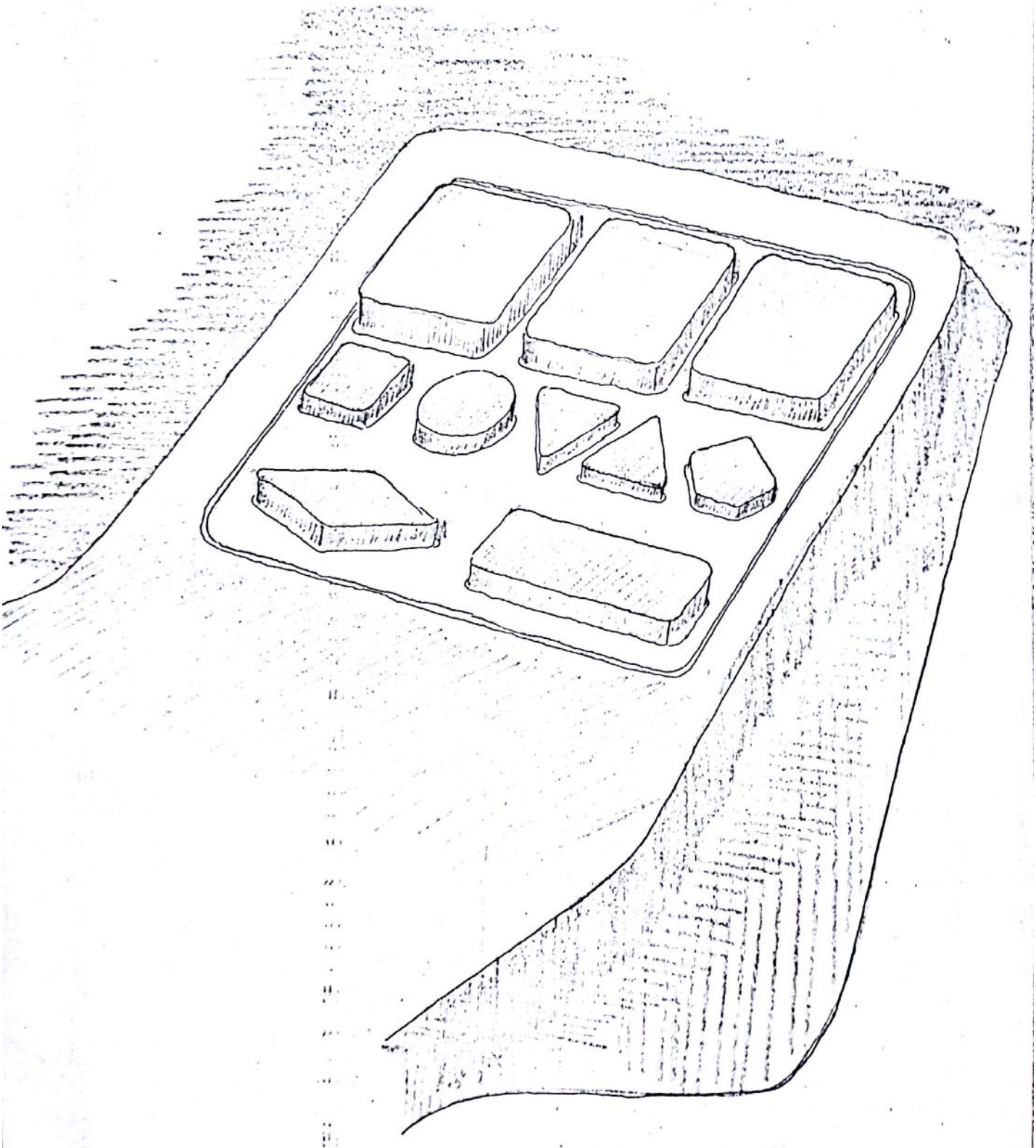
GUI BONSIEPE
INTEC/CORFO

Sala de operación
SILLON DE CONTROL

Vista en perspectiva
Panel con téclas integrado en el apoyo brazos.



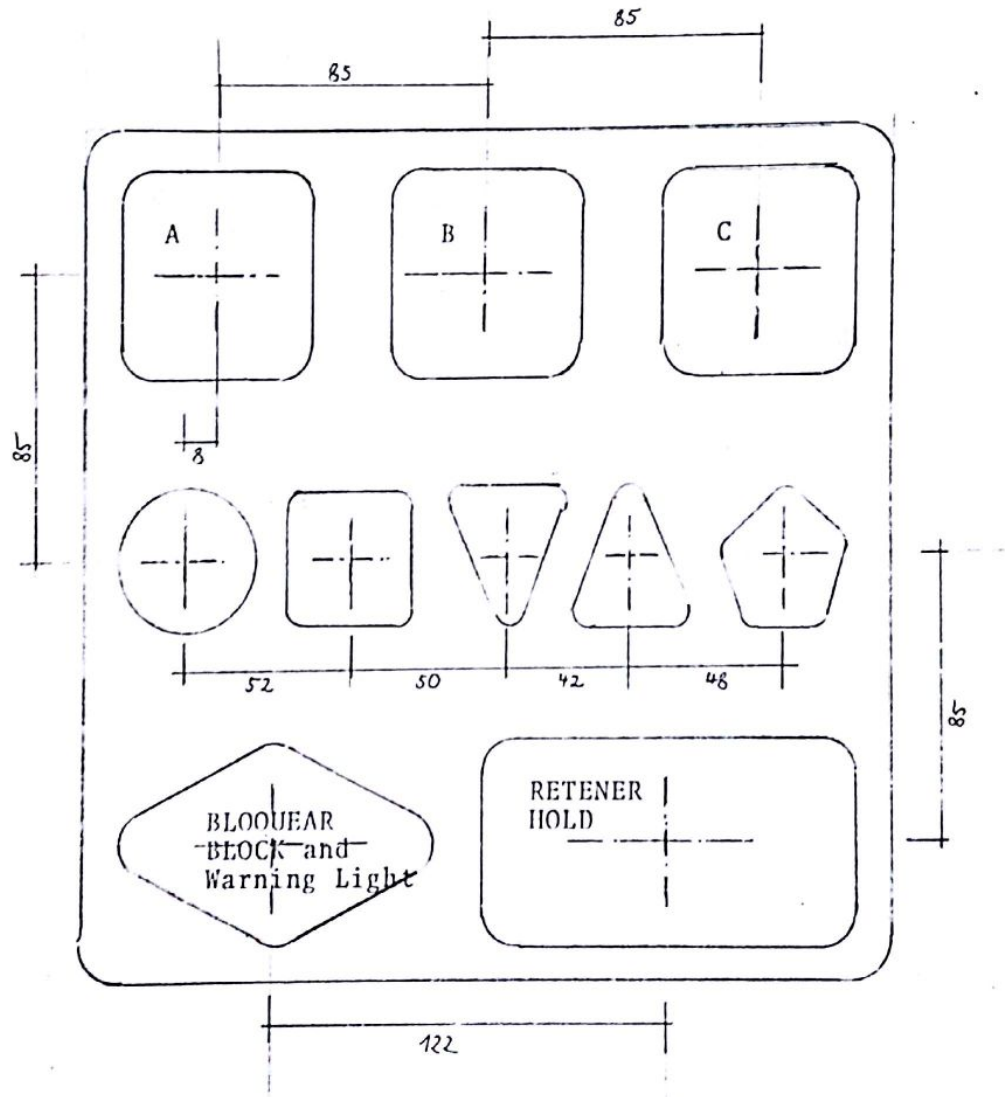
Vista en perspectiva del panel
con teclas integrado en el apoyo
del brazo derecho



Sala de operación
SILLON DE CONTROL

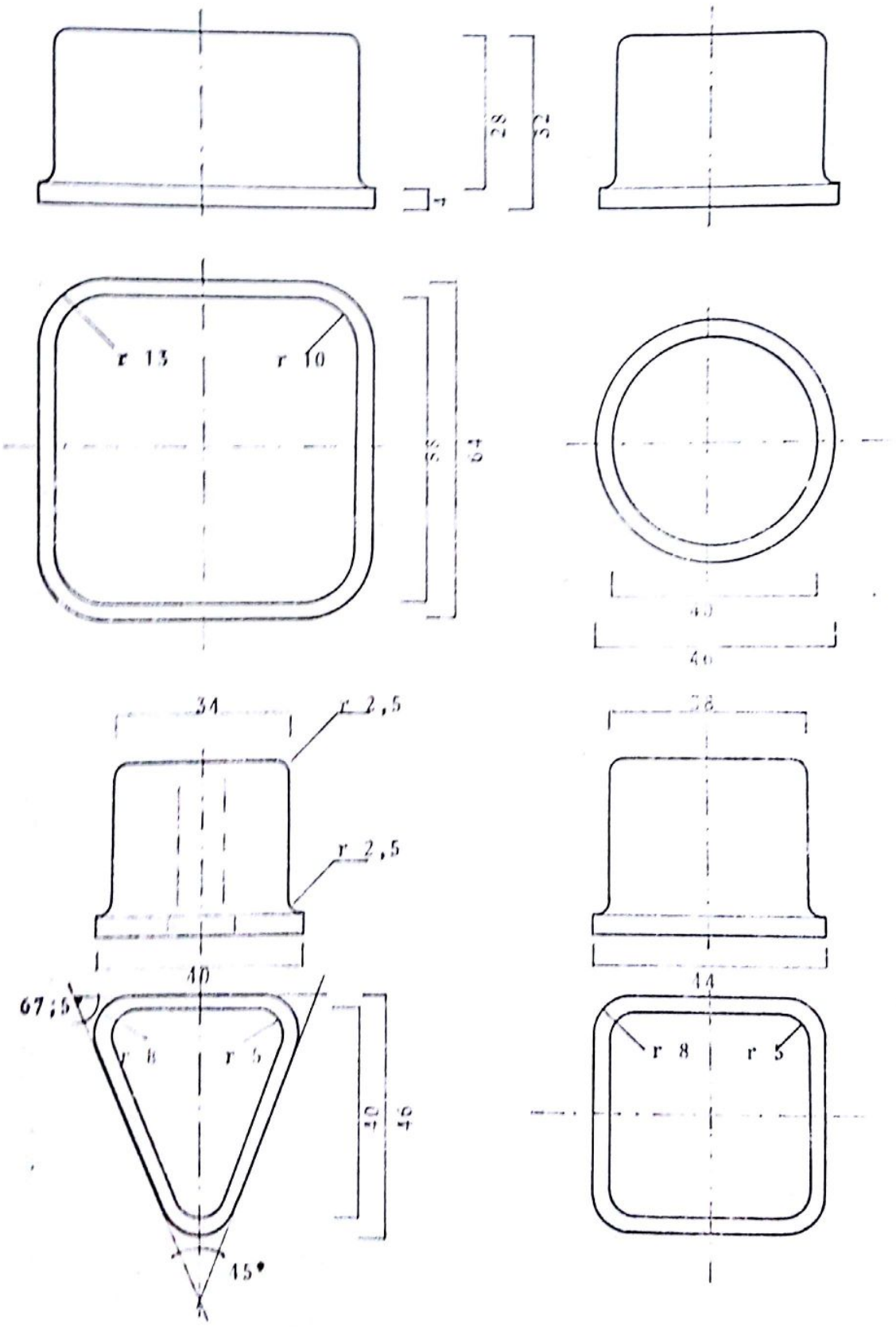
Panel con teclas
Distancias entre los ejes
Escala 1:2 mm

Key board of control chair
Distances between axes
Scale 1:2 mm



Teclas
Escala 1:1 mm

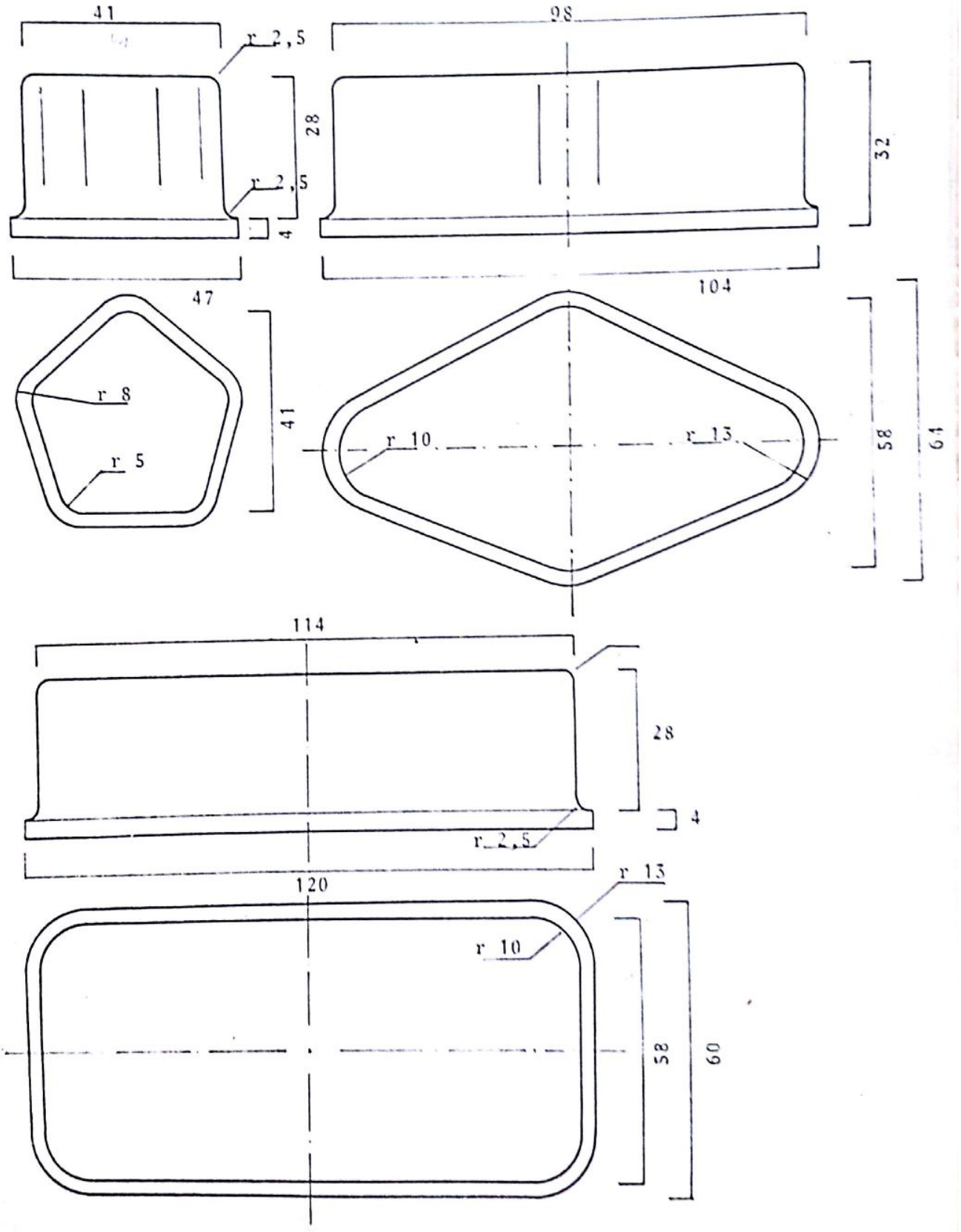
Keys for key-board of control panel of the eco-chair
Scale 1:1 mm



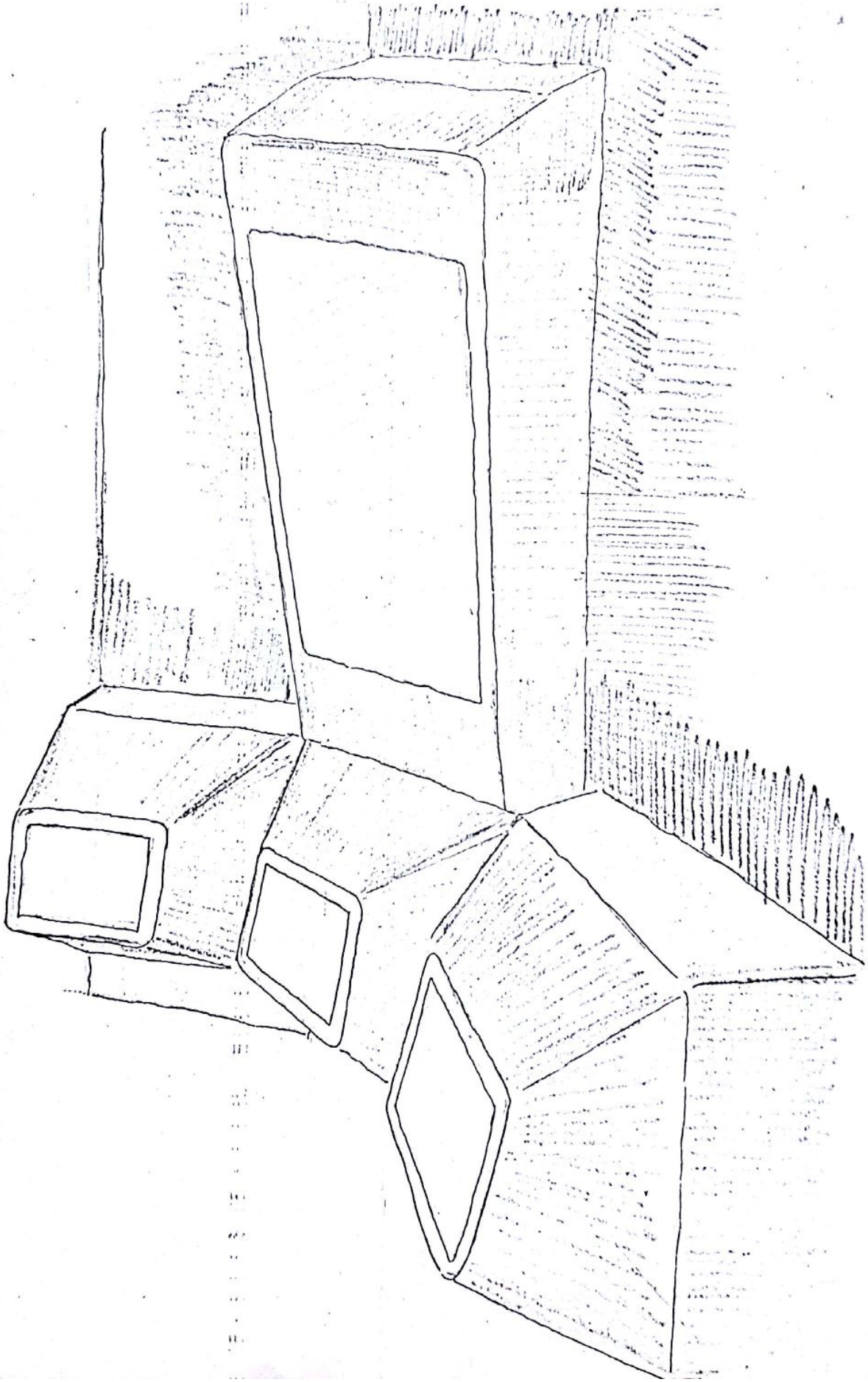
Sala de operación
PANEL DE CONTROL. TECLAS

Teclas
Escala 1:1 mm

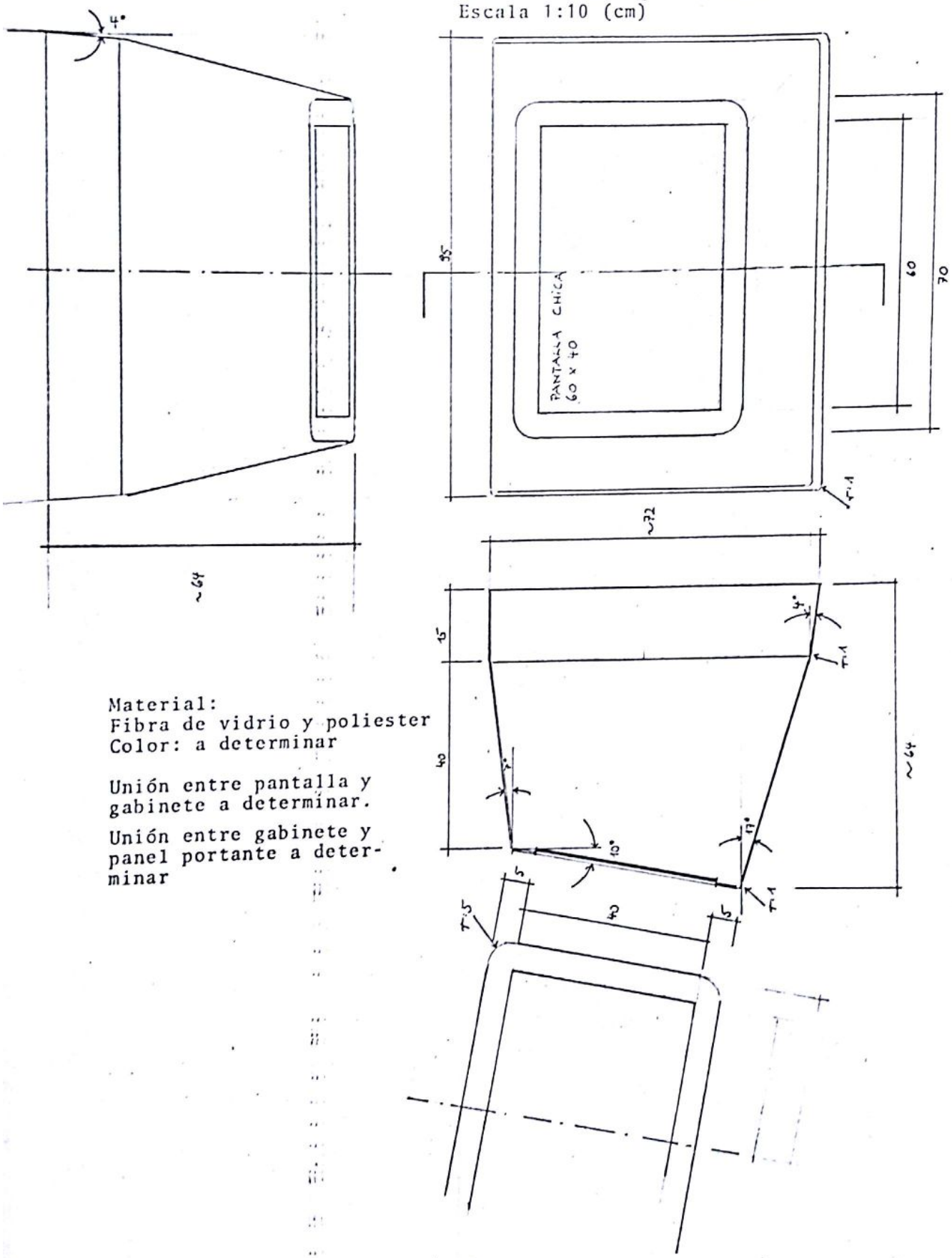
Keys for key-board of control panel of the eco-chair
Scale 1:1 mm



Vista en perspectiva del conjunto de las pantallas.



Dimensiones generales del gabinete
Pantalla chica (small screen)
Escala 1:10 (cm)



Material:
Fibra de vidrio y poliester
Color: a determinar

Unión entre pantalla y gabinete a determinar.

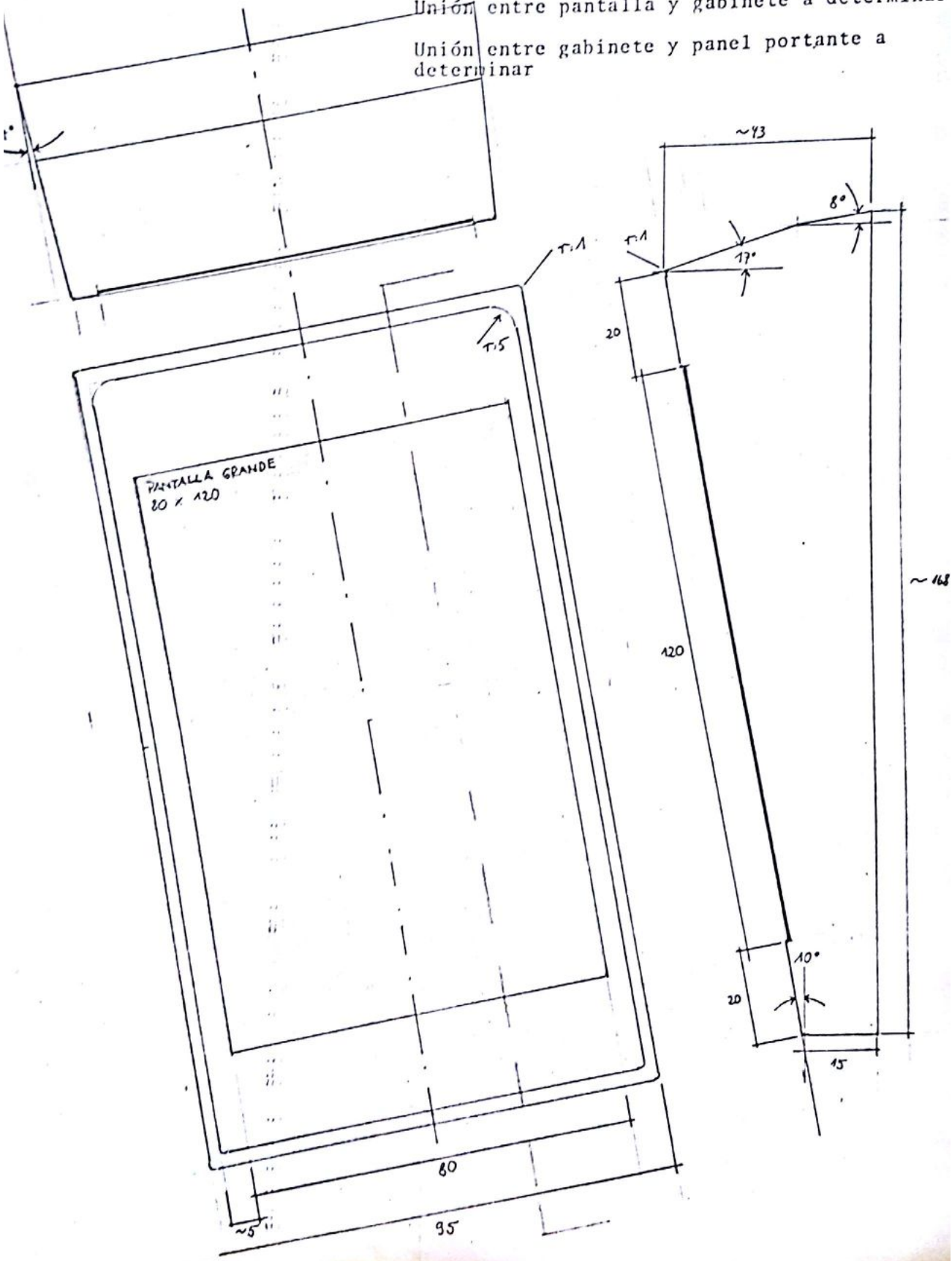
Unión entre gabinete y panel portante a determinar

Dimensiones generales del gabinete
Pantalla grande (big screen) para control
Escala 1:10 (cm)

Material:
Fibra de vidrio y poliester
Color: a determinar

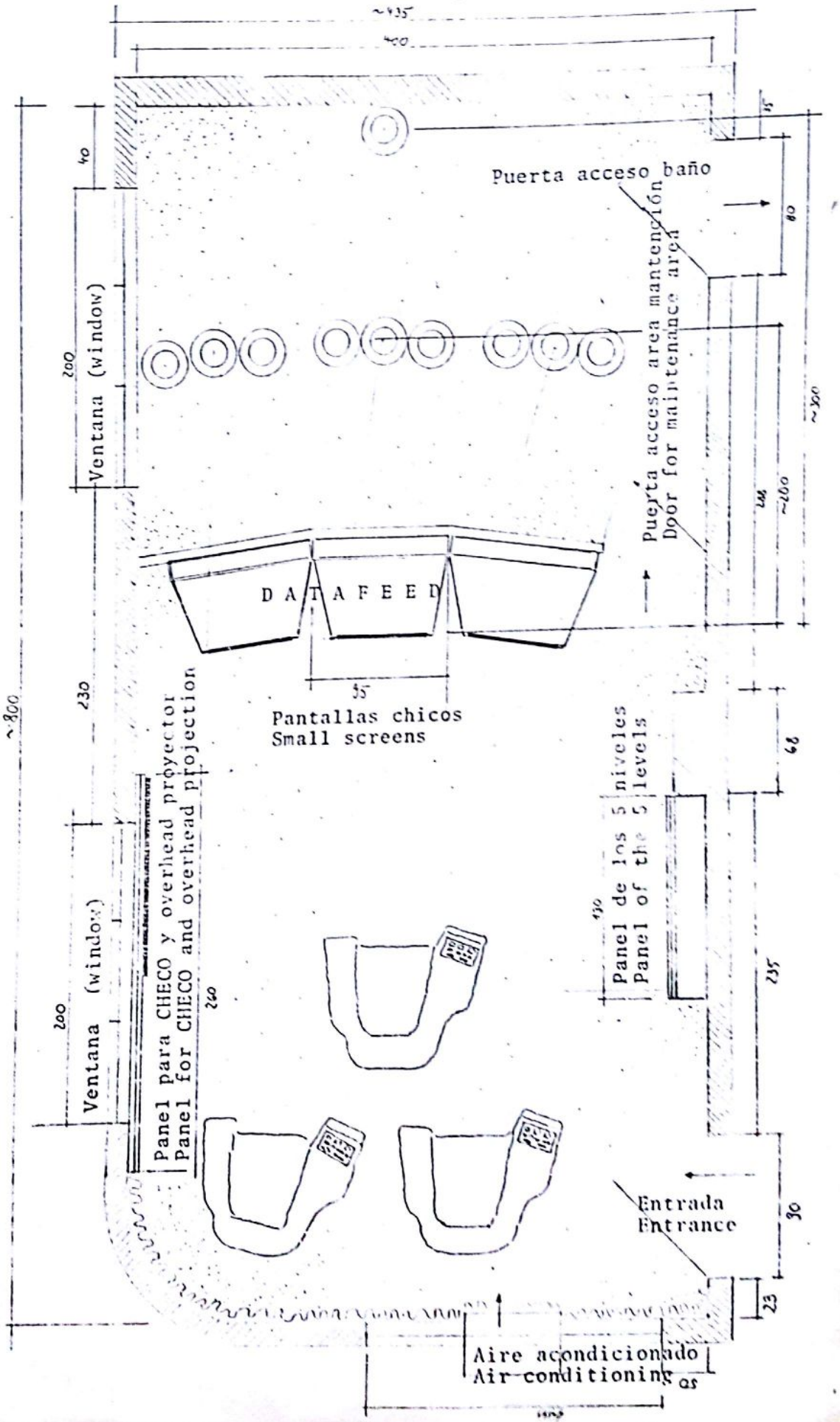
Unión entre pantalla y gabinete a determinar

Unión entre gabinete y panel portante a determinar

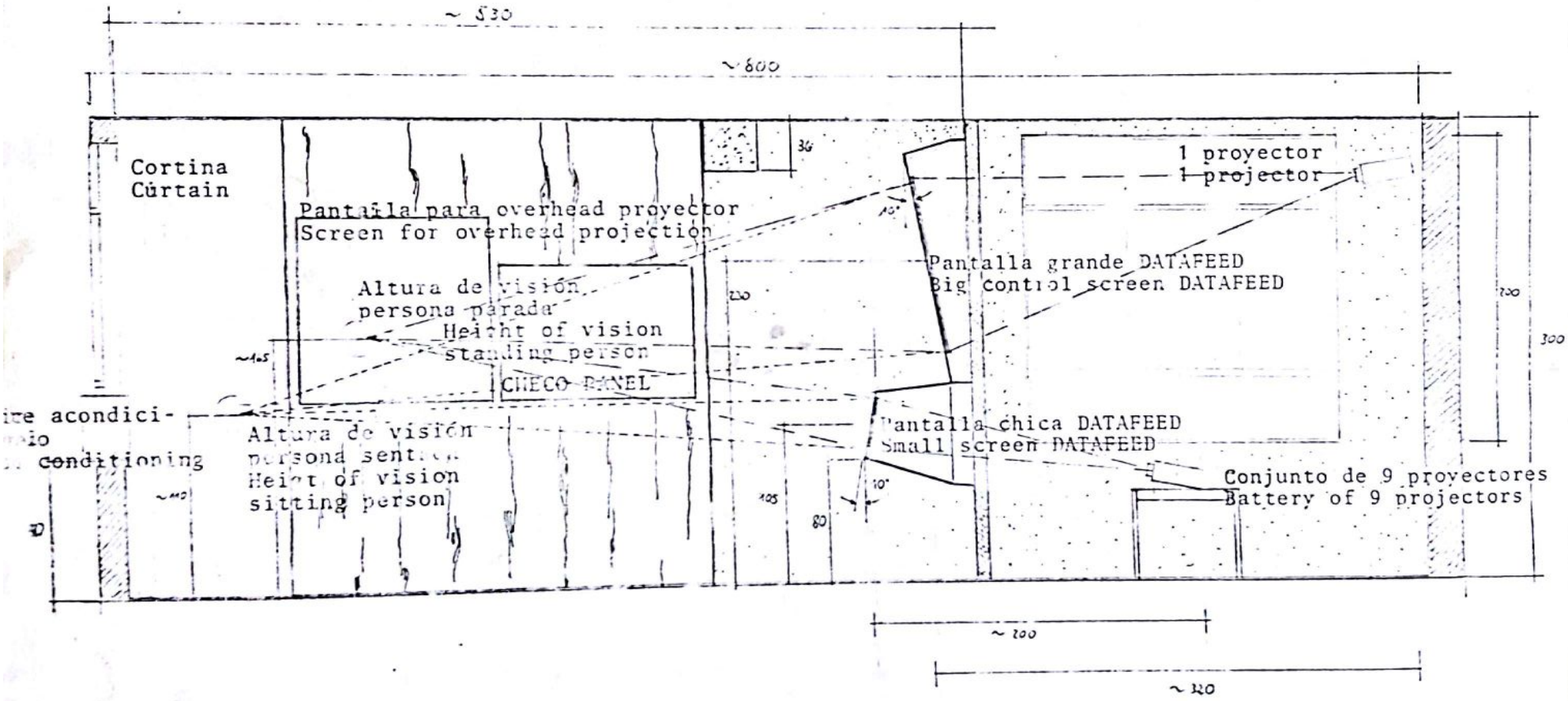


Sala de operación
General architecture

Dimensiones generales de la sala



Dimensiones generales (vista de la puerta de la entrada)
General dimensions (view from the entrance door)



INTEC/CORFO
06.72

Sala de operación
ARQUITECTURA GENERAL