

**catering system for aircrafts**  
diploma project  
munshi k l  
industrial design centre

**I. D. C. Library**  
**L. I. T. Bombay.**

22  
Design of catering system in aircrafts

Diploma project

Submitted in partial fulfilment of the  
requirements for the postgraduate diploma in  
industrial design

by

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I. D. C. Library

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My acknowledgement to

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1. Problem statement

Design a catering system for  
Air India International

## 2. Introduction

### 2.1

Good amount of work has already been done to improve the passenger comfort in aircrafts during flight. For improved passenger comfort, besides providing comfortable seats, good environment and entertainment, the services inside aircrafts have <sup>to</sup> improve and should keep on improving because of the newer problems creeping up daily in the air transportation of passengers.

### 2.2

Services inside the aircrafts include:

- Looking after passengers - old people and children
- Keeping passengers informed and giving instructions from time to time - audio and printed communication
- Offering pillows and blankets.

- Showing seats
- Miscellaneous services and seeing that there is no chance of any complaint
- The distribution of food articles into individual plates
- The serving of Breakfast, Lunch, Tea, Dinner, Coffee, Cigarettes and Drinks
- Collection of these utensils back from the passenger
- Storing them when they are filled or empty
- Storage of left-overs and disposable items like empty tin cans, bottles, etc.
- Cleaning of part or whole of cutlery for using it again during the flight, when the flight is long and non-stop
- Heating or keeping food articles cooled.

### 2.3

Now-a-days it is being seen that all international airline corporations are facing tremendous competition among themselves, and are virtually fighting for their survival. With the introduction of Jumbos the problem has become even more critical. For profitable operation of these aircrafts it is necessary that aircraft should take off with certain minimum percentage of the total capacity (break even point), depending on operation cost, fare structure, overheads, etc.

Some measures have already been taken by various airlines to attract passengers by the drastic cuts in the round trip air fare. But there are limitations to it.

#### 2.4

Among other methods of attracting more passengers is to offer better services on board than available at present. Of the services available at present on board the aircrafts the catering service seems to be one of the most important and flexible. The catering problems and services have become very complex in the airliners carrying 350 or more passengers.

#### 2.5

To increase profitability, airlines should be able to do more with less. That is economising in space, weight of the equipment that goes on board and effective utilisation of all the equipment. At the same time the efficiency of the whole system should also increase.

#### 2.6

To improve the efficiency of the system the units comprising the system - the man and the materials (equipment) - should be individually

and collectively efficient. The men can be made efficient by telling them the best ways of performing their tasks - training. The materials i.e. equipment can be made efficient by proper design.

## 2.7

The services in different airlines cannot be much different from each other, but they can show their individuality by the type of meals they serve and by the equipment in which they serve. The well designed equipment can build an image for the airlines and can form a part of corporate identity programme.

## 2.8

Sometimes the cutlery sets are sold as souvenir to the passengers who like it. This is possible if the cutlery is well designed and is different from what the other airlines use.

### 3. Problem definition

#### 3.1

The problem could not be defined precisely at the time when it was given, as the sufficient information about the present catering system of Air India was not available. It was only after investigating and collecting information, the problem could be specifically defined.

#### 3.2

Because of the limitation of the available time to complete the project, it was decided that only the designing of that catering equipment should be taken up with which the passenger comes into contact; keeping in view the total system of catering on Boeing 747 jumbo jets.

#### 3.3

The main design constraint is that over all

6  
dimensions of meal tra should not change as  
it goes inside tray cart, which in turn goes  
into a specified place in the galley.



#### 4. Information

##### 4.1

At present Air India operates about ten Boeing 707 and two Boeing 747 jets. They have placed order for two more 747's and will be acquiring the shortly.

##### 4.2

The total seating capacity of both these types of aircraft varies with the seating configuration in each aircraft.

The mostly used configuration in 747 is:

- 321 economy class, 32 first class
- 288 economy class, 52 first class
- 365 economy class

On 707 mostly used configurations are:

- 126 economy class, 16 first class
- 162 economy class



4.3

Passenger service in Air India is the responsibility of the customer services which is an arm of the commercial department. The catering and cabin services is a section of customer services and it looks after passenger needs in the aircraft i.e. the section caters to the inflight needs of the passengers using Air India's services.

The organisation of the catering and cabin services is headed by catering and cabin services manager. It is subdivided into four departments:

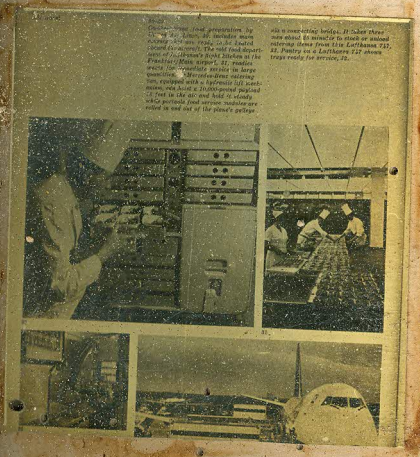
- . menu planning
- . stock control
- . planning and procedures
- . cost control.

4.4

Galleys are the places where the service equipment and items are stored inside the aircraft and from where the service takes place.

The microwave ovens and refrigerators are also located there. The size of each galley and number of galleys i.e. total cubic capacity required is determined by:

- . maximum cubic capacity required for each passenger per service.



9.  
maximum meal services required and type of meal services required, which in turn depend upon the flight time, the departure and the arrival timings. There are 8 galleys on 747. Two and half are for first class and the rest for economy class.

#### 4.5

In economy class there is pre-set tray service. That means all the food items are placed in the tray before serving it to the passengers. In first class the service is course by course and there is sometimes choice of menu as well.

#### 4.6

The trays are pre-set in the flight kitchen and then loaded in the tray carts which go into specified places provided in the galley. Sometimes when the cold foods have to be served as in case of buffet dinner, then the foods are pre-set. Raw foods like salad and packed foods are also pre-set.

#### 4.7

The other foods which are to be heated before serving are put into the oven cages. These oven cages are stored in the microwave oven. These ovens can be switched on before serving for a specified period of time depending on

the food items inside. Some food items like desserts, ice-creams are stored in refrigerators

4.8

Besides having equipment pre-set into the trays some over flow equipment like cups, saucers, water cups and plates are also lifted, in over flow container. There is a fixed location for these containers in the galley.

4.9

Different types of meals served on board are:

- . lunch
- . dinner
- . breakfast
- . continental breakfast
- . cold buffet
- . tea garni
- . coffee garni
- . coffee, tea complet

Lunch, dinner and breakfast are considered major meals and the rest minor meals.

Lunch, dinner, breakfast and cold buffet are served in large trays, while tea and coffee garni, continental breakfast are served in small trays called snack trays.



#### 4.10

The galleys are designed to uplift a maximum of two and half meals from one station i.e. uplifting of two large or meal trays and one snack tray or three snack trays and one meal tray. But generally one or one and half meals are lifted from one station.

#### 4.11

After studying Air India's 747 meal uplift instruction, galley loading plans and meal schedules, it was found that maximum items that go on pre-set large tray at a time are:

- . one meal tray mat
- . one large plate
- . one bread plate
- . two salad bowls
- . two creamers for butter jam or marmalade
- . one saucer
- . one tea cup
- . one soup bowl,
- . sugar, salt and pepper satchets
- . napkins
- . cutlery set, wrapped in cellophane paper
- . two knives/one knife
- one fork
- two dessert spoons/one dessert spoon
- one mocca spoon - coffee spoon
- one pastry fork





4.12

Besides this the entries are brought in:

- casseroles with cooked food
- tin foils with puris
- paper cups with ice cream, kulfi or cold drinks
- polystyrene cups with water or cold drinks

4.13

The maximum items that go on a pre-set snack-tray are:

- one snack tray mat
- one snack plate
- one teap cup
- one saucer
- sugar, salt and pepper satchets
- napkin
- cutlery set wrapped in cellophane paper
  - one knife
  - one pastry fork
  - one mocca spoon
  - tooth pick

4.14

26 of pre-set meal trays or 52 of pre-set snack trays can be accommodated in one tray cart.



4.15

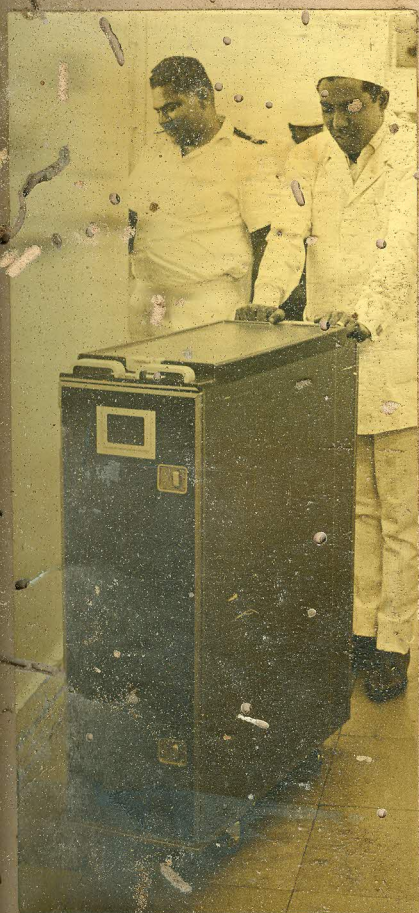
In 747 the tray carts can be taken out into the aisle spaces for distribution of meal trays. But at present there is hand service as Air India prefers hand service.

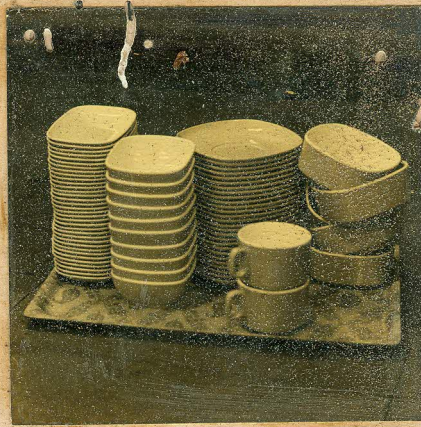
4.16

About 25 passengers in the economy class of 747 are catered to by one hostess.

4.17

Actual service on board the aircraft 747 or 707 could not be observed because this facility was not offered by Air India. Neither the service was observed in training aircraft as the training school was not running during the days of information collection.





### 5. Product analysis

#### 5.1

Large plate is a square plate with curved sides and generously rounded corners. Its dimensions do not have any relation with the containers in which it is stored as overflow equipment, nor with the dimensions of the meal tray. It does not seem to have been designed for use in the aircraft.

Large plate is made of melamine by compression moulding. This material is heavier than many plastics which can be compared with melamine in strength, stain and scratch resistance.

The colour is white. This colour forms a good background to perceive the natural colour of cooked and raw foods. But it can reflect white colour only when the light inside the aircraft is white, which is not always the case.



Large plate is mainly used to eat from - the foods which are brought in cassaroles. In case of cold buffet the main dish is pre-set in the large plate. In many cases it has been found that the passengers do not use large plate but directly eat from cassarole.

## 5.2

Salad bowl is a square bowl with curved sides and rounded corners. Its dimensions also do not have any relation with other items or containers. Because of this lot of storage space is wasted. It is much deeper than the other plates and rises above the rest when pre-set on the tray.

It is made of melamine and is white in colour.

It is used for keeping green, dressed salad - cucumber, luttice, onion, garbic, radish etc. all cut and sliced - pre-set on the tray.

Sometimes it is also used for keeping yoghurt i.e. dahi.

In case of breakfast, salad bowl is used for keeping cornflakes, over which milk is poured and it is eaten from the bowl itself.

Salad bowl is also used for keeping dessert - kulfi or ice cream and also pre-set fruit compote.

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Sides of the salad bowl are almost vertical at the edge, therefore handling is not ergonomical. Good grip is not possible without tilting.

### 5.3

Bread plate is a rectangular plate with rounded corners and curved sides and is very shallow.

Its material is melamine and is white in colour.

It is used for keeping bread roll - pre-set. Sometimes bread is served hot. In that case bread is kept in bulk in bun warmers.

Sometimes processed cheese is also pre-set with the bread on the bread plate.

### 5.4

Creamers are small circular cylindrical bowls.

Used for holding butter, cream, jam, marmalate and are pre-set.

Sometimes the butter is prepared and jam is served in cans. In that case creamers are not used.

It is difficult to take out the contents and both hands have to be employed. There is also possibility of soiling one's hands while taking out. Cleaning of greasy and sticky creamers is also difficult.

### 5.5

Tea cup is square cup slightly rounded at the corner. Its sides are vertical and it has a projected ring at the bottom. The stacking of these cups is not possible, hence a storage problem.

It is made of melamine. The inside colour is white and outside a pastel shade. The shape is not honest to the material. The handle is not ergonomical.

Tea is poured into the cup by the purser and then handed over to the passenger.

### 5.6

Saucer is square, with rounded corners, made of melamine. It has white colour on inside and pastel shade outside.

Saucer is used to hold the cup inside the tray. Its main use seems to be holding the cup while handling it over to the purser and taking it back after hot drink is poured into it.

Since the cup is not held directly, there is possibility of shake and splitting of tea or coffee.



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5.7.

Cutlery is made of stainless steel and is of conventional shape. Some of the problems with the airline cutlery are:

- . thefts by passengers
- . thefts by staff
- . loss and damage due to careless handling

Because of these the cutlery is uneconomic to maintain.

The shape is unergonomic. It is longer than necessary and is heavy.

5.8

Salt and pepper is sealed into aluminium foils lined with polythene. The salt and pepper is written on it.

One cannot know which one contains salt or pepper unless one knows english language. Also it is difficult to control and sprinkle uniformly. It is difficult to distinguish the two satchets unless closely observed thus likely-hood of confussion and delay in pre-setting.

5.9

Sugar powder is packed in cellulose acetate bags. The contents are not seen.



While putting the sugar in coffee or tea one does not really know how much to put for correct taste as it is unlikely that one has used powdered sugar earlier.

#### 5.10

All the above analysed items are pre-set in the meal tray. Besides this it should hold cassarole, soup bowl, tooth pick and napkin.

Meal tray is used to carry these items from galleys to the passengers and back. It also acts as a shelf during storage in tray carts.

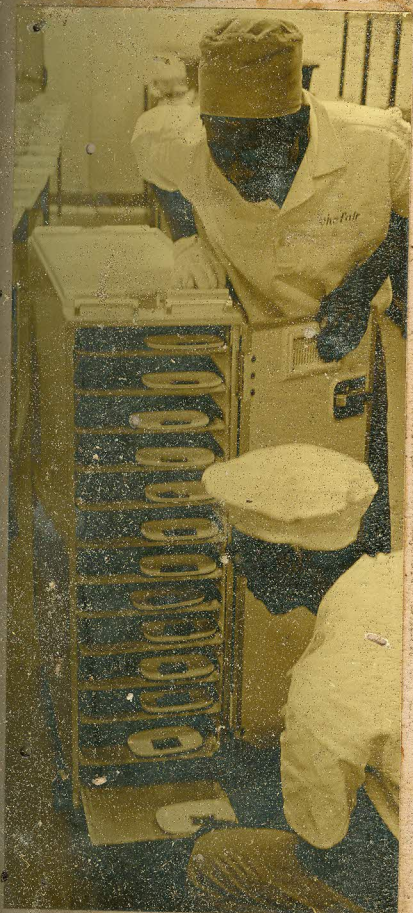
Because of the large size (16" x 11") and spread out equipment it has to be held by two hands.

During eating it just duplicates the work of the table.

The tray is made of formed plywood, coated with melamine or polyester with laid in gold printed paper laminate. Before pre-setting the plates etc., the tray is covered with cloth or paper which hides the gold print.

#### 5.11

Snack tray is made of the same material as the meal tray but is half in size.



It performs the same functions as that of large tray except that it contains less number of items.

5.12

Snack plate is a melamine, rectangular plate, with curved sides and rounded corners. It is pre-set in snack tray and is used for holding snack pastry etc.

5.13

Cassarole is a plate like container, used for cooking as well as serving.

The material used is melamine for low temperature cooking and porcelain for high temperature cooking.

Aluminium cassaroles are not used for serving.





## 6. System analysis

### 6.1

A fully stocked 747 carries 1450 cups 1395 plates 1098 glasses, 400 lbs of food, 2950 ice cubes 186 bottles of wine and 25 gallons of liquor.

### 6.2

Due to the inconsistency in the dimensions of the different items and the storage containers lot of storage space is wasted.

### 6.3

At present the trays are stacked in tray carts at a distance of about 2.5 inches because the cups and salad bowls are deeper than other items. The space above the other plates is not utilised.

### 6.4

Although the whole plane is divided into compartments and service is done formal the galleys simultaneously, but still there is one passenger in each compartment who gets his meals last of all.

### 6.5

Passing the trays; tea, coffee, drinks over the heads of the aisle side passengers is another drawback of the service. With this the spilling of liquids due to slight carelessness on the part of the passengers or hostesses is possible.

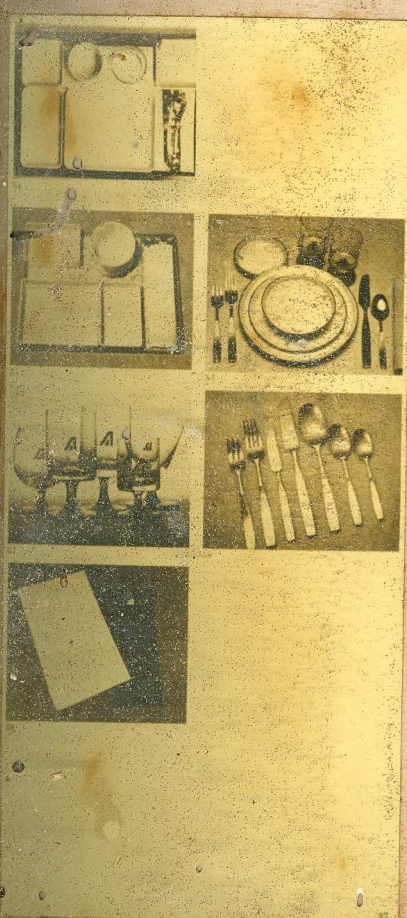
### 6.6

Collection of trays with left overs is another back breaking job for the hostesses, particularly when the cups, plates, etc. are overturned in the tray or kept outside the tray by the passenger.

### 6.7

It seems too much of hostesses' time is spent in serving the food while much less is spent in entertaining the passengers.

Left: Tray and dinnerware has a weight of only 25 ounces which is not only presentable but practical. Walter Lindsley Associates' complete program for Alitalia included the application of their new logo-type to the breakfast tray, 35, first class service, 36, stowaway, 37, stainless steelware, 38, and menus, 39.





## 7. Hypothesis

### 7.1

The shape of all the items be made simpler. The dimensions of all items should have some relationship with each other. All the items should fit in some dimensional grid, so that loss of space in storage is reduced to minimum. There is possibility of making all items more ergonomical i.e. easy to handle. All the items should be individually stackable.

### 7.2

The material for all the items could be any other plastic which is:

- light
- strong
- cheap for disposal
- easy and simple to manufacture

It could be

- polystyrene
- 24

- polypropylene
- ABS
- SAN

### 7.3

Large plate could be eliminated as the passengers can eat the main dish directly from the cassarole.

### 7.4

For keeping salad one need not necessarily have a salad bowl. Salad can be packed in polythene bags in which moisture and freshness can be retained for a considerable length of time. These bags can be pre-set instead of bowls. These bags if pre-set, can be cut open by passengers and taken from large plate, which does not seem to have any specific function. Corn plates also can be pre-set in paper bags. Ice-cream can be served in cardboard containers.

### 7.5

At present there are two system of serving bread

- pre-set
- serving after heating

It has to be specified by the planning and

procedures department whether the bread should be pre-set or loaded in bulk. Instead the procedure could be standardised by loading the bread in bulk and then served by trolleys, hot or cold according to meals, like any other entry. The passengers can pick it themselves.

Avoidance of pre-setting will be more hygienic as the bread will be touched by fewer hands. It will save time in pre-setting the tray and also some work in planning and procedures department.

#### 7.6

Cramers could be totally avoided if the butter jam and marmalade is pre-packed.

#### 7.7

The cup could be made such that it is stackable. Integrated and ergonomic handle could be tried out.

The handle can be removed from the cup if the whole cup is easy to handle and the outside surface does not get too hot to hold.

While sipping, tea or coffee should not drip from outside.



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### 7.8

If the problem of heat transmission to the outside surface is solved then saucer can be eliminated. The passenger can directly hold the cup, filled with hot drink, without burning his fingers.

### 7.9

Inexpensive materials like ABS, SAN polystyrene, than stainless steel could be used for cutlery.

If cutlery is made inexpensive very few people will think of stealing and if at all stolen the loss will not be much.

It can be made throw away or disposable after one use if cost is reduced considerably. In case of disposals the problems like washing, drying, sorting, storing, counting, keeping records, checking are eliminated.

The form could be made functionally more efficient, more ergonomic and aesthetic. At the same time all the pieces should go with each other and the system.

### 7.10

To the salt and pepper satchets, a powdered red chilly satchet could be added for the benefit of Indians, who relish hot and spicy foods.

Disposable plastics cutlery



27

The communication on the satchets should cross the barriers of the language.

There could be different shapes for three satchets or colour coding to distinguish them. The satchets could be transparent on one side so that the contents are seen.

#### 7.11

It would be more convenient for the passengers if it is mentioned that the sugar satchet contains equivalent of  $\frac{1}{2}$  spoon, 1 spoon or 2 spoons of sugar. Sugar tablets equivalent to  $\frac{1}{4}$  or  $\frac{1}{2}$  spoon can be packed together and served.

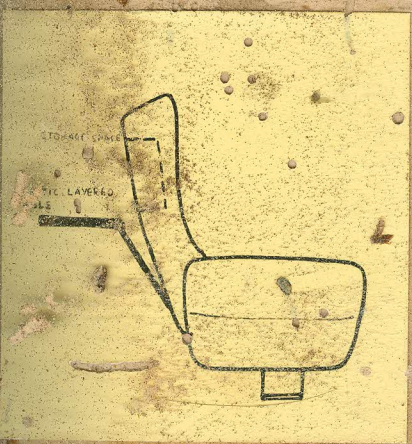
#### 7.12

The meal tray could be replaced by large plate for holding and carrying the rest of the items. The passengers can themselves take out different pieces and arrange it on the table according to their own choice and convenience.

#### 7.13

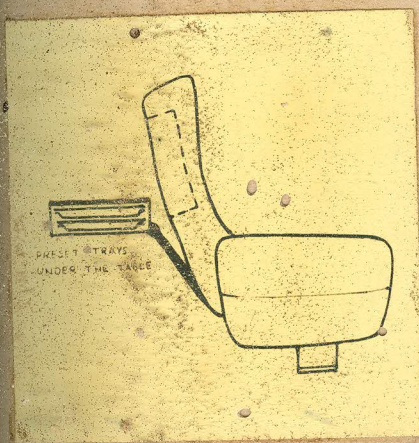
By removing the tray all the items could be packed compactly and if stored somewhere near the seat before passengers board the plane, the distribution of trays can be avoided. Thus lot of time and energy will be saved. The service of entry food items will become much faster.

In this system there is a problem of collecting the items back and cleaning the table, which becomes a cumbersome job. To avoid the cleaning of tables, the tables can have different plastic layers which can be peeled off.



7.14

The alternative could be that compactly pre-set trays with covers; could be inserted or slid into the tables, before passengers board and then removed after the meals.



But both these system need lot of changes to be made inside the aircraft which may be difficult in the existing ones.

7.15

Large plate could be used as a snack plate as well.

7.16

It would be convenient if the casseroles are put on the meal tray before distribution. In that case it should fit into the grid dimensionally and should be similar in form to other plates.

8. Design decision and solution

8.1

The overall size of the meal tray 16" x 11" (406 mm x 280 mm) was divided into the grid of 30 mm square. The equipment that goes inside was dimensioned exactly according to the grid. When all the plates etc. are kept inside the tray, there would be playing space of 10 mm in longitudinal side and 4 mm in the other side. This playing about space is desirable for easy pre-setting and removing of the plates from the tray.

8.2

A flange of 18 mm wide provided on all the four side of the meal tray to make it convenient to hold and also for sliding into the tray carts.

8.3

The flanges were provided on all the plates for easy and firm grip and also for formal characteristics.

8.4

The depth of the each plate and trays were so determined that none of the plates put inside the tray rise above the rest. They all flush

at the top. This makes the stacking of the pre-set trays easier.

#### 8.5

The sides of the trays as well as the plates were kept straight so that there is maximum utilisation of space. The corners were rounded to have the continuity of the form and also to provide some relief when the tray is fully set. The radii were so chosen that when three plates are kept close to each other, there is space for at least one finger to go in. The radii at the corners of the trays were made in relation to the radii of the other plates.

#### 8.6

The sides of the trays and plates were made tapering downwards to make them stackable individually.

#### 8.7

The snack trays were so designed, that these two fit exactly in the meal tray, and also large plate fits in it. The snack tray has a flange of 18 mm on two shorter sides only.

#### 8.8

The material for all the plates, bowls, trays except cassarole was chosen as injection

moulded ABS as it is light, strong and retains good surface finish.

### 8.9

In the tea cup the handle was done away with. A double walled cup was introduced. These are actually two cups just pushed into each other. The air gap between the two cups acts as an insulator and minimises the heat flow to the outside surface, thus making it convenient to handle.

The outside dimensions of the cup were so determined that it can be gripped easily in an average sized hand.

Both inside and outside cups were made tapered so that they are individually stackable and visually pleasing. To minimise dripping the edge of the cup was flanged at an angle and thickness reduced to minimum.

The material for inside cup was chosen as ABS so as to resist temperature upto 100°C (boiling point of water). Transparent polystyrene or SAN was decided as material for outside cup. The outside cup was made transparent so that passenger can see the inside cup and hold the cup containing hot drink without any fear.

The outside cup can also be used as cold drink cup or water cup separately.

#### 8.10

The length of the cutlery was determined by the average sized hand and it was also made to fit into the grid.

#### 8.11

The cutting angle for knife was determined by experiment and was found to be 20°. The cutting edge was made slightly curved to have freedom of movement while cutting. The part of the cutting edge was made toothed. The overall form was conceived keeping in view the cutting angle, the ergonomics of cutting and the material - which was chosen as SAN - to be used.

#### 8.12

It was observed that the fork is used as a :

- . fork
- . knife
- . spoon
- . knife and fork combined
- . spoon and knife combined.

It was decided to incorporate a cutting edge with the fork. The form of the fork was decided keeping in view the above requirements.

SAN was the material chosen for the fork.

### 8.13

It was observed that while eating with spoon, one has to turn his wrist fully to take the spout - which is opposite to the handle - of the spoon into the mouth. The spout was put at an angle to the handle of the spoon so that full turning and straining of the wrist can be avoided. The almost straight edge opposite the handle, facilitates the picking and cutting of soft foods. Its material was also chosen as SAN.

### 8.14

Instead of mocca spoon a SAN stirrer was proposed with a slight depression at one end, as it is to be used only for dissolving sugar in tea or coffee and not for measuring. The radius of stirrer at its end was made same as that of the tea cup bottom. The length of the stirrer was made such that it does not slip into the cup, if left in it, and is also convenient to stir.

### 8.15

All the cutlery is transparent with slight brown tint. The alternative material for cutlery could be polycarbonate, which is

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virtually unbreakable and is transparent.  
But it is very costly material.

#### 8.16

The butter and jam was decided to be served in polythene squeezers. The end, if which can be torn off along the cutting line provided; and the contents can be squeezed out. The difficulty with butter was that it may get hard, but it is recommended that butter should be ~~served~~ at a temperature at which it is spreadable.

#### 8.17

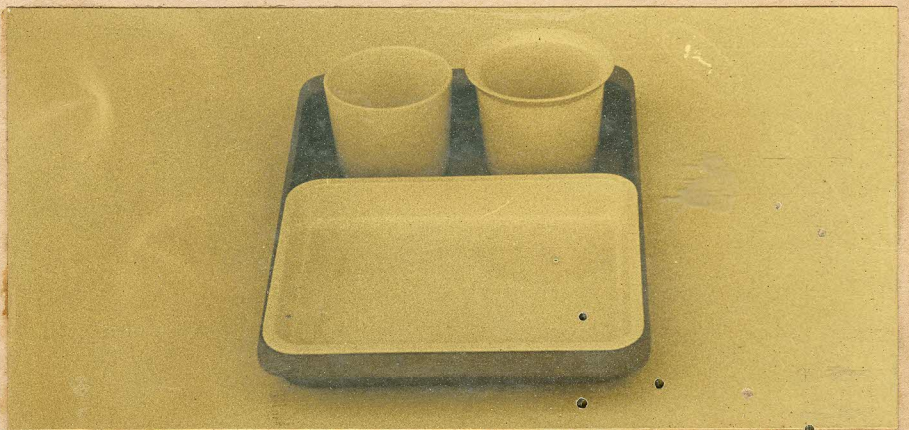
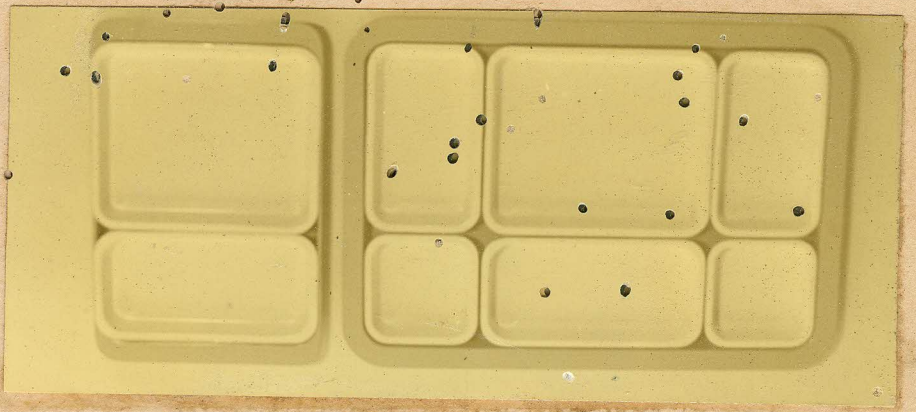
Instead of serving powdered sugar it was decided that 8 sugar tablets, each tablet equivalent to  $\frac{1}{4}$  spoon of ordinary granular sugar be packed in cellophate paper and served.

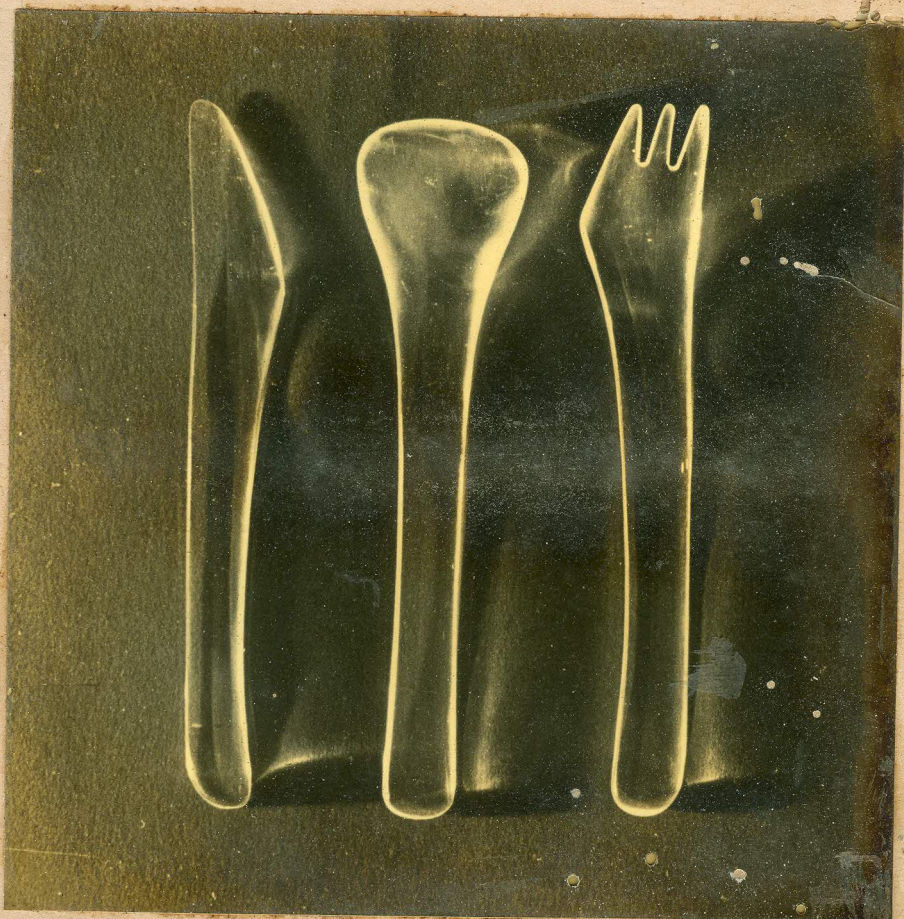
#### 8.18

Chilli satchet was added to the salt and pepper satchets. To distinguish between the three, they were colour coded:

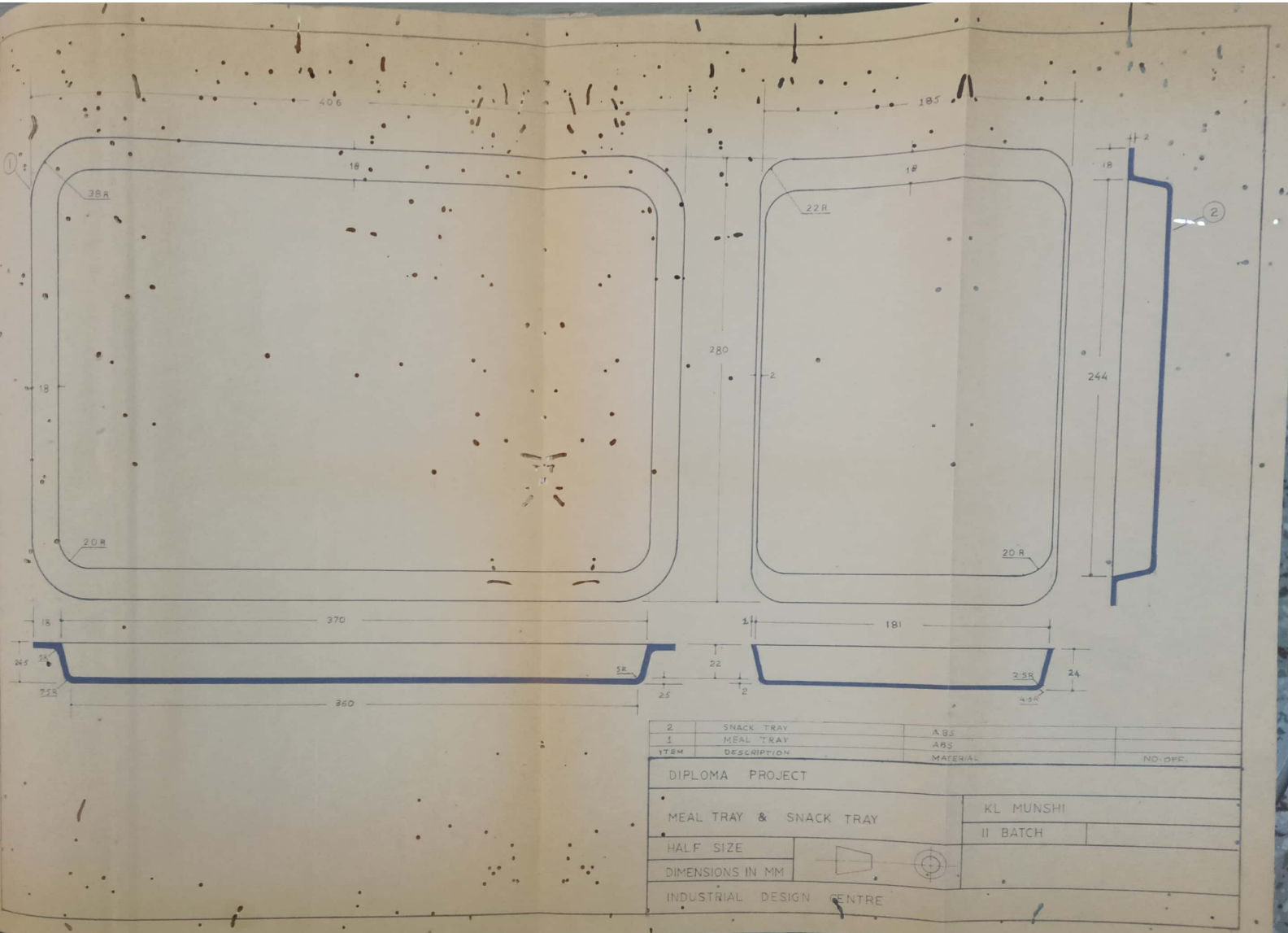
- . white for salt
- . black for pepper
- . red for chilli

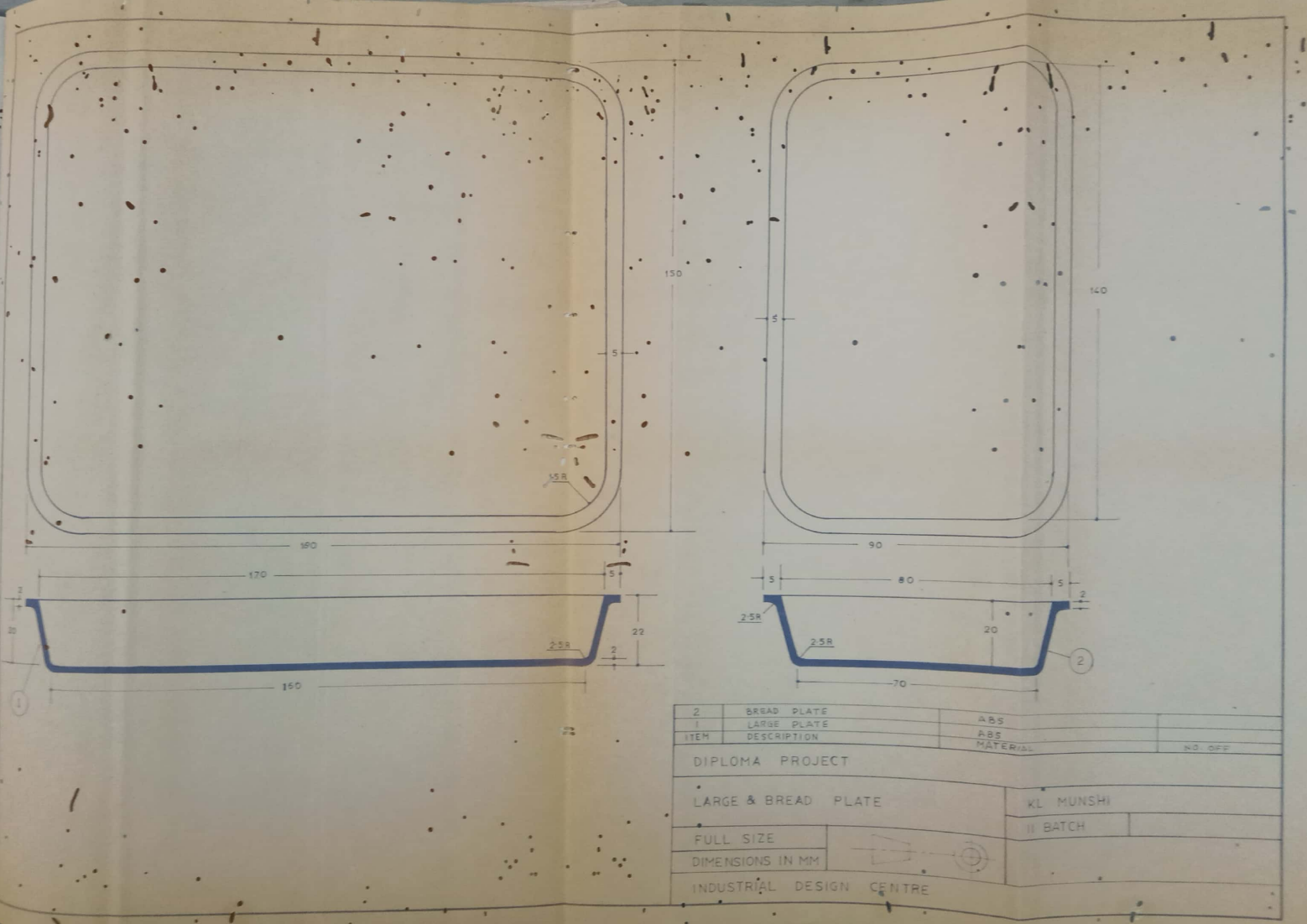
Shape of these satchets was also altered to go with the shape of butter and jam squeezers. The materials for the satchets was chosen as polythene coated paper.




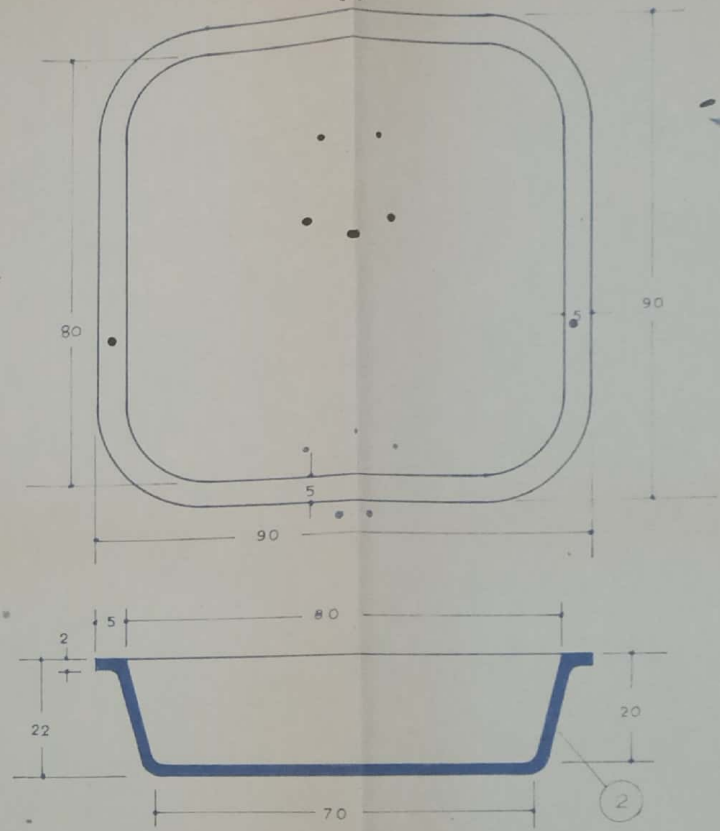
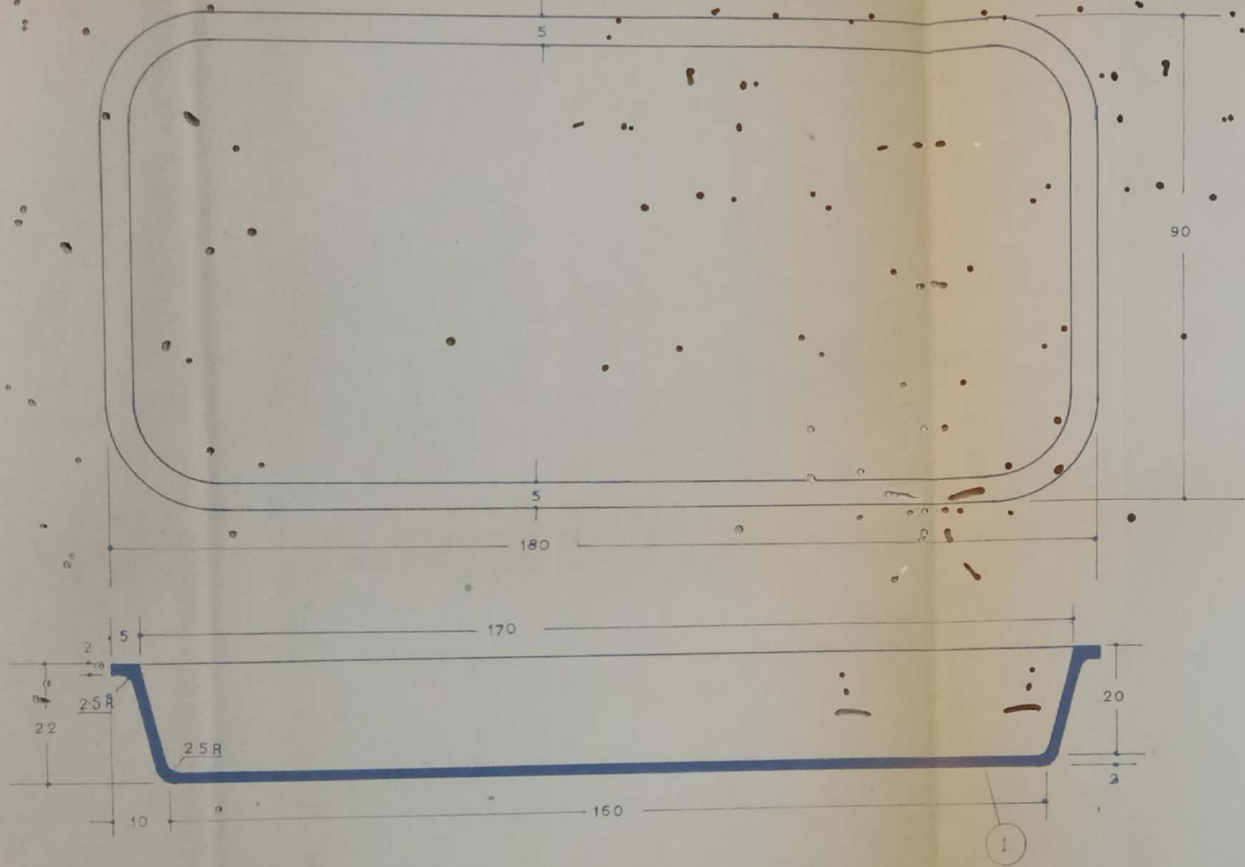








2	BREAD PLATE	ABS	
1	LARGE PLATE	ABS	
ITEM	DESCRIPTION	MATERIAL	NO. OFF
DIPLOMA PROJECT			
LARGE & BREAD PLATE		KL MUNSHI	
FULL SIZE		II BATCH	
DIMENSIONS IN MM			
INDUSTRIAL DESIGN CENTRE			



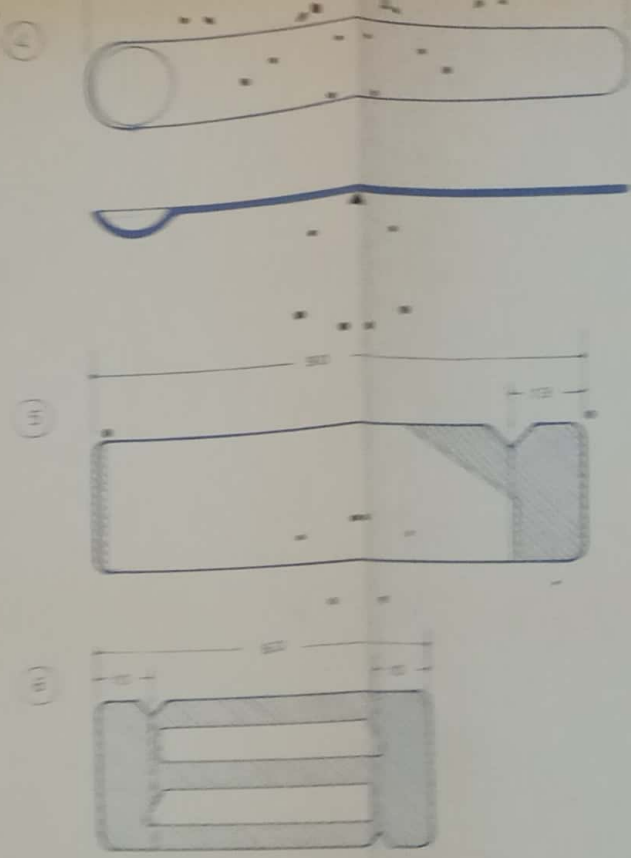
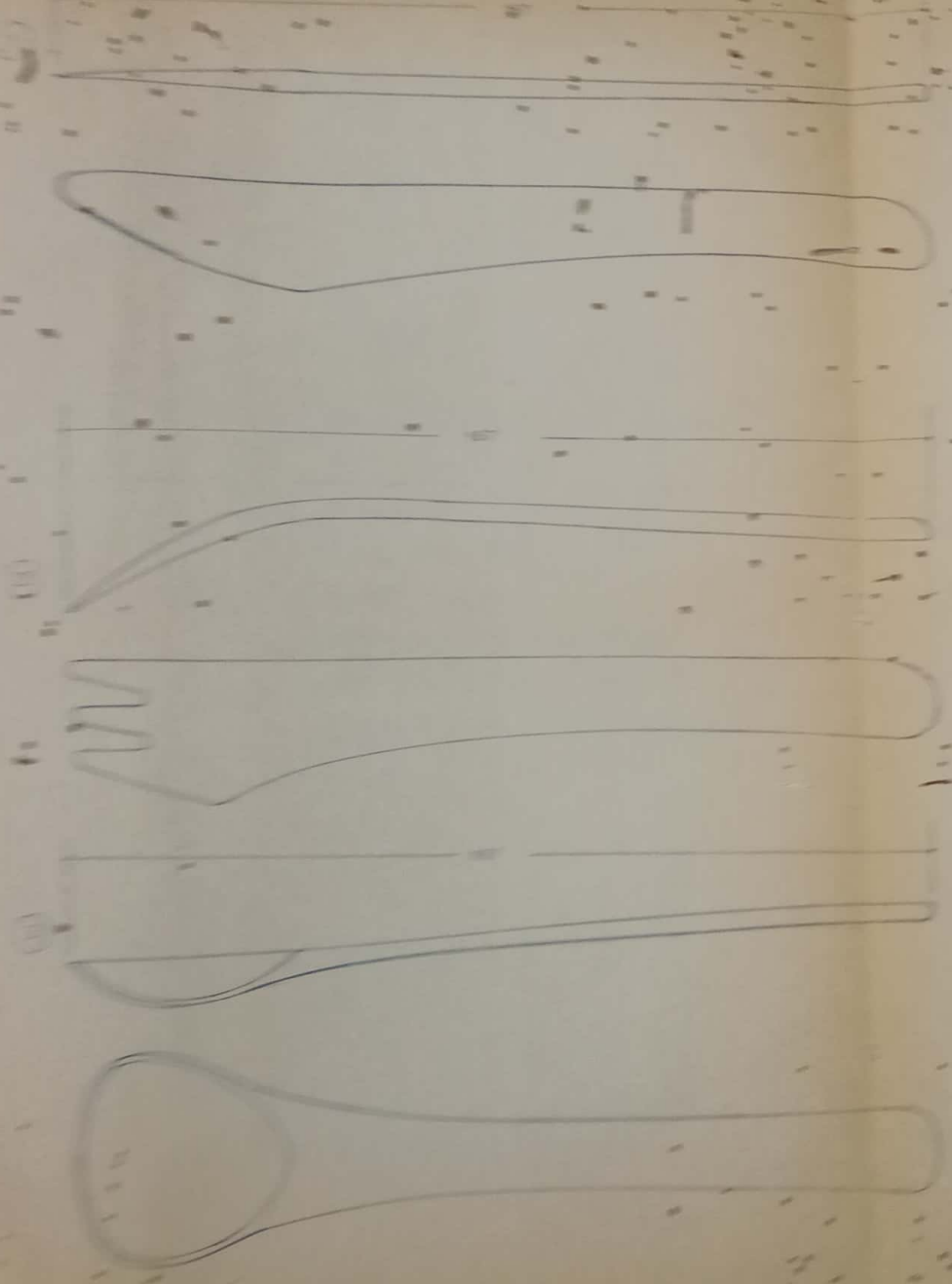
ITEM	DESCRIPTION	MATERIAL	NO OFF
2	SALAD BOWL	ABS	
1	CASSAROLE	MELAMINE OR PORCELAIN	

DIPLOMA PROJECT	
CASSAROLE & SALAD BOWL	
FULL SIZE	
DIMENSIONS IN MM	
INDUSTRIAL DESIGN CENTRE	

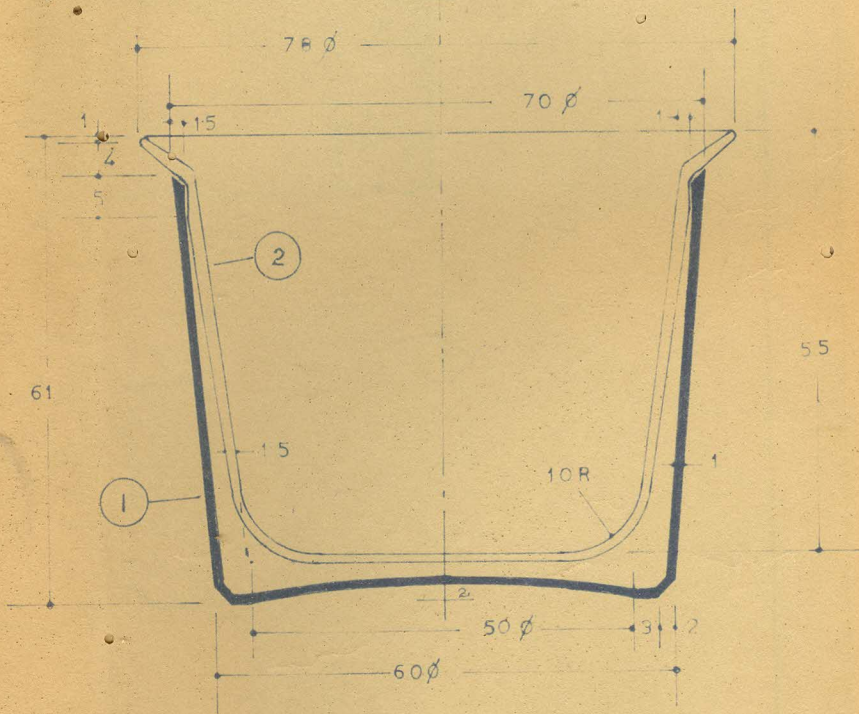
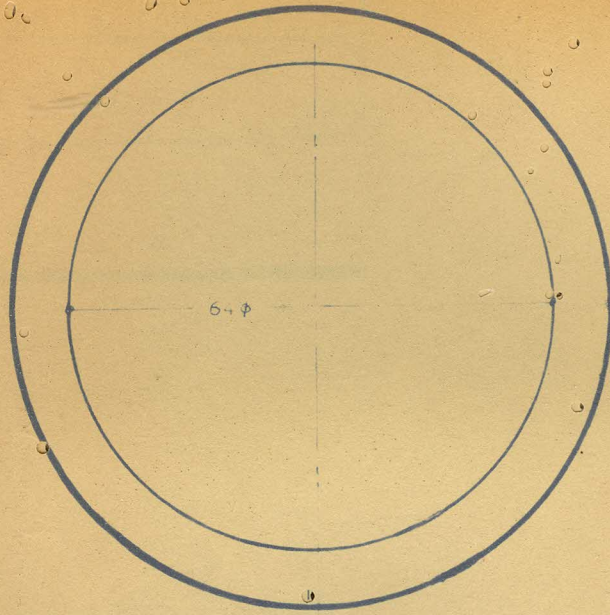
KL MUNSHI
II BATCH



1	Material	POLYMER COATED PAPER	
2	Substrate	POLYMER	
3	Process	SAW	
4	Shape	SAW	
5	Color	SAW	
6	Finish	SAW	
7	Dimension	SAW	NO OFF

DIPLOMA PROJECT

OUTLET		K. MURTHI	
PALLIYER		D. SATHI	
DIMENSIONS IN MM			
INDUSTRIAL DESIGN CENTER			



ITEM	DESCRIPTION	MATERIAL	NO. OF P.
2	INSIDE CUP	ABS	ONE
1	OUTSIDE CUP	POLYSTYRENE	TWO

DIPLOMA PROJECT

CUP

KL MUNISHII

II BATCH

FULL SIZE DIMENSIONS IN MM

INDUSTRIAL DESIGN CENTRE

## Bibliography

- Industrial Design, October 1970
- Design March 1970
- Design June 1970
- Design May 1971
- Design June 1971
- Meal schedules, Air India
- Meal upleft instructions, Air India
- Galley loading plan, Air India