

Arizona State University

A contemporary approach to designing the interior of the
Boeing 767 : a passenger airline

Michelle A. Jimeno

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A CONTEMPORARY APPROACH TO DESIGNING THE INTERIOR
OF THE BOEING 767 - A PASSENGER AIRLINE.

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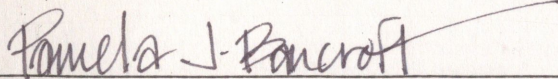
MICHELLE ANGELA TUTT JIMENO

A program document submitted in partial fulfillment for the degree

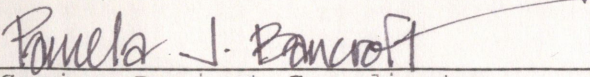
BACHELOR OF ARTS IN INTERIOR DESIGN

College of Arts and Architecture
Montana State University
Bozeman, Montana

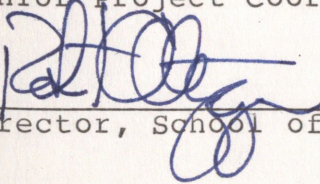
June 1989



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Director, School of Architecture

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Michelle A. Jimenez
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June 8, 1989
Date

DEDICATION TO: My parents, Owen & Sherry Tutt. Thank you for teaching me to make the most out of life.

SPECIAL THANKS TO: Alan J. Anderson, Chief Engineer
Payloads Systems Advanced Programs
Boeing Commercial Airplane

Robert J. Cebull
Design Director
Walter, Dorwin, Teague Association INC.

Byron Mikellides
Co-author "Color for Architecture"

Tom White
Boeing Company

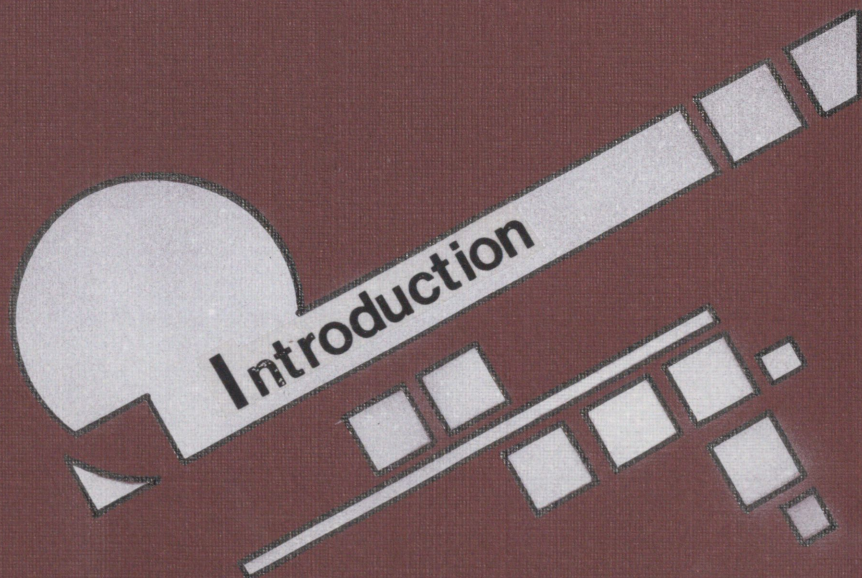
Pamela Bancroft &
Clark Llewellyn
Architecture Professors

Military Liason
Executive Office
Washington D.C.

Russell Jimeno
My Loving Husband

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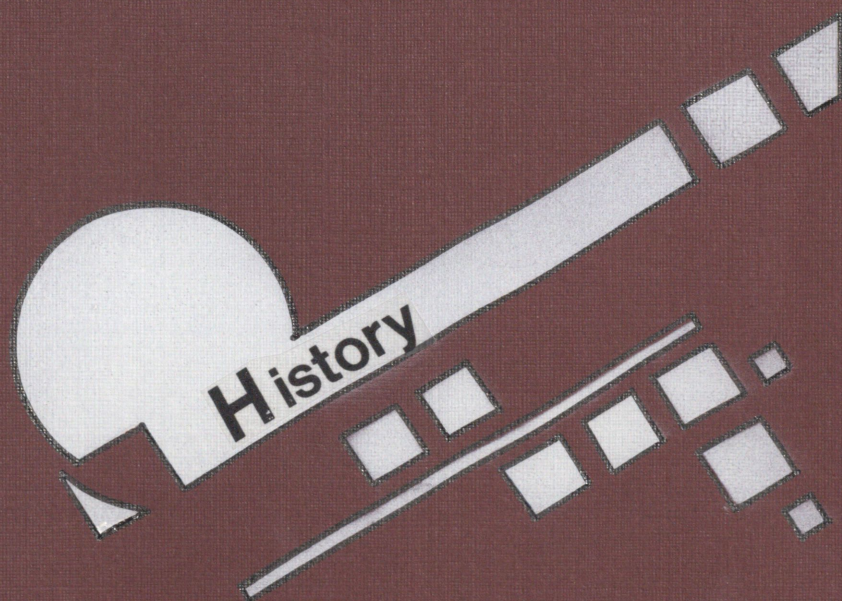
INTRODUCTION and PROBLEM STATEMENT

As indicated in the project title, the focus of this project will be on the contemporary designing of the interior of the Boeing 767. The basis from which this project stems is a need for airline interiors that do more for passengers than merely transport them from location to location. Passengers should not be stifled during the time in which they are flying. Ideally aircraft environments will encourage people to think, relax, and enjoy the time they spend in the air. This is a real concern. People want more out of their flying experience, which is apparent through the existence of first class sections. In this project I will design an interior which solves this problem and accomplishes our idealistic goals.

Boeing Commercial Airplane Company is an aircraft manufacturer. They conduct business with airlines who order and purchase airplanes from them. This project will be conducted in a similar manner. I have set up a scenario in which a hypothetical airline addresses Boeing with a request to order a Boeing 767 with a specialized interior. Due to the scope of this project

being limited to ten weeks, emphasis will be placed on a design approach more than a technical or analytical approach. To not undermine the importance of the technical roll, I will address it by reviewing the applicable issues in this documentation and respecting them throughout the design process.

This documentation was created to familiarize the reader with the applicable aspects of this project. As this documentaion progresses it will become more and more focused on specific items and implications. It begins with a broad history of passenger aviation then narrows to the Boeing 767, next it discusses the passengers needs and the objectives of this project. After a review of existing case studies it establishes the project scenario. Then it deals specifically with the implications of color, economics, and interior spaces. This written program lays the ground work for an effective design to follow.



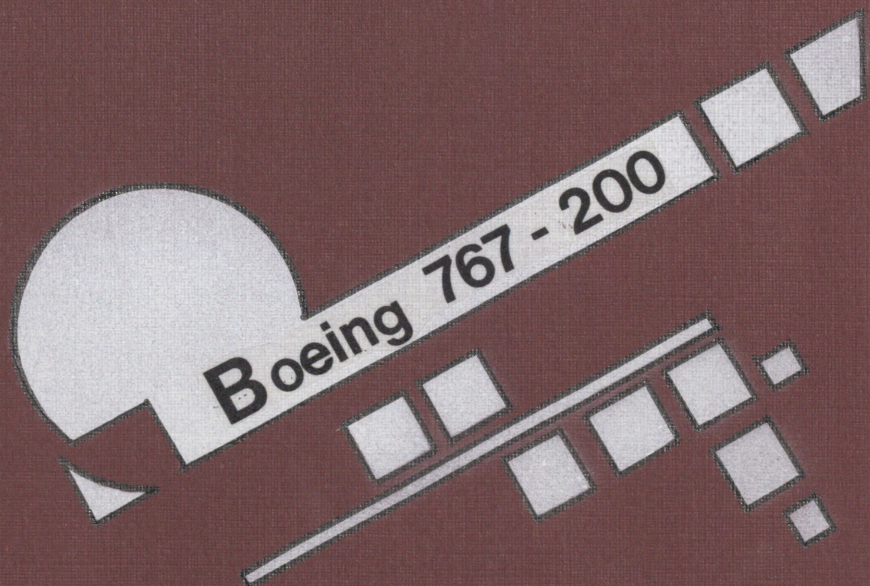
HISTORY

low-winged all-metal construction. United Airlines fully tied up Boeing. One would have to say that the history of air transportation began with a 12 second, 120-foot journey on December 17, 1903 when Orville and Wilbur Wright gave birth to aviation. However, air transportation specifically got its start with the first passenger flight ten years later. On January 1, 1914, the former mayor of St. Petersburg, Florida paid \$400.00 for the privilege of being the first passenger on the **St. Petersburg-Tampa Air Boat Line**. The airline's first plane was the open cockpitted wooden-hulled **Benoist** type XIV biplane. At the maximum of 63 mph a one way trip took 23 minutes and cost \$5.00. The big event of aircraft manufacturing occurred.

Although commercial flight had begun, it took Charles A. Lindbergh flying from New York City to Paris in 1927 to make the world realize the significant meaning of flight. Commercial aviation was henceforth viewed on a businesslike basis. Soon major airlines began emerging and competition between aircraft came to the forefront.

In 1933 the first truly modern airliner, the **Boeing 247D**, was designed. It was readily distinguishable by its clean lined

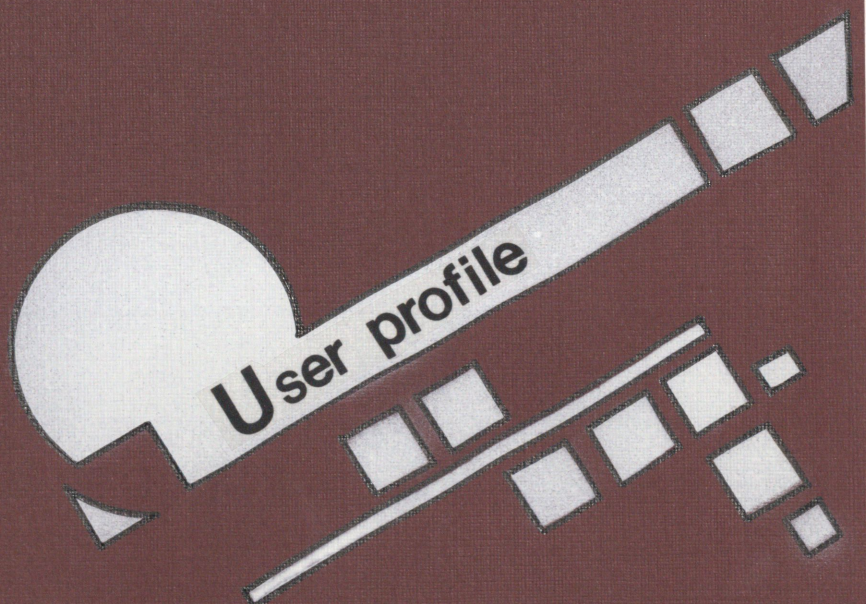
low-winged all-metal construction. United Airlines fully tied up Boeing's production lines by ordering the first sixty, thus denying its use by any other airline. This monopoly forced competitive companies to go to Douglas for an aircraft that could compete. This demand originated the **DC-1**. Only one **DC-1** was ever built, but soon to follow was the **DC-2** and the **DC-3**. The **DC-3**, with a capacity of 21, was the first airplane to make money hauling only passengers. In 1953 the **DC-7** became the first airliner to offer non-stop service to either coast. This piston-engined airliner soon became obsolete with the advent of the turbine-engine-powered **Boeing 707's**. The final big event of aircraft manufacturing occurred with the creation of the "Jumbo Jet", a coined name for the **Boeing 747**. The National Air and Space Museum has stated that the only reason a **Boeing 747** isn't on display is that it is so huge, it wouldn't fit.



BOEING 767-200

The Boeing 767-200 is a wide body, twin engine, medium-range airplane. With conventional configurations it is designed to carry from 211-290 passengers. It is designed to operate with a 2-3 member flight crew. As written in the Boeing 767 brochure, "The 767-200 and its planned derivatives herald an era of commercial jet transports designed for energy conservation and to satisfy expanding market requirements far into the future."^[5] In comparison of size to other passenger jets, the 767 falls right around the middle. I with the assistance of Alan Anderson, chief engineer at Boeing Commercial Airplane Design group, have selected the Boeing 767 as the airplane for this project. The Boeing 767 was selected because of its large size and capacity, but its feasible scope. The 767 is designed with onboard entertainment consisting of projected movies. Another important consideration is maintenance turnaround time. As existing the Boeing 767 has an effective turnaround time due to the strategic locations of galleys and lavatories. In order to maintain this efficiency, attention

shall be paid to retaining these locations or creating equally efficient locations. Existing air conditioning, ventilation, and pressurization systems shall be retained as well. Appendix A contains data on the Boeing 767, including information on the aforementioned items. With the decrease in passenger numbers, below level cargo spaces will be freed for additional passenger usage. This can play a significant role in the design of this plane. This additional space can allow for a lower level entry as well as additional square footage.

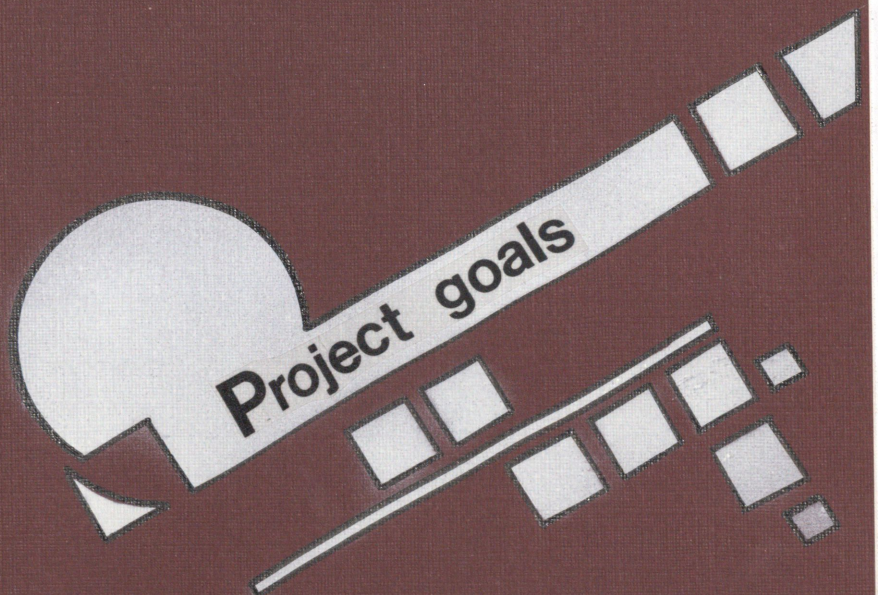


USER PROFILE

The user this scheme will cater to is willing to pay a bit more for the privilege of escaping the monotony of sitting for hours in a seat surrounded by rows and rows of other seats. This person may want to enjoy his or her trip sitting in a quiet lounge reviewing documents from work while sipping a drink, or escape into a suite and enjoy private relaxation. On the other hand these travellers may want to launch off on their annual vacation with seats on a flight in a luxurious dining area with live entertainment.

Many jobs and lifestyles today dictate that a person travel frequently. It's a matter of how each person wishes to spend their time in flight. This design will give the passengers the option of whether they want to use this time effectively. It will also give them the option of beginning their vacations as they step onto the plane instead of as they step off.

This project is for the user who wants a little more.

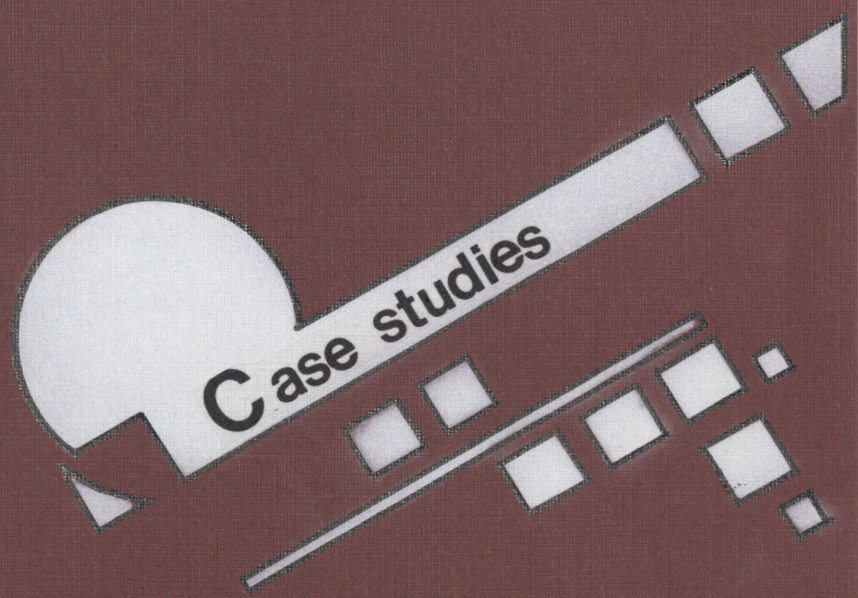


PROJECT GOALS

This section will list the goals I wish to accomplish with this project.

- To design an interior environment that is inviting and intriguing to sophisticated air travellers.
- To create a design of quality and luxury.
- To use color and design to alleviate some of the psychological and physiological effects of flying.
- To use color and design to create an interior which seems spacious in a limited space environment.
- To use lighting and texture to stimulate travellers senses.
- To create an effective acoustical barrier between quiet and loud areas.
- To offer passengers a variety of travelling options.

- To design a variety of distinctive appealing spaces.
- To create a flexible design that can be thought of realistically.
- To maximize the number of passengers without creating a cramped feeling.
- To meet Boeing's corporate jet criteria of Versatility, Capacity, and Range.



CASE STUDIES

CASE STUDY 1

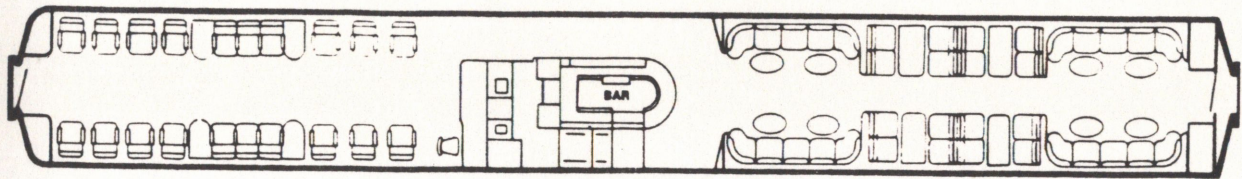
Project: Amtrak

INTRODUCTION

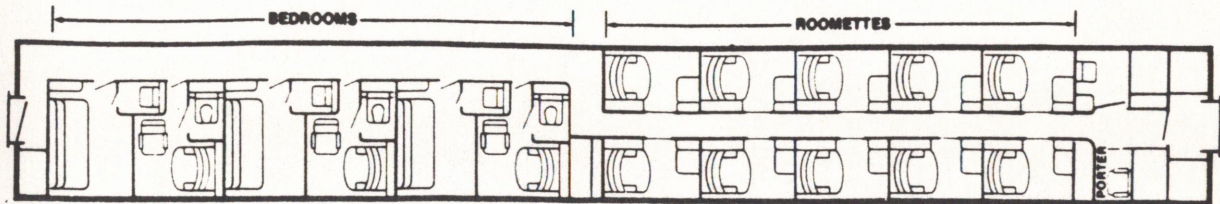
I chose to write a case study on Amtrak because of the similarities a passenger train has with a passenger airplane. These similarities are that both are moving transportation vehicles, both interior configurations are in a narrow elongated form, and both carry people for long distances and for extended periods of time.

ANALYSIS

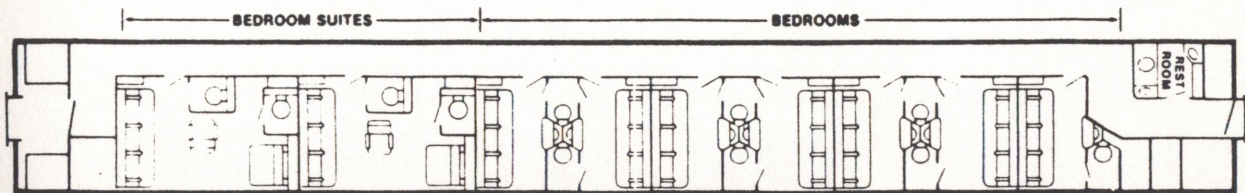
Amtrak offers several seating possibilities for travellers, such as coach and chair cars, roomette and sleeper cars, metroclub cars, dining and beverage cars, lounge cars, and the typical Amclub or seating cars. The following are examples of some of these in plan as well as some photos.



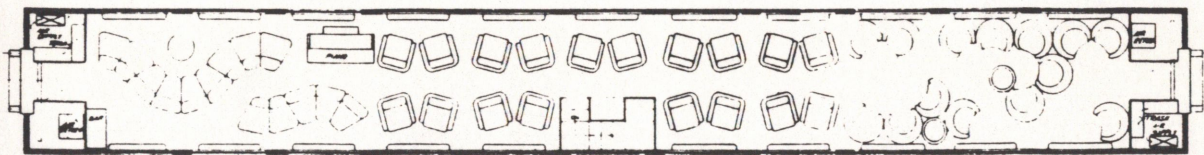
EXAMPLE OF LOUNGE CAR



EXAMPLE OF 10-ROOMETTE, 6-BEDROOM SLEEPER



EXAMPLE OF 11-BEDROOM SLEEPER

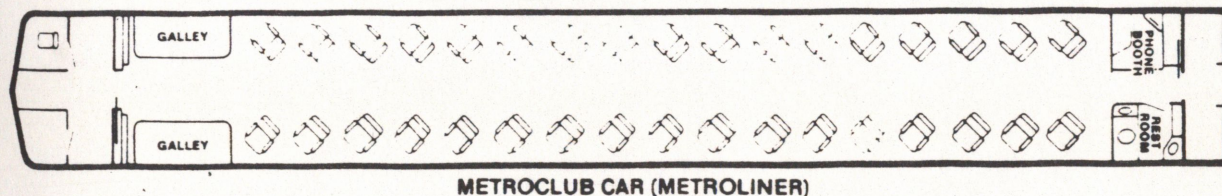


Amtrak's new lounge

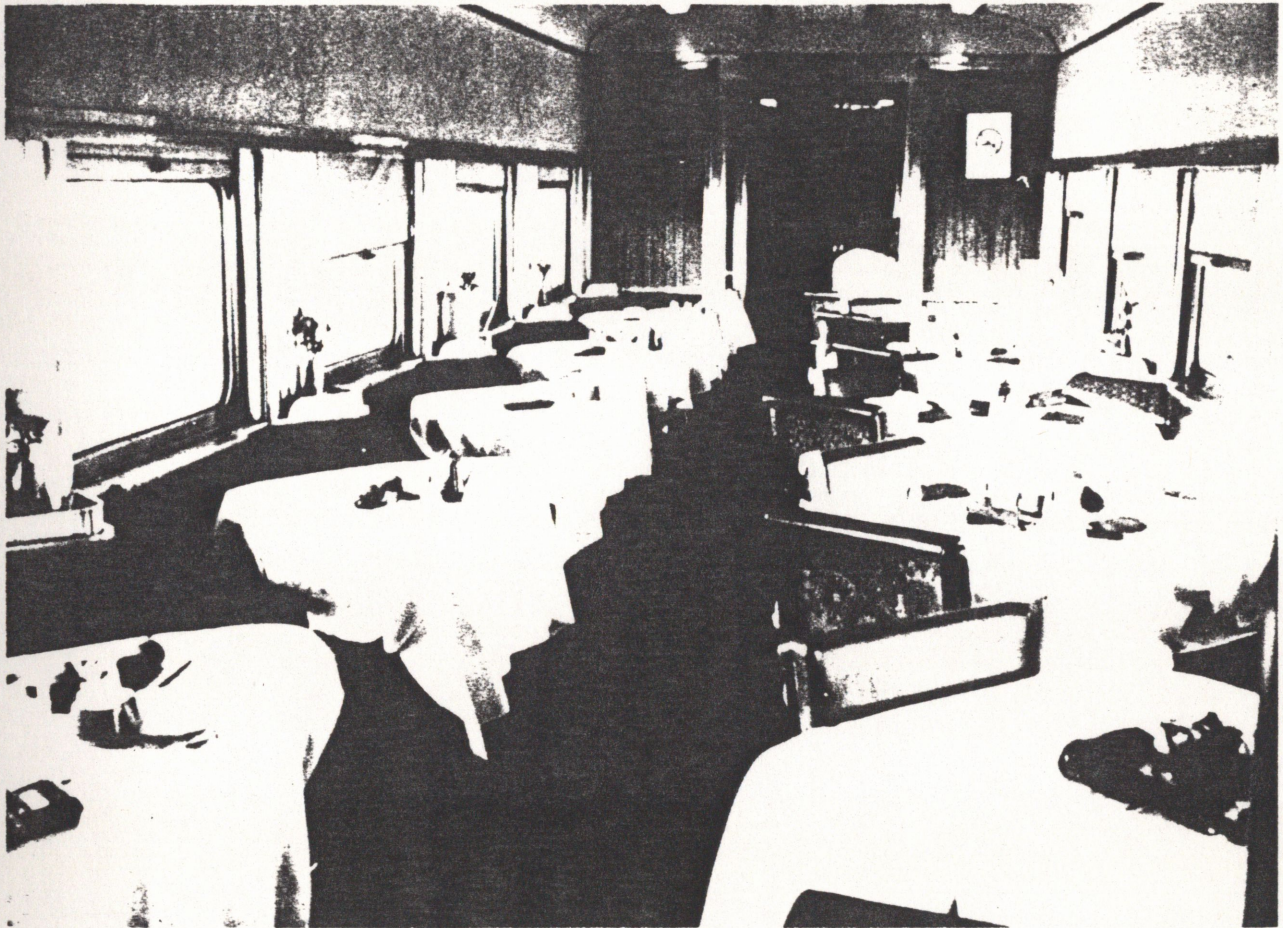
Amtrak views their sleeper cars as a continuation of first class service on long distance routes. Amtrak designed their club cars with the intent of giving more for an extra fare. They believe that the high occupancy rate of their club cars demonstrates the demand for this service. Lounge cars are usually placed midtrain for service to both sleeping and coach cars. Dining cars come complete with white jacket service and the Amtrak saying, "Nothing could be finer than dinner in the diner."



Metroclub car seating, until 1979, provided the usual single, reclining, rotating parlor car seat and was highly popular with businessmen. (Amtrak)

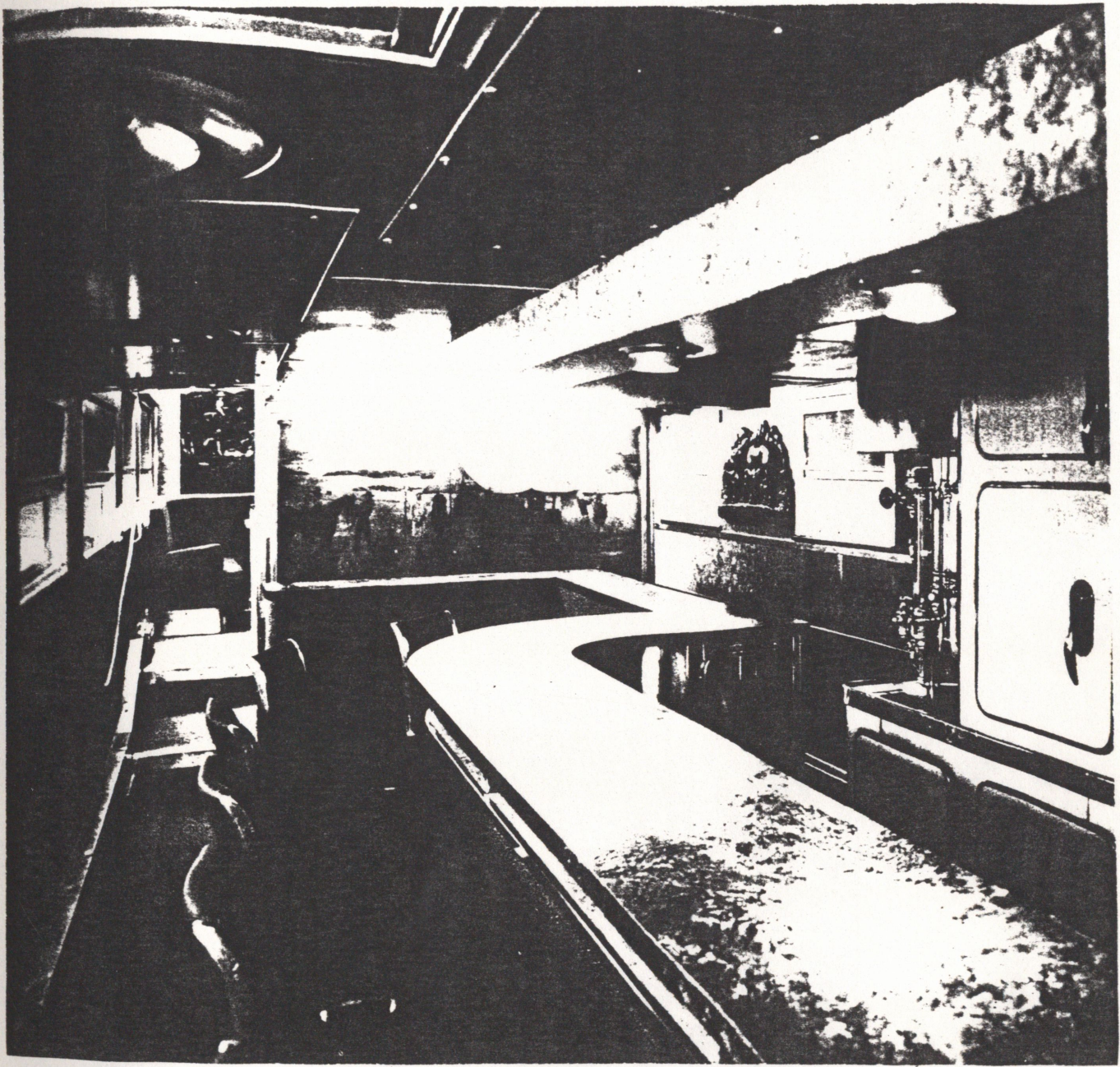


Amtrak also sports a lively rolling cabaret car called the "Discodome". This car enabled passengers to mix fun with scenery. It included live entertainment and a light meal. It is Amtraks intent to offer a full spectrum of service - "to be a fully stocked store where a customer may shop for either economy or luxury."^[2]



IMPLICATIONS

Although trains have an advantage over airlines in unlimited number of cars, a lesson can be learned from the variety of travelling spaces Amtrak has to offer. As Amtrak insists there is a market for travel that offers more. Airlines should make an effort to tap that market. Not only would it be profitable for them but the public would benefit as well with the privilege of being able to select how they wish to fly.



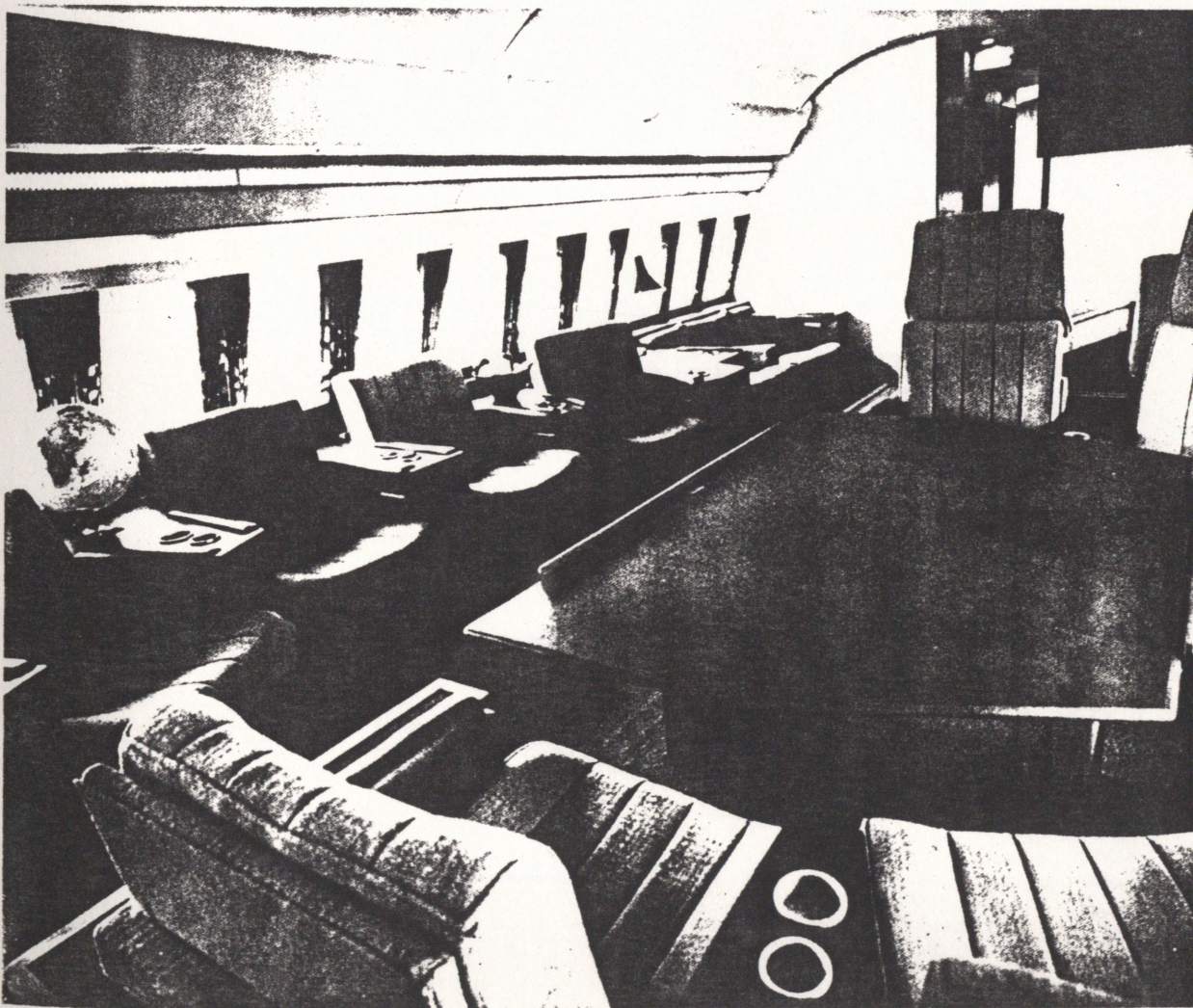
CASE STUDY 2

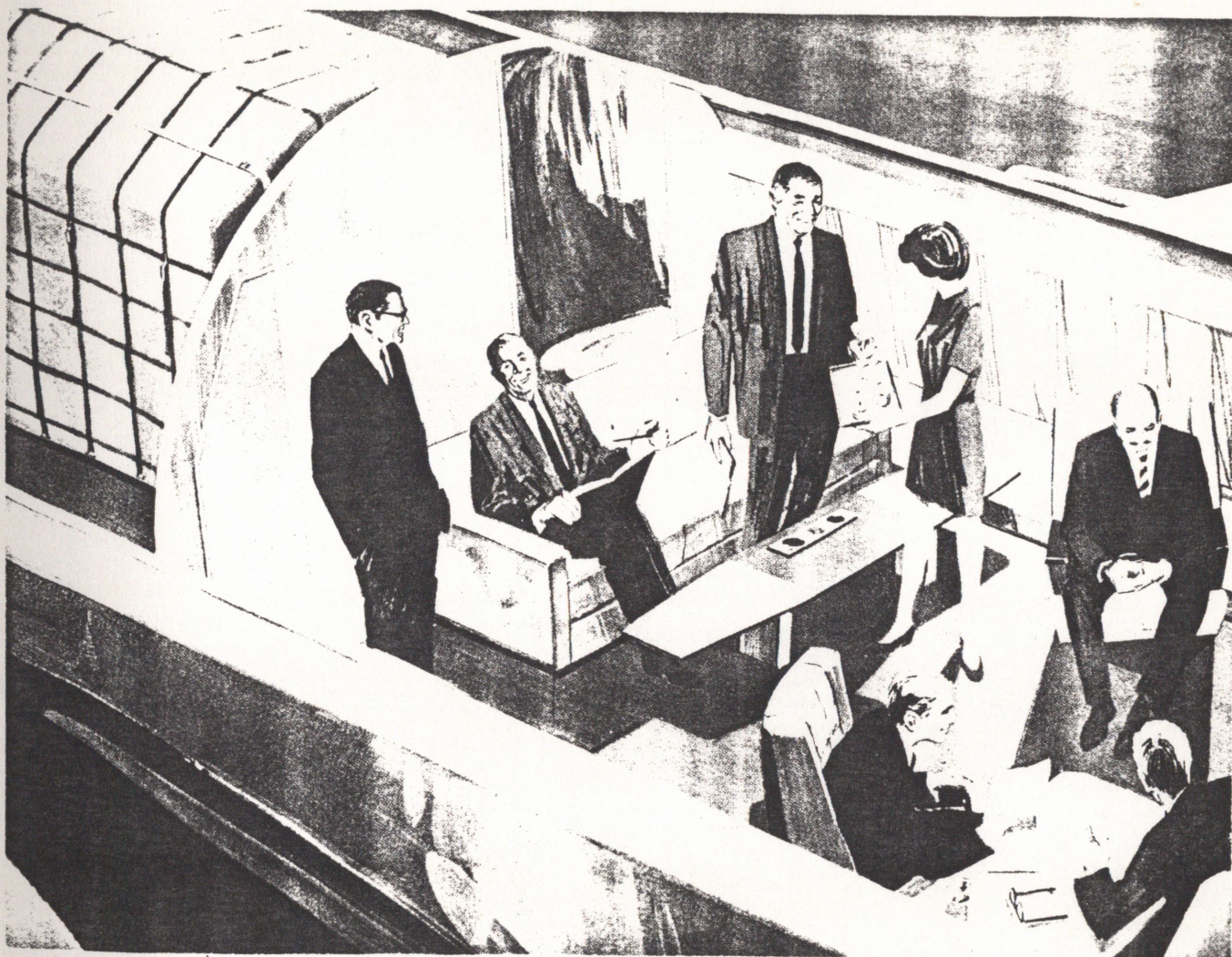
Project: The Boeing Advanced 737-200 Corporate Aircraft

Designers: The Boeing Company

INTRODUCTION

The Boeing advanced 737-200 Corporate aircraft was designed for corporations who wish to own their own jet and have the luxury of decideing on their own personalized interior.

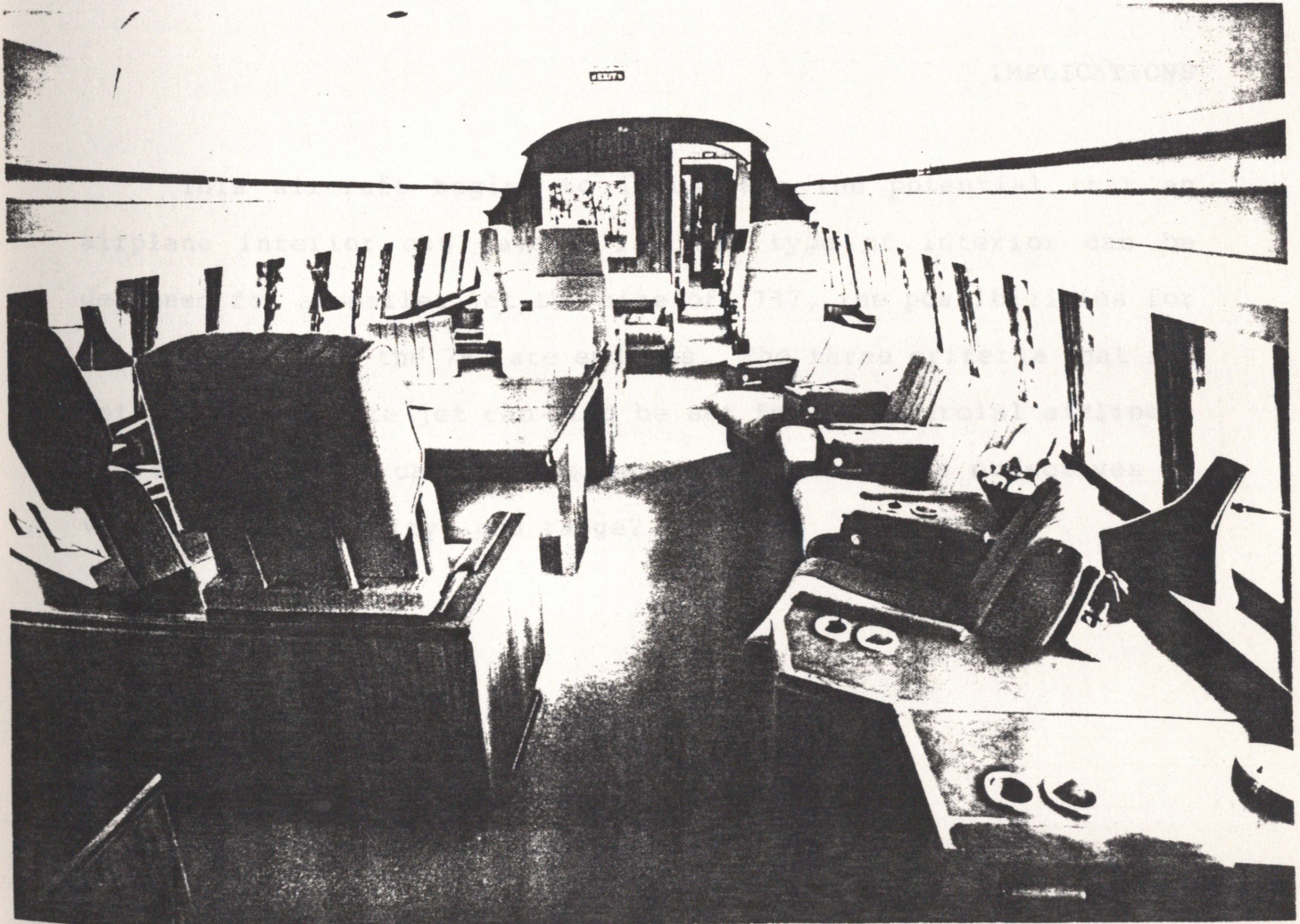




ANALYSIS

The Boeing advanced 737-200 is a regular commercial jet airliner, except it is the smallest of the Boeing jets with only 687 square feet of floor area. The efficiency potential of a corporate jet depends on three main criteria: versatility, capacity, and range.^[3] The 100' Boeing 737-200 corporate aircraft is designed to come in three different configuration options. The purpose for this is to give the individual the opportunity to determine their own balance between workspace and luxury.

The Transcontinental configuration - all executive interior, can carry around 20 people and baggage over 2,500 miles non-stop, or 25,500 pounds over 2,000 miles non-stop. The Transoceanic interior - also all executive, is similar only it is capable of carrying the same amount 1,500 miles further non-stop because of supplementary fuel tanks. The convertible configuration - mixed interior - cargo/executive, can transport bulky items as well as dense payloads needing strong plane structure. This configuration can carry 10 tons of commodities and 20 executives simultaneously. This configuration can also come with transoceanic capabilities.



This aircraft has the same cabin width and height as a commercial jet liner, which allows for arrangements that are impossible in smaller planes. Possible areas include large conference spaces, office spaces, sleeping quarters, bathrooms with showers, and a corridor with separate access to all rooms for added privacy. This aircraft comes with the extra bonus of custom built corporate interiors.

IMPLICATIONS

This aircraft begins to illustrate the potential that an airplane interior can have. If this type of interior can be designed for a smaller jet the size of a 737, the possibilities for a jet the size of the 767 are endless. The three criteria that are set for a corporate jet can also be set for a commercial airliner, and the large 767 can also be designed to meet the objectives of versatility, capacity, and range?

CASE STUDY 3

Project: Air Force 1

Designers: The Boeing Company

INTRODUCTION

Air Force 1 is the airplane used by the president of the United States. Whenever the president travels via air he flies on Air Force 1. In order to find information on this topic I contacted the Executive office of the United States who in turn referred me to the Military Liason. He then sent me a data sheet on Air Force 1. This data sheet had a very limited amount of information due to the confidentiality of this subject. I finally was able to supplement this section with information I obtained on my trip to Boeing on May 11, 1989. During my visit to Boeing, I had the privilege to speak to a designer of Air Force 1. He again stated that due to security reasons he was unable to give me specifics as to the layout.

ANALYSIS

Air Force 1 is similar to other executive planes that Boeing designs, with one main distinction, that being Air Force 1 has a tremendous amount of electronic equipment. The need for electronics is due to the nature of the office of the President. The following is a listing some of the interior spaces; bedroom suite, office area, conference room, press area, staff seating, as well as typical spaces to a plane such as this. The designer of Air Force 1 gave me some plans of other executive planes that he has worked on so as to help me on my project. I have included one of these plans. Although the included plan is not of Air Force 1 it gives the basic idea of the quality of interior.

IMPLICATIONS

Air Force 1 and the Executive planes designed by Boeing show the kind of quality and luxury I wish to design into my plane. The main difference being that I'm designing for a passenger airline instead of a single person airplane. These planes do support the need for an airline which offers more.

767-200 EXTENDED RANGE EXECUTIVE AIRPLANE

ENTRY

- reception
- communication
- lounge seating

STATEROOM

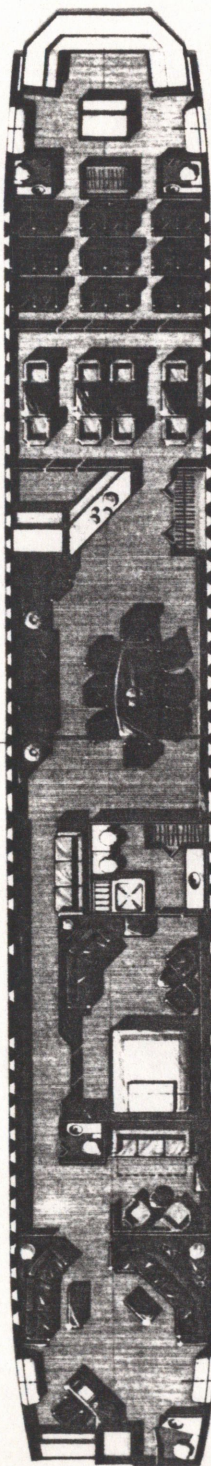
- bedroom
- lounge seating
- lavatory / shower

GUEST SEATING

- dining for 8
- sleepers for 4

FOOD SERVICE

- main galley
- auxiliary galley



MEETING ROOM

- sleeper for 1
- seating for 5

CONFERENCE ROOM

- dining for 8
- lounge seating
- service galley

STAFF SEATING

- first class for 18

CASE STUDY 4

Project: Private Executive Jets

Designer: Edward J. Perrault - First Jet

I. David Porras - Second Jet

INTRODUCTION

The two jets researched for this section of case studies are owned by businesses and business entrepreneurs. Today executives spend much of their time travelling to and from locations and meetings. In order to enable them to travel on a moments notice and in more aesthetic conditions, some companies chose to purchase their own jets. The following is an analysis of how the interiors were designed in two particular jets.

ANALYSIS

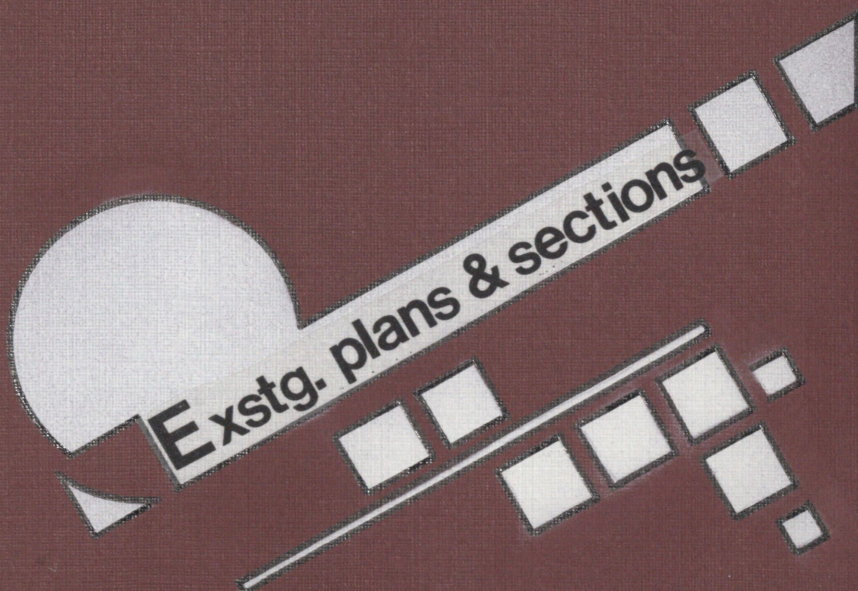
Edward J. Perrault, FASID, designed the Interiors of the Gulfstream II Jet owned by the entrepreneur George Ablah, headquartered in Wichita. The three main objectives in this design

were to incorporate pleasure, business, and Ablah's collection of rare sculptures. As with all airplane interiors, the design had to work within approved aviation standards, as well as within the capability of the planes weight distribution. Within these restrictions, Perrault developed a design scheme of "restrained elegance". He interjected the light character of the sculptures into the palette of the interior. His color scheme consists of creams and corals with glints of gold. This interior has a luscious, expensive and comfortable feel. He created areas for working, relaxing, eating, television viewing, and a restroom.

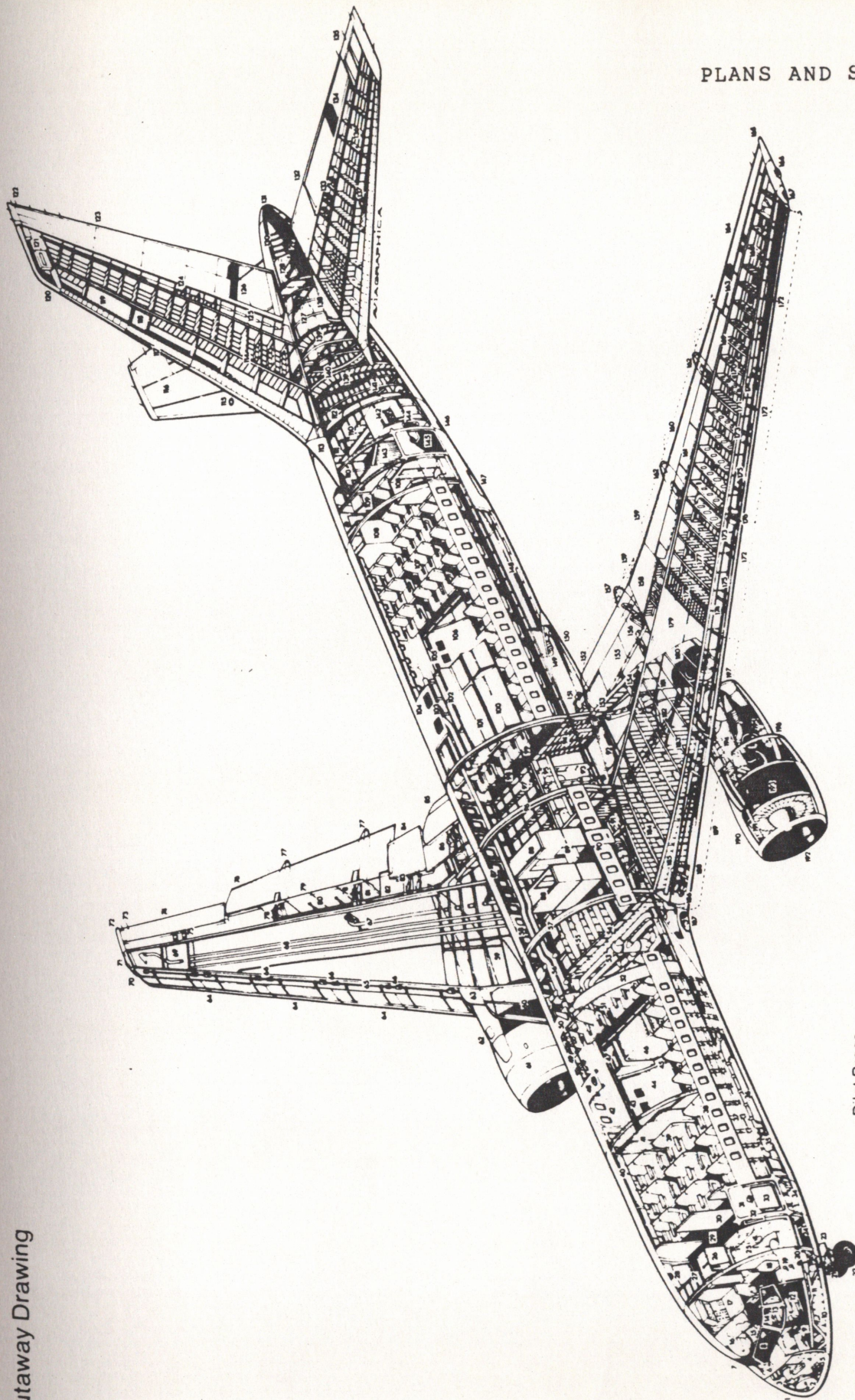
I. David Porras designed the interiors of a whole fleet of twin engine executive airplanes. His client is a company which maintains operations spread throughout the western United States and Canada. His intent was to make the passenger space seem larger by using dark carpeting and upholstery contrasting with the white walls and ceiling of the cabin. He arranged the seating within this plane to provide work spaces and opposing seats for discussions.

IMPLICATIONS

The information found on both of these planes deals greatly with the implications of color within the interior. This is one of the reasons why an exclusive chapter has been written about color within this documentation. The main lesson that can be learned from these two studies is the need to alter the arrangements of furnishings from rows of seats, to areas for activities.



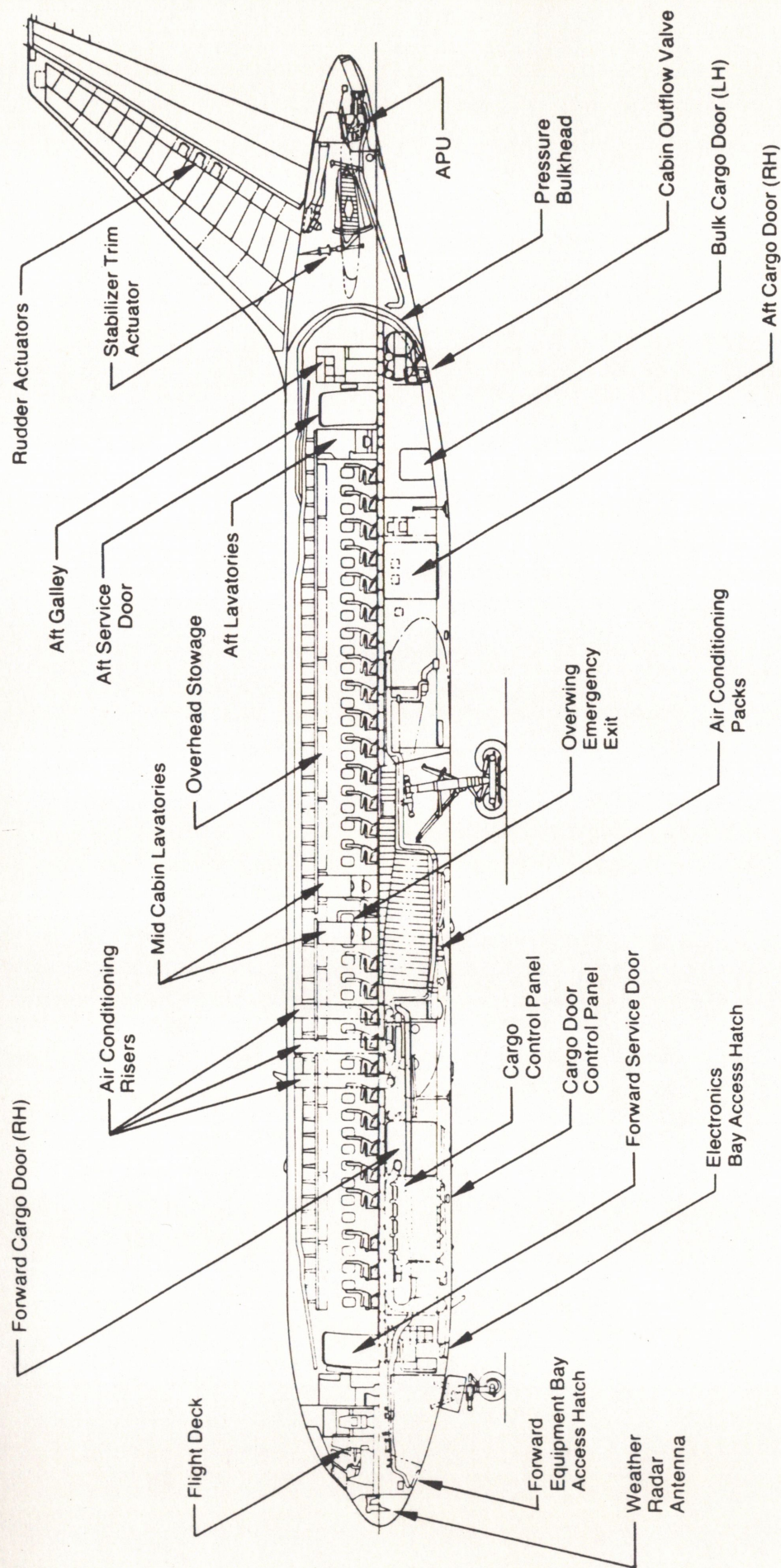
PLANS AND SECTIONS



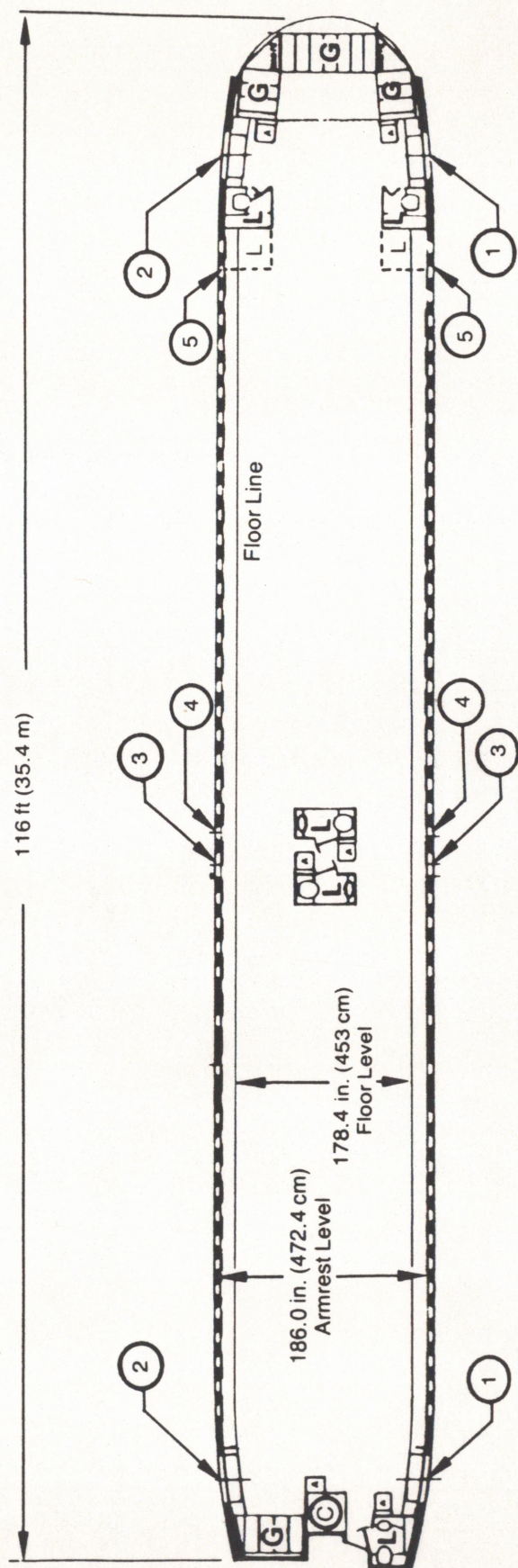
Pilot Press
Copyright
Drawing

Cutaway Drawing

Inboard Profile



Basic Passenger Cabin



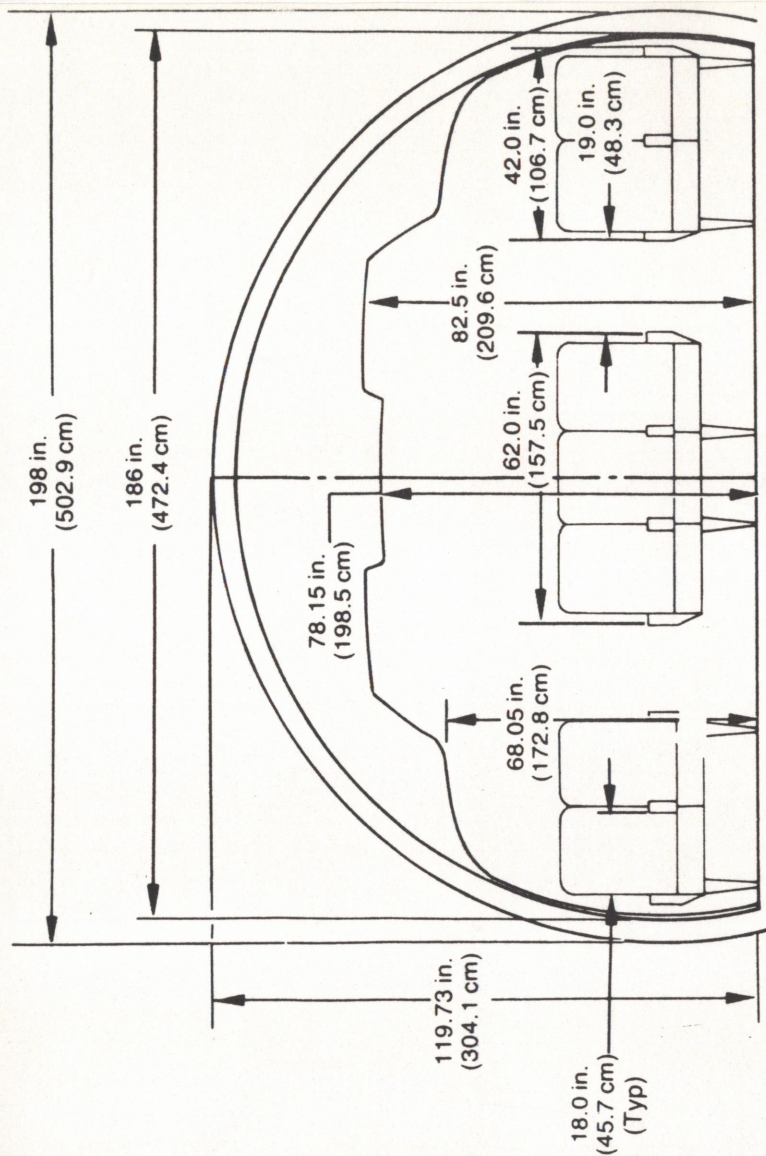
- ① Entry Door, Type A Exit, 42 x 74 in. (107 x 188 cm)
- ② Service Door, Type A Exit, 42 x 72 in. (107 x 183 cm)
- ③ Overwing Exit, Type III, 20 x 38 in. (51 x 96 cm)
- ④ Additional Overwing Exit, Type III, 20 x 38 in. (51 x 96 cm), Optional
- ⑤ Alternative Lavatory Position

L = Lavatory
 G = Galley
 A = Attendant Seat
 C = Optional Use Space (Closet, Lavatory, or Galley)

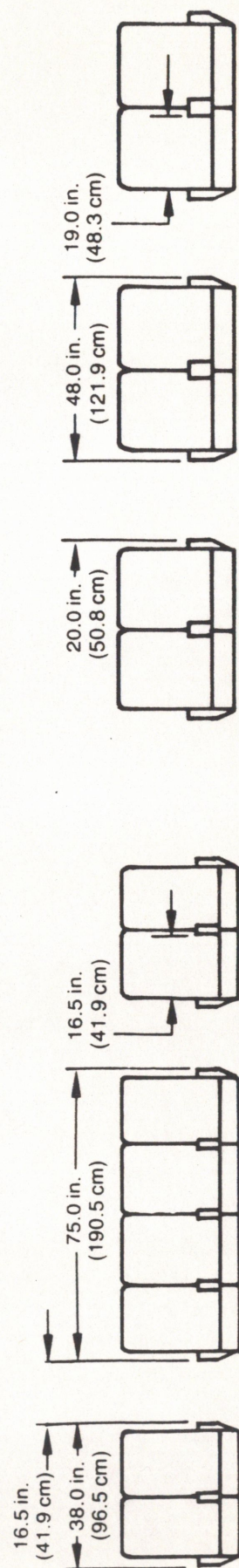
Cross Section and Seats

In a 200-passenger size airplane, the seven abreast cross section has several advantages:

- High proportion of window and aisle seats
- Increased overhead stowage per passenger
- Good body volume utilization
- All passenger seats within body constant section
- Wide straight aisles
- Spaciousness



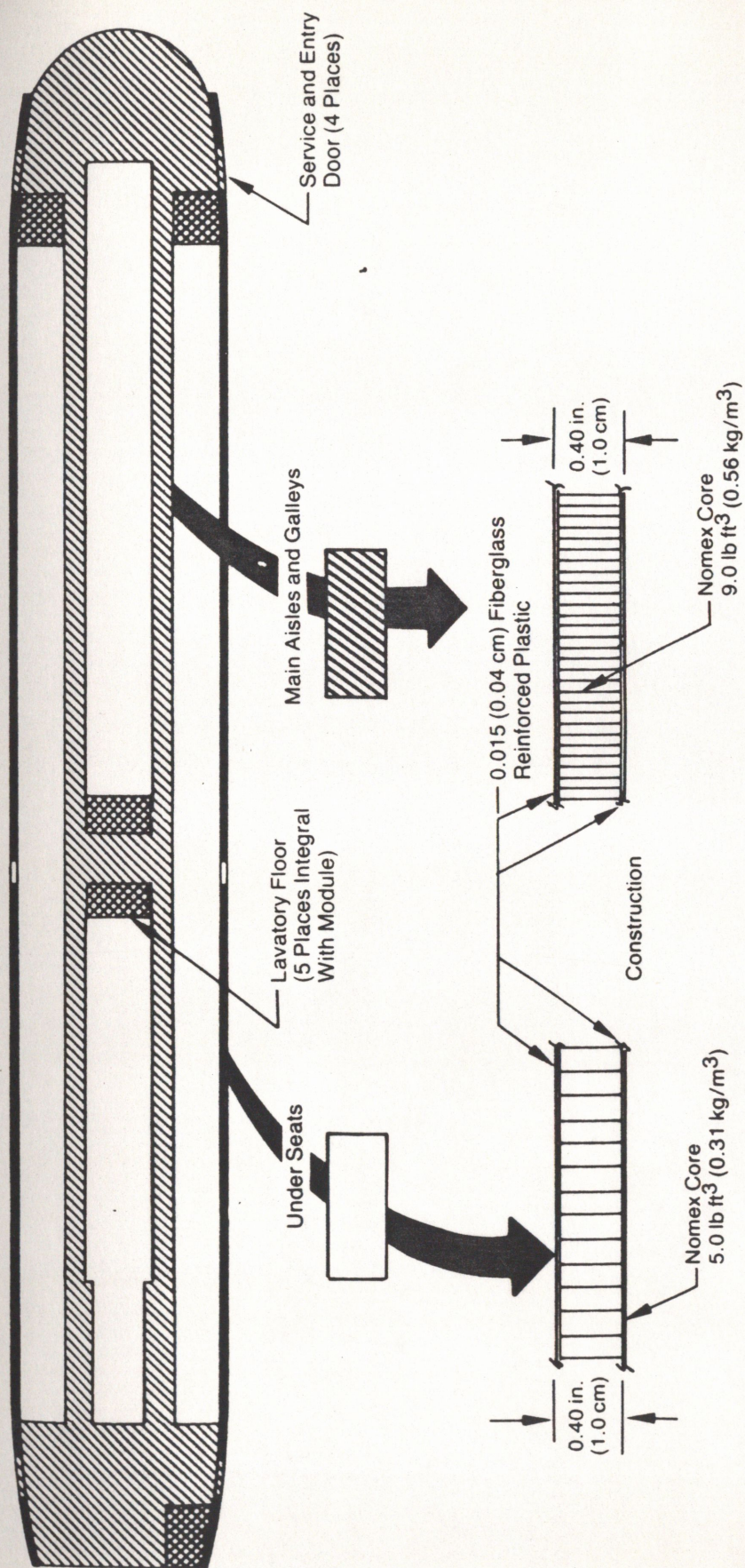
7 Abreast
Tourist Class



8 Abreast
High Density

6 Abreast
First Class

Floor Panel Construction

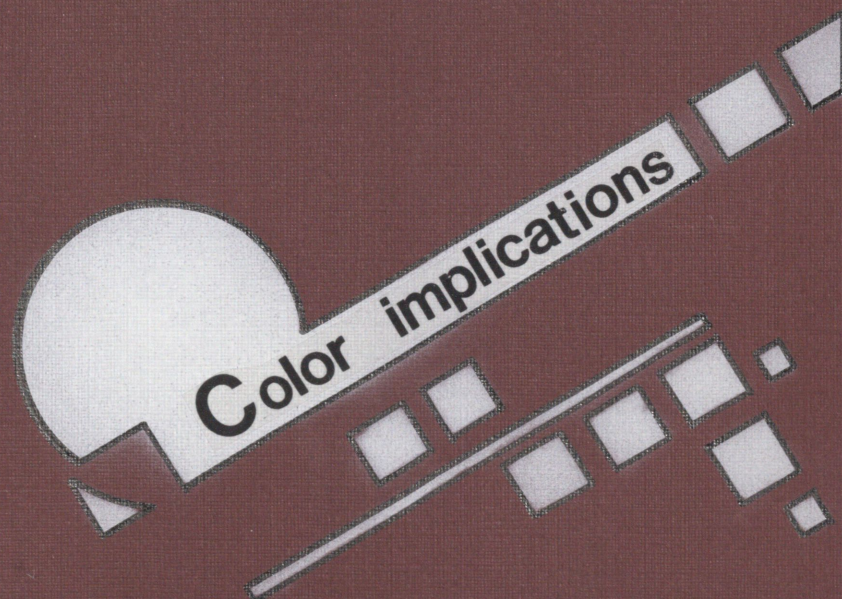


Design considerations

- Service-proven corrosion resistant floor panels
- Corrosion protected and sealed floors in entry ways, galleys, and lavatories
- Positive entryway drainage
- Floor panels replaceable without removing major components (galleys, lavatories, etc.)
- Reinforced lavatory floors

Usage

- 727 total—after September 1976
- 737 total—after April 1977
- 747 partial



COLOR IMPLICATIONS

I had the opportunity to speak with Byron Mikellides author of **Color for Architecture** concerning my project. He advised me on different implications and referred me to a chapter in his book concerning color for NASA. Nasa decided to investigate the use of color as a neccessity to provide visual stimulation, volume enhancement, and in creating moods in order to relieve the monotony of prolonged confinement. Color schemes are planned in relation to room volume and function, purpose, and desired behavioral aspects. The association of color with moods and mental conditions are general, no absolutes can be given. Most good color schemes consist of no more than three colors. Warm hues are associated with extroverted spaces, and cool hues are associated with introverted spaces. Warm hues should generally be used if the room temperature is cool and the noise element is low, the room size is too large, texture is smooth, physical exertion is light, time exposure is short, a stimulating atmosphere is desired, and the light sources are flourescent(cool). Cool hues should generally be applied in the inverse condition.^[4] The following charts are taken from the chapter on NASA from the previously mentioned book.

1. Effects of Hue

EFFECT	HUE	CONTRAST
Exciting	Bright red Bright orange	High
Stimulating	Red Orange	Moderate
Cheering	Light orange Yellow Warm grey	Moderate
Neutralizing	Grey White/off-white	Low
Retiring	Cool grey Light green Light blue	Low
Relaxing	Blue Green	Low
Subduing	Purple	Moderate
Depressing	Black	Low

2. Brightness, Colour Saturation and Illumination Level Effects on the Perception of Volume

VOLUME (ROOMINESS)	BRIGHTNESS	COLOUR SATURATION	ILLUMINATION LEVEL
Enlarge	Areas will be enlarged by lightness and small patterns (use to alleviate feelings of oppression or 'closed-in').	Pale or desaturated colours 'recede'. In situations where equipment projects into a room and tends to make it appear smaller than it actually is, paint the projections the same colour as the ceiling or wall — a very light shade — to make them appear to recede into wall or ceiling.	High
Close-in	Areas will be closed-in by darkness and large patterns.	Dark or saturated hues 'protrude'.	Low

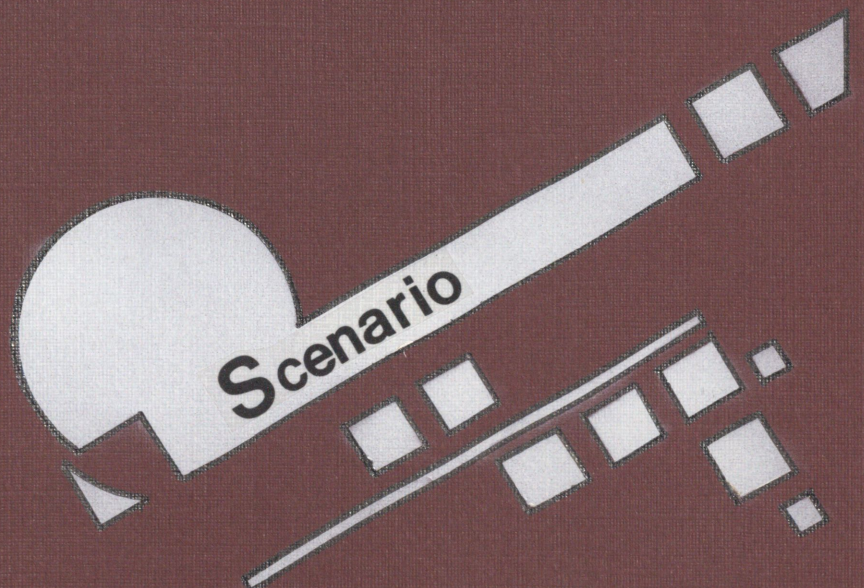
3. Colour Effects on Perception of Time, Size, Weight and Volume

COLOUR	PERCEPTION OF TIME	SIZE	WEIGHT	VOLUME
'Warm'	Time is over-estimated; use warm colours for areas where time in apparent 'slow motion' might be more pleasureable (eating, recreation).	Things seem longer and bigger.	Weights seem heavier.	Decreases apparent size of rooms.
'Cool'	Time is under-estimated; use cool colours for areas where routine or monotonous tasks are performed.	Things seem shorter and smaller.	Weights seem lighter. (Use on boxes & containers which must be carried about)	Increases apparent size of rooms.

4. Interrelationships in Living Areas

COLOUR	SOUND	TEMPERATURE	SUBJECTIVE IMPRESSION IN LIVING AREAS
'Warm'	Noise induces a hazier perception of warm colours. Brightness, loudness, stimulation of senses in general are associated with the most active effect of warm colours.	'Warmness' — use to soften up chilly or vaulty spaces	Centrifugal action — with high levels of illumination, warm and luminous colours, the person tends to direct attention outward. There is increased activation in general, alertness, outward orientation. Such an environment is conducive to muscular effort, action, and cheerfulness.
'Cool'	Noise increases sensitivity for cool colours. Dimness, quietness and sedation of the senses in general are associated with the most active effect of cool colours.	'Coolness' — use where working conditions expose person to warm temperatures.	Centripetal action — with softer surroundings, colour hues, and lower levels of illumination, there is less distraction and a person's ability to concentrate on difficult visual and mental tasks is enhanced. Good inward orientation is furthered.

After reviewing these charts and selected reading materials, I have developed my own view of how color should be used in this project. Each space shall be dealt with individually according to their function, however I feel that a few general rules should be applied throughout. Cool colors shall generally be used to minimize time perception, and light colors should be applied where possible to alleviate the feeling of being "closed-in".



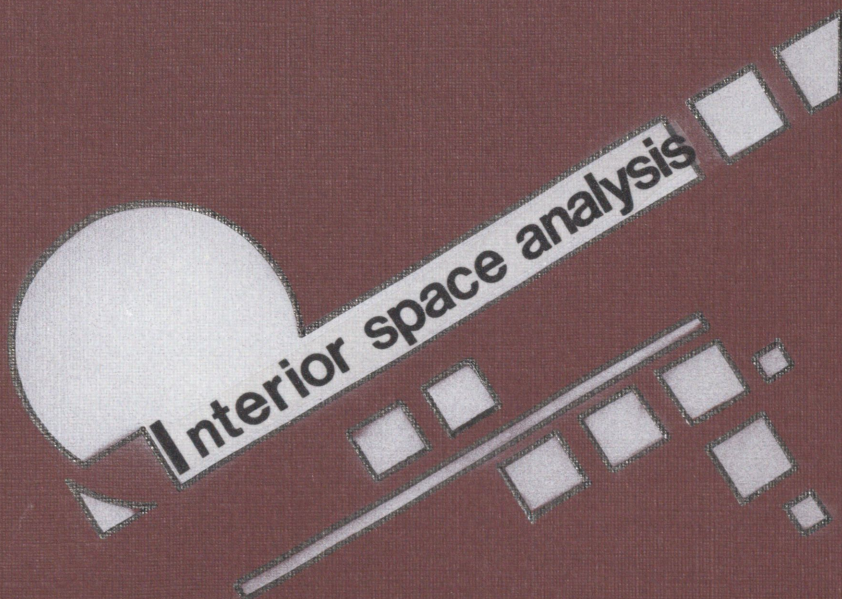
SCENARIO

This section will layout specific information about the hypothetical airline, as well as listing desired criteria from the airline.

TITLE: Triumph Airlines

CONCEPT: A prestigious airline which pays special attention to the comfort and enjoyment of its passengers. Typically scheduled for 12-14 hour flights.

DESIRED CRITERIA: Have a variety of Interior Spaces that the passengers can move between. Entertainment facilities. Spacious areas. Quality materials and finishes. Separate Dining facilities.



INTERIOR SPACE ANALYSIS

The following is a list of desired spaces and the Hard and Soft Requirements for each.

DINING & BEVERAGE AREA

Hard Requirements-

dining table area

tables, chairs,

bar area

counter, stools or chairs,

Soft Requirements-

greenery, music, deeper color tone to create a dramatic mood

PRIVATE SUITES

Hard Requirements-

bedrooms

beds, night stand, closet

bathrooms

toilet, sink, shower and or bath

seating area

occasional chair or two, lamp, small table, or desk

entertainment system. TV, stereo, VCR.

Soft Requirements-

greenery, light to medium color scheme to create
volume and cheery feeling, additional natural light.

CLUB ENTERTAINMENT AREA

Hard Requirements-

live entertainment stage
raised platform area with chairs or stools.
seating
chairs, tables, possible counter area
music or movie equipment for between shows
neccessary equipment

Soft Requirements-

spotlighting, low lighting, deeper color tone,
luxurious feeling

QUIET LOUNGE AREA

Hard Requirements-

seating with tables
plush chairs, coffee tables or work tables, couches,
lamps,
reading materials
magazine racks, shelves, newspapers
Music listening area - CD, tape, library

Soft Requirements-

light color scheme, soft background music, greenery

SUPPORT AREAS

galleys

oven, sink, refrigerator, microwave, fire extinguisher

restrooms

toilet, sink, trash recepticle

cockpit

service areas

counter and storage space, small sink, first aid,

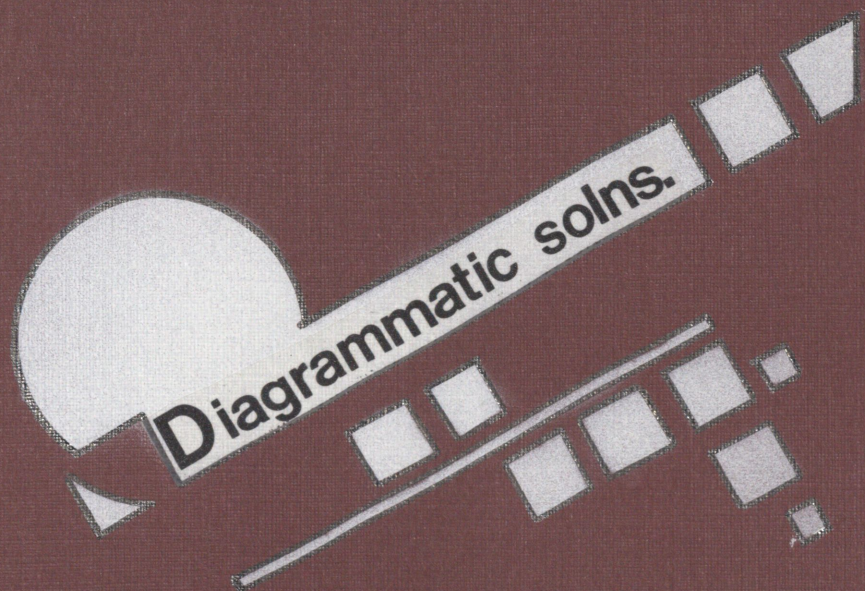
speakerphone

attendants areas

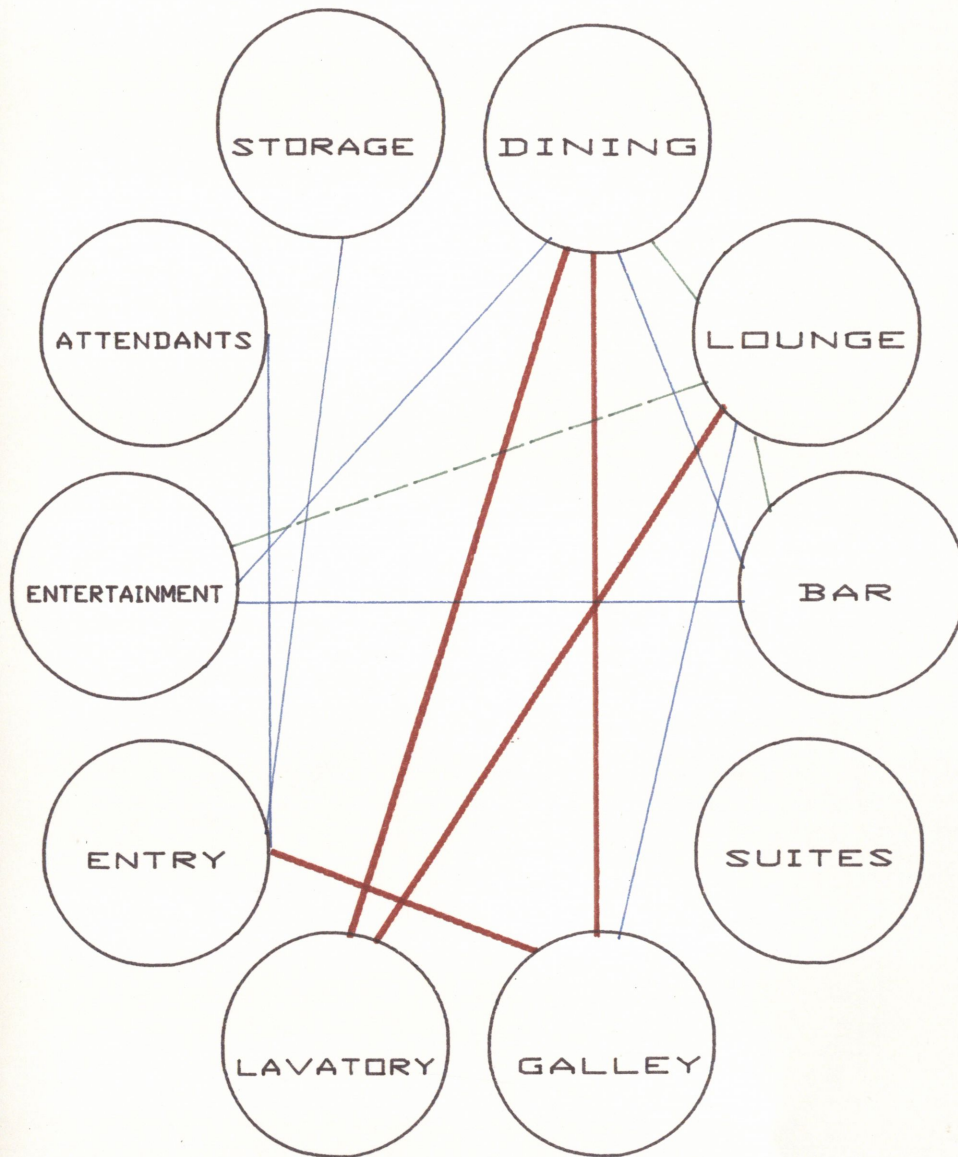
seating, storage, closet, beds.

Staff seating

chairs, work space



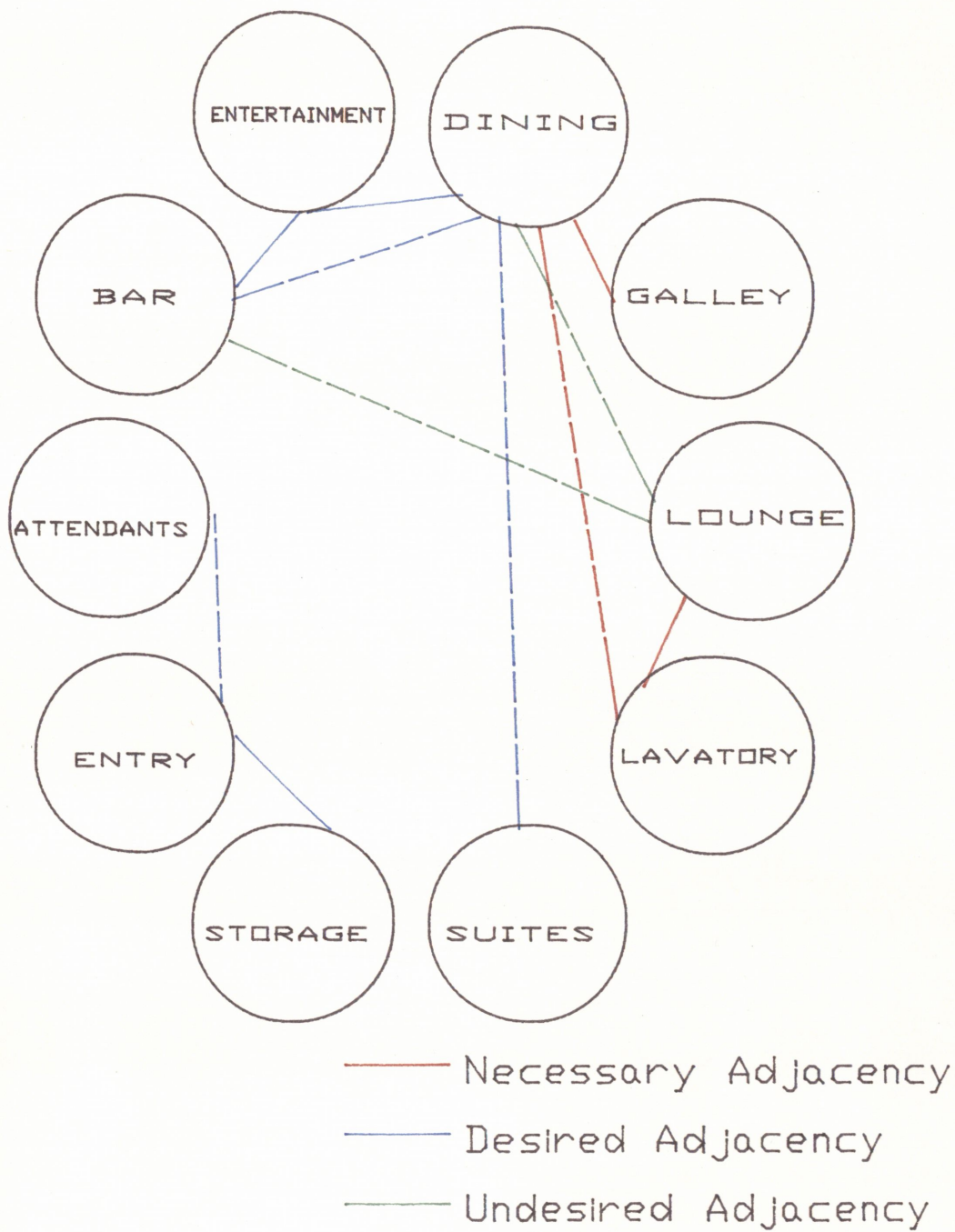
DIAGRAMMATIC SOLUTIONS

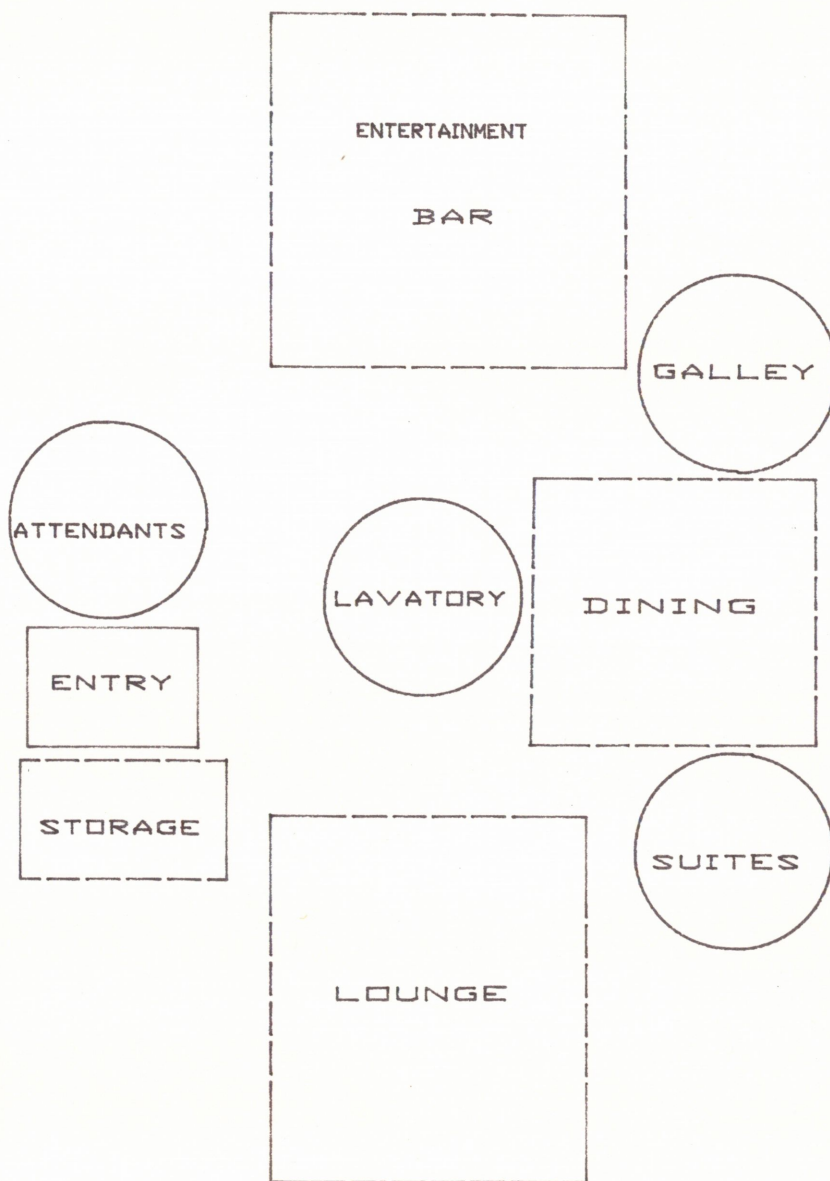


- Necessary Adjacency
- Desired Adjacency
- Undesired Adjacency

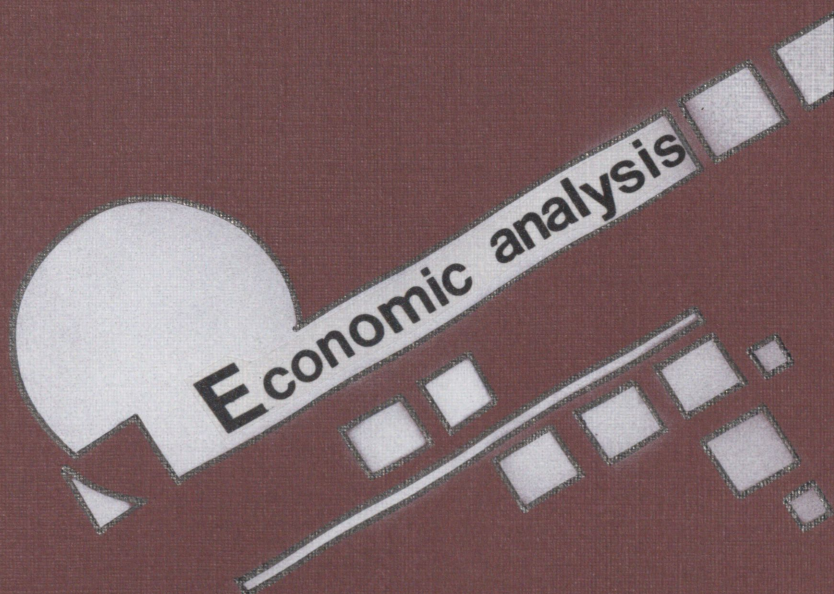
Bubble Diagram of Basic Space Relationships

DIAGRAMMATIC SOLUTIONS





This begins to illustrate diagrammatically size and shape relationships.

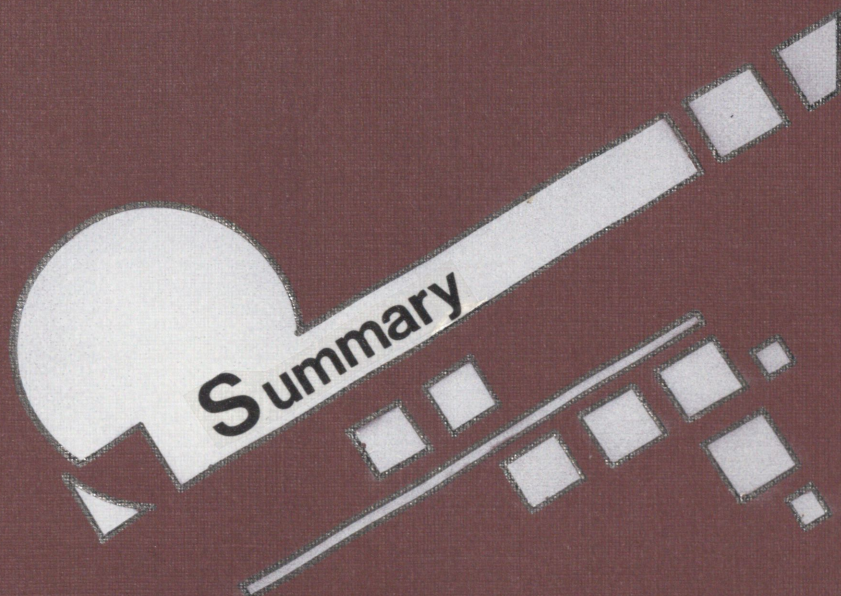


ECONOMIC ANALYSIS

This section is an analysis as to the realistic feasibility of this type of a project. Boeing requested that I look at this aspect of the project. Most of the statements I will make are derived from my discussion with Boeing on this topic.

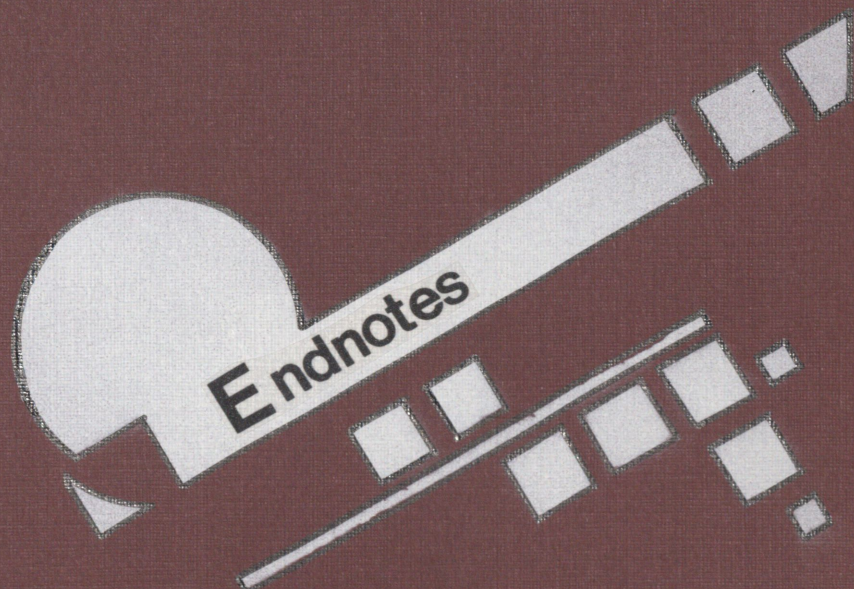
On May 11, 1989 I visited with Boeing in Renton, Washington at their offices. After presenting my proposed ideas and schematics we discussed the feasibility of such a project. The feed back was positive. The Concord is a plane which flies from the United States to over seas destinations. They have a typical configuration but still charge in excess of \$3000.00 a ticket. This project would be feasible in long distance flights where comfort is in more of a demand, and ticket prices are already highly inflated. This type of a flight would also play an important role to business travellers who typically do not shop ahead for tickets, but by tickets on a last minute notice thus paying premium rates. They would be able to travel in luxury at rates comparable to conventionally configured planes. Overall this is a feasible project. There is one item that tends to be unrealistic but for this particular designs implications it will be left in the project. That item is the heightened windows. I discussed the possibilities of enlarging the windows with Alan

Anderson of Boeing. Although it would increase the cost of the plane, it is possible to heighten them. This added touch might not be worth the cost of actually constructing the plane in that manner, but I feel it is an aspect that needs to be brought out. This project would not be as effective if they were mass produced, simply because the fact that there is only a limited number of people who are willing or able to afford a trip such as this. In summary, this project is viable at a small scale of production for use on long distance flights primarily.



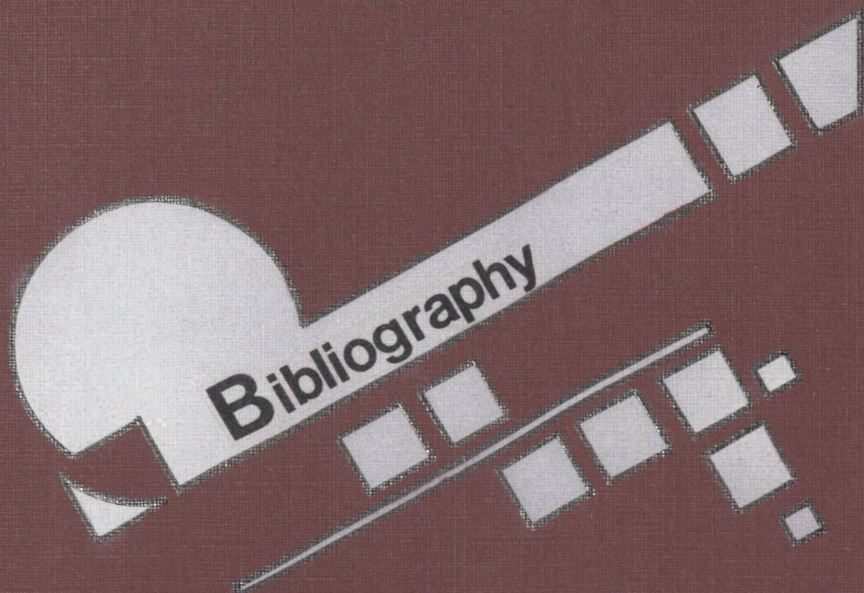
SUMMARY

In summary I would like to emphasize that this project is not only about a design but also about an innovative concept for air transportation. Design should address an issue and then take it a step further. I have confronted the issue of Passenger air transportation and then I took it a step beyond the expected point of view. I created a dynamic flying environment, that is functional and feasible as well as exciting and intriguing. Passengers can now expect to enter a interesting space which offers variety.



ENDNOTES

- 1 The Boeing Company. The Boeing 767-200 General Description. U.S.A.: Business Exchange Aircraft Sales, 1980. Pg. 1-2
- 2 Dorin, Patrick. Amtrak Trains and Travel. Seattle, Washington: Superior Publishing Company, 1979. pg. 64.
- 3 The Boeing Company. The Boeing Advanced 737-200 Corporate Aircraft. U.S.A.: Business Exchange Aircraft Sales, 1971. pg. 1-4.
- 4 Pile, John F. Interior Design. New York : Harry N. Abrams INC. 1988. pg. 243-249.



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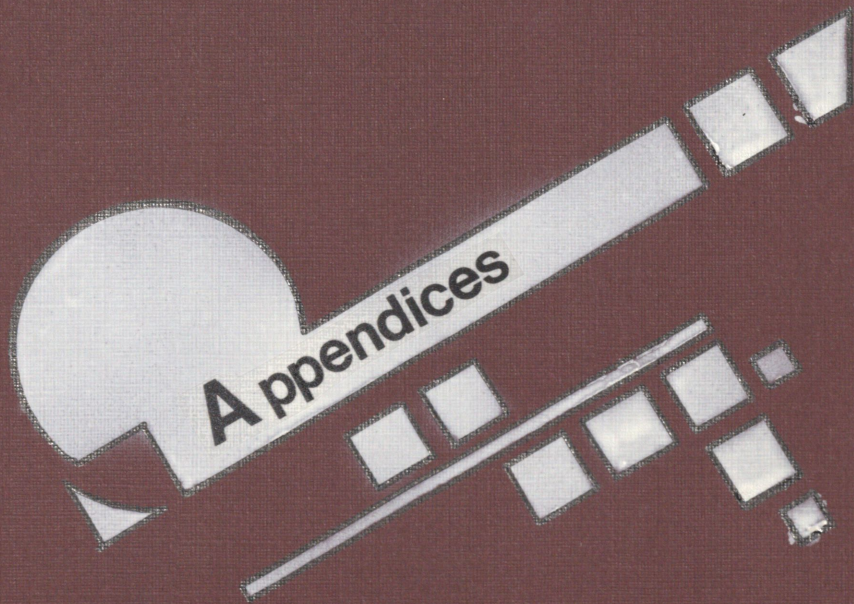
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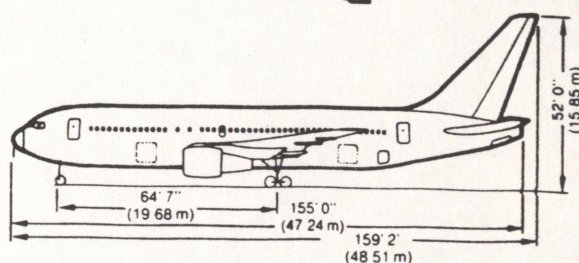
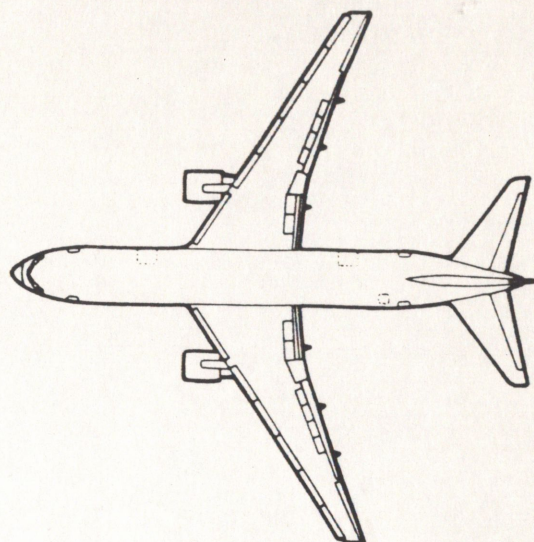
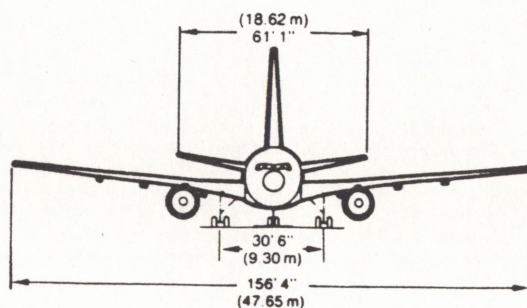
APPENDICES

Appendix A - Boeing 767-200 Information

Arrangement

Passengers	
Basic Mixed Class	211
Basic All Tourist	230
High Density	290*
Engines	(2) JT9D-7R4 or CF6-80A
Containers	(22) LD-2

*More than 255 passengers requires optional second overwing exit



Basic Data

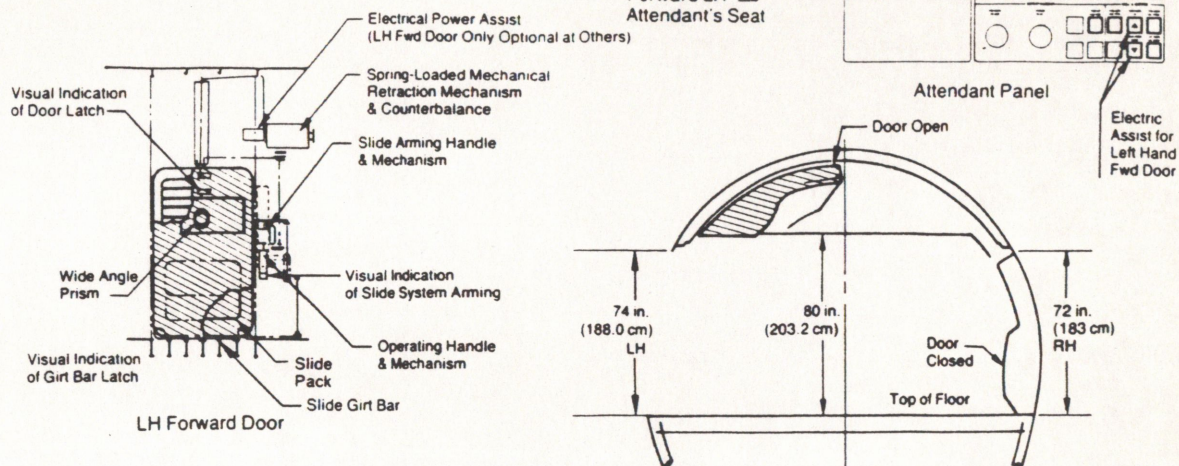
		Options		
		Basic	Medium Range	Increased Gross Weight**
Max Taxi Weight (MTW)	lb (kg)	302 000 (137 000)	284 000 (128 900)	312 000 (141 500)
Max Takeoff Weight (MTOW)	lb (kg)	300 000 (136 100)	282 000 (127 900)	310 000 (140 600)
Max Landing Weight (MLW)	lb (kg)	270 000 (122 500)	257 000 (116 600)	270 000 (122 500)
Max Zero Fuel Weight (MZFW)	lb (kg)	248 000 (112 500)	242 000 (109 800)	248 000 (112 500)
Passengers (Mixed Class)		211	211	211
No. of Containers (LD-2)		22	22	22
Fuel Capacity	U.S. Gal (l)	15 560 (58 900)	11 320 (42 850)	15 560 (58 900)
Engines		JT9D-7R4D CF6-80A	JT9D-7R4D CF6-80A	JT9D-7R4D CF6-80A
Sea Level Static Thrust	lb (Newtons x 1000)	47 700 (212)	44 000*** (197)	47 700 (212)
		47 900 (213)	47 900 (213)	47 900 (213)
Manufacturer's Empty Weight (MEW)	lb (kg)			
3-Crew Config		164 170 (74 500)	163 620 (74 240)	164 170† (74 500)
2-Crew Config		164 230 (74 515)	164 050 (74 425)	164 230† (74 515)
Operational Empty Weight (OEW)*	lb (kg)			
3-Crew Config		181 095 (82 160)	180 715 (81 990)	181 095† (82 160)
2-Crew Config		180 960 (82 100)	180 580 (81 930)	180 960† (82 100)

* Includes 2000 lb (900 kg) Customer Options

† Subject to Change *** Derated Value ** Availability, October 1983

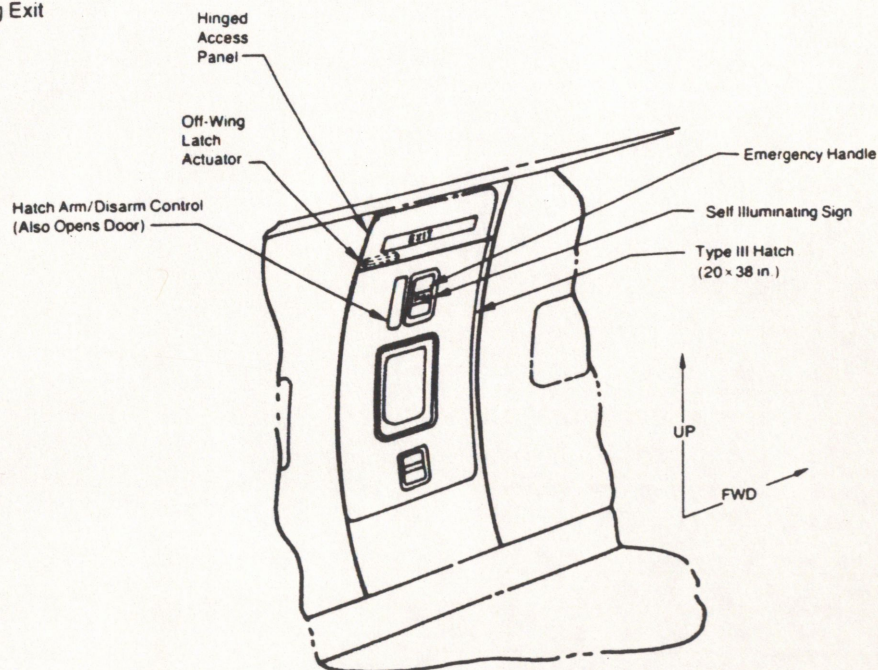
Entry Door

- Manual actuation – electrical or pneumatic boost not required
- Forward LH door has electric power assist – optional at other doors
- Overhead internal stowage
- Continuous door stops, in lieu of discrete stops, improve fatigue life
- High reliability and ease of maintenance
- Improved safety in emergency situations

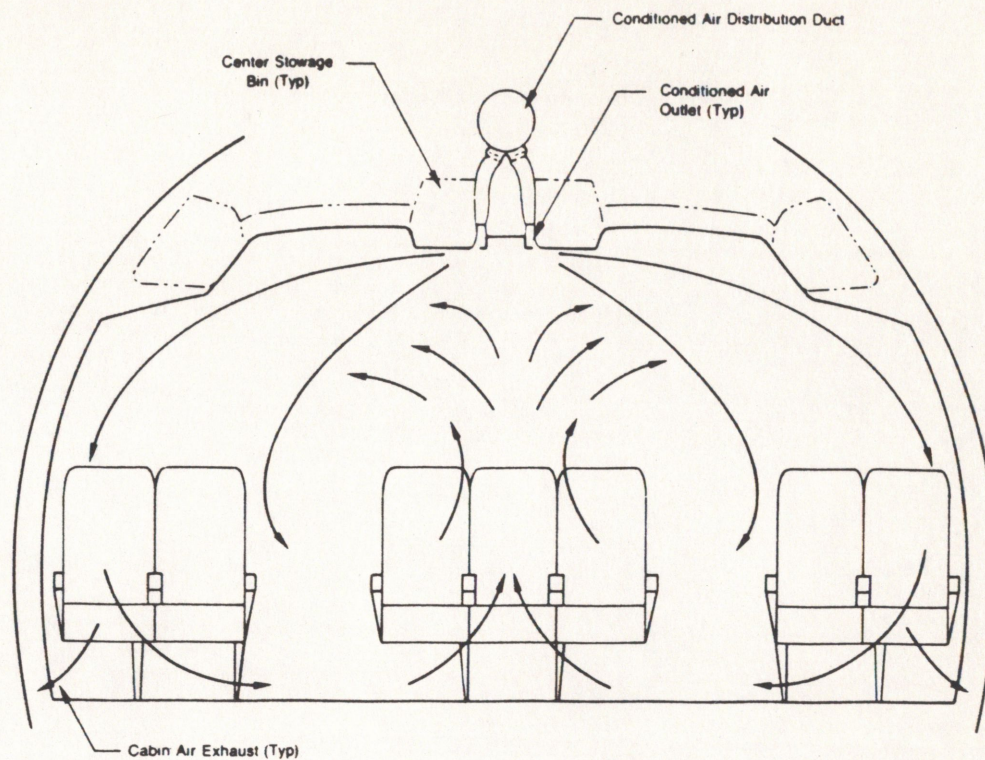


Emergency Evacuation Systems

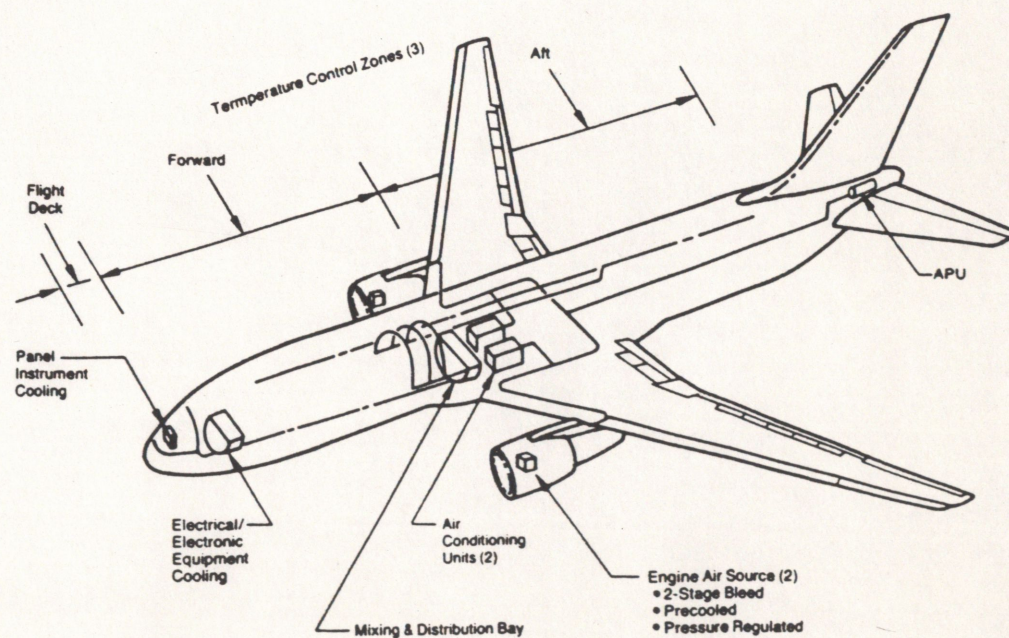
Overwing Exit



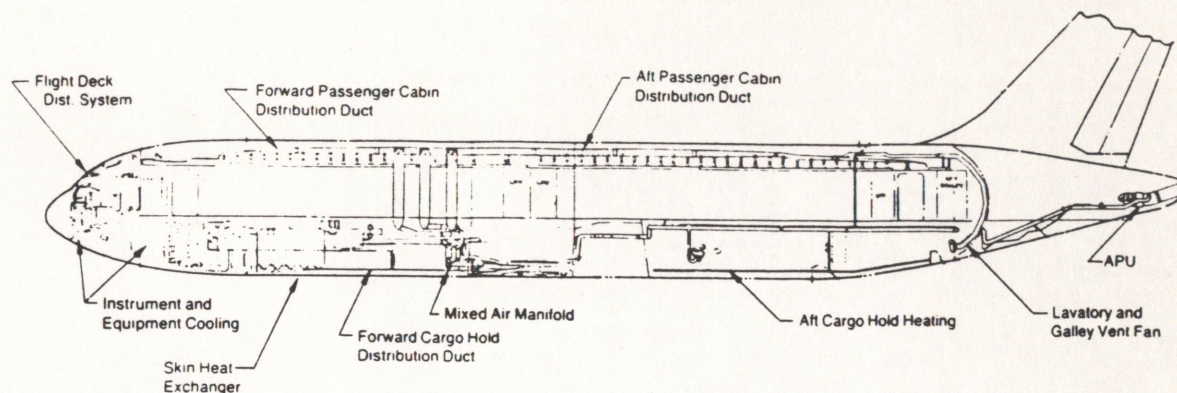
Cabin Air Distribution



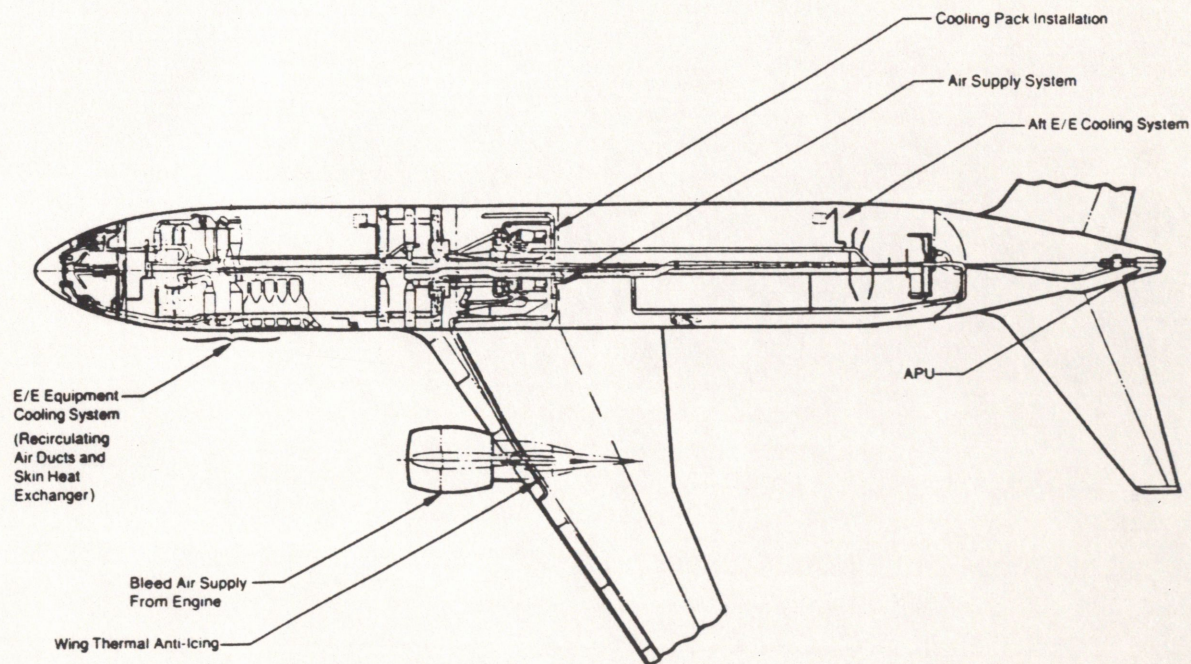
Air Conditioning System



Air Conditioning System- Inboard Profile

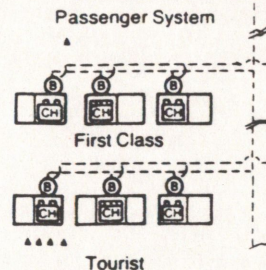
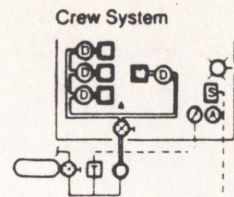
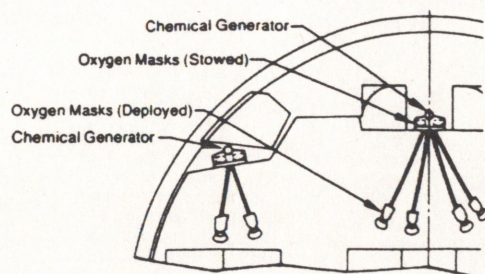


Air Conditioning System- Plan View



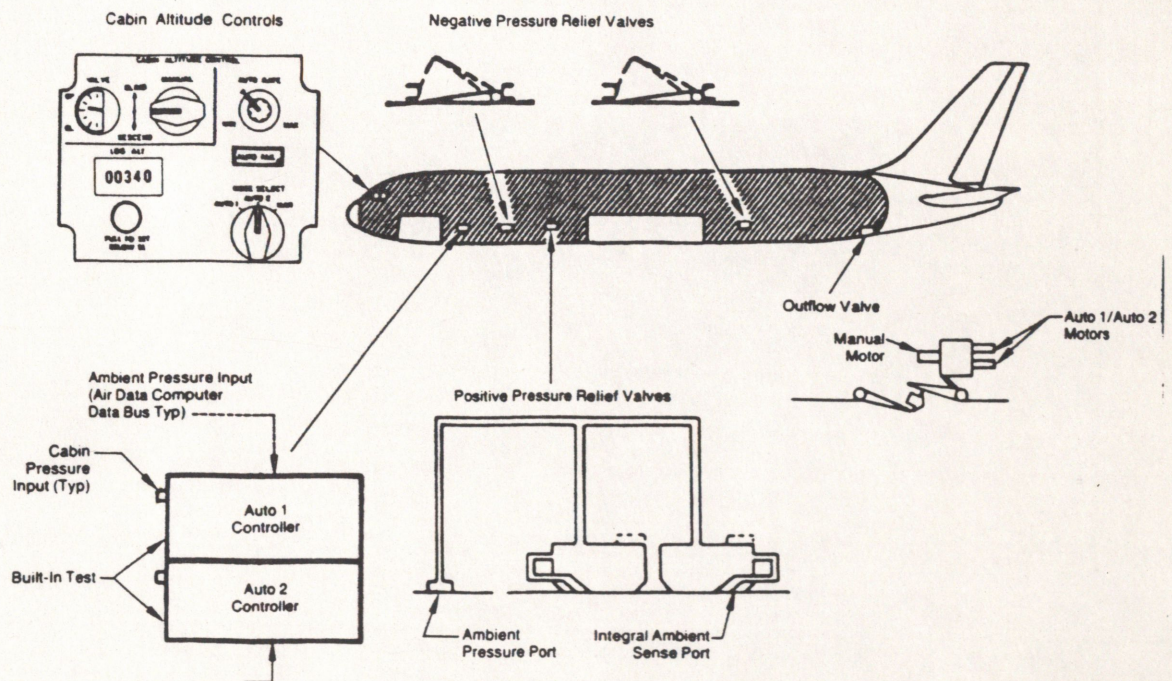
Oxygen System

- Gaseous oxygen system for crew
- Overhead chemical oxygen for passengers
- Use of one mask starts generator for seat unit
- Reduces high pressure passenger oxygen bottles and associated risk in servicing and replacing bottles
- Reduced maintenance in passenger system
No bottle regulators or valves to leak
Eliminate dispatch inspection of oxygen supply

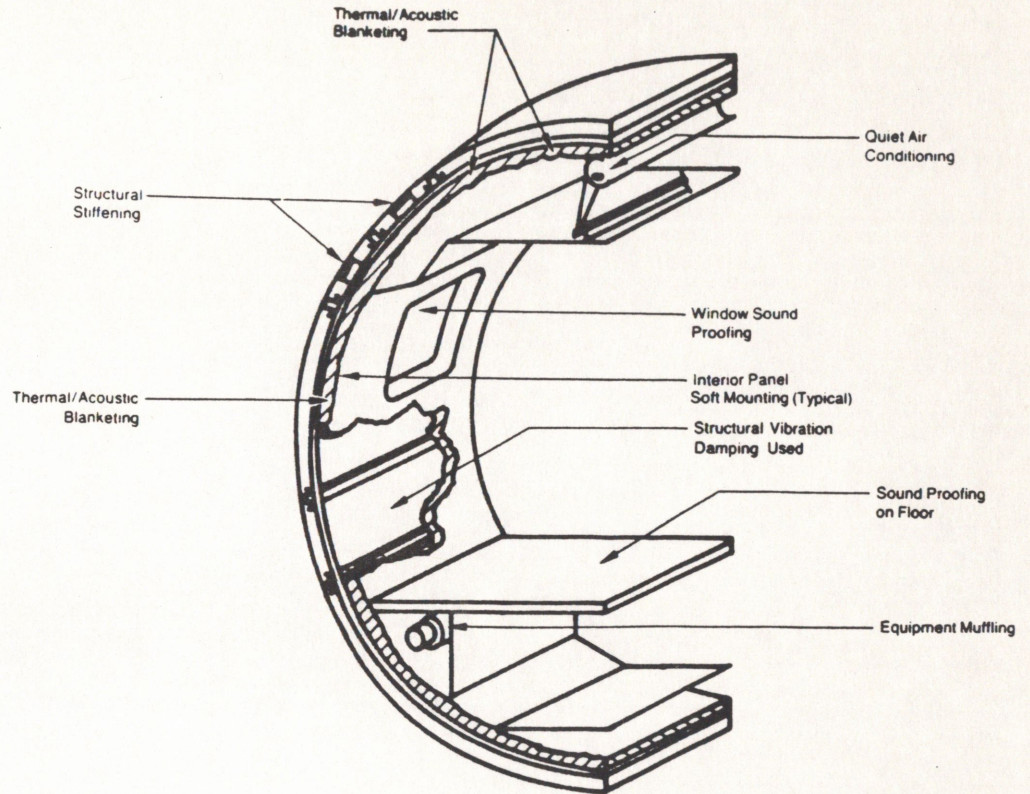


- ▲ Portable Oxygen Cylinder 4.25 ft Capacity
- Crew Mask Coupling
- Passenger Outlet With Mask
- Ⓢ Electric Switch
- ⊖ Pressure Reducing Regulator
- Ⓜ Pressure Transducer
- ⓐ Automatic Switch Barometrically Operated
- ⓑ Electrical Actuated Door Latch
- ⓧ Shutoff Valve, Manual
- Ⓩ Pressure Indicator
- Ⓛ Indicating Light
- Electrical Connection
- == Low-Pressure Tubing
- Ⓛ Overboard Discharge
- High-Pressure Tubing
- CH Chemical Oxygen Supply
- ⓐ Oxygen Cylinder Assembly 76 cu ft Capacity
- ⓓ Diluter Demand Regulator

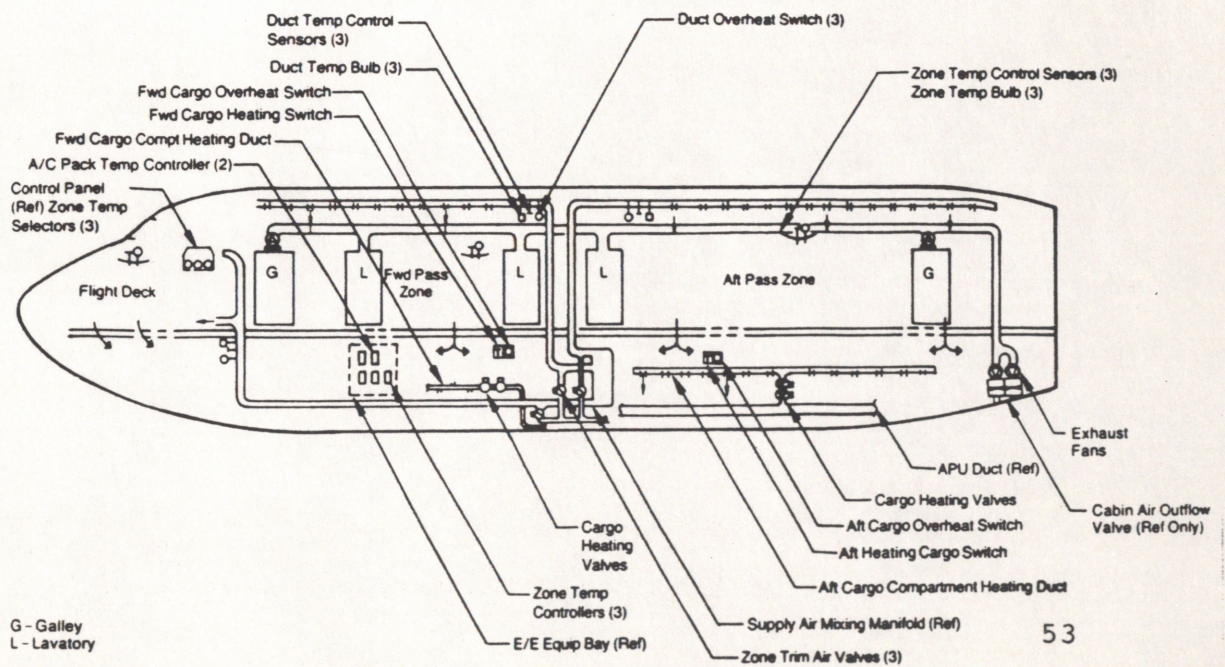
Cabin Pressurization System



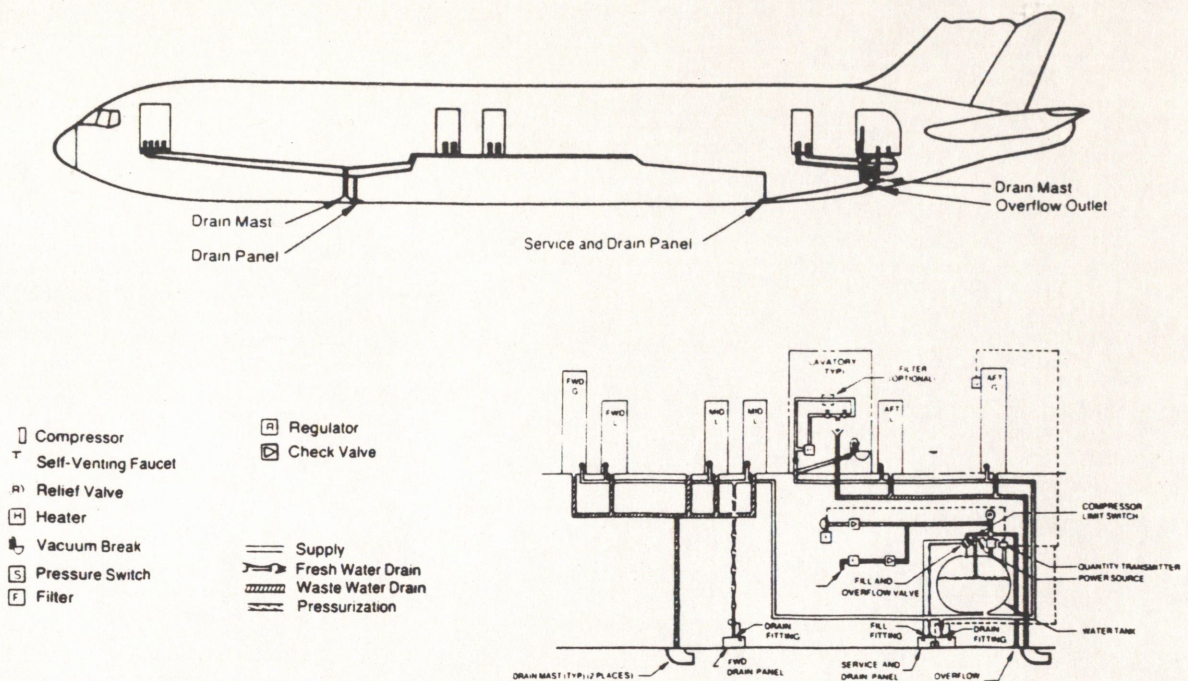
Acoustic Features



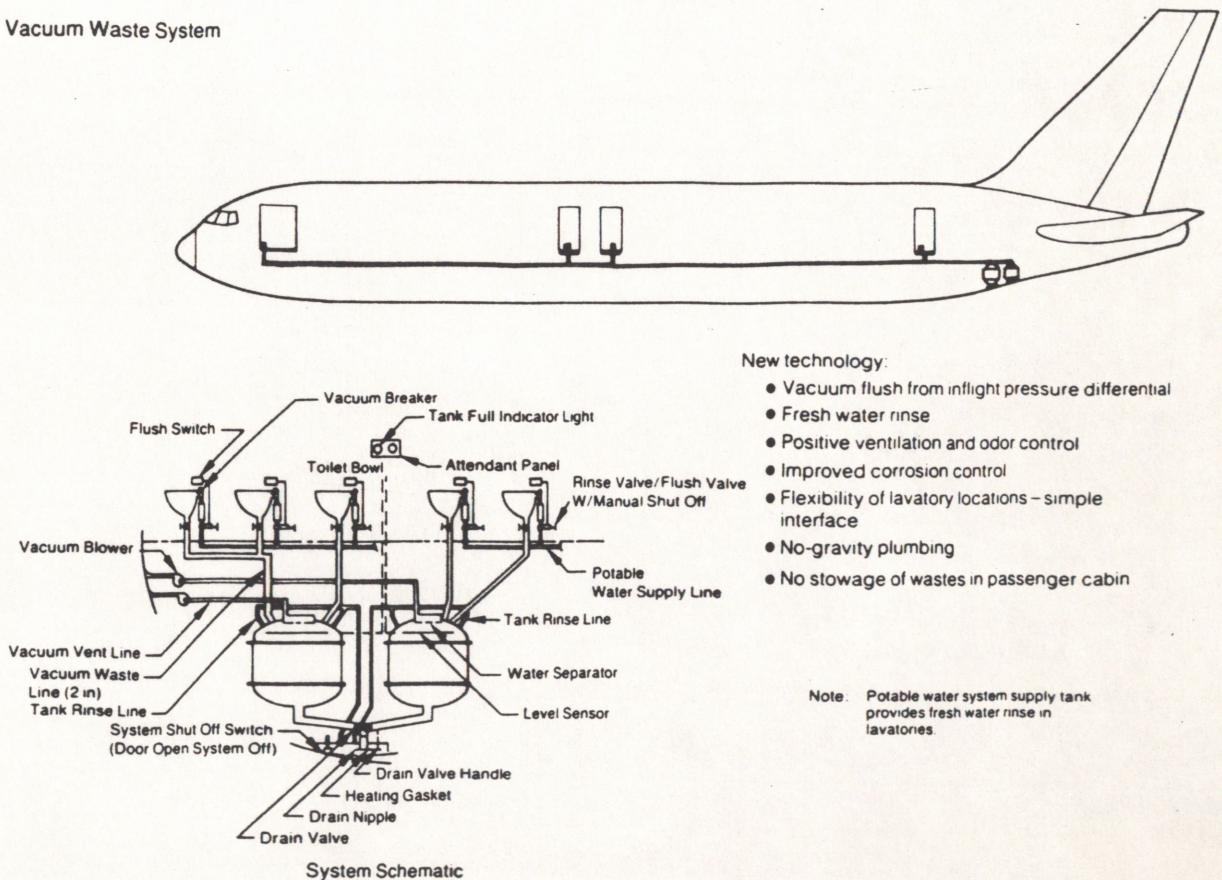
Temperature Control System



Potable Water System



Vacuum Waste System



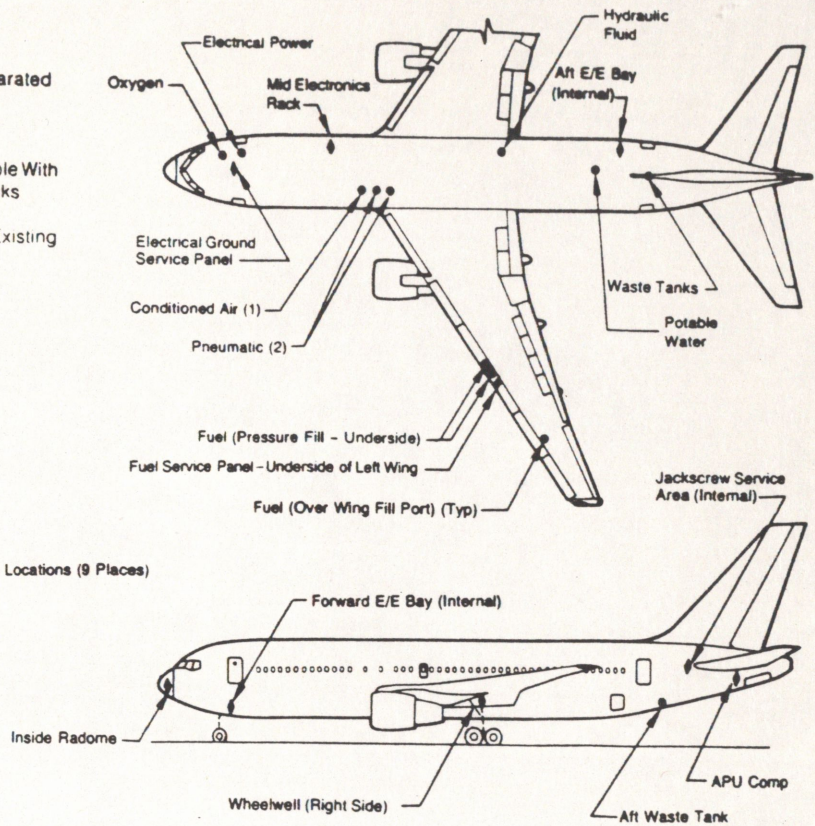
New technology:

- Vacuum flush from inflight pressure differential
- Fresh water rinse
- Positive ventilation and odor control
- Improved corrosion control
- Flexibility of lavatory locations – simple interface
- No-gravity plumbing
- No stowage of wastes in passenger cabin

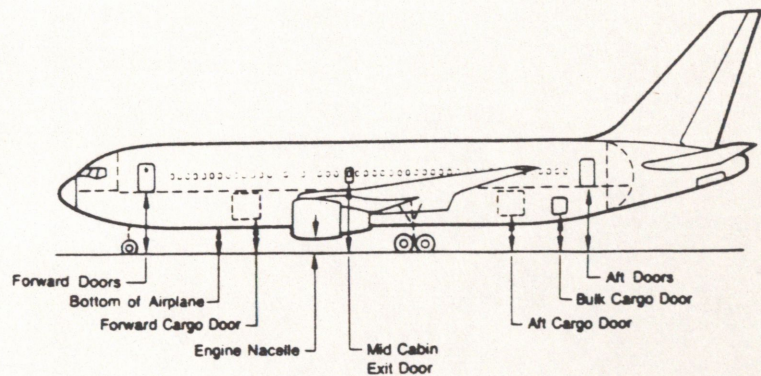
Note: Potable water system supply tank provides fresh water rinse in lavatories.

Service Points

- Service Connections Separated to Facilitate Simultaneous Operations
- Door Sill Heights Compatible With Loaders and Service Trucks
- Geometry Permits Use of Existing Terminal Docks



Servicing Heights



Service Point Height 767-200

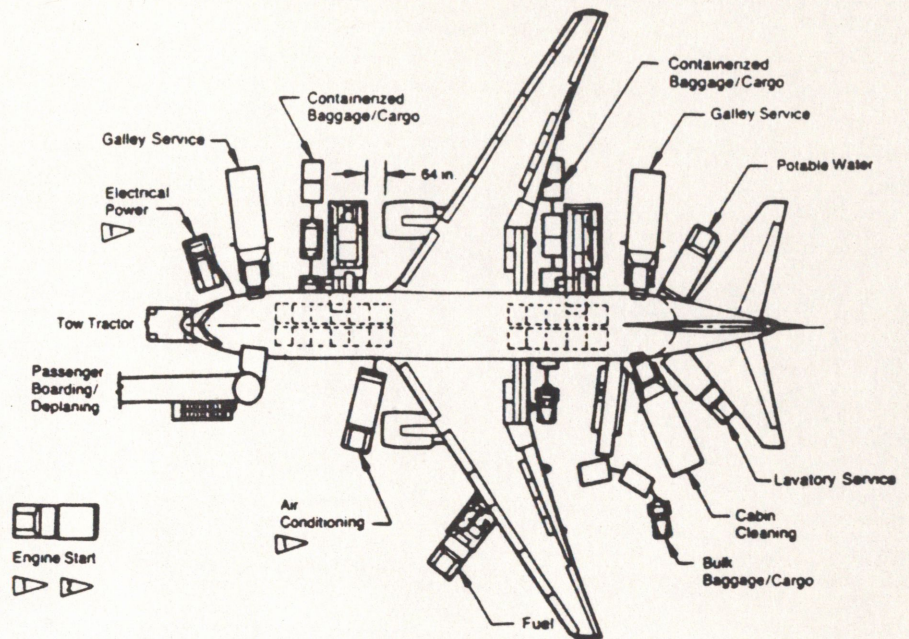
Turn-Around Service Items	Distance Above Ground in (m)	
Electric Power	82-90	(2.06-2.34)
Fwd Cargo Door Control	77-83	(1.96-2.11)
Air Conditioning	83-88	(2.11-2.24)
Engine Start	77-83	(1.96-2.11)
Fueling Position	169-175	(4.29-4.45)
Aft Cargo Door Control	80-86	(2.03-2.18)
Lavatory Service Panel	106-113	(2.69-2.87)
Potable Water	72-80	(1.83-2.03)

Comparative Heights - Inches (m)

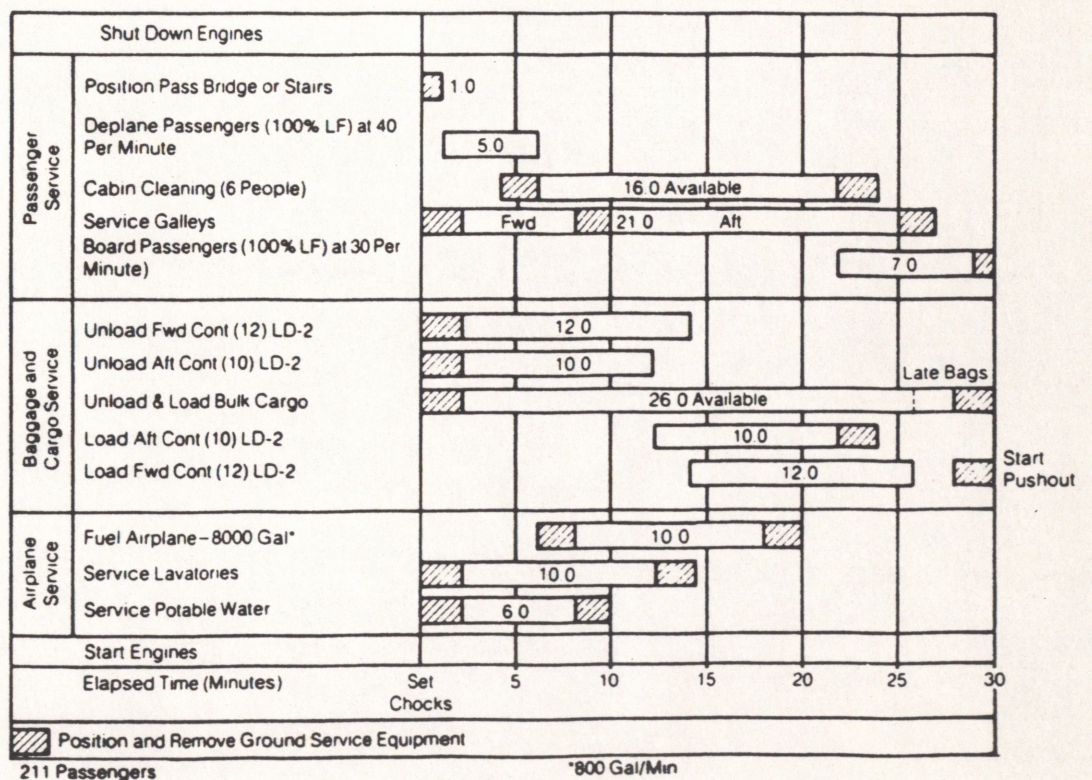
	767-200	727-200	707-320B
Fwd Entry Doors	169/163 (4.29/4.14)	117/105 (2.97/2.67)	126/119 (3.20/3.02)
Mid Cabin Exit Door	186/182 (4.72/4.62)	128/124 (3.25/3.15)	139/132 (3.53/3.35)
Fwd Cargo Door	96/91 (2.44/2.31)	65/57 (1.65/1.45)	61/54 (1.55/1.37)
Aft Cargo Door	98/93 (2.49/2.36)	64/59 (1.63/1.50)	63/58 (1.60/1.47)
Bulk Cargo Door	106/101 (2.69/2.57)	67/66 (1.70/1.68)	77/73 (1.96/1.85)
Aft Doors	173/167 (4.39/4.24)	114/115 (2.90/2.92)	127/123 (3.23/3.12)
Bottom of Airplane	77/73 (1.96/1.85)	56/49 (1.42/1.24)	55/48 (1.40/1.22)
Engine Nacelle*	40/36 (1.02/0.91)	—	40/33 (1.02/0.84)

*Inboard Engine

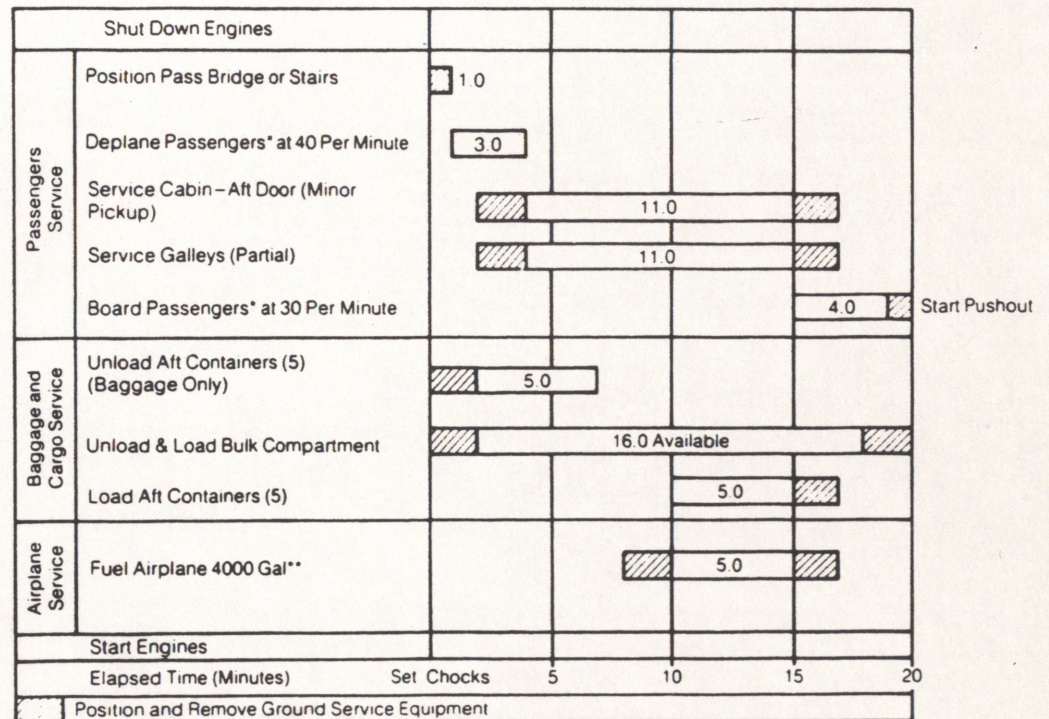
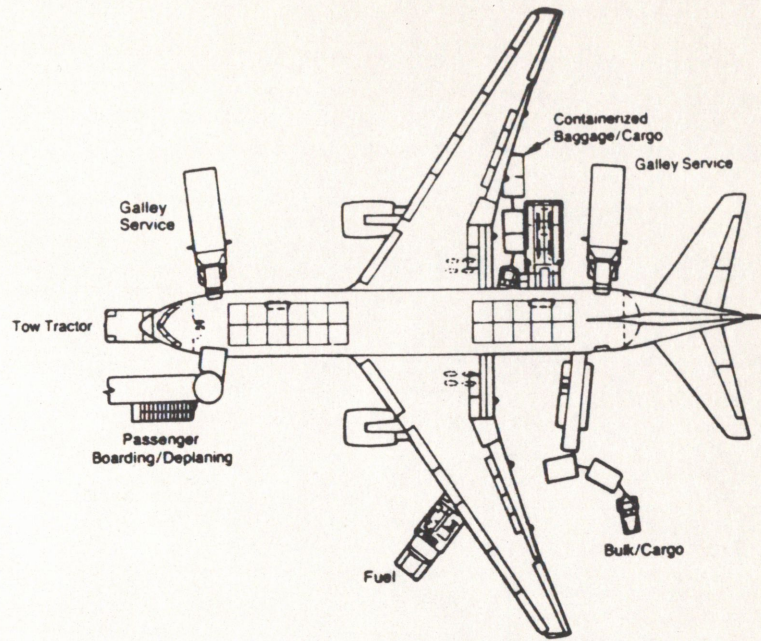
Turnaround Servicing



- Not Required if Auxiliary Power Unit is in Use
- Can Also Be Used to Run Air Cycle Machines For Ground Air Conditioning in Lieu of Conditioned Air Truck.



Through-Stop Servicing



211 Passengers

*100% Load Factor.
50% Exchange
of Passengers

**800 Gal/Min

Cabin Systems Features Galley System

Passenger Services

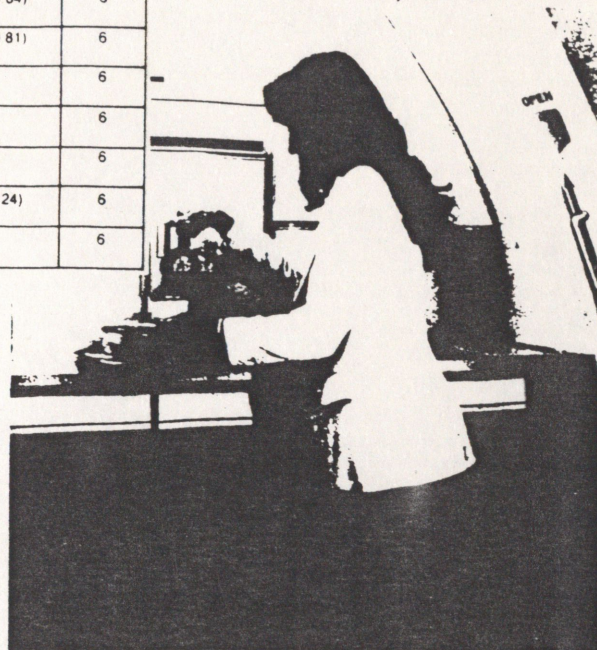
Interior	Lavatory Ratio Pass/Lav		Galley Volume - ft ³ /Pass (m ³ /Pass)		Coat Rod in /Pass (cm/Pass)	Attendants
	F/C	T/C	F/C	T/C		
208 Mixed Class	18	48	7.72 (0.20)	2.10 (0.06)	0.16 (0.41)	6
211 Mixed Class	18	48	5.11 (0.14)	1.61 (0.05)	0.33 (0.84)	6
213 Mixed Class	18	49	5.11 (0.14)	2.04 (0.06)	0.33 (0.84)	6
216 Mixed Class	18	50	5.11 (0.14)	1.57 (0.04)	0.32 (0.81)	6
230 All Tourist		46		1.47 (0.04)		6
241 All Tourist		60		1.67 (0.05)		6
255 (7) All Tourist		64		1.85 (0.03)		6
255 (8) All Tourist		51		1.85 (0.03)	0.49 (1.24)	6
289 (8) All Tourist		58		1.39 (0.03)		6

One Meal Service - 211 Passenger Arrangement (Typical)

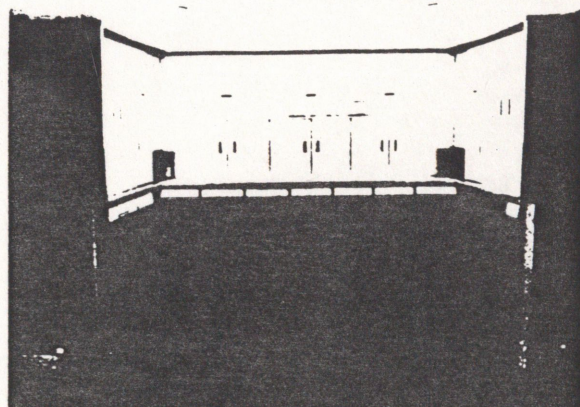
Item	Total
Tray Carts 12 in. Wide (14 or 28 Tray Capacity)	10 *(252 Meals)
Bev Carts	4
Misc Carts	2
Waste Carts	1
Waste Bins	2
Coffee Makers	6
Ovens	7
Refrig. Compl.	5
Misc Stowage	7 ft ³

* 211 Meals Plus 19% Overage for Crew and Spare Meals

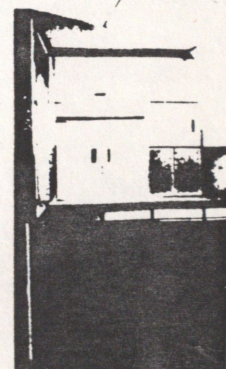
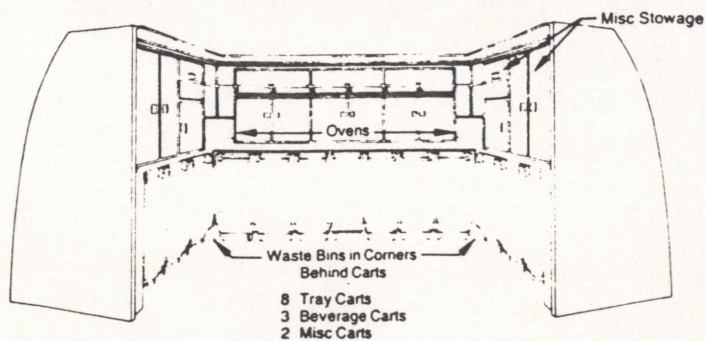
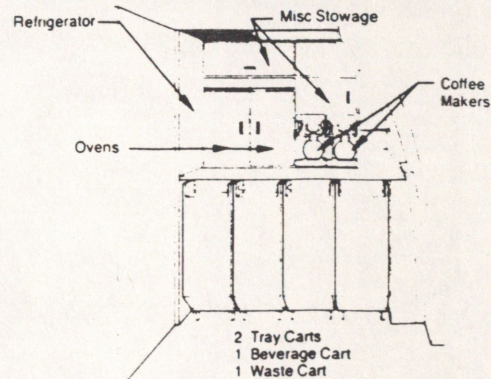
Typical Service
in Forward Galley



Aft Galley (Typical)



Forward Galley (Typical)



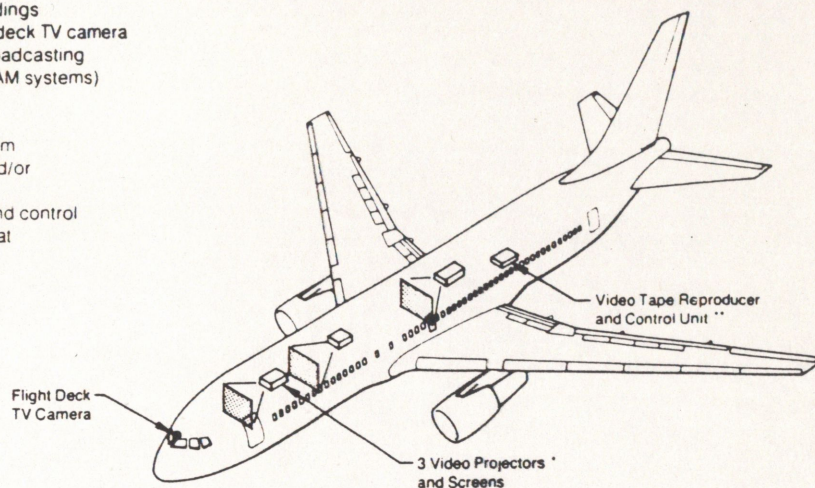
Passenger Entertainment System (Optional)

Video Entertainment System

- Wide viewing angle maximum brightness screen
- Low weight and power consumption
- Capabilities for showing:
 - Video tape recordings
 - Views from flight deck TV camera
 - Worldwide TV broadcasting (NTSC/PAL/SECAM systems)
- AM radio capability

Audio Entertainment System

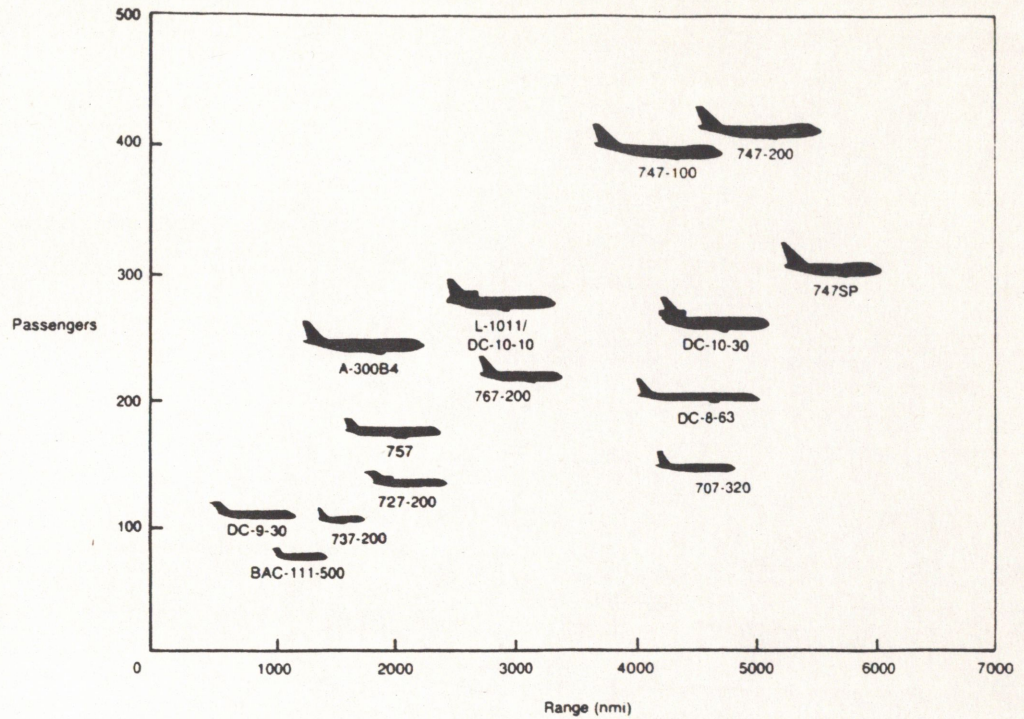
- Selection of stereo and/or monaural tapes
- Individual selection and control at each passenger seat



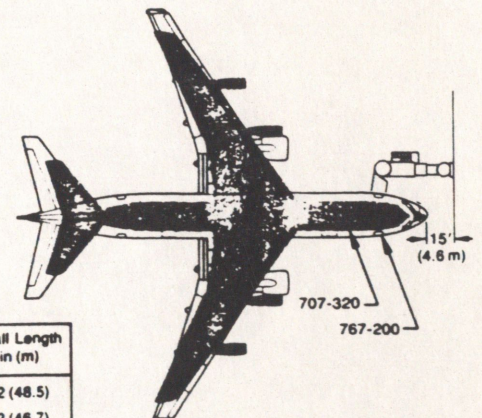
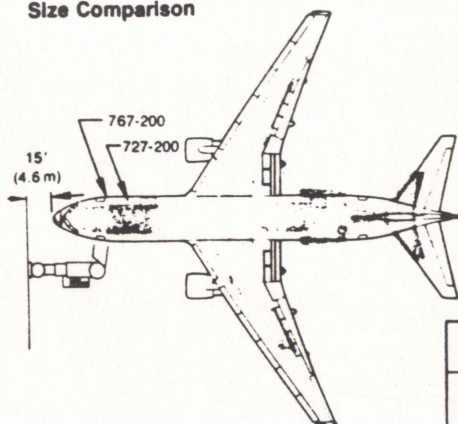
*Mounted on Ceiling Between Center Stowage Bin

**Located in Side Stowage Bin

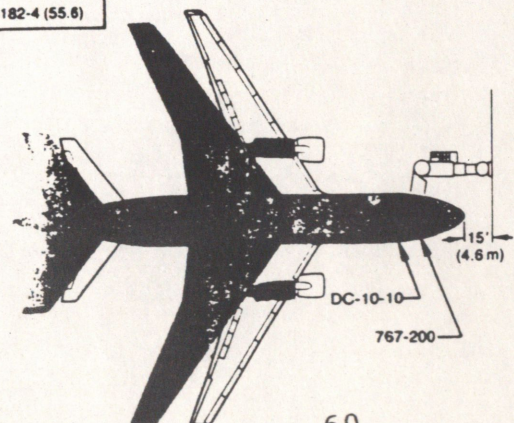
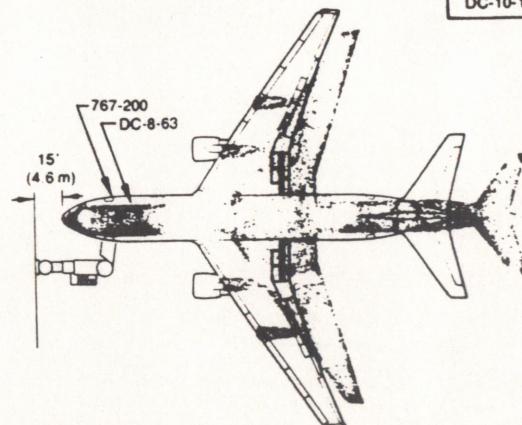
A New Medium-Range Airplane



Size Comparison



Airplane	Wing Span ft-in (m)	Overall Length ft-in (m)
767-200	156-4 (47.6)	159-2 (48.5)
727-200	108-0 (32.9)	153-2 (46.7)
DC-8-63	148-5 (45.1)	187-5 (57.1)
707	145-9 (44.4)	152-1 (46.6)
DC-10-10	155-4 (47.3)	182-4 (55.6)



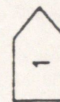
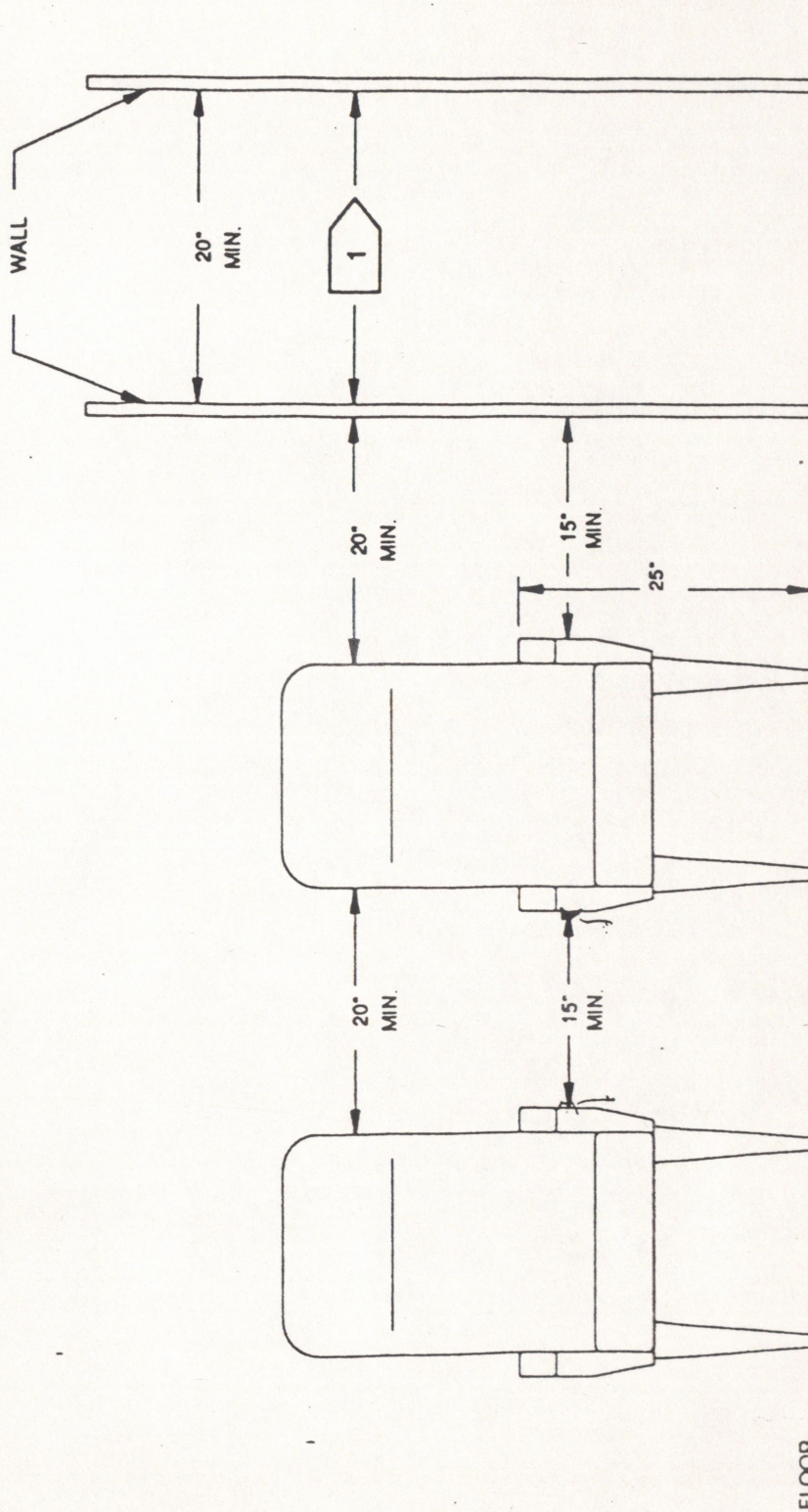
Appendix B - FAA Requirements

MINIMUM FAA AISLES

LONGITUDINAL AISLES FAR.25.807[7(V)]

20" MINIMUM ABOVE 25" OFF FLOOR

15" MINIMUM BELOW 25" OFF FLOOR



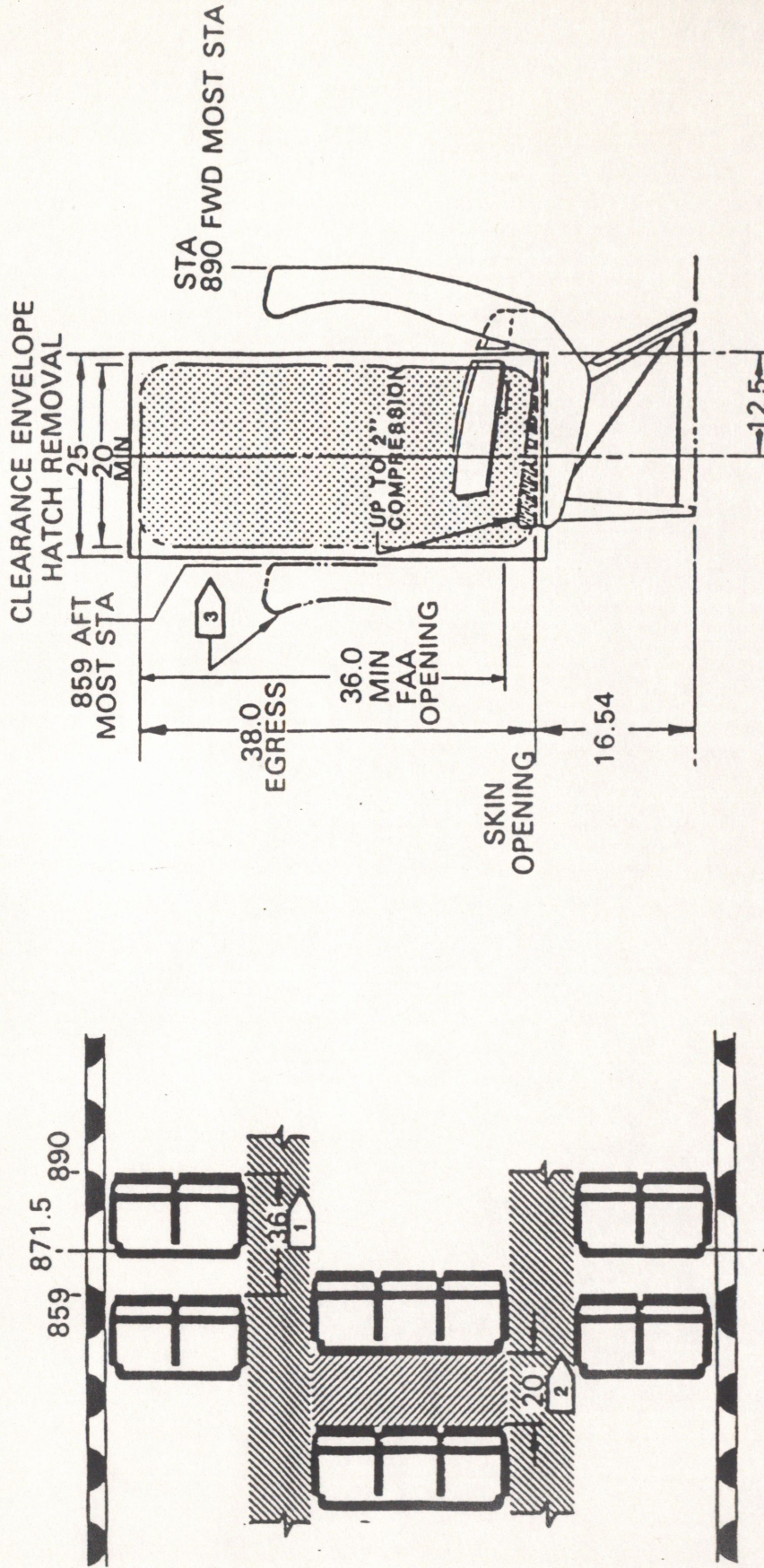
BOEING DESIGN CRITERIA

747 - 25 INCHES

767 - 24 INCHES

TYPE III EXIT-SINGLE

767 FAA REQUIREMENTS



THE SEAT PITCH OF THE SEAT ROW THAT PROVIDES ACCESS TO EACH OVERWING EXIT FROM THE MAIN AISLE MUST NOT BE LESS THAN 36 INCHES

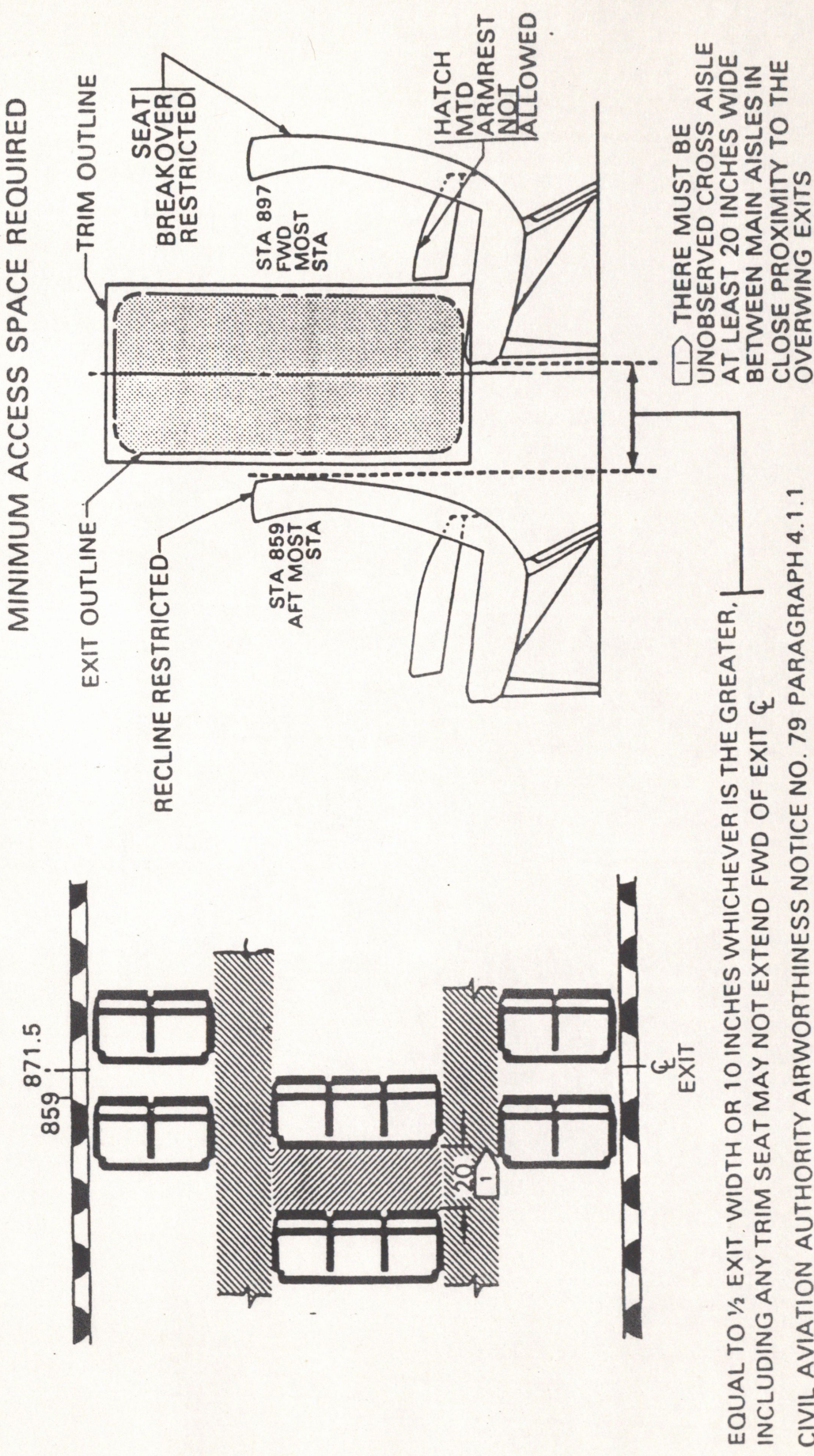
THERE MUST BE UNOBSERVED CROSS AISLE AT LEAST 20 INCHES WIDE BETWEEN MAIN AISLES IN CLOSE PROXIMITY TO THE OVERWING EXITS

SEAT BACK MAY NOT ENCROACH INTO THE LEGAL OPENING

TYPE III EXIT - SINGLE

767 CAA REQUIREMENTS

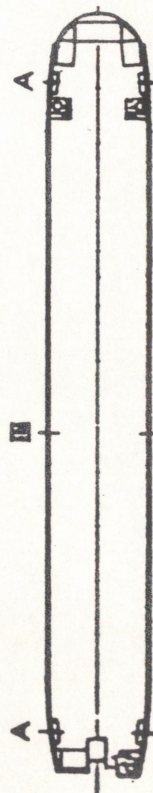
PRODUCT
DEVELOPMENT
STUDY



CDM 1803
1-26-86

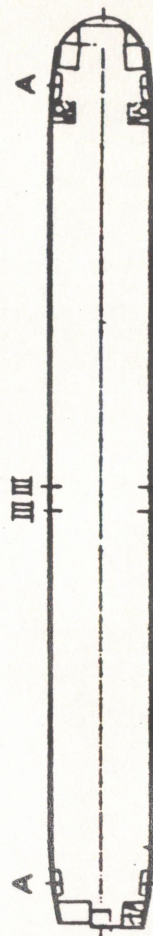
767 EXIT LIMIT SUMMARY

767-200

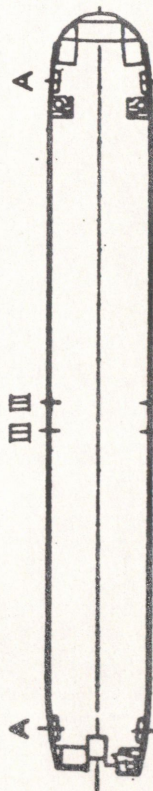


255 SEATS

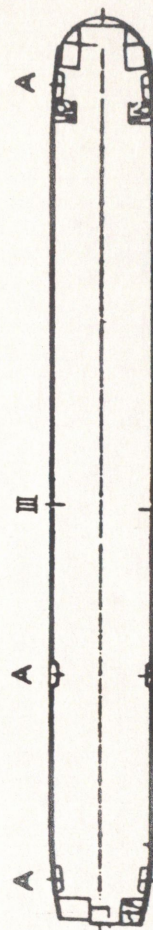
767-300



**290 SEATS



290 SEATS
FAR 25 ONLY



* 330 SEATS

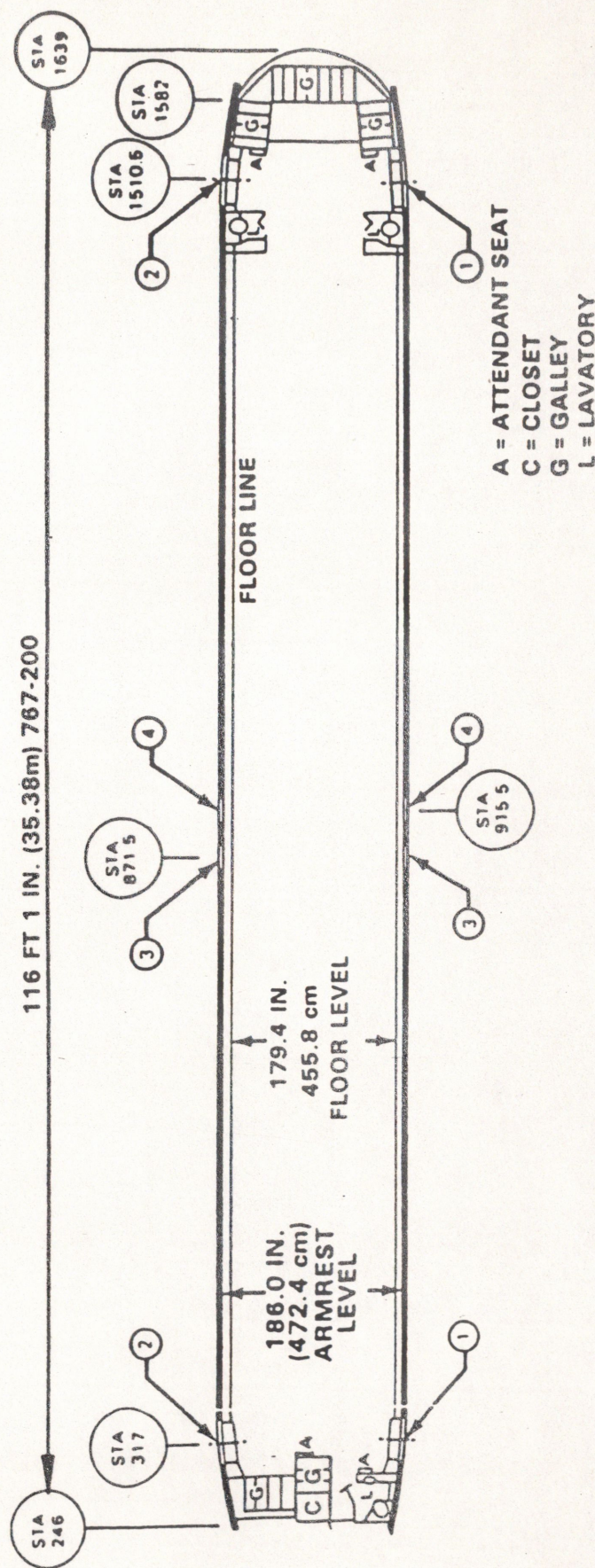
** SUBJECT TO FAA APPROVAL.

* SUBJECT TO FAA APPROVAL
WAIVER WILL BE REQUIRED

BASIC PASSENGER CABIN

767-200/-200ER

PRODUCT
DEVELOPMENT
STUDY

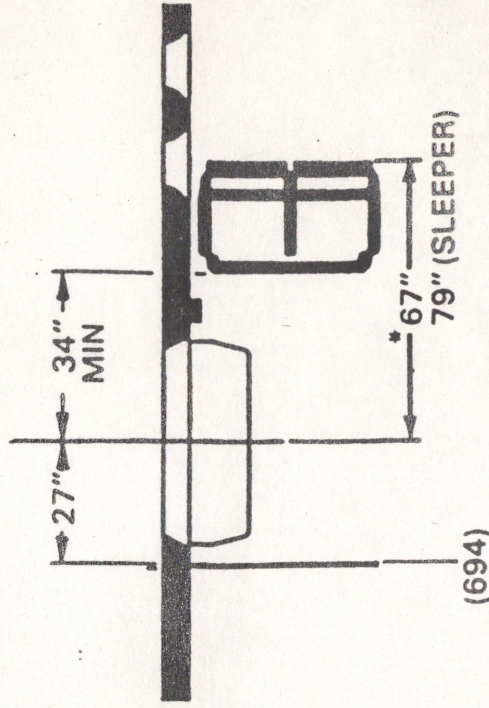
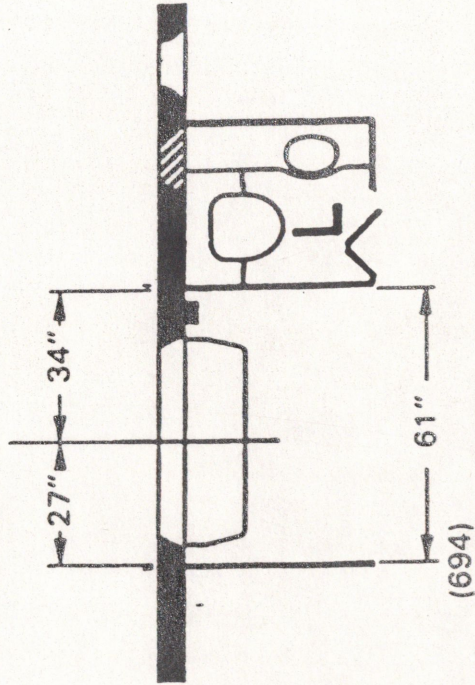


- ① ENTRY DOOR, TYPE A EXIT - 42" x 74" (106.7 cm x 188 cm)
- ② SERVICE DOOR, TYPE A EXIT - 42" x 72" (106.7 cm x 182.9 cm)
- ③ OVERWING EXIT, TYPE III - 20" x 38" (50.8 cm x 96.5 cm) 255 PASSENGER EXIT LIMIT (767-200/-200ER)
- ④ ADDITIONAL OVERWING EXIT, TYPE III - 20" x 38" (50.8 cm x 96.5 cm) 290 PASSENGER EXIT LIMIT (OPTIONAL ON 767-200/200ER)

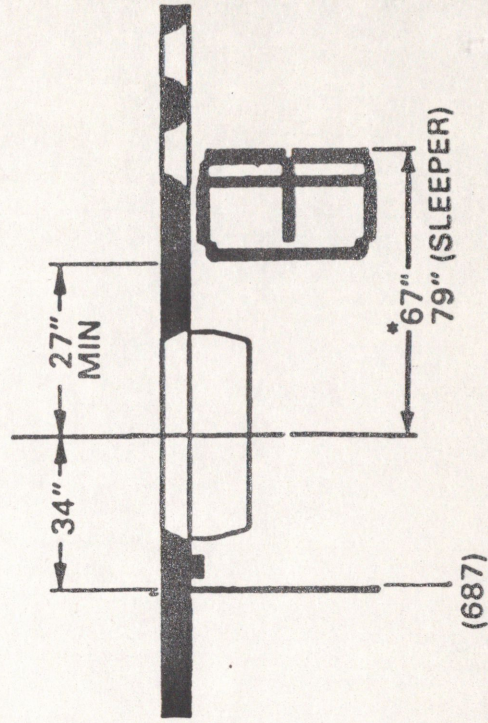
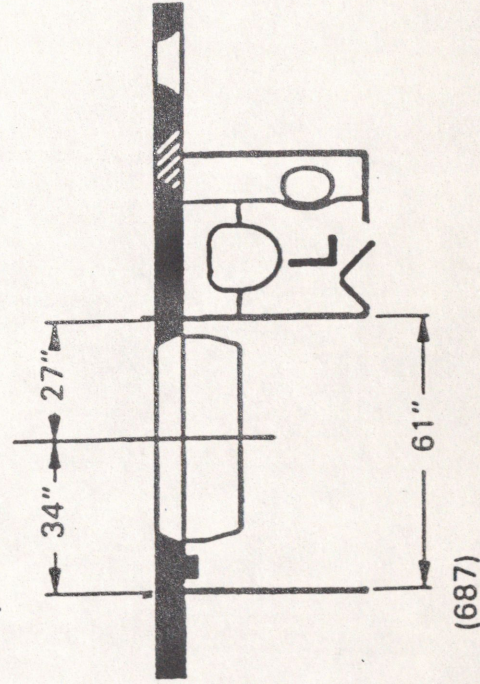
TYPE A EXIT - MID CABIN

767 HANDLE LOCATION

AFT HANDLE (BASIC)



FWD HANDLE (DESIGN CHANGE REQ'D)



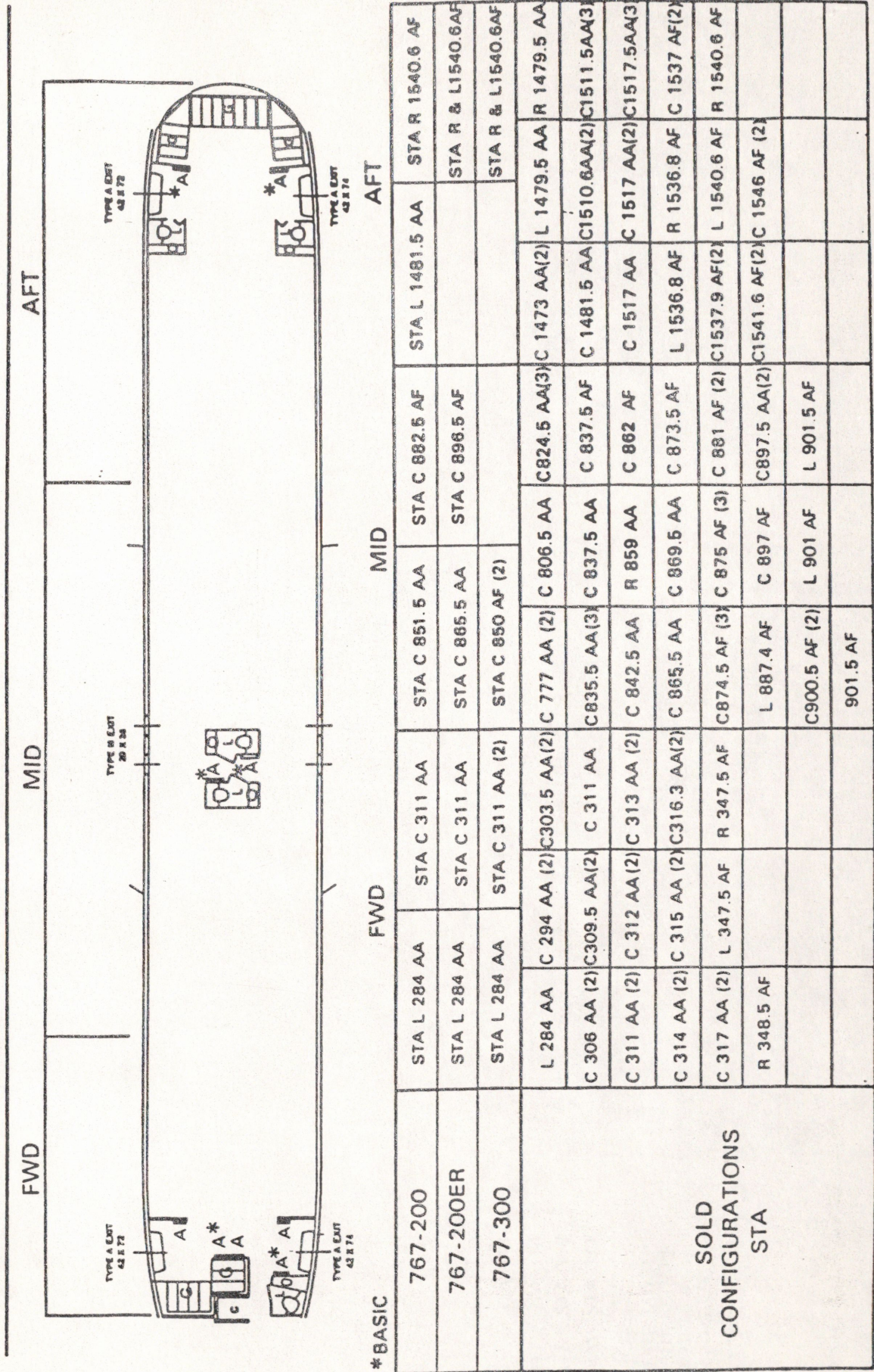
* 63" MINIMUM WITHOUT DOOR BUSTLE DELETHALIZATION

CDB 0359
4-9-85

PRODUCT
DEVELOPMENT
STUDY

ATTENDANT SEAT LOCATIONS

767



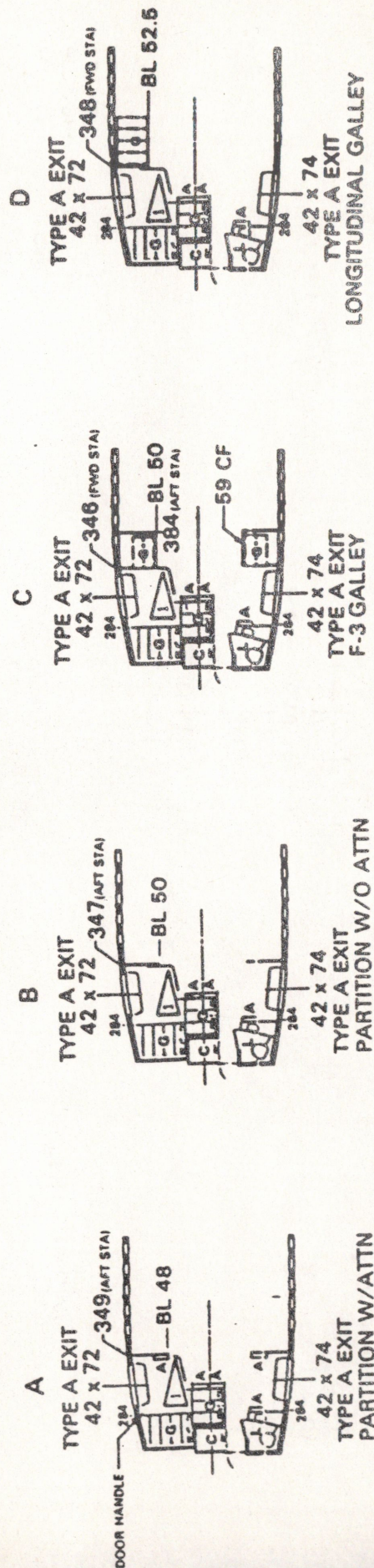
767-200/200ER

STA 317

TYPE A EXIT

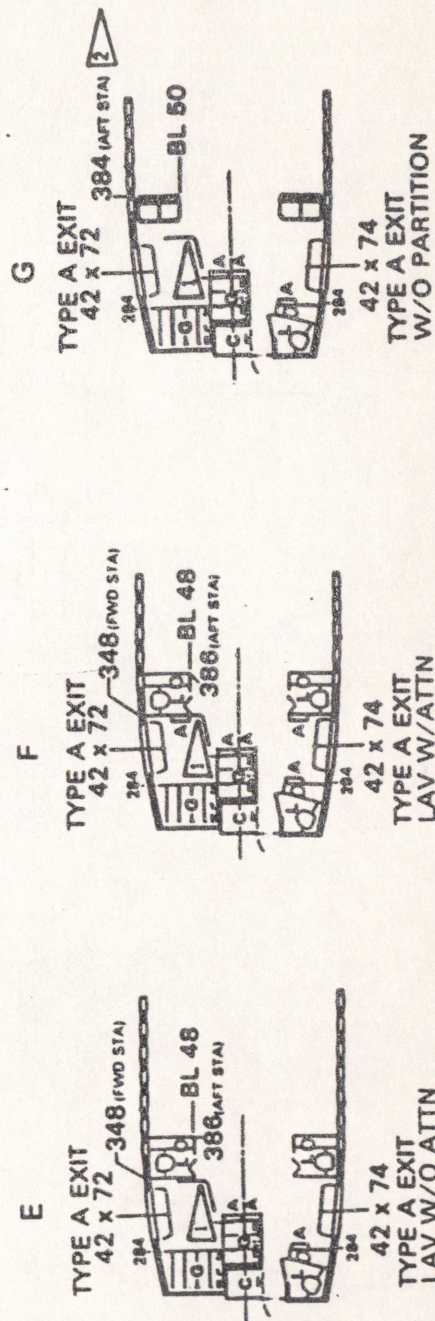
42 x 72/74

PRODUCT
DEVELOPMENT
STUDY



- 2-12" CARTS - STA 296
- 3-12" CARTS - STA 311
- 3-13" CARTS - STA 314
- 3-14" CARTS - STA 317
- LAV. STA 311

STA 380 FWD MOST
LOC WITHOUT ESCAPE
SLIDE COMPT
DELETHALIZATION



FWD MOST LOCATIONS

82.2

INTERIOR CROSS SECTIONS

767-200

PRODUCT
DEVELOPMENT
STUDY

TOURIST CLASS

SEATING WIDTH - 184"

A - 70.1

B - 78.5, B1 - 68.8

C - 82.5

SEATED CLEARANCE

HEAD - 7.56

SHOULDER - 10.84

ARM - 12.20

FOOT - 8.46

LOWER LOBE

HEIGHT - 68"

WIDTH - 132"

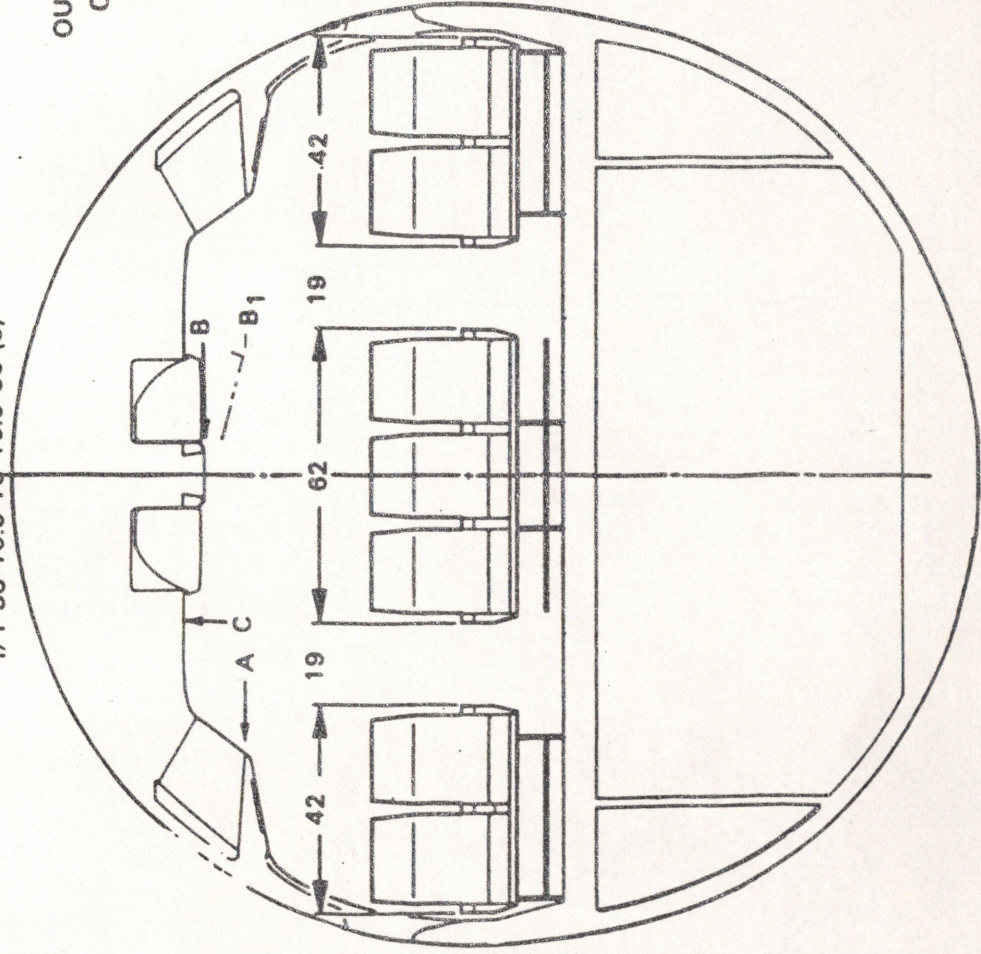
CONTAINERIZED - LD-2

12 - FWD

10 - AFT

BULK - 430 FT³

F/C 57-21-28-21-57 (5)
F/C-B/C 48-20-48-20-48 (6)
I/T 38-16.5-75-16.5-38 (8)



OVERHEAD STOWAGE
OUTBD - 320.7 IN² (88") (86.4")
CTR - 191.7 IN² (44") (40.83")
767-200 - 576 FT³ (SPEC)

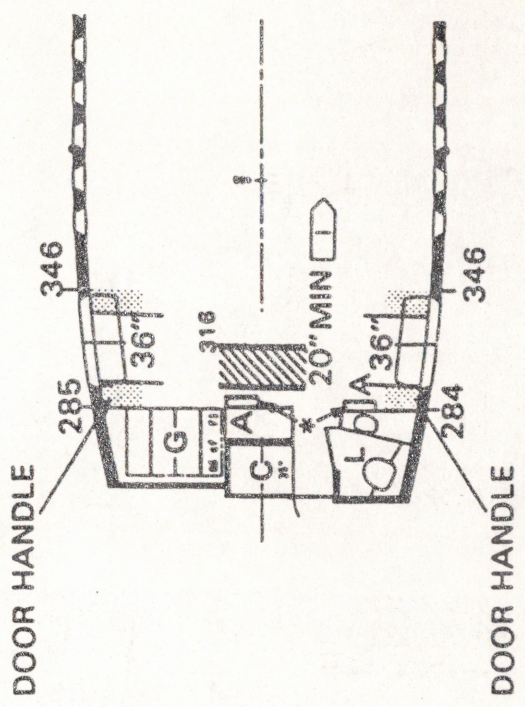
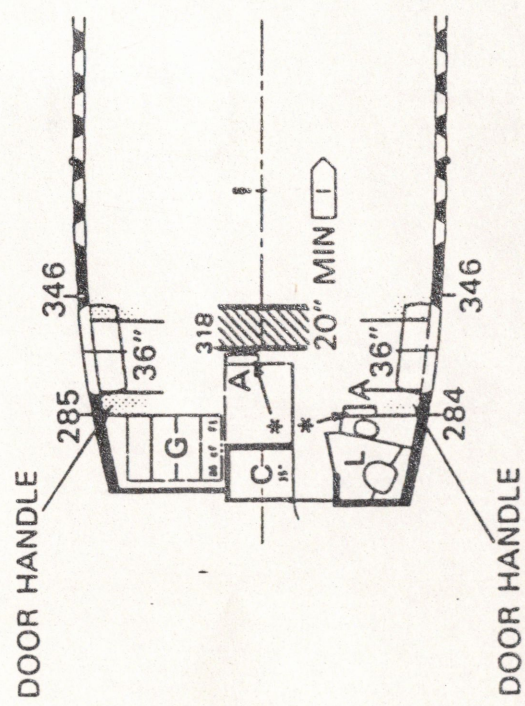
767-200
CONFIG STD PASS
SPEC 220 (18/202)
ER SPEC 211 (18/193)
STD TRI 174
STD DUAL 216
36-32 231
ALL 34 230
ALL 32 242/273
ALL 30 255/290
EXIT LIMIT 255/290

CDM 1590
12-18-86

EXIT REQUIREMENTS

767 FWD ENTRY/SERVICE

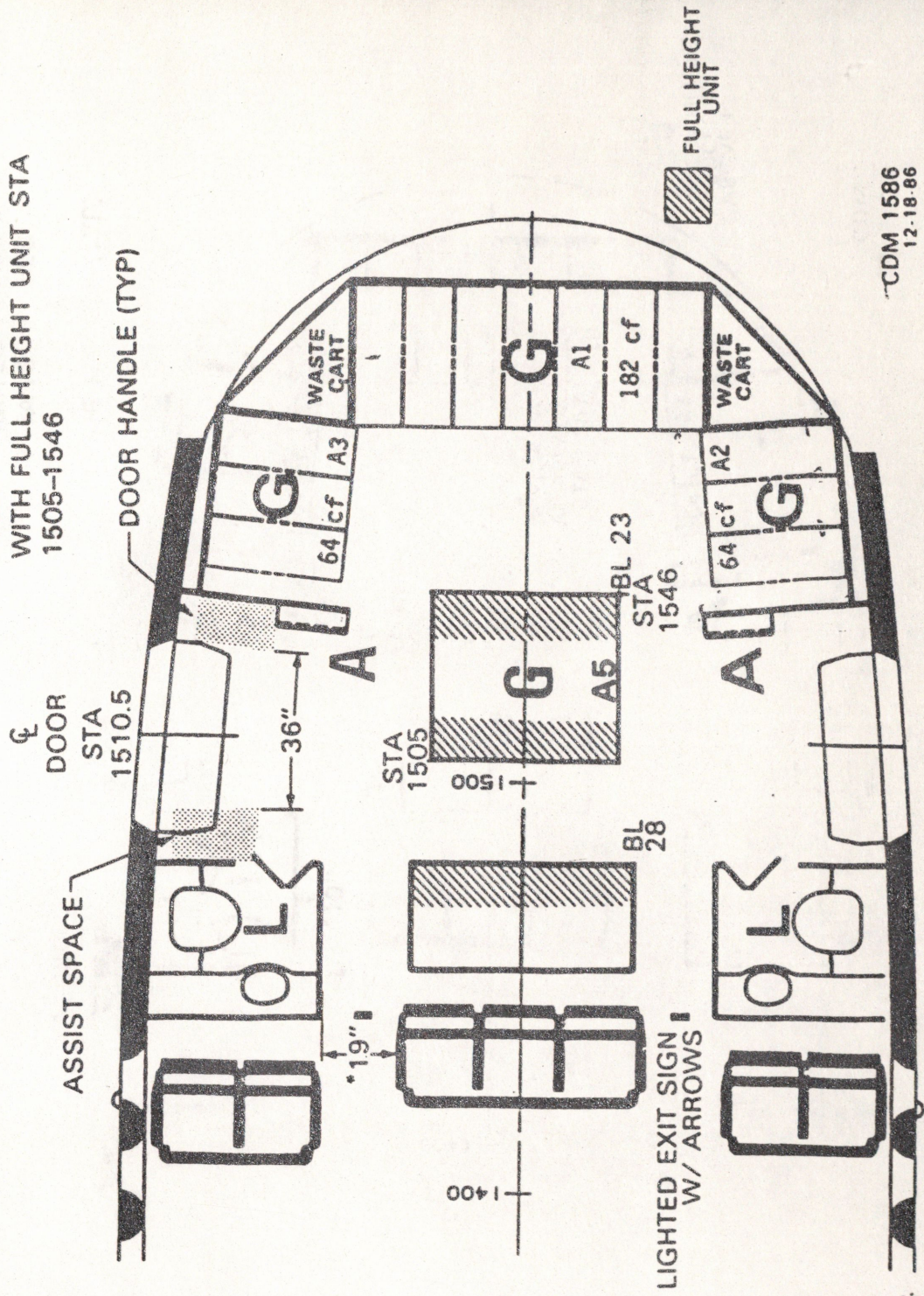
PRODUCT
DEVELOPMENT
STUDY



* CABIN INTERPHONE REQUIRED FOR ATTENDANT AT EACH TYPE A
 □ A 20" MINIMUM CROSS AISLE MUST LEAD DIRECTLY TO EACH EXIT ACCESS AISLE
 NOTE: MINIMUM SPACE FOR ATTENDANT IS 32" BETWEEN WALLS

EXIT REQUIREMENTS FWD CROSS AISLE 767 AFT ENTRY/SERVICE

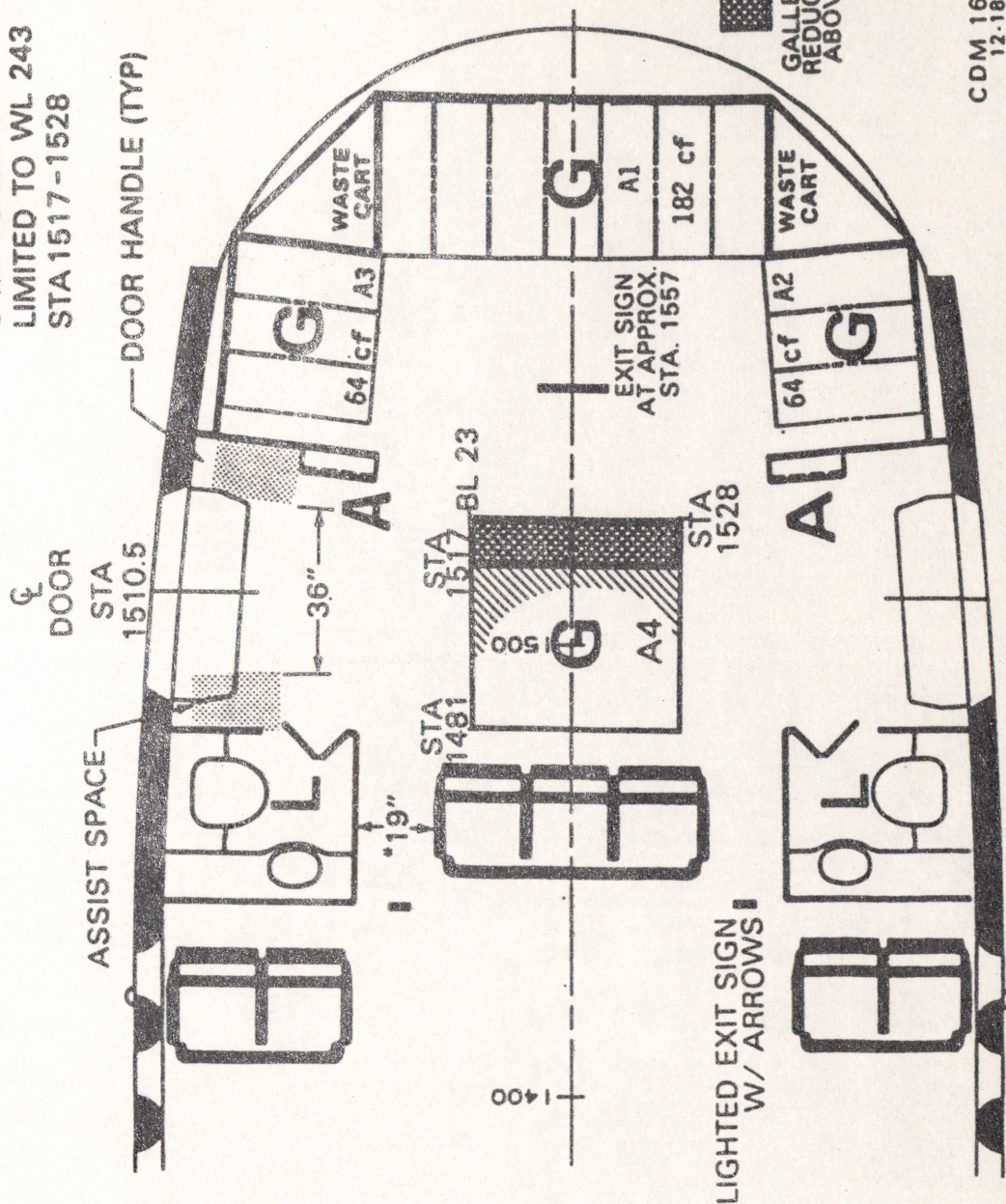
REPRESENTS REQUIRED CROSS
AISLE TYPE ARRANGEMENT
WITH FULL HEIGHT UNIT STA
1505-1546



EXIT REQUIREMENTS AFT CROSS AISLE

767 AFT ENTRY/SERVICE

REPRESENTS FULL HEIGHT
UNIT TO STA. 1517 HEIGHT
LIMITED TO WL 243
STA 1517-1528



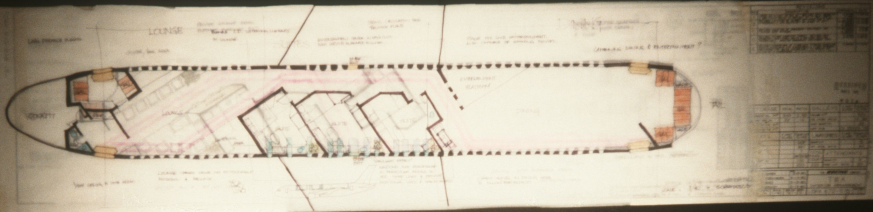
CDM 1609
12.18.86

* 21" ABOVE WL 225

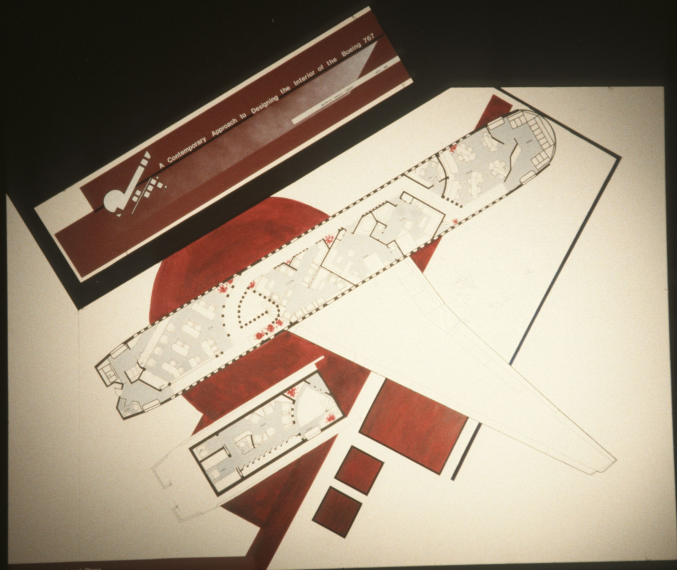
Appendix C - Project Slides



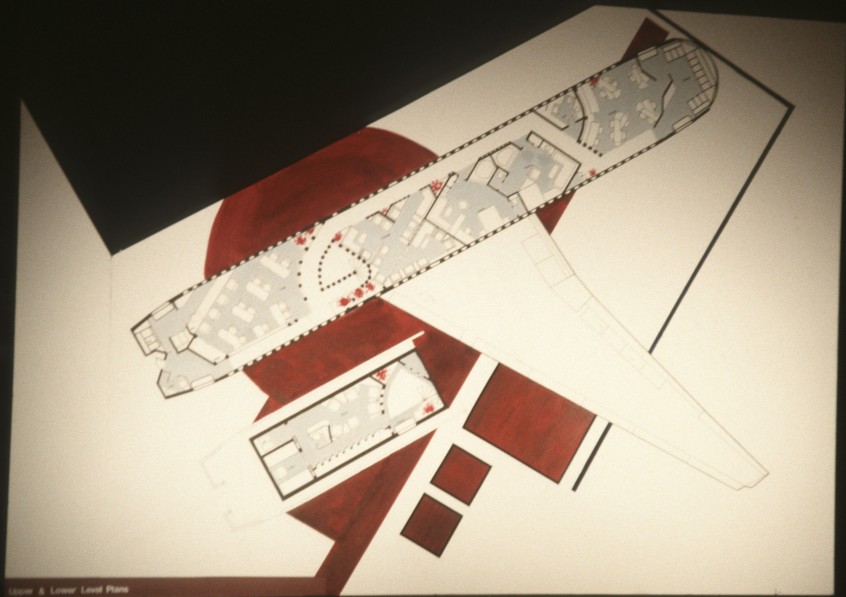
A Contemporary Approach to Designing the Interior of the Boeing 757



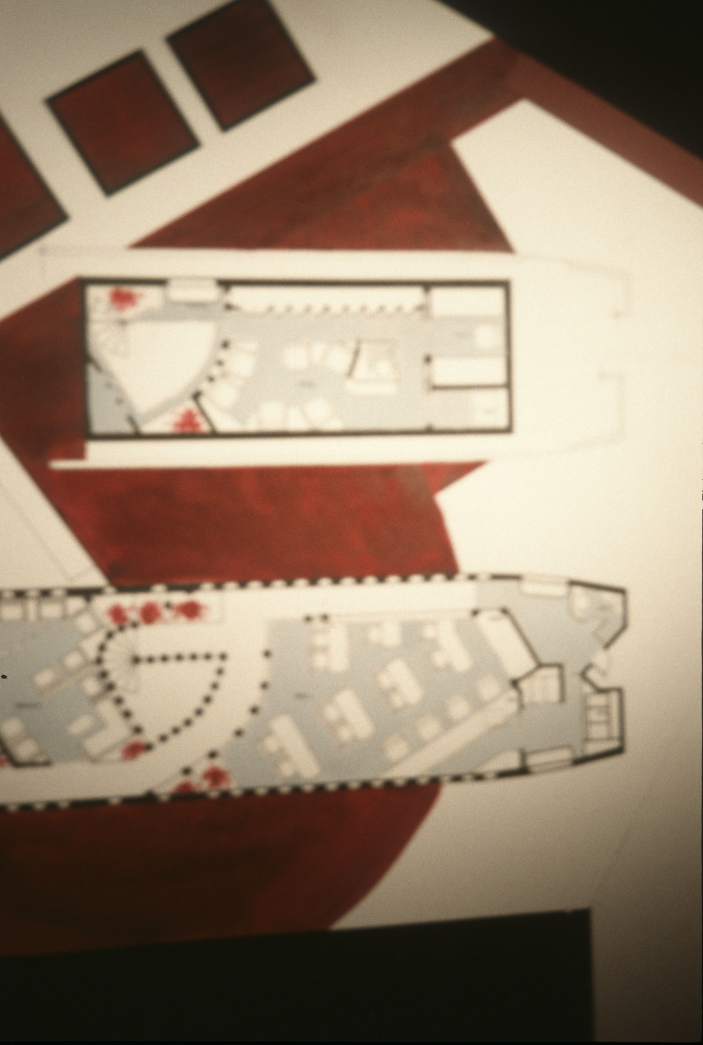
SCHEMATICS

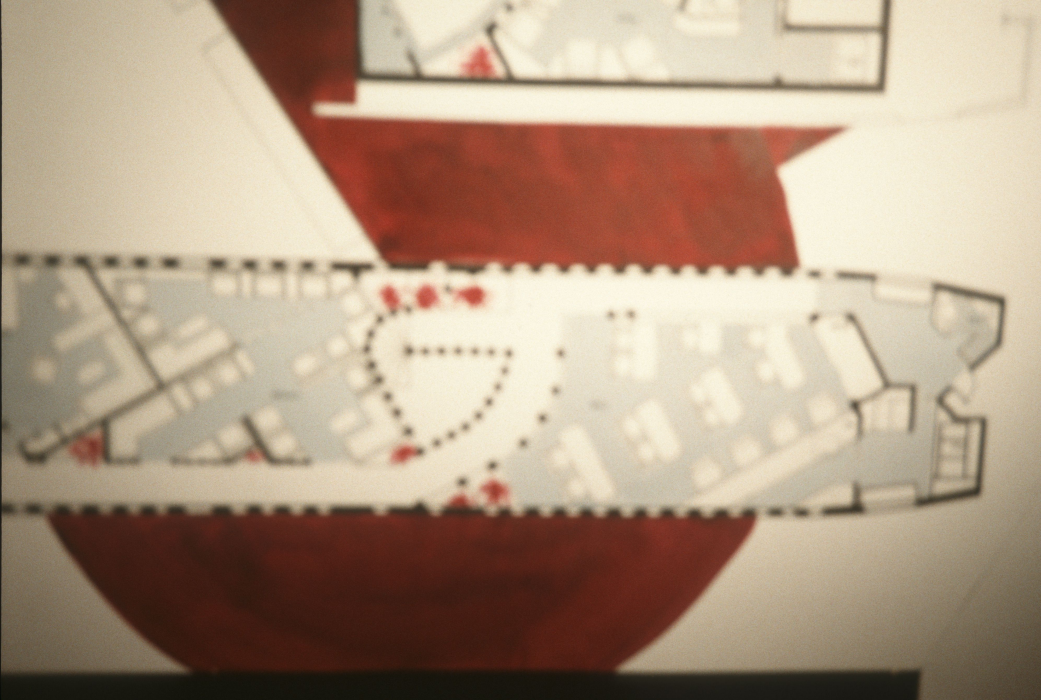


Upper & Lower Level Plan

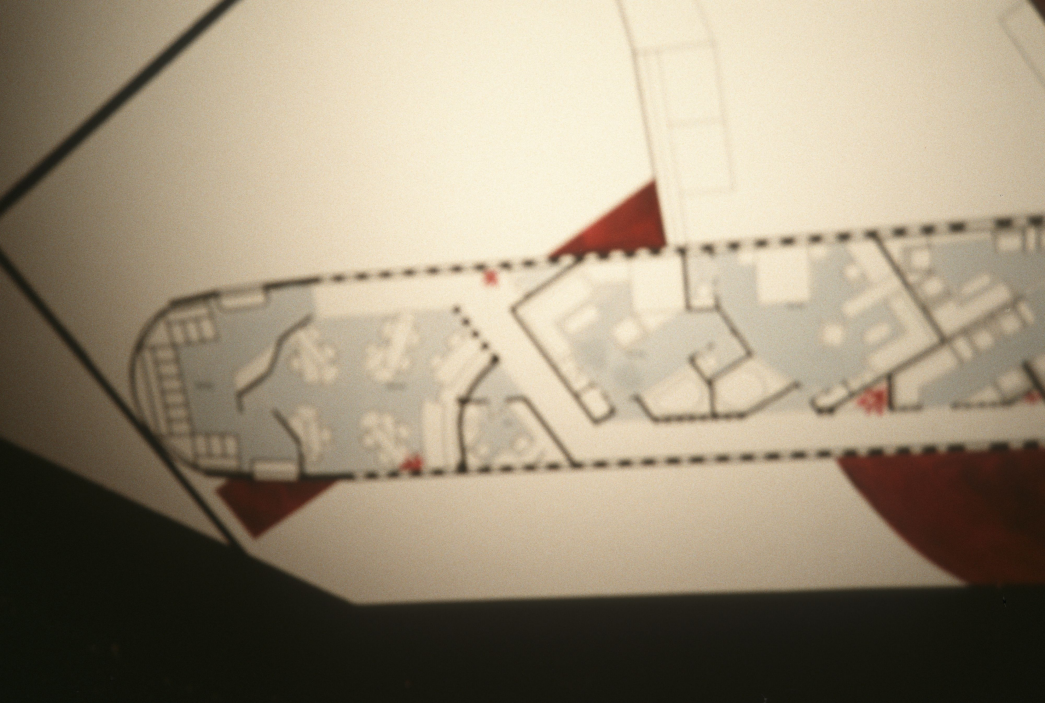


Upper & Lower Level Plans



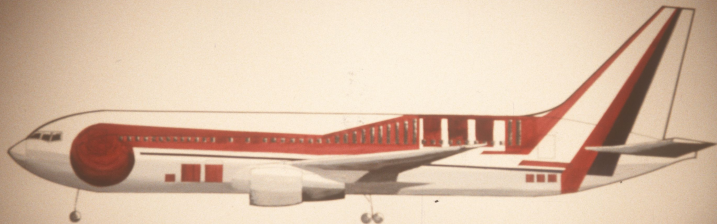




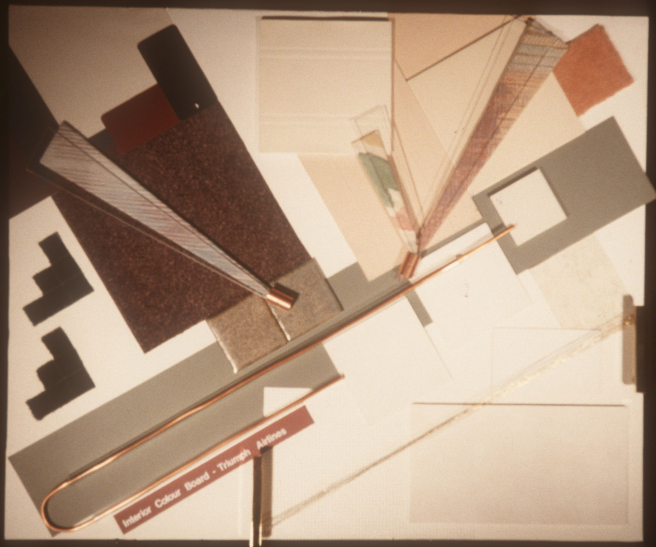




Entry Perspective

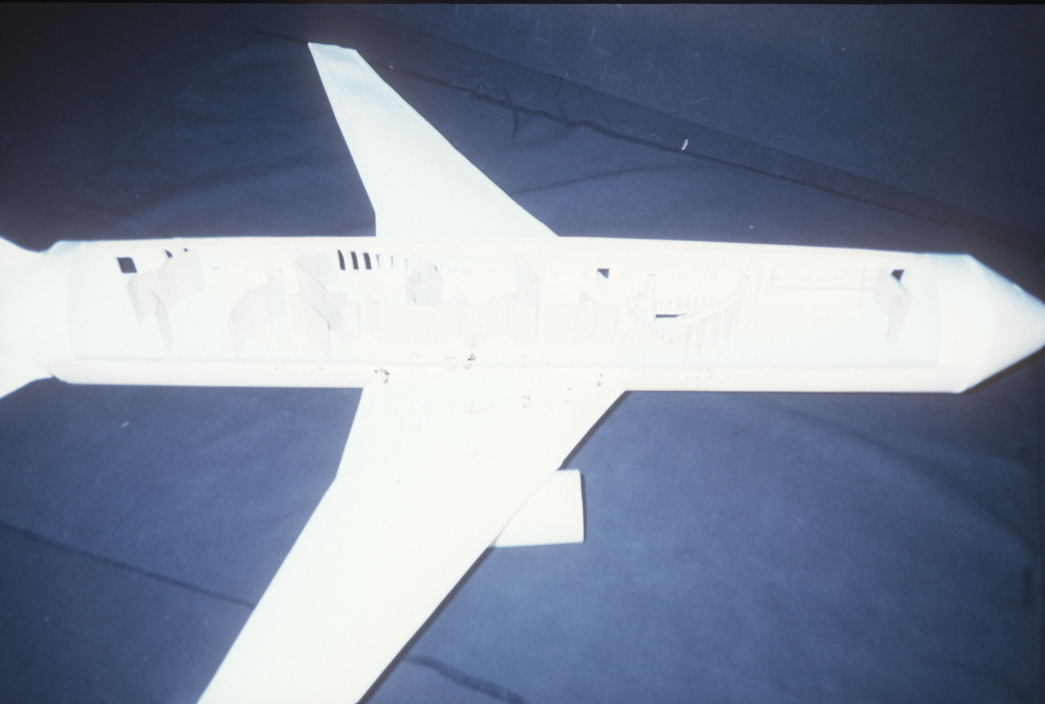


Super Graphics



Colour Board - Triumph Airlines







3 1762 10076863 7

[illegible]

Demco, Inc. 38-293

