DC-8
AIRBORNE LABORATORY
EXPERIMENTER HANDBOOK

National Aeronautics and Space Administration
Dryden Flight Research Center
Edwards, CA 93523-0273

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EXPERIMENTER HANDBOOK

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INTRODUCTION

Since August 1987, NASA has been operating A Douglas DC-8-72 Aircraft (NASA 817) for research activities in earth, atmospheric, and space sciences. This aircraft, extensively modified as a flying laboratory, is based at Dryden Flight Research Center (DFRC), Edwards, California. It is operated for the benefit of researchers whose proposals have been previously approved by NASA Headquarters. Airborne laboratory flights may be operated out of DFRC or from deployment sites worldwide, according to the research requirements.

The DC-8 is a four-engine jet aircraft with a range in excess of 5,000 nmi (9,200 km), a ceiling of 41,000 ft (12,500 m), and an experiment payload of 30,000 lb (13,600 kg). Utilization is planned to be 350 to 500 flight hours per year. Special viewports, power systems, and instruments have been installed in the aircraft to support a wide range of research programs.

Airborne research missions for the DC-8 are planned, implemented, and managed by the Airborne Science Directorate at DFRC. A designated mission manager is responsible for all phases of an assigned mission and is the official point of contact for experimenters as well as for ground support and flight operations groups. The mission manager leads a core team, specific to each mission, consisting of him/herself, an operations engineer, a project pilot, and the contract maintenance lead. This team makes all significant decisions regarding mission aircraft operations. The mission manager also functions as the onboard mission director during flight phases of the mission. The mission director coordinates and monitors science and operations activities on the aircraft during flights.

The purpose of this handbook is to acquaint prospective DC-8 researchers with the aircraft and its capabilities. The handbook also contains procedures for obtaining approval to fly experiments, outlines requirements for equipment design and installation, and identifies the personnel and facilities that are available at DFRC for supporting research activities in the DC-8 airborne laboratory. This handbook is managed and revised from time to time by the DFRC Airborne Science Directorate. Therefore, before arranging for experiments it is advisable to review the web site listed below, then contact the DFRC Airborne Science Directorate or your assigned mission manager for a current issue.

For information about the overall DFRC Airborne Science Program, including aircraft schedules and Airborne Science flight request procedures, and for an electronic version of this and other experimenter handbooks, look on the World Wide Web at:

http://www.dfrc.nasa.gov/airsci/.

NOMENCLATURE

AC	alternating current
ADC	air data computer
ADF	automatic direction finder
AED	automated external defibrilator
APT	automatic picture transmission system
ASCII	text format
ATC	Air Traffic Control
BCP	best computed position
CCTV	closed circuit television
CDU	control display units
CONUS	contiguous United States
CPU	central processing unit
DC	direct current
DCE	data communications equipment
DCP	Dryden Centerwide Procedure
DFRC	Dryden Flight Research Center
DME	distance measuring equipment
DTE	data terminal equipment
EIF	Experiment Integration Facility
EMI	electromagnetic interference
EPOS	emergency passenger oxygen system (or smoke hood)
FAA	Federal Aviation Administration
FMS	flight management system
GFI	ground fault interrupter
GMT	Greenwich Mean Time
GPS	Global Positioning System
GS	glideslope receiver
HF	high frequency
HP	horsepower
ICATS	information collection and transmission system
IDLH	immediately dangereous to life or health
ILS	instrument landing system
INS	inertial navigation system
IR	infrared
IRIG	Inter-Range Instrument Group
KTAS	knot, true airspeed

LOC	localizer receiver
MFD	multi-function display
MIL-STD	military standard
MS	military specifications
MSDS	Material Safety Data Sheet
NAS	National Aerospace Standard
NASA	National Aeronautics and Space Administration
NEMA	National Electrical Manufacturers Association
NM	nautical mile
NMS	navigational management system
NOAA	National Oceanic and Atmospheric Administration
NTSC	National Television Standards Committee
PARM ID	parameter identification code
PMS	Particle Measuring Systems
PVC	polyvinyl chloride
RF	radio frequency
RIB	Research Instrumentation Branch
SAT	static air temperature
SATCOM	satellite communications system
SLA	sealed lead acid
SVHS	super video home system
TACAN	tactical air navigation transmitter/receiver
TAS	true air speed
TAT	total air temperature
TCAS	traffic alert and collision avoidance system
TCG	time code generator
TLV	threshold limit value
UHF	ultra high frequency
UPS	uninterruptible power systems
UTC	Coordinated Universal Time
VDC	volts of direct current
VHF	very high frequency
VOR	VHF omnidirectional ranger
W	watts
WGS	World Geodetic System

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CHAPTER 1

AIRCRAFT PERFORMANCE

1. Basic Aircraft Performance

The NASA DC-8-72, serial no. 46082 (NASA 817), is similar in appearance and performance to other four-engine, standard-body jet transports, as shown in figure 1-1(a) and 1-1(b). The aircraft is powered by four CFM International, CFM56-2-C1, high bypass ratio turbofan engines developing a maximum thrust of 22,000 lb each.

Basic aircraft performance in standard atmospheric conditions is summarized in the following subsections. Adding external instrument pods or pylons that increase drag will reduce performance parameters correspondingly.

A. Range

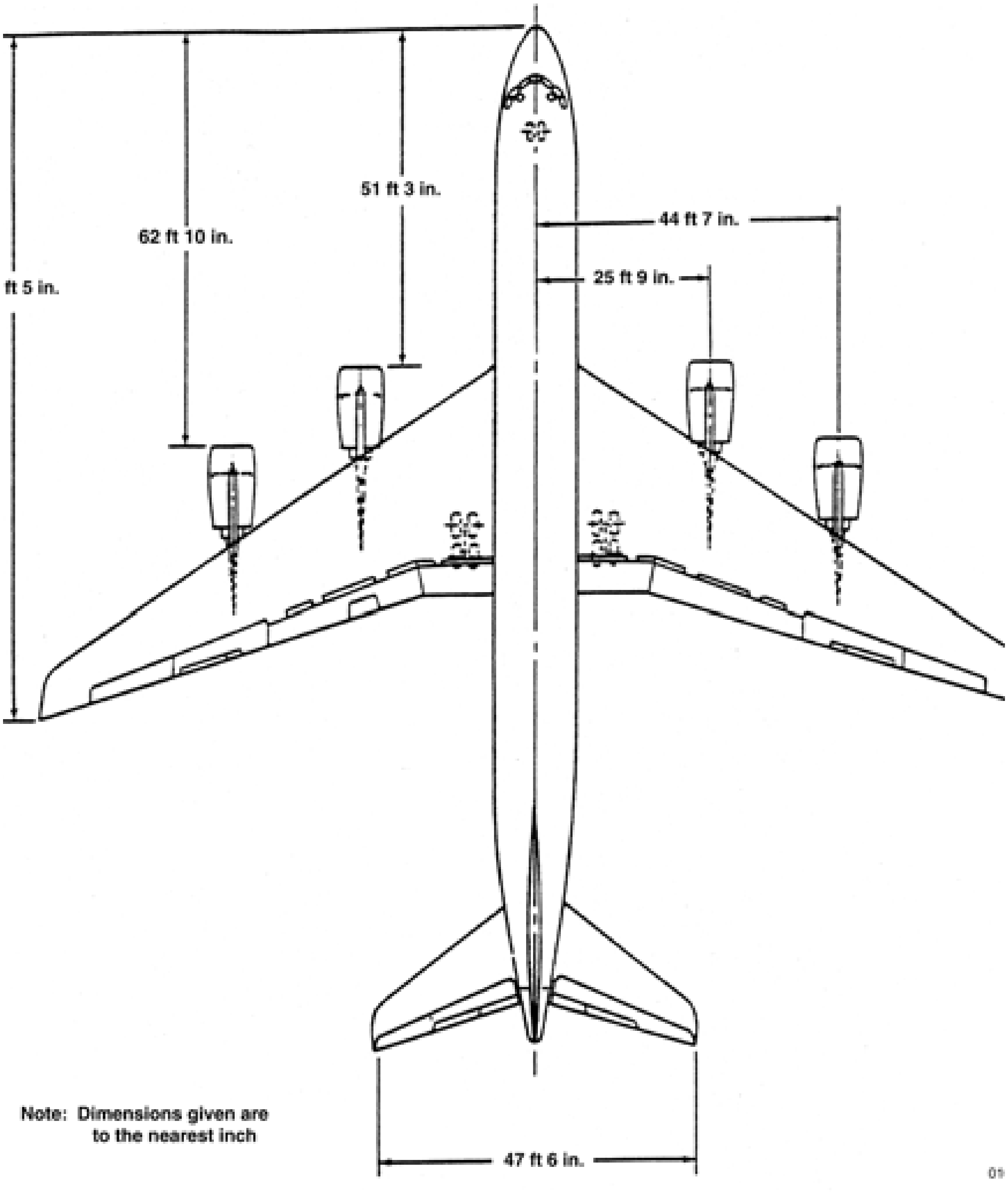
Maximum aircraft range with normal fuel reserves, for several payload weights, is as follows:

Table 1-1. Maximum aircraft range with normal fuel reserves.

Payload[1], lb	Fuel wt, lb	Gross wt[2], lb	Range, nmi
20,000	160,000	334,000	5,700
30,000	150,000	334,000	5,400
40,000	140,000	334,000	5,000

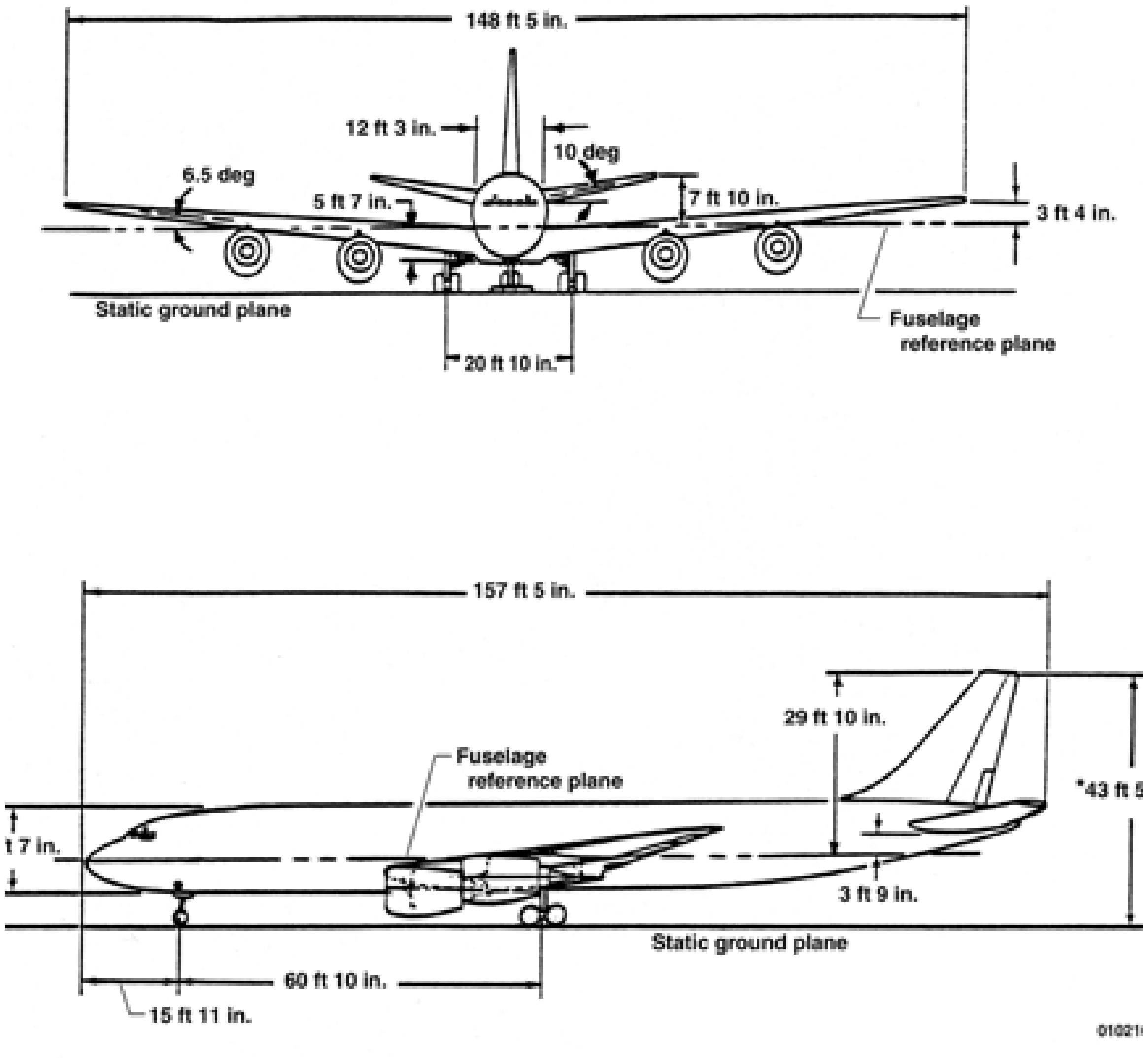
[1] Payload = experimenters, crew, equipment, seats, and baggage.
[2] Assumed empty weight = 154,000 lb

Payload weights seldom exceed 30,000 lb (13,608 kg), so that a 5,400 nmi (10,000 km) range is usually available except as reduced by special requirements for altitude profiles, flight patterns over ground test sites, external experiments, or headwinds.



Note: Dimensions given are to the nearest inch

Figure 1-1(a). General view and over-all dimensions of the DC-8.



Note: Dimensions given are to the nearest inch

* Based on: 13.9 in. rolling radius for the nose gear and 17.9 in. rolling radius for the main gear with the airplane at operator's weight empty

Figure 1-1(b). General view and over-all dimensions of the DC-8.

B. Runway Length

At standard sea level conditions, the DC-8-72 typically requires a jet transport-rated runway of 7,500 ft (2,286 m), when take off weight is 300,000 lb (136,079 kg). For a take-off weight of 325,000 lb (147,419 kg), the runway length must be at least 8,500 ft (2,591 m). With a maximum take-off weight of 350,000 lb (158,759 kg), the runway length must be 9,800 ft (2,987 m), minimum. The allowable aircraft take-off gross weight will be reduced by such limiting factors as runway length, weight-bearing capability, slope, height above sea level, as well as by air temperature, wind, and obstacles.

C. Time at Altitude

The time at a desired research altitude is dependent upon numerous factors. The table below gives times for various take-off weights and two sample payloads, as representative of aircraft performance. The one-hour allowance for time to climb and descend is an average, allowing variations in local air traffic control. The initial flight altitude will be reached in about 30 min. If a higher altitude is desired, a step-climb can be achieved after aircraft weight has been reduced by fuel burn-off. Factors such as air temperature, aircraft configuration (probes, pylons, antennas, etc.), and air traffic control will determine when the aircraft can climb to a higher altitude. Traditionally, an individual flight plan is developed for each case, to optimize total research requirements.

1) 20,000 lb (44,092 kg) Payload

Table 1-2(a). Mission duration and initial altitude for 20,000 lb payload.

Take-off Gross wt, lb	Fuel wt, kg	Initial Flight Altitude, ft	Climb & Descent	Time at Altitude
230,000	60	41,000	1 hr	3 hr 15 min
270,000	100	37,000	1 hr	7 hr 15 min
300,000	130	35,000	1 hr	9 hr 45 min
330,000	160*	35,000	1 hr	12 hr 0 min

* Maximum fuel

2) 30,000 lb (66,138 kg) Payload.

Table 1-2(b). Mission duration and initial altitude for 30,000 lb payload.

Take-off Gross wt, lb	Fuel wt, kg	Initial Flight Altitude, ft	Climb & Descent	Time at Altitude
230,000	50	41,000	1 hr	2 hr 15 min
270,000	90	37,000	1 hr	6 hr 15 min
300,000	120	35,000	1 hr	8 hr 45 min
340,000	160*	33,000	1 hr	11 hr 30 min

*Maximum fuel

The maximum allowable flight duration is dependent on crew rest and aircraft weight limitations. Also, regulations require that sufficient fuel reserves be maintained at all times to assure adequate fuel for airport and air traffic delays plus reaching an alternate landing field. Fuel loads are subject to the discretion of the air commander. The need for this reserve and the distance between possible alternates in remote areas may combine to shorten the listed flight times. Exceptions to this reserve fuel requirement, in order to prolong experiment time, are not permitted.

D. Speed Envelope

At standard atmospheric temperature conditions, the true airspeed (KTAS) envelope for this aircraft is shown in table 1-3.

For preliminary planning, normal cruise speed at altitudes above 30,000 ft can be estimated at 450 KTAS.

E. Turn Radius

For certain types of experiments, it may be desirable to fly over several closely spaced checkpoints. However, the DC-8-72 is a relatively high-speed aircraft and its turning radius is quite large. Experimenters planning closely spaced checkpoints should consult with their mission manager regarding flight planning. The following table indicates radius of turn, with no wind, in nautical miles as a function of speed and bank angle. See table 1-4.

Table 1-3. True airspeed envelope.

Altitude, ft	--- min	Knot, True Airspeed KTAS[1], Long Range Cruise	--- max	Mach no. max
5,000	220	275 to 355	370	0.57
10,000	235	315 to 395	410	0.63
15,000	260	325 to 415	440	0.70
20,000	275	350 to 450	470	0.77
25,000	300	380 to 465	485	0.86
30,000	320	400 to 470	490	0.88
35,000	350	425 to 465	495	0.88
40,000	390	430 to 460	500	0.88

Dynamic pressure (Qmax) = 572 lb/ft^2

[1] KTAS = (knots nautical miles per hour), true airspeed. One nautical mile = one arc-minute of latitude at the equator, or 6,076.12 ft (1,852 m).

Table 1-4. DC-8 turn radius in NM, as a function of airspeed and bank angle.

Bank Angle, deg	Airspeed, KTAS						
	300	325	350	375	400	425	450
5	15.0	17.6	20.5	23.5	26.7	30.2	33.8
10	7.5	8.8	10.2	11.7	13.3	15.0	16.8
15	4.9	5.8	6.7	7.7	8.7	9.9	11.0
20	3.6	4.2	4.9	5.6	6.4	7.3	8.1
25	2.8	3.3	3.8	4.4	5.0	5.7	6.3
30	2.3	2.7	3.1	3.6	4.1	4.6	5.1

2. Frequency and Duration of Flights

During the early stages of each mission, the mission manager develops mission specific operational guidelines affecting flight frequency and duration. These guidelines take into account the type of flights being proposed by the scientists, the proposed flight duration, the location, take-off times, and other mission specific conditions, and reflect the overall agreement of the aircraft flight crew, operations engineer, safety, mission management, and maintenance crew. The following general guidelines can be used for initial planning.

The duty day for DFRC personnel, including contractors, is limited to 14 hours maximum. The rest period between duty days must be a minimum of 12 hours. Given requirements for pre-flight and post-flight aircraft access, maximum flight duration is nominally 10 hours. Longer flights can be made but flight planning will be restricted and crew augmentation may be necessary.

A limit of 30-flight hours in a seven-day period and 100 hours per month is used for planning purposes. This has proven to be a practical limit for aircraft maintenance crews and, as experience has shown, for experimenters participating in the flights. However, given adequate crew rest and reasonable flight pacing, an absolute maximum of 40-flight hours in seven days can be allowed. Requests to exceed the 30-in-7 guideline will be evaluated on a case-by-case basis.

A typical operational schedule will consist of “fly days,” “no-fly days,” and “down days.” Any day the aircraft flies, or the flight and maintenance crews arrive and complete preflight preparations and then the flight is cancelled, is considered a fly day. Generally, the number of consecutive fly days is limited to a maximum of six, to be followed by a no-fly day or a down day. Any day the aircraft is accessible to experimenters but does not fly is considered a no-fly day. Members of the DC-8 crew will be at the aircraft on these days. Fly days and no-fly days are duty days and subject to the limitations outlined above. A down day is a day off. The aircraft is not accessible to experimenters and aircraft crews will perform no mission duties. A down day must be planned at no greater than ten-day intervals. Scheduling will be flexible to accommodate real time conditions; however, down day planning must be done from the outset within the overall scheduling of the campaign.

3. Cabin Environment

The cabin, cargo areas, and electronics compartment are pressurized to an equivalent altitude of approximately 7,500 ft (2,286 m) when the airplane is at its 40,000 ft (12.2 km) cruise level. Humidity during flight nominally averages about ten percent; the temperature is held between 65 and 74 °F (18 and 24 °C). Different sections of the interior can vary considerably in temperature, however, depending on the airflow patterns and the location of heat-producing equipment. Also depending on operating location, low altitude operator may significantly increase cabin temperature and humidity.

4. Aircraft Stability

An SP-30AL analog autopilot system controls the heading and attitude of the aircraft. In smooth air, the autopilot limits deviations of pitch, yaw, and roll to within ±1 deg.

Records of aircraft stability from the inertial navigation system (INS) can be made available to experimenters. In flight, the information collection and transmission system (ICATS) acquires the aircraft attitude and altitude, and then distributes this information to experimenters (see chapter 7).

5. Aircraft Attitude

A. In-flight

When cruising at a constant speed and altitude, the aircraft flies at a one to three deg nose-up attitude. A nominal value is 1.5 deg; however, the actual angle depends on a combination of gross weight (decreases as fuel is consumed), altitude, and true airspeed. A gross weight increase, altitude increase and an airspeed decrease results in an increased nose-up attitude.

B. Parked

When parked, the aircraft is at a 1.5 deg nose-down attitude. If necessary, during the installation and/or calibration of equipment, the aircraft can be leveled to zero deg by elevating the nose.

6. Worldwide Capability

NASA 817 is equipped and certified to meet airspace, communication, altimetry, and navigation performance specifications worldwide. All experiment payloads and aircraft configuration changes are reviewed to ensure that worldwide capability is not degraded.

A flight test to verify and re-certify aircraft performance will be accomplished when appropriate. If flight test determines the aircraft does not meet requirements throughout its normal operating envelope and the deficiencies cannot be corrected, limitations may be imposed. Such limitations may restrict the altitude, airspeed, or geographic regions within which the aircraft may operate.

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CHAPTER 2

COMMUNICATION AND NAVIGATION

1. Basic Equipment and Operation

The NASA DC-8 is equipped with color weather radar and multiple communication and navigation systems. Communication equipment consists of: two high frequency (HF), very high frequency (VHF), and ultra high frequency (UHF) radios, one VHF-FM transceiver, and an ATT AirOne and Inmarsat Aero-H SATCOM telephone. Navigation aids include dual flight management systems (FMS), which include two 12-channel GPS receivers, two inertial navigation systems (INS), two VHF omnidirectional range (VOR) systems, two distance measuring equipment (DME) systems, a traffic alert and collision avoidance system (TCAS), 2 glideslope receivers, a tactical air navigation (TACAN) transmitter/receiver, and two automatic direction finders (ADF). Additional equipment, such as radar tracking beacons and GPS receivers, can be installed for experimenter support (see section 4).

A. Frequency and Interference

Frequency ranges of the navigation, radio, and radar units are listed below. Experimenters are cautioned to engineer their equipment to prevent spurious response at these frequencies, and to limit any output from their systems to 100 milliwatts (as in telemetry).

Table 2-1. Frequencies and interferences.

Equipment	Frequency	Receive	Transmit
Low Frequency ADF	190 to 1750 kHz	●	
HF Radio	2.0 to 30.0 MHz	●	●
Marker Beacon	75 MHz	●	
Localizer Receiver (LOC)	108 to 112 MHz	●	
VHF Omnirange (VOR)	108 to 118 MHz	●	
FM Radio	30 to 87.975 MHz	●	●
VHF Radio	108 to 173.975 MHz	●	●
Glideslope Receiver (GS)	329.3 to 335.0 MHz	●	
UHF Radio	225 to 400 MHz	●	●
DME & Tactical Air Nav (TACAN)	1025 to 1150 MHz	●	●
Air Traffic Control, transponder	1030 MHz	●	
	1090 MHz		●
Global Positioning System (GPS)	1575.42 (±2.0) MHz	●	
DC-8 Radar Altimeter	4.2 to 4.37 GHz	●	●
Experimenter Radar Altimeter	4.25 to 4.35 GHz	●	●
Weather Radar (C-Band)	5400 (±40) MHz	●	●
Traffic Alert and Collision Avoidance System (TCAS)	1030 MHz	●	
	1090 MHz		●
AirOne Telephone	850 MHz	●	
	895 MHz		●
SATCOM Telephone	1530 to 1559 MHz	●	
	1626.5 to 1660.5 MHz		●
Stormscope		●	

B. Radio System Specifications

Detailed specifications, for the radio equipment installed in the DC-8, are listed in the table below.

Table 2-2. Radio systems specifications.

Characteristic	HF Radio	VHF Radio	FM Radio	UHF Radio
Frequency Range	2.000 to 29.999 MHz	108.0 to 173.975 MHz	30.00 to 87.975 MHz	225.00 to 399.95 MHz
Number of Channels	28,000	2,160	2,320	7,000
Channel Spacing (Increments)	1.0 kHz	8.33 kHz	25 kHz	25 kHz
Power Output	AM: 125W* SSB: 400W PEP CW: 125W	AM: 25W*	AM: 25W*	AM: 30W*
Type of Emmission	USB: Compatible AM, (USB with carrier inserted) SSB: (with carrier suppressed, USB or LSB)	Amperage and frequency modulated; double sideband, full carrier		

* Carrier power

C. Location and Operation

The communications systems, both flight management systems, and the weather radar are set and controlled from the cockpit. The flight management system can be controlled from the navigator's console. The control display units (CDU) for the inertial navigation systems are also located at the navigator's console.

2. Navigation Accuracy

The following are general guidelines of the accuracy attainable with selected systems under average flight and weather conditions.

A. Global Positioning System (GPS)

The global positioning system provides the most accurate location and motion coordinates for the aircraft. Accuracy is as follows:

Horizontal Position	49 ft
Altitude	49 ft
Ground Speed	1.0 kn
Track Angle	0.5 deg
Vertical Velocity	0.1 kn
Horizontal Velocity	1.0 kn

B. Distance Measuring Equipment (DME)

Distance measuring equipment permits locating the aircraft within a two-nmi radius. DME measures slant range and is not accurate directly over the station.

C. Inertial Navigation System (INS)

The inertial navigation system permits locating the aircraft with an average position error of less than two nautical miles (3.7 km) per flight hour. The INS also provides displays of present position (latitude and longitude), wind speed and direction, ground speed and track, and time and distance to next waypoint. These displays are updated every 0.6 seconds.

D. Flight Management System (FMS)

The flight management system accepts primary position information from short and long-range navigation sensors. Inputs from the DME, VOR, TACAN, and GPS are utilized to determine the aircraft's position. In addition to the navigation inputs, the system also receives true airspeed and altitude information from the air data computer (ADC) and heading reference from the INS. The primary position data received from the sensor is filtered within the FMS to derive a “best computed position” (BCP). Using the BCP, the FMS navigates the aircraft along the programmed flight path.

3. Navigation Planning

DFRC Flight Crew Branch navigators provide navigation planning and support to accommodate experimenters' requirements. A flight plan including positions, headings, airspeed, and altitude is developed for each segment of the flight. Additionally, a vector map of the route of flight, and when required, an altitude-profile, are provided.

4. Radar Tracking Beacons

Radar tracking of the aircraft by a ground station is sometimes needed for certain missions (such as operation near a sounding rocket range, or oceanographic measurements coordinated with a surface ship). Radar beacons to be placed on the aircraft must be supplied by the experimenter. Power supplies and controls for the transponder may be mounted on a standard equipment rack in the main cabin.

NOTE: Information and specifications defining radar beacons must be supplied in advance, to insure correct interface with aircraft power and fixtures.

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CHAPTER 3

INTERIOR DIMENSIONS AND SUPPORT FACILITIES

1. General Information

The DC-8-72 is similar in size and basic furnishings to other four-engine, standard-body jet transport aircraft. Passenger seating, windows, lavatories, emergency oxygen supplies, and the general cabin environment conform to current commercial standards. Extensive modifications have been made to accommodate a wide variety of experiments; these will be described in this and subsequent chapters.

2. Cabin and Cargo Areas

Figures 3-1, 3-2, 3-3, and 3-4 give the general layout of the cabin, aircraft, and the cargo areas.

A. Figure 3-1

This figure illustrates a top and side view of the fuselage, and a plan view of the main cabin and cargo areas that identifies entrances, exits, housekeeping systems, the data system, and stations for the navigator and mission director. Optical viewports and electrical power outlets, for experimenters' use, are also identified at their approximate locations.

Positions within the aircraft are identified by station numbers (in inches) beginning with 0 at the nose and increasing to 1620 at the rear of the fuselage. The basic structural locators are the belt frames, 20 in. apart longitudinally, and running throughout the aircraft.

B. Figure 3-2

This figure identifies the antennas and their location. It also gives the frequency of each antenna.

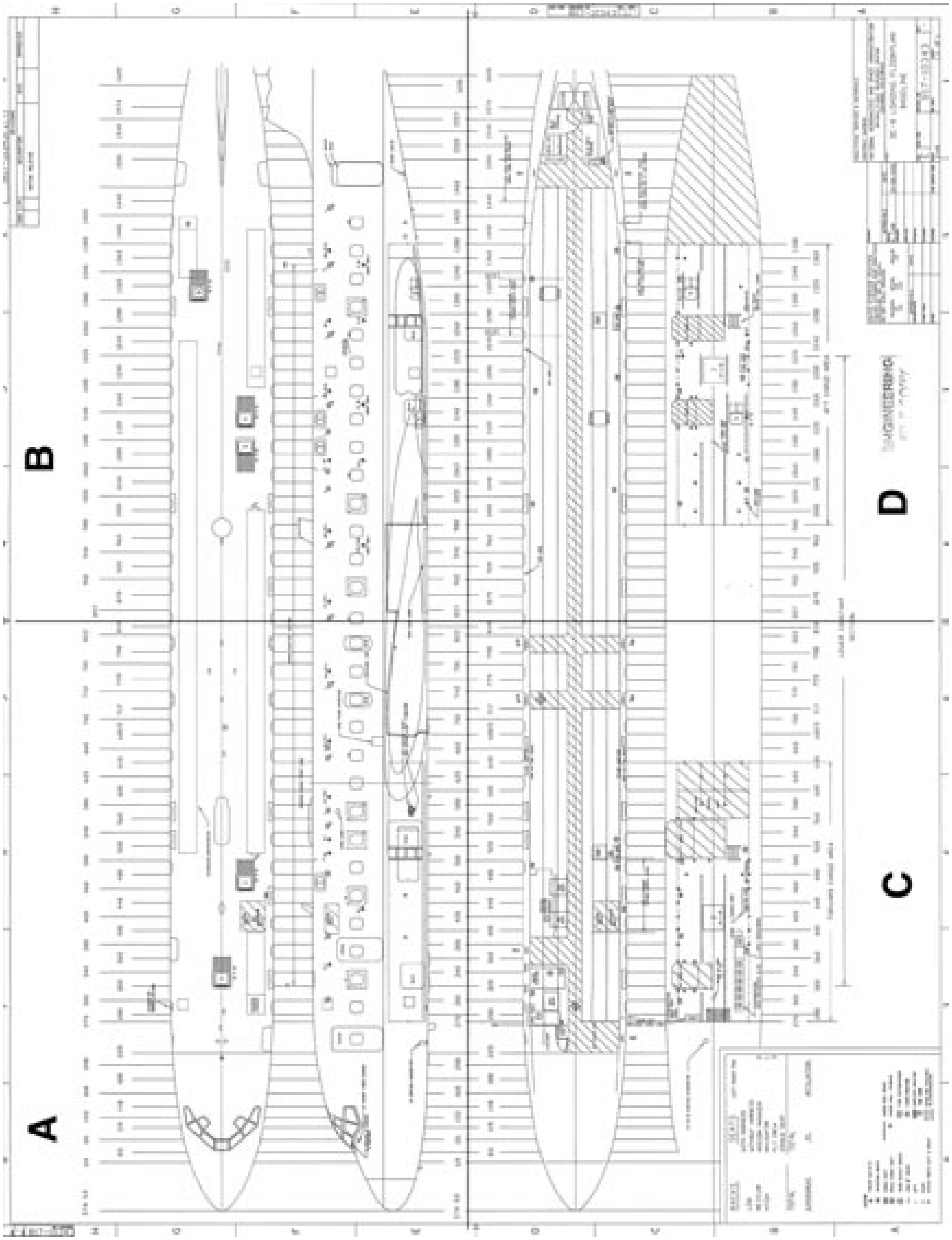

Figure 3-1. Plan and side views of the aircraft, overview.

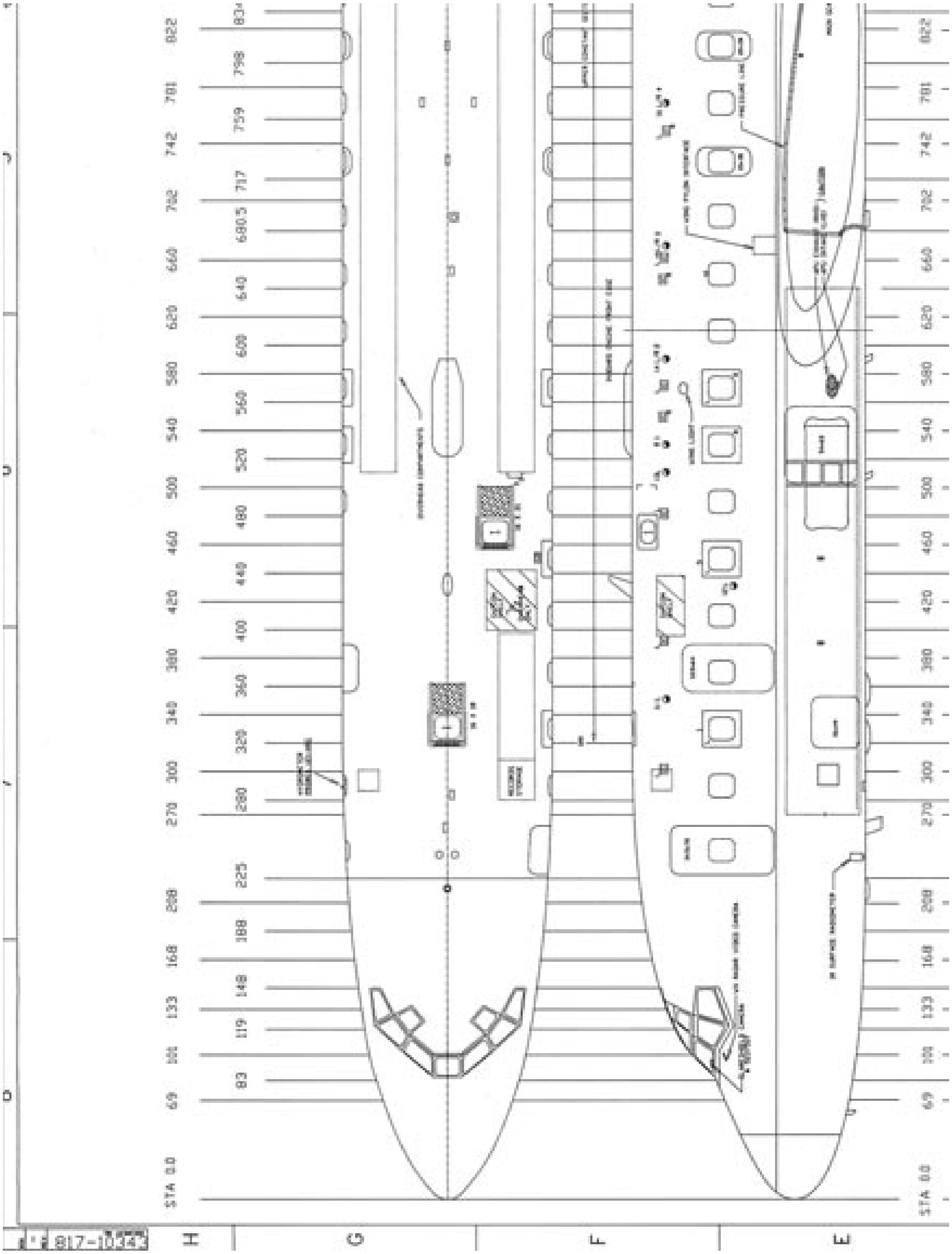

Figure 3-1(a). Section A.

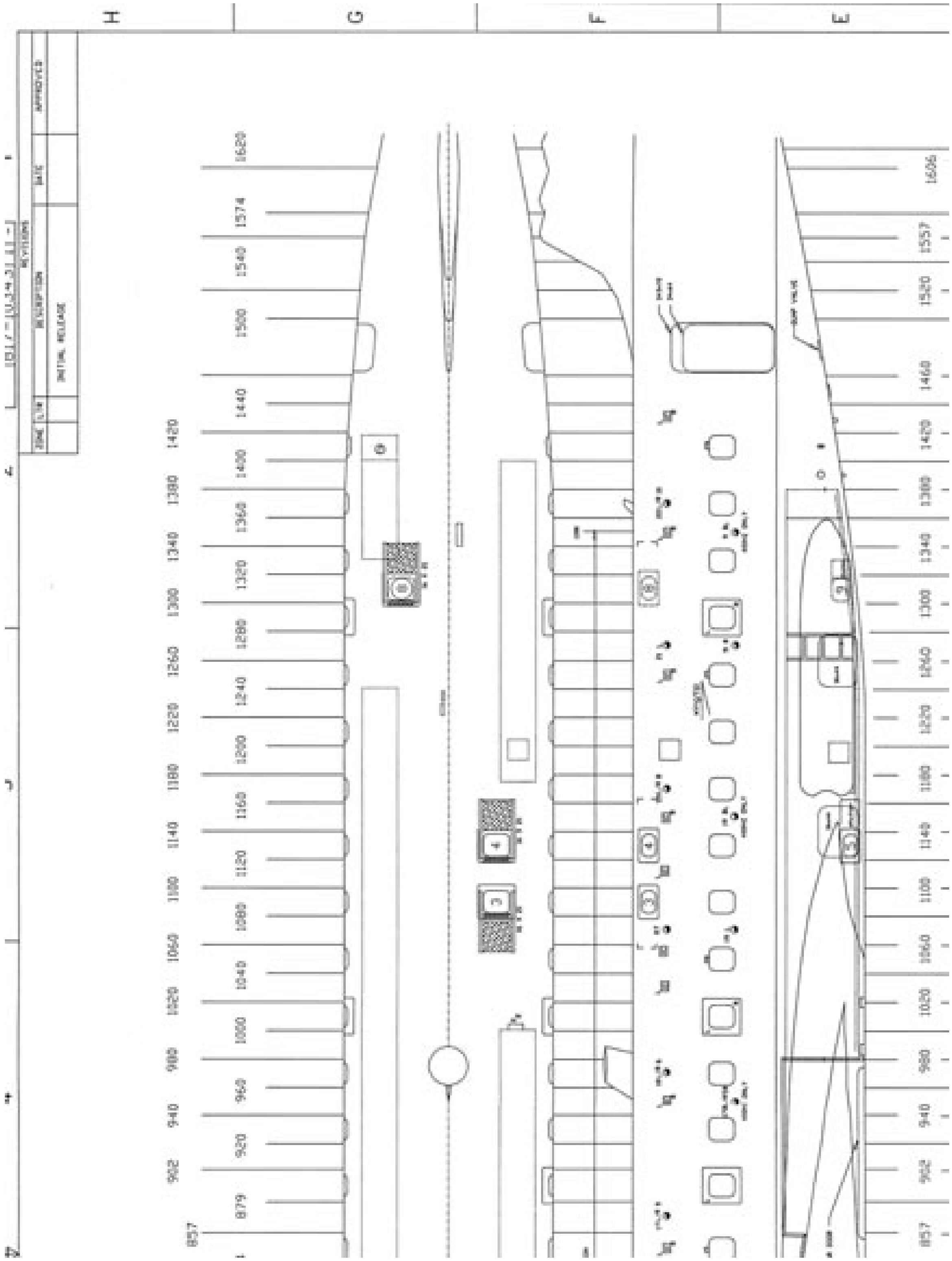

Figure 3-1(b). Section B.

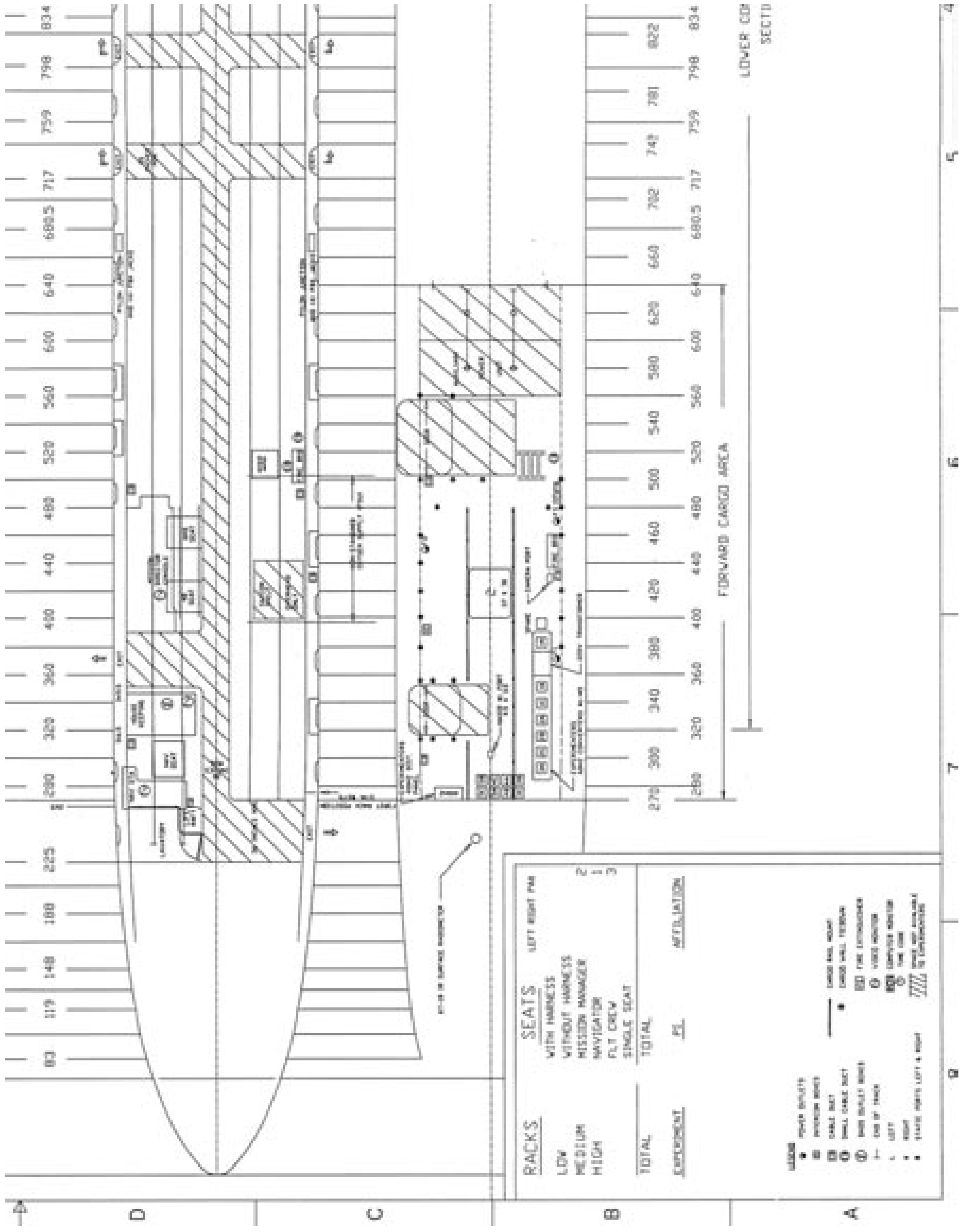

Figure 3-1(c). Section C.

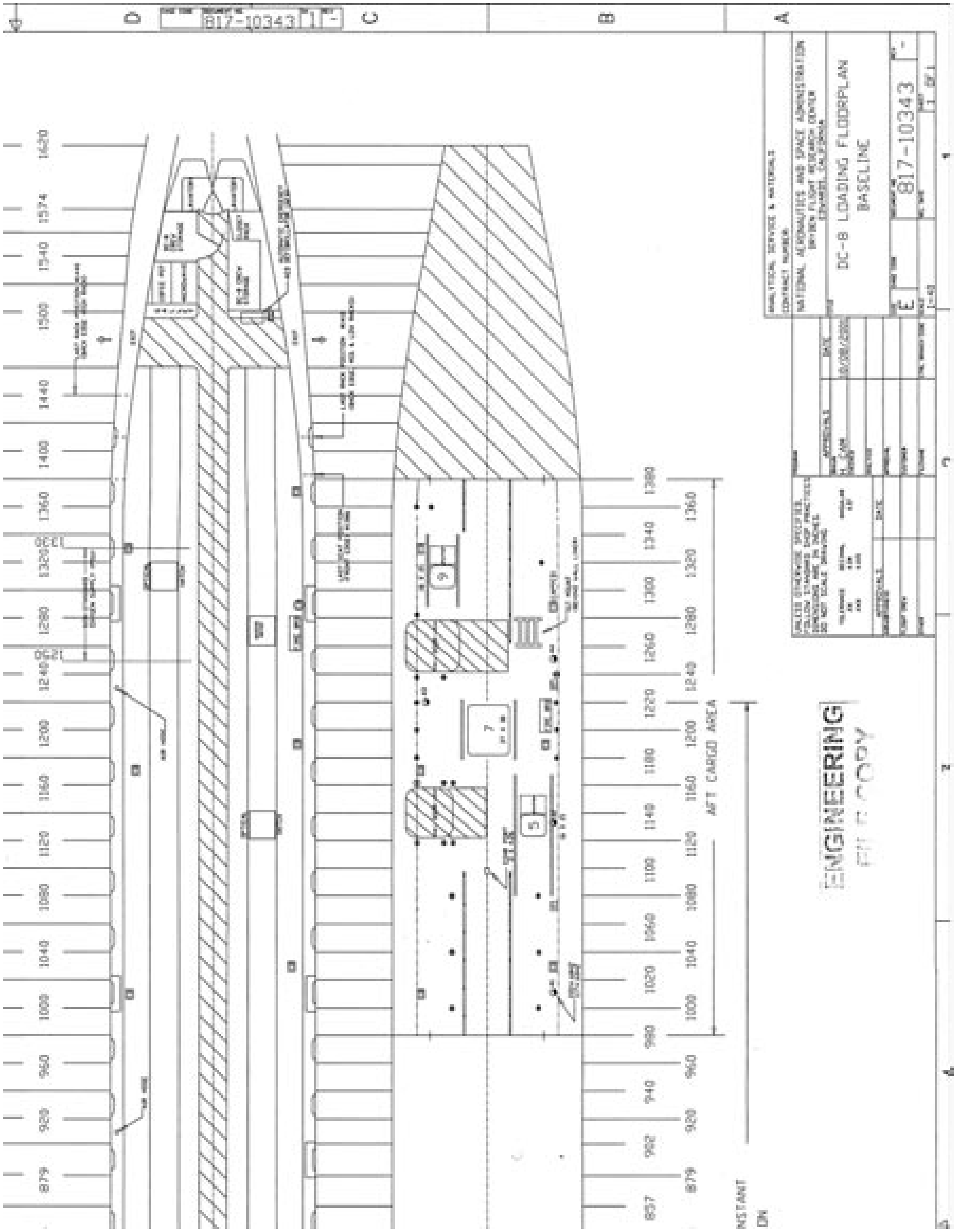

Figure 3-1(d). Section D.

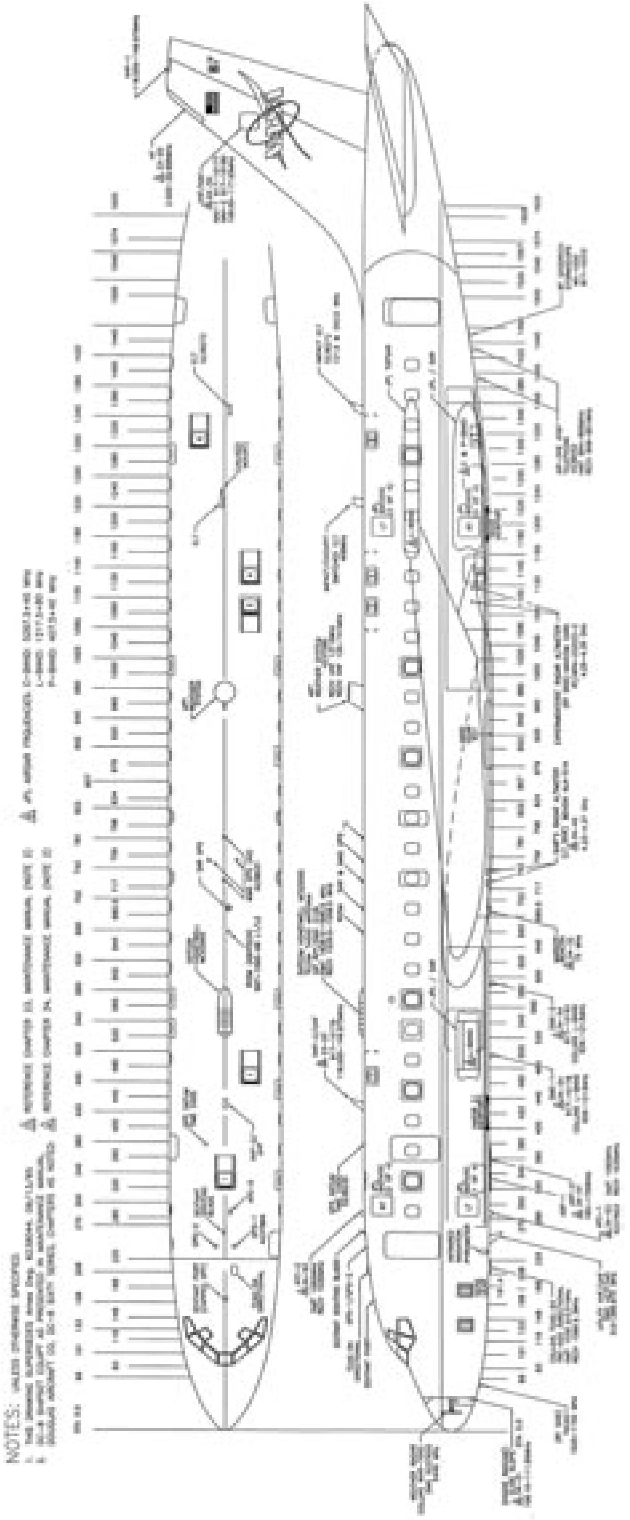

FIgure 3-2. Antenna locations and identification.

NOTES: UNLESS OTHERWISE SPECIFIED.

1. THIS DRAWING SUPERSEDES Ames Dwg. 6238044, 09/13/95
2. DC-8 SHIPSET EQUIPT AS PRESENTED IN MAINTENANCE MANUAL, DOUGLAS AIRCRAFT CO, DC-8 SIXTY SERIES, CHAPTERS AS NOTED:

△ REFERENCE CHAPTER 23, MAINTENANCE MANUAL (NOTE 2)

△ REFERENCE CHAPTER 34, MAINTENANCE MANUAL (NOTE 2)

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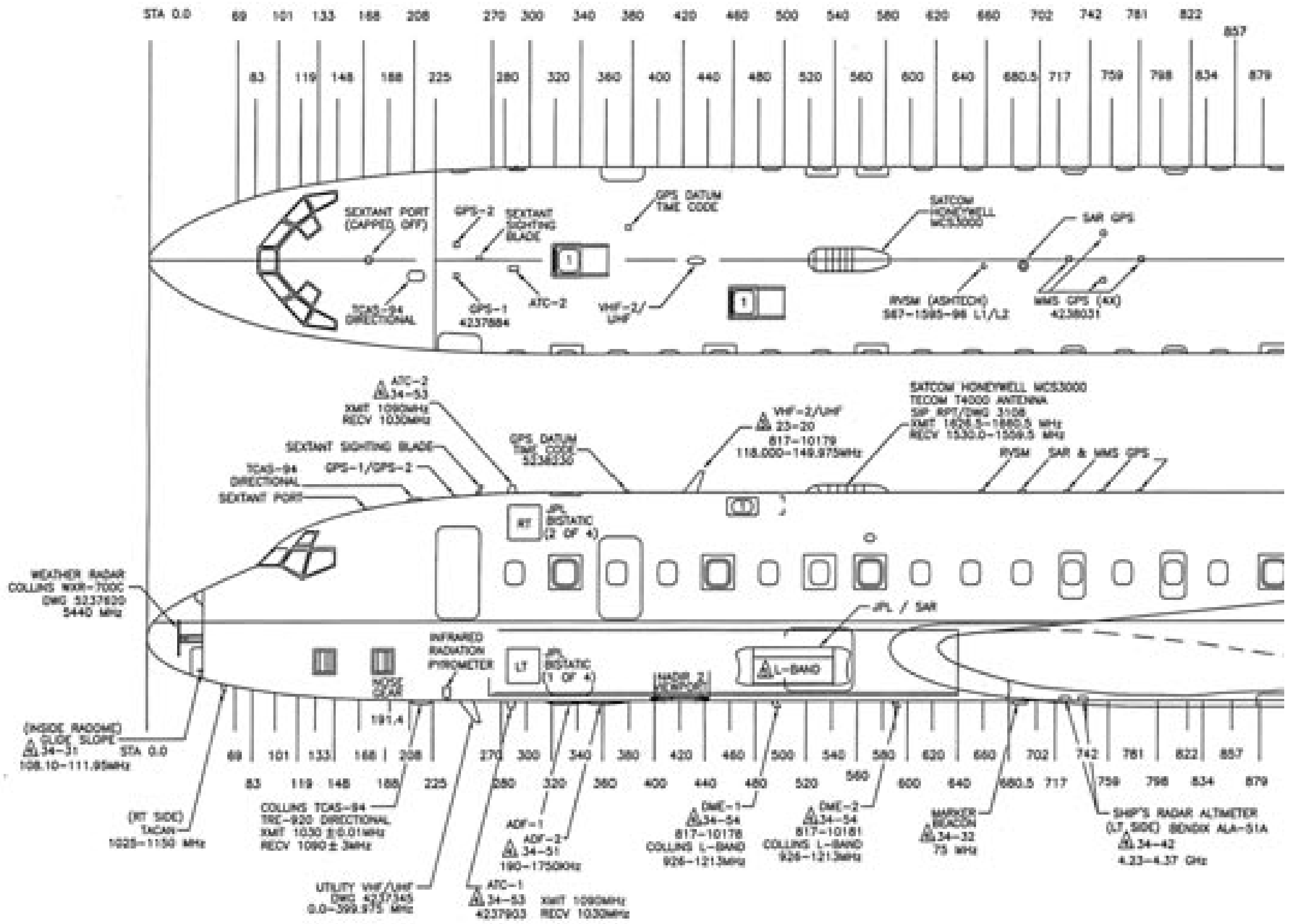


Figure 3-2(a). Section A.

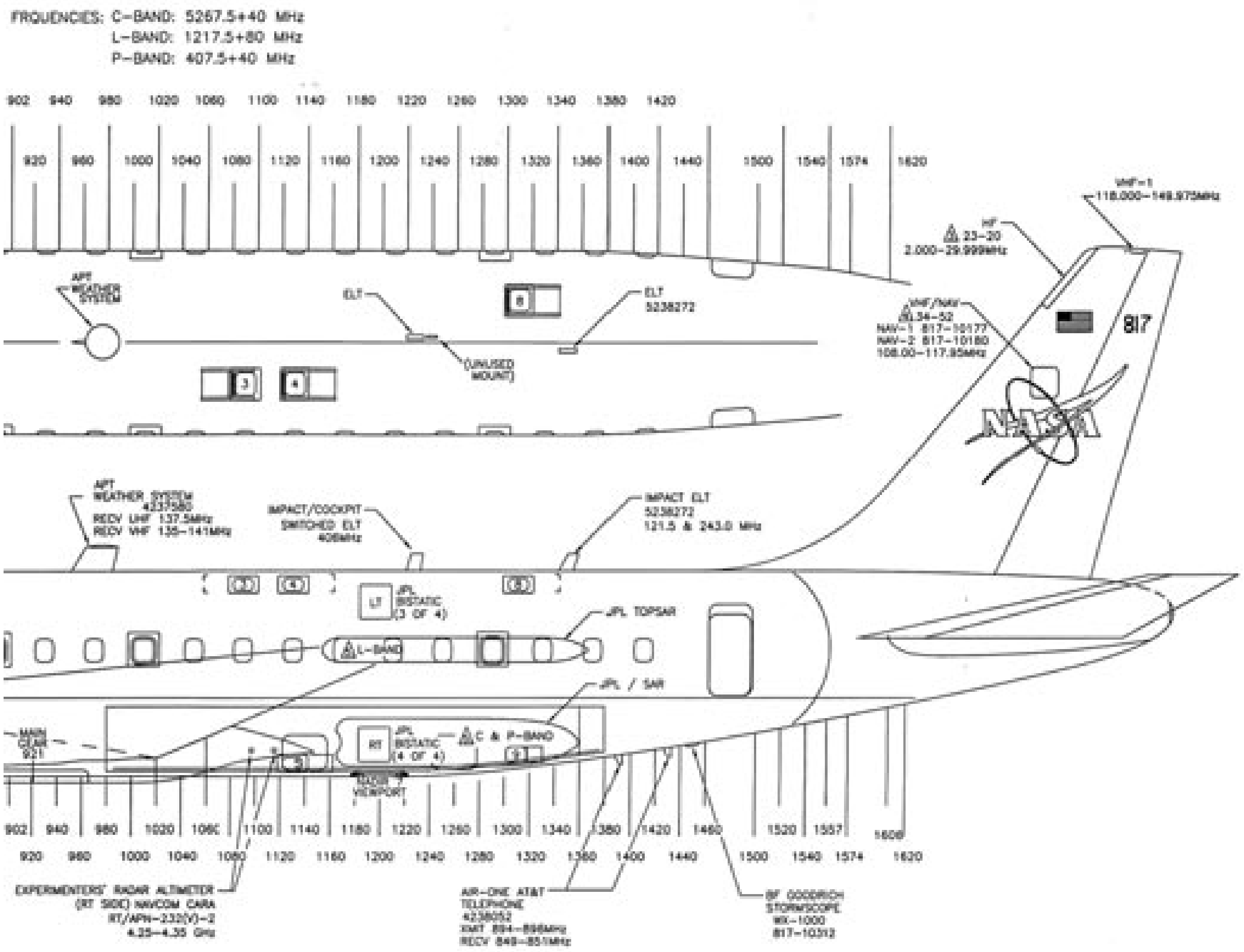


Figure 3-2(b). Section B.

C. Figure 3-3

This figure illustrates a cross section of the fuselage, which is approximately symmetrical about the vertical centerline. The illustration summarizes the space available in the cabin and cargo areas. The main cabin is 127.5 in. wide at floor level, with approximately 82 in. of headroom. The cargo area has Brownline rails centered 33.6 in. apart at floor level, with approximately 52 in. of headroom.

Four Brownline seat-support tracks extending the length of the cabin provide the primary attachment points for equipment racks.

The floor, made of aluminum panels, can withstand a distributed download; however, fore, aft, and lateral forces must be sustained by the seat-support tracks.

D. Figure 3-4

This figure illustrates the external access doors in the main cabin and two cargo areas.

3. Fuselage Access

The main cabin has two passenger access doors, approximately 34 in. by 72 in., on the left hand side of the aircraft. There are two similar service doors, approximately 33 in. by 64 in., on the right hand side. Only the aircraft crew may operate these doors.

CAUTION: When any of these four doors are in the open position, a stairway or a safety net must be in place.

There are two cargo areas and each has two exterior access doors, three approximately 36 in. by 44 in. and one 54 in. by 63 in., on the right hand side of the aircraft (figure 3-4). In addition, there are two interior floor hatches that are approximately 18 in. by 20 in., granting in-flight access to both of the cargo areas (figure 3-1).

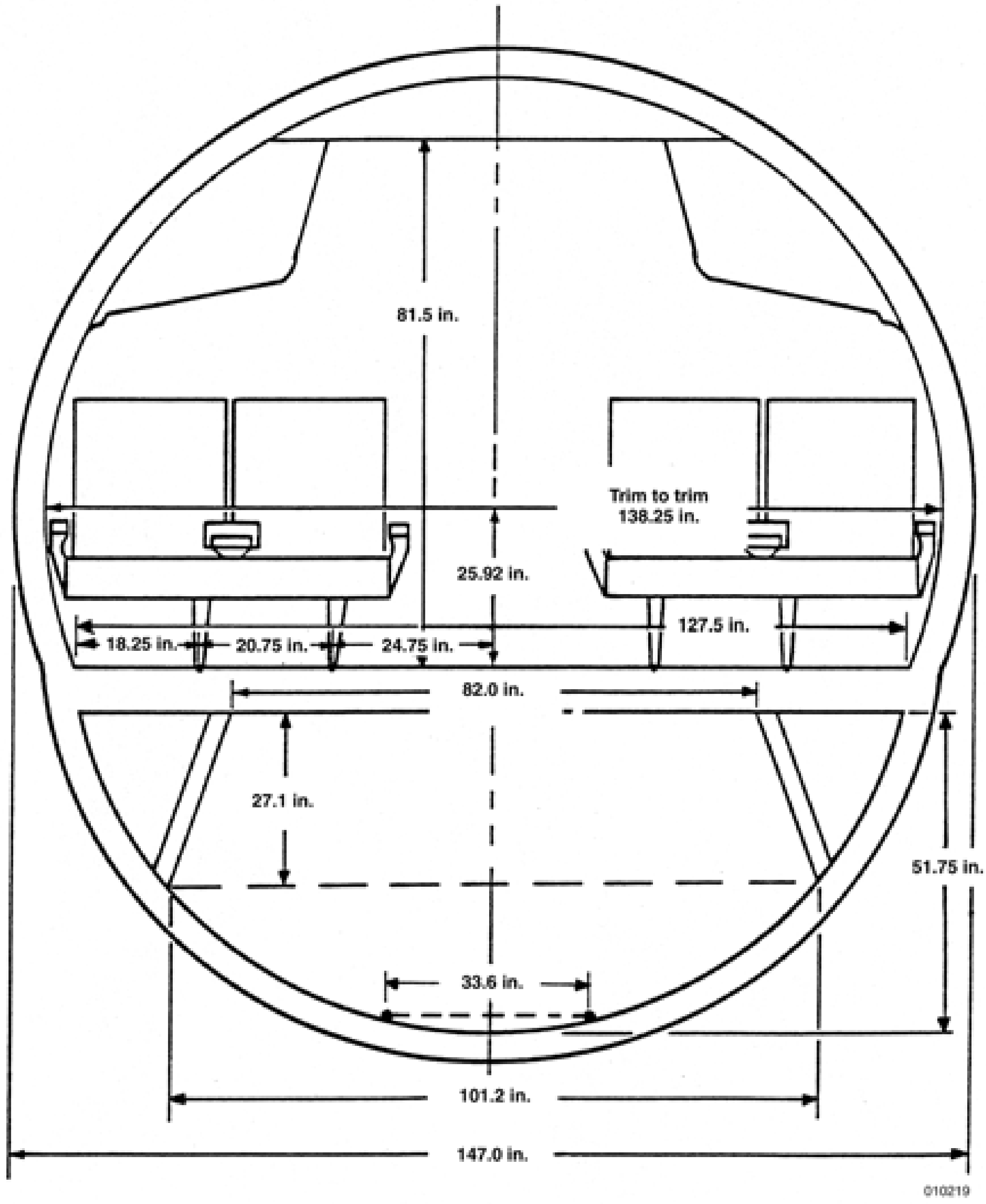
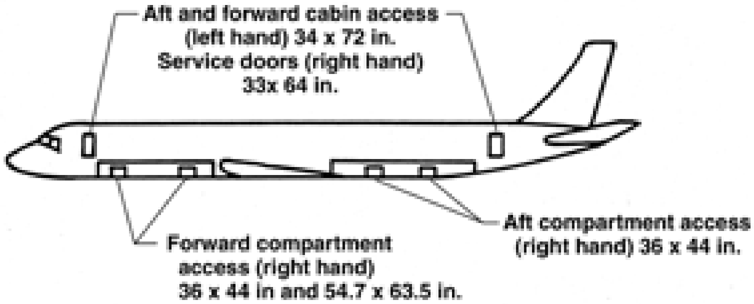
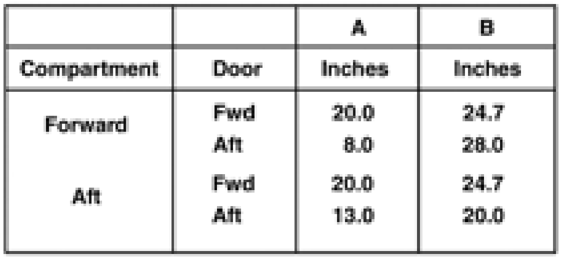


Figure 3-3. Cross section of the fuselage.





		A	B
Compartment	Door	Inches	Inches
Forward	Fwd	20.0	24.7
	Aft	8.0	28.0
Aft	Fwd	20.0	24.7
	Aft	13.0	20.0

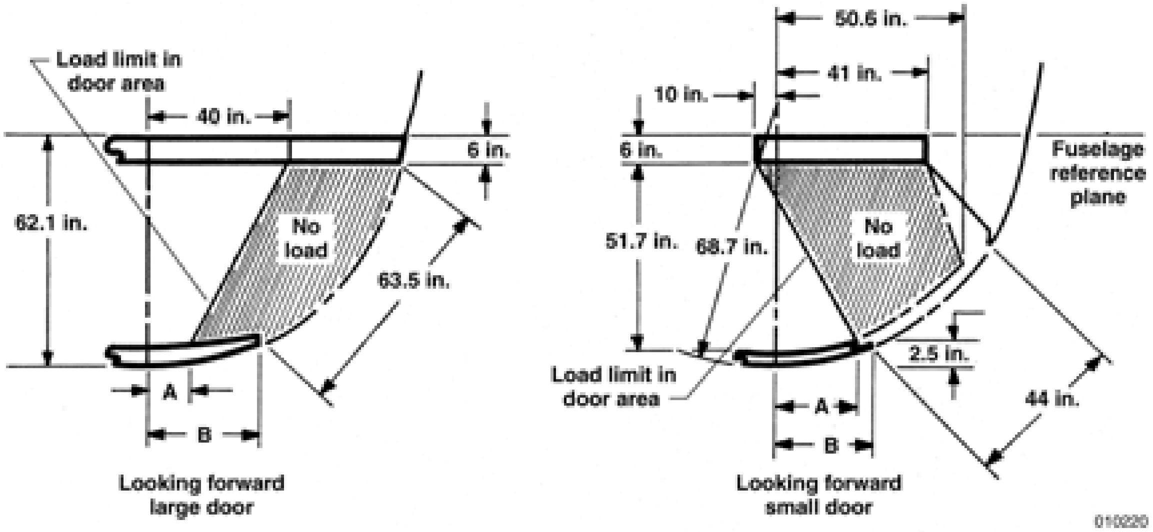


Figure 3-4. Cabin and cargo area access doors.

4. Support Facilities

Facilities lending support to the experimenters' operations are listed briefly below.

A. Mission Director Console

The mission director and his/her assistant are stationed at a command console in the forward part of the main cabin (figure 3-5). This console is the central control point for mission operations. From here the mission director can control the power to the experiments, nadir viewport shutters, and the cabin communications systems including the intercom system.

The console also has controls for several research support instruments, specifically, hygrometers that measure atmospheric dew point or frost point, and an IR surface temperature radiometer. Radio/telephone communication with the ground, ships, or with other aircraft can be conducted from this location. An eight-channel closed circuit PBX system switchboard with an interface to an Inmarsat Satellite Communication (SATCOM) telephone is also located at the console.

Remote display units at the mission director console include closed circuit television from the data system (ICATS), video cameras, time code, NMS, radar and pressure altimeters, and cargo area temperatures.

B. Intercom System

The aircraft intercom system extends throughout the cabin and cargo areas, with outlets adjacent to wall power stations. The system has two channels of communication between the mission director and the experimenters. There are discrete channels to the cockpit and the navigator available to the mission director.

One of the channels is normally selected for general communication between the mission director and the experimenters. Upon request, experimenters needing a separate communications channel may use the second channel. Either or both channels will be recorded for an audio log using the aircraft's video recorders.

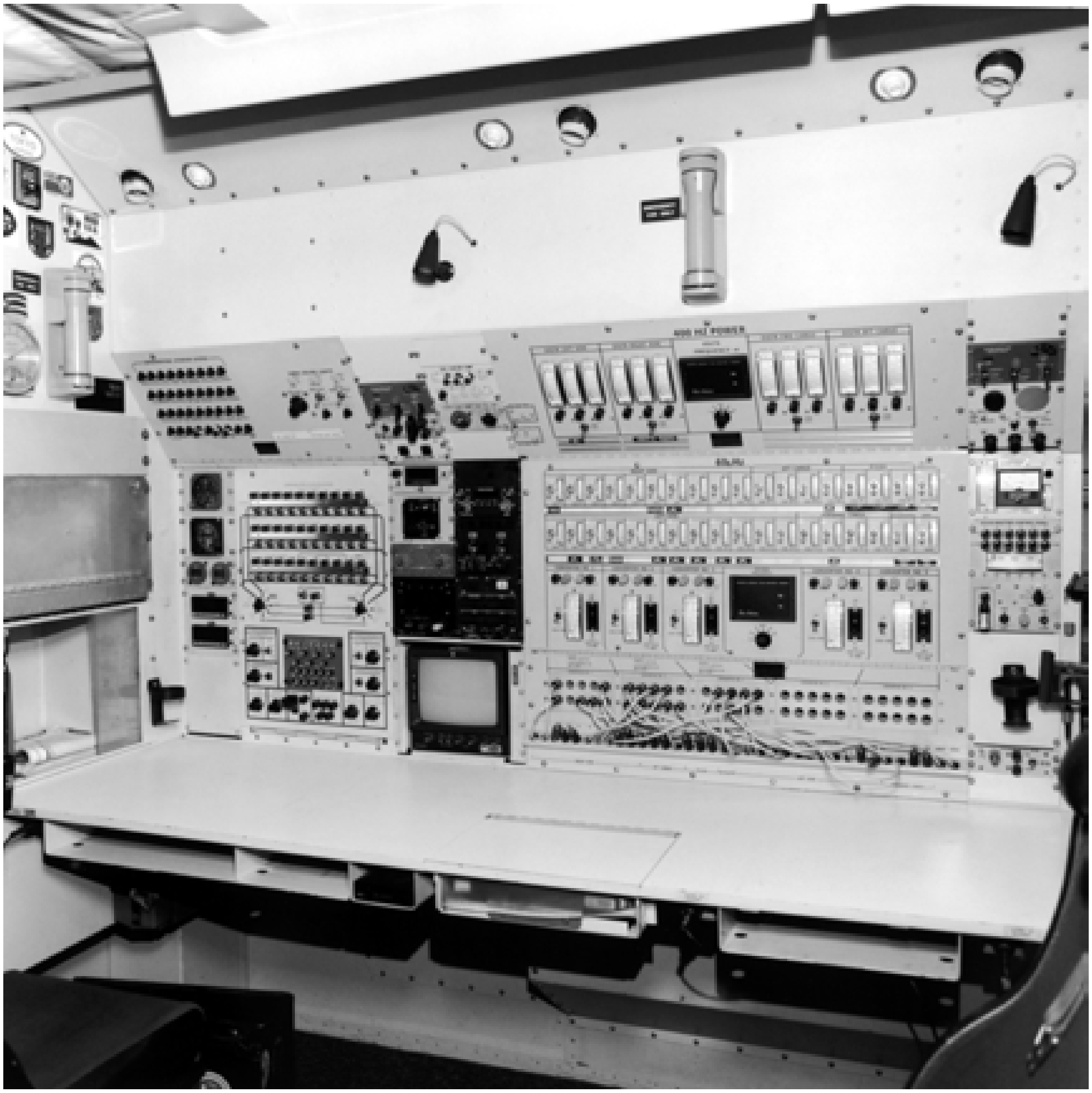


Figure 3-5. Mission director's console.

C. Liquid Nitrogen

Three 35-liter dewars can be located in the main cabin, and arrangements can be made for local storage of smaller amounts of liquid nitrogen at the experimenter's station.

CAUTION: Personnel must wear personal protective gear during in-flight and ground handling of liquid nitrogen.

D. Dry Nitrogen Supply

Cylinders of dry nitrogen can be placed adjacent to the experiment or in the cargo areas. Advance notice to the mission manager is required for these types of facilities.

NOTE: Aluminum cylinders are preferred for all types of gases.

E. Liquid Helium

A container system is available to transport liquid helium to field bases for experimenter use. One 60-liter or two 30-liter dewars can be accommodated. Advance notice to the mission manager is required for use of this facility. Shipment of liquid helium to a remote site by commercial or military aircraft is very difficult, and requires special arrangements. Most commercial cargo flights will not carry liquid helium. The most careful consideration should be given to consumption rates, and arrangements made well in advance to ensure adequate re-supply deliveries to remote sites.

NOTE: In-flight handling of liquid helium is not permitted aboard the DC-8.

F. Passenger Seats

Conventional airline type seats are installed aboard the aircraft, each accommodating two people and equipped with safety belts and shoulder harnesses. These seats are placed facing forward at intervals between equipment racks throughout the cabin. The location of the seats is fully adjustable, in one-inch increments, throughout the length of the aircraft. The seats feature a non-removable center console/arm rest extending three inches forward of the edge of the seat cushion. The console has compartments containing life preservers and emergency passenger oxygen systems (EPOS), also known as smoke hoods. The console is 26 in. high. Keyboard drawers installed in experiment rack should be 27 in. above the floor to avoid obstruction. Experimenters may indicate their seating preference, coordinating their seating with their equipment location. A limited number of individual swivel seats are also available for experimenters who require access to equipment from the side or aft of their seat while seated. All seats must face forward for take-offs and landings.

G. Wing Pylon Installation

A wing pylon can be installed near each wing tip to accommodate 100 lb (45 kg) of experimenter equipment. While each pylon is designed to hold two laser aerosol probes (such as PMS), other instruments of comparable size and weight could be used. Power, signal cables, and a dry nitrogen purge line are available at each pylon. Since pylon installations may require extensive structural and aerodynamic analysis to assure flight safety, it is mandatory that the mission manager be notified at least nine months prior to a proposed application.

H. SATCOM and AirOne Telephones

An Inmarsat Aero H Satellite Communications System (SATCOM) provides global in-flight voice and modem communications (excluding the arctic regions). Calls are placed or received by the mission director at the mission director console and then routed to one of eight handsets that can be located at experimenter stations in the cabin. Two SATCOM calls can be accommodated simultaneously. Data can be transmitted with prior arrangements.

The two-channel ATT AirOne telephone of the DC-8, provides air-to-ground communications within the forty-eight contiguous United States region only. This is a less expensive but more limited alternative to SATCOM. Experimenters must use a handset located at the mission director console to place calls using this telephone.

The cost of calls on both SATCOM and AirOne systems are charged to the appropriate mission sponsor as a mission peculiar cost.

A VHF radio for mission scientist communications is available with prior arrangements. VHF radio transceivers operate only in line of sight and are unsuitable for over-the-horizon communication.