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THE YEMEN ARAB REPUBLIC

AIRPORT STUDY

JUNE, 1973

Project Agreement No. TAR-73-104.3

THE YEMEN ARAB REPUBLIC (YARG)

Pre-Development Studies

SUB-PROJECT - TAIZ AIRPORT FEASIBILITY STUDY

Project Agreement No. TAR-73-104.3

I. Period of Study - May 16 to June 11, 1973

INTRODUCTION

A. Original Project Goal

The goal of this study was to define the investment needed to bring the Taiz Airport up to a condition that would support heavier traffic under conditions of greater safety than are presently possible.

B. Scope of Work for Original Feasibility Study

1. Analyses of current and future traffic and general economic appraisal.
2. Adequacy of existing geometric layout of runways, taxiways and aprons, and recommendations for changes, if required.
3. Adequacy of existing structural improvements.
4. Determination of requirements for communications and airport control equipment.

C. Revised Project Goals

Upon the arrival of the Study Team in YAR, a joint AID-Embassy briefing was held for the Study Team. Based upon the background information supplied to the Team and the additional areas of the aviation program that the USAID, Embassy and YARG desired the Team to study, a new scope of work for the study was prepared. The major change in the study was the addition of the secondary airports (Barat, Saadah, Al Beida, Ma'areb and Harib) which the YARG wanted evaluated for potential development. This evaluation should include:

1. Adequacy of existing landing facilities and recommendation for improvements.
2. Determination of requirements for communications, meterology and control equipment at all airports.

This report covers, to the extent possible within the period of the study, the revised scope of work and or evaluation of the existing airport, communications and navigational systems in YARG with recommendations for future improvements.

D. Economic/Social Feasibility Study

An attempt was made to gather data on current and projected traffic and revenue for the Yemen Airline operations. Unfortunately, there was not enough time available to identify or locate sources for this data. The data which was located is included in Appendix C and was obtained from the YARG's Central Planning Organization's "Statistical Year Book - 1972" which was published in May 1973.

The forthcoming Yemen Airlines study, to be performed by a Pan American Technical Assistance Team, should be able to identify past airline operations and provide a reasonable forecast of future airline and airport support facilities required in YARG.

E. Study Team

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APPENDIXES

A. ICAO Statement of Basic Operational and Planning Criteria for YEMEN (ARG).

B. Organizational Planning Chart YARG CAA

C. Aviation Statistical Data for YARG

D. Airport Photographs

E. YARG Commercial Airline Flight Schedules

F. Detailed List of Recommended Communications and Navigational Equipment.

I. Summary

Although this survey was instituted to cover only the Taiz Airport, later expanded to include four additional airports, the report has been prepared covering requirements for the basic airport/airway portions of an aviation system within the YAR. The report then includes recommendations for the physical airport facilities, navigational aids for both enroute operations and terminal approachs, communications, electrical power, air traffic control and personnel training. Delineating of airways is basic to the airways system but airway designations are not included as this is considered beyond the scope of this study.

At this time the YAR has three airports designated as International, ie; Sanaa, Taiz and Hodeida. Of these, the Team believes that only Sanaa should be improved to fully meet ICAO Standards for International Airports. The latter two locations could be designated as "Regional International Airports". For these two locations there is no forseeable (next 5 years) requirement for night operations or, for larger terminal buildings than presently exist. For this reason our recommendations for Taiz Airport do not include runway or approach lighting. No detailed recommendations are made for physical improvements to the Hodeida Airport but the runway is in need of re-surfacing. This is a joint use airport, with the military serving as airport operator and prime user. The Sanaa International Airport is of minor interest, insofar as this report is concerned, as it is presently being improved to ICAO Standards for an International Airport under a Federal Republic of Germany loan project.

A few years ago the YARG prepared a comprehensive plan for development of a suitable airport at Taiz, implemented and partially completed it before financial and civil difficulties brought work to a halt. The completion of this original plan, modified to current requirements, is essential if the Taiz area is to realize the economic and social benefits derivable from reliable air service. However, because of the large amount of work already done on the Taiz Airport only relatively minor improvements are now needed. Paving of the 400 meter over-run on the existing runway, grading of runway shoulders and the safety area off the approach end of runway 19 and, installation of reliable navigational aids will make it suitable for use as an instrument runway. However, there will be times when flight operations, either visual or instrument, cannot be conducted safely from this runway due to strong cross-winds. But, the present and projected volume of air traffic does not presently justify recommending construction of the "primary" runway (east-west) for use during those periods of high cross-winds on runway 01-19.

The inadequacy of provisions for domestic air service is considered one of the major deficiencies of the aviation system in the YAR. At this time domestic service is provided routinely only between Sanaa and Taiz. Routine

air service between other locations in the YAR can appreciably advance the over-all development progress of the YAR but is not presently feasible because of lack of suitable airport facilities. The existing air strips at Barat, Saadah, Ma'areb and Al Beida were viewed but are not satisfactory for scheduled air service on a continuing basis. None have facilities for providing any type of service(s) to passengers or aircraft. This report then includes recommendations for improving these air strips and for providing the basic facilities needed for safely operating aircraft to these locations. Also, recommendations are included for providing the basic air navigational facilities (VOR/DME and NDB) needed for providing enroute guidance to aircraft operating within the YAR airspace.

Investigation of the existent communications between ground stations and ground stations/aircraft indicate considerable equipment improvement is needed before reliable communications can be attained. Closely related to the equipment needs is the need for a sufficient number of trained personnel for operating and maintaining the equipment. This also applies to the personnel needed for instituting control of air traffic for assuring the safety of aircraft operating within the YAR airspace.

Several methods for accomplishing the recommended airport/airways improvements project were evaluated. The method recommended for airport improvements (see part X, section 1.A), basically force account with limited technical expertise in construction and installation, was chosen because it is lowest in cost. If adequate financial support from donor nations is available, the recommended program could be implemented under a conventional type of capital improvement project (detailed project design plans and specifications, construction by international contractors and supervision of construction by a consulting Engineering Firm). This latter method of project development would result in the project being completed faster but would also increase the costs of the project two to three times over the recommended method.

II. Evaluation of Airport Sites

A. Taiz Airport

The existing airport was developed by the YARG, under the Taiz District Highway Authority, using a combination of local contractors and Highway Authority equipment and personnel. This combination provided a near ideal combination for sound construction work at minimum cost.

The original airport Master Plan provided for the development of two runways. The main runway (07-25) would be 4000 meters long by 45 meters wide and was to be designated the instrument runway. The secondary runway (01-19) was designed to be 2800 meters long by 45 meters wide. Only part of phase 1 of the project was completed due to delays caused

by political disturbances and lack of finances. The present runway (secondary runway) is 2400 meters long rather than the planned 2800 meter length. the grading, sub-base and base for an additional 400 meters (1300') of runway has been completed but asphaltic pavement not installed. Also, the grading, sub-base and base for the complete terminal apron was installed but only a portion of the asphalt pavement was laid. The aircraft maintenance hangar was completed except for the siding and floor. For the proposed main runway, 1400 meters was graded with a partial placement of the sub-base and base. All the work was done during the period 1968 - 1970.

1. The physical characteristics of the Taiz Airport at this time are:

   a. One runway (01-19) - 2400 m (7875') x 45m (148') paved
   b. Overrun area - south end, 400 m (1315') x 100M (328'), gravel
   c. Sub-base laid for main runway (07-25), 1400m x 50m
   d. Taxiway - from runway to apron, 272.5m x 22.5m, paved
   e. Apron - 220m x 130m gravel base of which 100m x 50m paved
   f. Wind sock - installed between runway and terminal area
   g. Terminal building - stone, adequate size for present traffic
   h. Electrical power -supplied by diesel generators. Unreliable (see Section IV. B.1.f.)
   i. Fire/crash - 4 - Bay building, but no usable equipment.
   j. Runway lights - none
   k. Navigational aids - none reliable (see Section IV.B.1.a.)
   l. Communications - very limited (See Section IV.B.1.b. and c.)
   m. Hangar - 70% complete, needs siding and floor.

2. Site data

   a. Mean maximum temperature (ART) - 31° C.
   b. Elevation - 1350 meters (4430')
   c. Soil - silty clay, FAA class F9
   d. Pavement thickness
      (1) Surface - asphalt concrete - 7.6cm/3"
      (2) Base Course - crushed rock - 15cm/6", CBR-80
      (3) Sub-base - quarry run rock - 100cm/40", CBR-35
      (4) Sub-grade - silty clay, CBR-5-7
      (5) Strength - LCN 60 (ICAO appraisal)

3. Runway Length Requirements (standard air 4430 ft. above SL)

   For typical short range operations such as conducted from Taiz:

Taiz - Asmara	330 nm
Taiz - Sanaa	115 nm
Taiz - Hodeida	100 nm

Aircraft	Weight, typical	Runway required
DC-3	25,200 lbs.	4500 ft (approx. 1370m)
DC-6B	88,000 lbs.	5000 ft (approx. 1525m)
B-720	175,000 lbs.	5250 ft (approx. 1600 m)
B-737	98,000 lbs.	7520 ft (approx. 2210m)

4. Major Deficiencies:

(a) Lack of reliable communication and navigational aids
(b) Inadequate power and water supply
(c) Incomplete development of landing facilities
(d) Lack of adequate airport operations staff
(e) Poor airport security

5. Needed Improvements:

a. (1) Widening of landing strip to 150m width, 2½% maximum transverse gradient
(2) Seeding of graded shoulders
(3) Enlargement of Terminal apron: 3-4 inch asphaltic pavement on top of existing base
(4) Paving of 400m runway overrun to handle jet aircraft
(5) Construction of turn-around areas at each end of the runway
(6) Grading of north end of the runway to remove terrain obstructions
(7) Relocation of airport security fence

b. Fire/Crash Equipment

(1) Existing equipment - hand extinguishers and one inoperable dry chemical truck
(2) Needed equipment - 2 ea. 1,000 gallon water/foam pumper trucks plus portable dry powder units.

To provide for the safer operation of aircraft the landing strip should be widened as noted above. The width of the strip as originally constructed was 65-70m, with pavement 45m wide and, with 15-20m wide graded shoulders along each side of the pavement. The shoulders have not been maintained so many ditches exist, created by erosion and, many small trees and brush from uncontrolled growth. (A Yemen Airlines DC-3 was lost at Taiz when the aircraft ran off the paved strip and struck a ditch on the shoulder). The widening of the landing strip may be complicated by a question of who owns the land needed for the expansion. Highway Authority personnel who built the airport state the local farmers were paid for the land when the airport was built. Local farmers claim this was not so and still farm what is supposedly airport property.

AIRPORT DATA

AIRPORT	TOWER CONTROL	RUNWAY LIGHTS	TAXIWAY LIGHTS	THRESHOLD LIGHTS	RUNWAY MARKINGS (per Annex 14)	FIRE/CRASH EQUIPMENT	FUEL	JET START EQUIPMENT
Sana'a	118.1	High Intensity (Available by prior request)	Not operational	Yes	No	1 Dry Powder Truck not usable	Benzine 100/130 No JP-1 or JP-4	None
Taiz	118.1 intermittent operation	None	No taxiway	None	Partially Designation & Threshold Optional Pattern		Benzine 100/130 No Jet Operation	Not Applicable
Hodeida	118.1	Low Intensity (Lights activated by Tower After generator started)	Low Intensity except between high speed turn-off and end of runway. south end	Yes	No	1 Dry Powder Truck (not usable) 1 Water Truck 5,000 gal.	Benzine 100/130 No. JP-1 No. JP-4	None

B. Domestic Airports (Barat, Ma'areb, Seadah and Al Beida)

The airstrips at these locations consist of reasonably level stretches of ground, outlined with fuel drums, rocks painted white, or covered with a thin layer of volcanic cinders. Each has a wind-sock erected upon a 3 to 4 meter high pole. Because of the erratic rainfall and the altitude of these fields, all landing strips lack vegetation cover and are subject to wind and water erosion rendering them frequently unusable under wet conditions. Detailed data on the wind and temperature conditions at the interior airports is not presently available. The recommended project implementation plan would provide initially for construction work to begin at Taiz. Concurrently, collection of weather data would commence at the interior airports. By the time work is to start at these airports, sufficient data can be available to correctly orient the runway at each location.

During the inspection of these airstrips the visibility was reduced to about 2 miles due to dust and about twenty or thirty minutes was spent in searching for the Barat airstrips (three were pointed out). Without a pilot thoroughly familiar with the area these airstrips would not be locatable. In any event, the Barat airstrips appeared to be identifiable only by wheel marks from previous landings.

III. Preliminary Airport Design Criteria

A. General:

The Yemen Arab Republic is a mountainous country located along the west coast of the southern half of the Arabian peninsula, latitude 14° - 17° north of the equator. There are three distinct areas: the Red Sea Coastal strip; the highlands of the interior, ranging from 8,000 to 12,000 feet; and the eastern mountainous area, tapering off into the so-called Empty Quarter of the Arabian Peninsula. The coastal strip is hot and humid in the summer and mild in the winter. The central highlands are mild the year around, with rainfall ranging from 15 to 20 inches in the north to 32 inches in the south. The area of the country is approximately 75,000 square miles but the eastern boundary is not well defined.

B. Aircraft Serving Yemen

Currently, there are six carriers serving Yemen. They are: Yemen Airlines (DC-3, DC-6), Saudi Airlines (B-737), Djibouti Airlines (DC-3), Alyemda Airlines (DC-3), Ethiopian Airlines (DC-6) and Aeroflot (IL-18). These carriers operate from one or more of the three principal cities - Sanaa, Taiz and Hodeida.

To properly design an airport system for Yemen, definite criteria on the type of aircraft to be utilized must be known. Presently, Yemen Airlines is operating DC-3 and DC-6 aircraft. Future expansion plans for the airline have not been finalized but studies have been completed or are in process for use of several varied types of aircraft, i.e. F-27, B-737, B-720 and CV 340. For the purposes of this study it is projected that:

1. International service will be provided from Sanaa and Hodeida airports which have sufficient runway length to accommodate the previously mentioned aircraft.

2. That domestic and regional services between Taiz, Sanaa, Hodeida, Aden, Djibouti and Asmara will be provided by DC-3, DC-6 and B-737 aircraft.

3. That domestic service provided from Saadah, Barat, Ma'areb and Al-Beida would be provided by aircraft with operational characteristics similar to DC-3's and DC-6's.

C. Temperature, Altitude and Wind Data

Reliable temperature and wind data are not available from any airport site other than Sanaa and Hodeida. Data on temperature for Taiz was obtained during the period 1962-68, but the wind data obtained was from the old airport site, 15 km away and adjacent to a mountain, and is not considered representative of the conditions found at the new airport in the center of the valley. Extensive interviews with pilots in Yemen and local farmers living near any proposed airport location on their past experiences with wind velocity and direction will be required before a reasonable judgement can be made on the orientation of any new runway.

Exact data on each airport's location, other than the three existing airports, is unavailable. Accurate information on latitude, longitude and elevation will need to be obtained for each potential airport site selected for development.

Temperature data is unavailable but reasonable estimates of average mean temperature can be made.

D. Soil Data

There is no existing soil data for new airport locations. Initial layout and design surveys will have to include the collecting of adequate samples of soil to properly identify the existing ground and to design the thickness of pavement necessary to support the critical (design) aircraft. Adequate soils laboratory facilities are available at the District Highway Authority to properly test the soil samples.

E. Domestic Airports

The basic design criteria for the domestic airports should follow the "International Standards and Recommended Practices" for AERODOMES, Annex 14" as published by the International Civil Aviation Organization. For the critical (design) aircraft, DC-6 (see para. B-3, preceeding), the following design criteria should be utilized:

1. Runway

   (a) Length - dependent upon actual airport elevation and temperature. Will vary between 1400 meters at sea level to 1800 meters at 6000 feet above sea level.

   (b) Width - ICAO class "C", 30m (100 ft.)

   (c) Strength - 25,000 lbs. single wheel loading.

   (d) Slope - 1.5% maximum longitudinal.

   (e) Surface - Asphalt 3 inches thick.

   (f) Base - Stone, thickness dependent upon type of subsoil.

   (g) Marking - Basic, numbers plus 1 ft. wide centerline color white.

2. Landing Strip

   (a) Length - 60 m beyond the ends of the runway

   (b) Width - 75m (250 ft.) each side of the runway center line.

   (c) Clearing and grading - 60m (200 ft.) each side of center line should be cleared and graded.

   (d) Transverse Slope - Should be adequate to prevent the accumulation of water on the surface but should not exceed 2.5% except for the first 3m (10 ft.) outward from the runway edge where the slope may be as great as 5% to facilitate drainage.

3. Taxiway

   (a) Width - 15m (50ft.)

   (b) Length - Dependent upon location, minimum recommended distance between runway center line and edge of apron is 120m (400 ft.).

F. Fire/Rescue Requirements

I. General

In the United States, the Federal Aviation Administration (FAA) established a system of indexing airports that are regularly served by scheduled air carriers operating aircraft for public convenience. The airport index is determined by the length of the aircraft serving the airport and the frequency of such operation.

The fire fighting and rescue equipment must be capable of rapid access to any portion of the airport used for landing, takeoff and surface manuevering of aircraft. The minimum amount of fire extinguishing agent(s) required for each index is specified in Federal Air Regulation (FAR) 139.49 together with the minimum number of vehicles required to transport the agent(s). There are a number of combinations of vehicles and agents which will comply with these requirements. In addition to the combinations specified, other combinations of vehicles may also be capable of performing the required service. These alternate combinations should be given full consideration when actual equipment selection is made. Each piece of fire/rescue equipment should be provided with a complete set of protective clothing for the required crew. A complete set should include: a proximity suit consisting of a coat, trousers, boots, gloves and hood, @ $250-300. In addition, each truck should be equipped with the rescue equipment as listed in the enclosed page 9 from AC 150/5210-6B, at an estimated cost of $2500.

II. Fire Extinguishing Agents and Equipment

1. Index I Airports - Aircraft length less than 90 ft. (DC-3, CV-340/540, F-27, FH-227, M-404, and Viscount V-745 series aircraft).

   a. Total Minimum Quantities of Extinguishing Agents

      (i) Pounds of dry chemical - 500
      (ii) 450 pound dry chemical 50 gallons AFFF 9 (Aqueous Film Forming Foam)

   b. Water/Foam Trucks - (None required)

   c. Equipment description

      (i) Lightweight dry chemical truck. Can be installed in a combination dry chemical/rescue vehicle or skidmounted and installed on a pickup truck, either two-or-four wheel drive.

   d. Cost CIF YAR

      (i) Dry chemical/rescue vehicle - $35,000
      (ii) Pickup skid mounted dry chemical unit - $15,000

2. Index II Airports - Aircraft length more than 90 ft. but less than 126 ft. (BAC-111, B-737, SE-210/310, DC-6, DC-7, DC-9 and L-1049 Series aircraft).

   a. Total Minimum Quantities of Extinguishing Agent
      (i) Pounds of dry chemical - 300
      (ii) Gallons of water - 1500

   b. Water/Foam Trucks: Capacity
      (i) Gallons - 1 unit - 500 - 1 unit - 1000
      (ii) GPM - 750

   c. Estimated Equipment Costs for CIF, YAR, TAIZ and SANAA

Basic of Selection
and
Combinations

Quantities/trucks/costs based on the use of protein foam per Part 139.49(b)(2)	Quantities/trucks/costs based on the use of AFFF (Aqueous Film Forming Foam) per 139.49 (c)(1)
One 500 gal - 300# truck $35,000	One 500 gal - 300# truck $35,000
One 1000 gal. truck $50,000-70,000	One 700 gal. truck 45,000
(Note: $50,000 is assembly type truck and $70,000 is custom built.)	TOTAL..... $80,000

Estimated Cost of Extinguishing Agents

Type Agent	Quantity/Unit
Foams	
Aqueous Film Forming Foam 6% type	$8-$10 gallon
Aqueous Film Forming Foam 3% type	$14-$16 gallon
Protein Foam 6% type	$4.25 gallon
Protein Foam 3% type	$5.50 gallon
Dry Chemical Powders	
Potassium Bicarbonate (Purple K or PKP)	$ 0.50 pound
Monoammonium Phosphate (MAP or ABC)	0.47 "
Sodium Bicarbonate Base	.16 "
Potassium Chloride (Super K)	.45 "
Potassium Monnex (ICI)	1.00 "

Description of Equipment	No. Required
Sledge hammer, 8 pound size	1
Shovel, D-handle type, round point type	1
Lanterns, electric hand type, 6 V battery, to throw 1,000 ft. light beams	2
Pike, pole, 12 ft. length	1
Crowbar, pinch point type, 60 inches long	1
One set of the following forcible entry tools in a canvas roll with pockets and straps:	
Bolt cutter, 36 inches long, 9/16 inch cutting capacity	1
Wrecking bar, goosneck type with claw	1
Cold chisel, 8 x 1 inch	1
Cutter, aircraft cable; Aircraft Tool Company, At-501C, or equal	1
Flashlight, 2-cell explosion proof type	1
Fastening tools for aircraft access panels	2
Screwdriver, double grip type, 18 x 1/2 inch	1
"V" blade rescue knife, W.S. Darley & Co., #RN-2 or equal	1
Blades, spare for rescue knife	6
Axe, hand type, metal cutting insulated handle	1
Pliers, lineman's type 8-inch, insulated handles	1
Ball peen hammer, 1¼ pound	1
Screwdriver, blade type 8 x 3/16 inch	1
Screwdrivers, phillip type, sizes 2 & 3	2
Hacksaw, pistol grip, 12 inch with one dozen assorted blades	1
Sheetmetal shears	1
Hydraulic rescue ket (forcing tool)	1
Portable, metal-cutting, circular type saw, preferably gasoline-driven engine	1
Dry chemical extinguishers having a minimum UL rating of 80:BC	2
First aid kit, appropriate for crash truck crews, 5 - 10 person unit size	1
Extension ladder, 2 section folding "A" type, capable of being extended 18 ft, or flat type step ladder 18 ft. long preferably of light-weight alloy, 24 inch minimum width and mounted in quick release brackets on the apparatus	1
Air operated metal chisel--may be operated by the use of bottles designed for breathing equipment.	1
Breathing equipment, preferably of compressed air type	1 for each crew position on each truck

IV. Evaluation of Air Traffic Control Service and Related Equipment

A. Air Traffic Control

There is no acceptable control of air traffic at the airports in the YAR, or within the YAR airspace. Even when the air/ground communications equipment is operational in the towers at Sana'a, Taiz and Hodeida, the tower instructions to aircraft are merely advisory. Aircraft operate only under visual flight conditions.

At Sana'a the tower advises aircraft taking off or approaching to land the whereabouts of other known traffic in the air or on the ground, and estimates the wind direction and velocity by observing a wind sock. It was noted on two occasions at Sana'a that DC-3 aircraft which had just landed on Runway 36 and were back-tracking on the runway to the turn-off had necessitated approaching B-737's to circle before landing. The advisory service is barely adequate if the communications are good, but no record of traffic positions is logged by the Sana'a tower.

At Hodeida, the tower (civilian) on top of the terminal building uses a hand operated anemometer for determining the wind velocity with direction by observation of a wind/sock. The Hodeida tower advises traffic positions of aircraft in the vicinity of the airport, but does not use logs or "strips". The military has a separate tower between the terminal building and the northeast end of runway 4-22, and it is not known whether instrument operation based on the NDB's located at one kilometer and four kilometers on the approach to runway 22 is controlled from the military tower.

At Taiz, the tower is located on top of the terminal building. The controller refers to the wind sock to estimate the wind direction and velocity. He advises traffic positions for visual meterological operation and logs all arrivals and departures on a daily basis.

Development of the airspace system, and the control of aircraft using the airspace is essential if aircraft operations within the YAR are to be conducted safely. At this time there are no designated instrument routes, no minimum reception altitudes for use of electronic guidance on routes, no minimum crossing altitudes to clear mountainous terrain in climb, no minimum enroute cruising altitudes and no airport instrument altitudes or minimum descent altitudes for non-precision facilities. "Non-precision" herein applies and is applicable in the YAR to NDB's at present, and VOR's in the immediate future.

B. Air Navigational Aids, Communication Services, Meterological Services and Electrical Aids

Serious deficiencies exist in all four of the categories of services

included in this heading. These deficiencies are attributed to a wide variation in the source of the equipment, lack of spare parts, inadequate test equipment and, inexperience of maintenance personnel.

The electronics equipment is of Russian, East German, U.S. and U.K. manufacture. Some is quite old and its maintenance even with spare parts available would probably be difficult for well-qualified technicians. Reportedly, spare parts are unavailable to the YARG for the Russian and East German equipment. A physical survey of all air navigational, communication, meterological instruments and electrical power operating equipment at Taiz, Sana'a and Hodeida airports was made during the period May 19 through 25 with findings as follows:

1. Taiz Airport
   (a) Navigational Aid Equipment
      1. NDB. Power Output unknown, Russian equipment. No spare parts available, no instruction books.

         This equipment is reported to be erratically operational. It is turned on only upon request by an aircraft pilot. The time from request to operational availability is estimated as 10 minutes minimum. This may be one reason the facility is operationally erratic, as the equipment is very old and probably takes considerable time to reach a stable operating condition. It may not have time to do this before the user no longer has need for it. Also, and reportedly, the equipment frequently fails to respond when turned on due to problems with the equipment power supply or with the airport electrical power generators.

   (b) VHF Air/Ground Communications Equipment
      1. 1 ea. VHF Transmitter, Collins 242F5, with 24SPS Power Supply (115/230V).
      2. 1 ea. VHF Receiver, Collins 51M8
      3. 1 ea. Microphone
      4. 1 ea. Loudspeaker, mounted in top of equipment ½ rack.
      5. 2 ea. VHF Transmitters, 250W, 4-channel, Russian, not operative, no spares.
      6. 2 ea. VHF Receivers, Russian, not operative, no spares.

The above items (1), (2), (3), and (4) operated satisfactorily during one visit to the Taiz Airport control tower but, on the second visit, was not operative. The Controller on duty stated the range of this equipment, when operating, is about 25 miles. It is intermittently providing, to some extent, the service for which it is intended.

(c) High frequency: Point-to-Point Communications
1. 1 ea. Transmitter, 100 watt, RFT (East German) transmissions A1 A3, no spares.
2. 1 ea. Receiver, RFT. Not operative at time of visit, no spares. This equipment has reportedly been out of service for about one month due to parts failure in the receiver. When operative it is used for communicating by A1 (manual telegraphy) or A3 (voice) with Sana'a, Hodeida, Aden, Djibouti, Asmara, Addis Ababa and Jeddah.

(i) Meterological Instruments
1. 1 ea. Wind direction and velocity instrument. Russian, not operative. No meterological information is provided to aircraft, other than estimated wind direction and velocity, determined from observation of a wind sock.

(e) Test Equipment
1. 1 ea. Tube checker. Weston model 981
2. 1 ea. HF Generator, Phillips PM5321, 0.15 mhz & 88-108 mhz 110-245V.
3. 1 ea. LF Generator, Phillips PM5100/04. 15-150Khz x1-10-100-1000, 110-245V
4. 1 ea. Oscilloscope, Phillips PM3200, 0-10Mhz. 110-220V

The tube checker, item (1), is reportedly 10 years old, and has not been used for several years. It requires 110V power and a step-down transformer is not available. Items (2), (3), and (4) are new equipments.

(f) Electrical Power Generating Equipment
1. 1 ea. Engine-generator, diesel driven, 20KVA, 390V 3Ø, 50 hz, 1500 RPM.
2. 1 ea. Engine-generator, diesel driven, 100KVA, 400-230V, 3Ø-4W, 50 hz, 1500 RPM
3. 2 ea. Engine-generator, diesel driven, 860KVA, 400/231V, 3Ø,50HZ

Items (1) and (2) are located in a structure about 200 meters from the terminal building, with overhead wiring to the terminal building. The 20KVA unit, item (1), was operating during the visit to Taiz. The NDB was turned on for demonstration purposes and within 5 minutes the temperature of the engine-generator rose 6°C. The NDB was then shut down. The 100 KVA unit, item (2), was reportedly inoperative for the month prior to our visit due to a failure in the generator section. The generator had been repaired in Sana'a, returned to Taiz and reinstalled, but the unit had not yet been restored to operation. This unit was built in 1971 and reportedly satisfactorily carries the full airport load. The two 860KVA units, item (3), are of a capacity well beyond the forseeable requirements for electrical power at the Taiz airport. They are new and, the engines reportedly have been operated for a 16 day test period, although the installation is not complete. They are located in a building approximately 1 kilometer from

the terminal building, and a distribution system has not been placed.

2. Sana'a Airport
   (a) Navigational Aid Equipment
      1. 1 ea. Locator (low power NDB), 80 watts. Equipment on temporary loan from Saudi Arabia. Located about 7½ KM on approach to runway 36, to left of extended C/L. Maintained by Cable & Wireless Co. personnel.

   (b) VHF Air/Ground Communications
      1. 1 ea. VHF Transmitter, Collins 242F5, with 248PS Power Supply, 115/230V.
      2. 1 ea. VHF Receiver, Collins 51M8
      3. 1 ea. Microphone, Electro-Voice 205STC, differential
      4. 1 ea. Loudspeaker, mounted in top of equipment ½ rack
      5. 1 ea. VHF Transceiver, Park Air Electronics 25A/SS
      6. 1 ea. Headset/microphone, "PAE"

All above items operable, but reportedly no spare parts for items (1) and (2). The reported coverage for items (1) and (2) is 85 miles and, for item (5) is 45 miles.

   (c) High Frequency, Point-to-Point Communications Equipment
      1. 1 ea. Transmitter, RFT, (East German), 100W, Transmissions A1/A3
      2. 1 ea. Receiver, RFT
      3. 2 ea. Transmitter, Collins type 50K model 15, 300W/A1 and 250W/A3 2-30Mhz, 115V, 60hz, 10
      4. 2 ea. Receivers, Hammarlund model SP-600, 0.54-54 Mhz
      5. 2 ea. Speech amplifiers, Collins type 177L-2
      6. 1 ea. Microphone, differential, Electro-Voice type 205
      7. 1 ea. Headset, ANB-HI
      8. 1 ea. Loudspeaker, oval, 8"x4"
      9. 1 ea. Rack, equipment, 72", containing above items (4),(5), and (8).

Items (1) and (2) are used for voice communications with Addis Ababa, Asmara, Djibouti, Khartoum, Aden and Jeddah. Also for manual communications with Taiz and Hodeida. Considerable ignition noise from nearby vehicles was noted during the visit. Items (3) through (9) were provided to YARG by Saudi Arabia about two years ago. The installation is incomplete and is not presently usable. Completion of the installation and maintenance of the equipment thereafter probably requires technical assistance from outside the YARG.

   (d) Meteorological Instruments

      No meteorological information is provided to aircraft other than estimated wind direction and velocity, determined from observation of a wind sock.

(e) Test Equipment

None noted. Maintenance of electronic equipment is by an Electronics Technician from Ministry of Communications in downtown Sana'a.

(f) Electrical Power Operating Equipment
1. 2 ea. Engine-generator, 4KVA, 220V, 50 hz.
2. 1 ea. Engine-generator Honda E1500, 1.25KVA, 220V, 50 hz, 12/24V, 2.4A.

The 1.25KVA unit, item (2), is reportedly used only for charging the 12V battery which powers the VHF Park Air Electronics Transceiver in the Tower.

3. Hodeida Airport (This airport may be considered joint use (civilian/military), although it is primarily a military airport. It is managed by military and, operation and maintenance of all electronics equipment is by military personnel. The Department of Civil Aviation has one man based here carrying the title "Director of Airport.")

(a) Navigational Aid Equipment
1. 2 ea. NDB, Russian. One reportedly 100 watt, the other 40 watt. The 100W facility is situated 4KM and 40W facility 1KM from the approach end of runway 22, on the extended runway C/L.

(b) VHF Air/Ground Communications Equipment
1. 1 ea. VHF Transceiver, Park Air Electronics 25A/SS
2. Unknown quantity and type of VHF equipment in Military Control Tower

Item (1) is located in the control tower atop the terminal building. Reportedly, it is used during periods when the airport is not being used for military flying activities. The control tower on the terminal building is not adequate for its intended purpose.

(c) High Frequency, Point-to-Point Communications Equipment
1. 1 ea. Transmitter, RFT (East German), 100W-300W-1000W
2. 1 ea. Receiver RFT
3. Unknown quantity and type of other P/P equipment operated by military.

Items (1) and (2) are located in an equipment room situated under the airport control tower atop the terminal building. The installation of the equipment has not been completed and the equipment is not presently operable.

(d) Meteorological Equipment
1. Anemometer, hand held, Russian

No meteorological information is provided to aircraft, other than wind direction and velocity. Wind velocity determined by item (1) and, direction by observation of wind sock.

It is not known whether or not other meteorological information is available from the military control tower located between the terminal building and the runway.

(e) Test Equipment

None noted.

(f) Electrical Power

Provided from the City of Hodeida electrical system.

C. Evaluation of ATC and Technical Personnel

An adequate number of technical personnel are included in the Taiz airport staffing, including one Chief of Radio and Engineering, two electronic technicians and one diesel mechanic. Reportedly, the two electronic technicians had completed, several years ago, the basic radio technicians course at the ICAO training center in Cairo. Since then opportunities for fully utilizing their training, or for advancing their skills, have been minimal. Each appeared to be interested in improving his technical capabilities and, in improving the reliability of the various equipments at Taiz Airport. However, there also seemed to be a more or less resigned acceptance of the equipment operational deficiencies existent at the time. This could be attributable to the difficulties, reportedly always existent, in securing replacement parts for the equipment. There are undoubtedly other factors contributive to the technicians attitudes.

An Electronics Technician headquartered at the Ministry of Communications in Sana'a reportedly is responsible for maintaining the electronic equipment presently installed at Sana'a Airport and, again reportedly, is without adequate test equipment or work space. It is considered probable that little or no preventive maintenance is performed at any location.

Two persons are assigned to duty in the control tower at the Taiz Airport who have received air traffic control training at the ICAO school in Cairo. Both completed the basic course and, one the advanced course. The person assigned similar duties at the Sana'a Airport control tower has received no formal ATC training. At Hodeida the duties are performed by military personnel and whether they are ATC trained is not known.

As may be noted by reference to Part IV, Section A of this report, advisory service only is provided by the Tower personnel at all airports, so it may be assumed that no fully qualified air traffic controllers are presently available to the YARG, although refresher training for the Taiz personnel should eliminate this deficiency.

V. Evaluation of Air Carrier Activity

A. Passenger Movements, Aircraft Movements, and Airport Data

1. The following statistics on passenger movements are based upon the

taxes received at the Taiz Airport and upon figures compiled by the YAR Central Planning Organization. The Taiz Airport statistics are broken down by airline, i.e. both the international and domestic passenger movement out of Taiz for Yemen Airlines, but also for the international passenger movement out of Taiz for Alyemda, Ethiopian Airlines and Air Djibouti. The Central Planning Organization statistics include the international passenger movements from Sana'a and Hodeida for Yemen Airways and domestic passenger movements for Yemen Airways from Sana'a to Saada, Sana'a to Barat, and Sana'a to El Beida. No analysis was made of the domestic operation to Saada, Barat or El Beida; but the figures tend this domestic operation relatively insignificant and undeveloped. All Central Planning Organization statistics are for both directions on each route, and the weekly enplanning passenger movements projected for Sana'a and Hodeida are based on the period from Dec. 1, 1972, through Feb. 28, 1973, which period was chosen as there was no reported Aden activity for the previous three months. Thus substantially all passenger movements from all scheduled air carrier activity are included in this representative three-month period excepting that of the Saudi Arabian Airlines which has only recently been in operation into Sana'a and Hodeida, and also excepting the activity of Aeroflot out of Hodeida to Aden and Mogadiscio to the south and to Cairo and Moscow to the north. Charter flights into Sana'a, Taiz and Hodeida are as follows: Air Djibouti between Sana'a and Taiz as well as on the scheduled route between Djibouti and Taiz, and infrequent (about once a month) charters into Hodeida by either MEA, BOAC, Libyan Airlines or Syrian Airlines.

Note: Saudi Arabian Airlines schedules flights Jeddah-Gizan-Sana'a-Hodeida-Jeddah on Wednesdays and flights Jeddah-Hodeida-Sana'a-Gizan-Jeddah on Mondays and Fridays. It was observed on Friday, June 1, that Saudi Arabian Airlines operated a flight on each routing, and a third flight which was turn-around between Jeddah and Hodeida. Future compilations will undoubtedly show a marked increase in traffic between Saudi Arabia and northern part of the YAR.

Note: There was activity from Sana'a to Saada, Barat and El Beida when the Aden traffic was cancelled and this particular domestic traffic was terminated when the Yemen Airways schedule to Aden was resumed.

2. Passenger Movements - Estimate of Enplanning Passengers Per Week (The Estimate of passenger movements is based upon the availability of aircraft to complete all international and domestic requirements.)

(a) Sana'a

International	324
Domestic (Sana'a to Taiz only)	82

(b) Taiz (Actual)

	Yemen Airways	Alyemda	Ethiopian	Djibouti	Total
International	226	228	56	37	547
Domestic to Sana'a and Hodeida only	102				102

(c) Hodeida

International	254
Domestic (Hodeida to Taiz only)	10

Note: There is no scheduled air service between these terminals and overflies Hodeida on the Sana'a to Asmara route. Saudi Arabian Airlines has flights between these two domestic terminals; and although SAA reportedly does not have traffic rights on this route, actually manages to carry passengers on the route (perhaps on a charter basis). From observation, the SAA flights have been high density, and the demand for service has been above the average of the Yemen Airways.

3. Aircraft Movements, Scheduled Flights Per Week

a. Sana'a Departures

Destination & Number of Flights Per Week

Yemen Airways		Saudi Arabian Airlines	
Taiz	5	Hodeida, Jeddah	-1 (Wednesday)
Asmara	1	Gizan, Jeddah	-2 (Mondays & Fridays)
Jeddah	2		
Doha	1		
Aden	2		

b. Taiz Departures

Destination & No. of Flights Per Week

Yemen Airways		Alyemda		Air Djibouti		Ethiopian Airlines	
Sana'a	5	Aden	7	Djibouti	3	Assab	2
Hodeida	1			Sana'a (Charter to Sana'a)	2		
Aden	6						
Djibouti	2						

c. Hodeida Departures

Destination & No. of Flights Per Week

Yemen Airways	Saudi Arabian Airlines	Aeroflot
Aden 2	Sana'a 2	Aden 1
Asmara 1	Gizan 1	Cairo 1
Taiz 1		

4. Type of Aircraft Utilized by Air Carrier

Yemen Airways	Douglas DC-3, Douglas DC-6
Saudi Arabian Airlines	Boeing 737
Ethiopian Airlines	Douglas DC-6
Air Djibouti	Douglas DC-3, Douglas DC-6
Alyemda	Douglas DC-3
Aeroflot	IL-18

5. Landing Fee Schedule

At present the YAR collects 30 Buqshas per 1000 kilograms landing weight for both piston and jet aircraft (15 rials for DC-3 and 45 rials for B-737 aircraft per landing). The YAR CAD is proposing a higher rate, with separate schedules for piston and jet. (40 Buqshas = 1 rial = U.S. ± 22¢ as of June '73)

VI. Estimated Airport Development Cost and Implementation

A. Construction Equipment - Force Account Construction

Item	Size	FOB Factory	Units	Total
1. Grader	Cat 12	$ 34,000	2	$ 68,000
2. Dozer Angle Blade/ ripper	D-7	65,000	4	260,000
3. Loader R.T.	944	35,000	2	70,000
4. Water Truck	1000 gal.	12,000	1	12,000
5. Roller, Self-propelled	Sheepsfoot	---	1	10,000
6. Dump Truck	5 cu. yd.	15,000	8	120,000
7. Pickups	3/4 ton	4,000	2	8,000
8. Lubrication/Ser. Tk.	---	17,000	1	17,000
9. Engineering Equip. Supps.		L.S.		20,000
			Sub.total	585,000
10. Spare parts 15%				88,000
11. Shipping & Ins. 15%				101,000
			Sub-total	$ 774,000

B. Technical Assistance

1. Airport Construction Engineer

36 ms. @ 32,000 per year
YARG to provide housing = 96,000

2. Equip. Specialist/Mechanic = 60,000

30 ms. @ 24,000 per year
YARG to provide housing

3. Electronic Installation Technician
12 ms. @ 30,000
YARG to provide housing = 30,000

Sub-total 186,000

C. Communications and Navaids Equipment

1. Taiz Airport

(a)	VOR/DME, including installation, 1 yr. in country; assistance & OJT, 2 yrs. spares	150,000
(b)	VHF Transmitters with 2 yrs. spares 2 ea. @ 3,000	6,000
(c)	VHF Receiver w/2yrs. spares 2 ea. @ 1,500	3,000
(d)	NDB w/2yrs. spares (NDB for Taiz proposed under UNDP plan)	3,500
(e)	VHF Antenna w/100 ft. RF Cable and connectors 2 ea. @ 200	400
(f)	Visual Approach Slope Indicator, 4 Box	6,000
(g)	Runway End Indication Light	2,000
(h)	1 Kw H.F. SSB Transmitter, w/2 yrs. spares	13,000
(i)	SSB Receiver w/2 yrs. spares	3,000
(j)	Test equip. and tools	2,500
(k)	Meteorological Equipment	2,500
(l)	Diesel Electric Generators w/2 yrs. spares	15,000
(m)	Shipping, ins. 15%	31,000
	Sub-total	238,000

2. Secondary Airports - Barat, Saadah, Al-Beida, Ma'arib

(a)	VHF Transmitter	*5 units @ 3,000	15,000
(b)	VHF Receiver	" " @ 1,500	7,500
(c)	VHF Antenna	" " @ 200	1,000
(d)	NDB	*4 units @ 3,500 (Procurement of two NDB's proposed under UNDP program)	14,000
(e)	SSB HF Transceiver (procurement of six proposed under UNDP program)		
(f)	Meteorological equipment	* 5 sets @ 2,000	10,000
(g)	Diesel Electric Generator	*5 units	20,000

(h)	Spare parts	6,000
(i)	Shipping - Insurance 15%	11,000
	Sub-total	84,500

* 5 units for 4 airports, one unit to be used as standby replacement.

D. Construction Material, Imported

1.	Asphalt	tons (Taiz, Barat, Maareb)	200,000
2.	Primer	tons " " "	40,000
3.	Cement	tons " " "	40,000
4.	Aluminum, siding Sq. yds.	(Taiz)	50,000
5.	Hanger doors	(Taiz)	20,000
6.	P.O.L. 3 yrs. supply	(Taiz, Barat, Maareb)	150,000
7.	Fencing	meters (Taiz)	30,000
8.	Power Cables	meters (Taiz, Barat, Maareb)	20,000
9.	Misc. pipe, fitting, hand tools		50,000
10.	Shipping & Insurance, 15%		90,000
			$ 690,000

Sub-total A-D	$1,987,500
Contingencies	198,000
TOTAL	$2,185,500

E. YARG Local Contribution

1.	Land Costs	Yr.	500,000
2.	Local Labor		
	100 men @ 10/Rials/day	720 days	720,000
	25 men @ 15 Rials/day	720 days	720,000
	sub-contracting		210,000
3.	Local support to Tech.-- Housing, Utilities 2,000 Rials/man x 78 months		156,000
4.	Local construction materials		200,000
	TOTAL - Yr.....		$2,056,000
	Say ...Yr.....		$2,000,000

VII. Civil Aviation Management Organizations

A. YARG

The management of civil aviation affairs is established as a Directorate under the Ministry of Communications. See attachment B.

B. ICAO

ICAO has provided the services of an Advisor since Mid-1970. The ICAO Mission is being augmented starting July/August 1973 and the Mission will thereafter consist of the following positions:

Chief of Mission, programmed until 12/31/76
Airworthiness Inspector, until 6/30/76
Air Traffic Controller, until 12/31/76
Aerodrome Fire and Rescue. Advisor, until 6/30/76
Aerodrome Manager about two year assignment, dependent upon Taiz Airport needs
Flight Operations Inspector, until 12/31/76
Electronic Technician, until 12/31/74

C. Federal Republic of Germany

For two years following completion of the Sana'a International Airport the FRG plans to provide grant aid technical assistance in operating the airport. Present plans are to provide:

Airport Manager
Air Traffic Control Specialist
Electronic Technician
Aeronautical Information Service Specialist
Meteorological Specialist

VIII. Economic and Social Benefits

The Yemen Arab Republic (YAR) suffers from the problem, common to undeveloped areas of the world, of a deficiency in transportation and communications. Great progress has been made and is continuing in improving the highway system within the YAR, but little progress has been made in developing an adequate air transportation system. To date, piecemeal approaches only have been made and these have primarily been confined to improvements at individual airports, with the current project for modernizing the Sana'a International Airport an example of this approach. Completion of the Sana'a Airport will provide the YAR with an adequate International gateway but improvements leading to the safe and adequate internal parts of an aviation system are needed before the benefits of air transportation can be fully realized. An aviation system may be considered as encompassing virtually anything directly related to aviation within the country, but as may be noted in the summary, this report covers only a small portion of a complete system under this definition.

Adequate data is not available to permit making a realistic forecast of future movement of people and freight by air within the YAR, either internationally or domestically. However, near capacity utilization of the current international flights indicates an increased frequency in international flights

is overdue. Currently there is little domestic traffic within the YAR, with the lack of adequate airports and an airway system with proper navigational aids, communication facilities, etc., and the personnel to operate and maintain the airway system, a major limiting factor. Of course, an airline capable of efficiently using these facilities is essential; however, negotiations currently under way by Yemen Airlines with various foreign airlines for guidance and technical/financial assistance will presumably lead to a viable airline system within the YAR. However, unless other aviation system improvements are affected, any airline improvements will provide only a small portion of the potentially realizable benefits. We do not consider it feasible to attempt a cost/benefit analysis of proposed improvements to the aviation system from data presently available within the YAR. However, based on experience by other lesser developed countries where reliable aviation systems have been developed, a major impact on the economy and society of the YAR can be expected if the recommendations of this report materialize.

Perhaps one of the principle benefits, potentially of a reliable aviation system is in the fostering of national unity, or political integration of the country by movement of people between areas widely separated, not only by distance, but by religious and social mores.

It is considered that potentially the most important near-term economic stimulus may come from the stimulus that reliable air transportation will provide in developing tourism in the YAR. Transportation by air is the only practicable means of surmounting some of the natural land barriers to areas of interest to tourists. And, the time factor related to air travel can be expected to prove attractive to tourists for the Sana'a-Taiz and Sana'a-Hodeida segments.

IX. Other Donor Activities

a. ICAO

(1) Equipment - A current request by YARG for a UNDP grant includes a proposal to expend approximately $95,000 for equipment for civil aviation activities. The specific equipment and, tentatively proposed usage, is as follows:

2 ea. NDB, 200 watt, dual (Taiz and Hodeida)
2 ea. NDB, 50 to 80 watt (Barat and one other domestic airport)
2 ea. VHF Transceiver, 50 watt (Taiz and Hodeida)
6 ea. HF Transceivers, SSB, 280 watt (Sana'a, Taiz, Hodeida, Barat, Saadah and Al Beida)
1 lot of spare parts for above, and for a few items of test equipment.

2. Training - Several persons reportedly received training at the ICAO Training Center in Cairo prior to establishment of the ICAO Mission in Yemen Mid-1970. Records concerning this training and current location of the recipients is not available, or has not been made available to the survey team.

Since establishment of the ICAO Mission in Mid-1970, training has been provided for 26 people, mostly at the Cairo and Beirut Training Centers. Of these, 8 are now with the Ministry of Communications or Department of Civil Aviation, 10 with Yemen Airlines and, the present whereabouts of 8 is not known.

Under the current request for a UNDP grant, funds for the following training have been requested.

Civil Aviation Administration	9 man-months
Air Traffic Control	44 " "
Flight Operations Safety	22 " "
Airport Fire Officer	14 " "
Airport Management Technical Services	22 " "

b. Federal Republic of Germany (FRG)

Under a 80.5 million DM loan, a major improvement program for the Sana'a International Airport is nearing completion. In addition to the loan funds, the FRG has provided considerable grant aid technical assistance and will continue to do so for two years following completion of the airport project (See Part VI, Sec. C).

(1) Equipment - Under the loan project equipment is being provided for two positions in the Sana'a International Airport Control Tower (Aerodrome control and Approach Control) air navigational aids, communications, meteorological instruments and electrical generating equipment. All this is for the Sana'a International Airport and is expected to be installed and operational prior to the end of 1973. A listing of the major equipment components follows:

(a) Navigational Aids

1. 2 ea. NDB, 200 watt. One located 1KM and one 4KM from approach to runway 36. Battery (12 hrs.) standby power.
2. 1 ea. VOR, 50 watt. To be located 550M from north end of runway toward south end and on the west side of the runway 225M from C/L. Battery (10 hrs.) standby power.
3. 1 ea. VHF/DF
4. VASI - 6 box units on each side of runway at both ends of runway.

(b) VHF Air/Ground Equipment

1. 3 ea. Transmitters, VHF, 50 W, 6-channel
2. 2 ea. Receivers, VHF, 6 - channel
3. 3 ea. Antenna, VHF

(c) HF, Point-to-Point Communications Equipment

1. 2 ea. Transmitter, 1KW (1 main, 1 standby)
2. 4 ea. Receivers, (2 for direct speech circuit use, main/standby, 2 for RTTY/MAS use main/Standby)
3. 1 ea. Antenna, omnidirectional, 16M high, with multicouplers and antenna switch
4. 2 ea. Teleprinter, send/receive

(d) Meterological and Test Equipment

Funds include 100,000DM for meterological instruments, test equipment and tools.

(e) Electrical Power Generating Equipment

1. 2 ea. Engine-generators, diesel, 500KVA, 400/231V, 50hz
2. 1 ea. Engine-generators, diesel, 150KVA. (This unit not yet purchased for permanent use but is presently in use by the terminal building contractor. The project manager considers this unit capable of carrying airport load over next several years and has recommended its purchase.)

It is possible the FRG will in the future recommend and provide funds, loan or grant, for DME, ILS, Approach Lights and Fire and Rescue Vehicles for the Sana'a International Airport.

2. Training

Through 1972 the FRG has provided grant aid funding for the training of 26 YAR people in aviation related activities. Additional grant aid funds were provided in 1973 for training 8 more people. All this training has been, or will be, administered in FRG. It is reported that if funding for further training is provided, it will probably be at the ICAO Training Centers in Beirut or Cairo.

Training, through 1972 funding. (Training has started and, in most cases is still in progress)

6 ea. Pilots, to rating of 2 engine commercial. (Pilot training provided as original planning was for funding assistance to Yemen Airlines as well as to the Department of Civil Aviation. After the training of pilots started decision was made to eliminate assistance to Yemen Airlines from the loan funds. Incidental to this is the technical assistance provided by the FRG to Yemen Airlines of two advisors for two years each. This technical assistance and all other FRG assistance to Yemen Airlines has been terminated)

8 ea. Technicians (Of these, 4 will be selected as radio technicians and 4 as electro-mechanical technicians.)

12 ea. Air Traffic Controllers, Communication Operators, Engineer, AIS Specialist.

Training with 1973 funding.

1 ea. Airport Director for Sana'a International Airport (18 months)
2 ea. Ass't Airport Directors for Sana'a. One Technical, one Commercial
1 ea. AIS Specialist
1 ea. Meteorologist
1 ea. Technician for Meteorological instruments and equipment
1 ea. Customs specialist
1 ea. Immigration specialist

c. Saudi Arabia (SAG)

Following the recent decision by YARG for inclusion of YAR airspace within the Jeddah FIR, the Saudi Arabia DCA has proposed assisting the YARG in implementing the decision. The proposal is presently in the discussion stage with YARG and may not be acceptable in toto by the YARG. The SAG is interested in assuring the adequacy of AFTN services within the Jeddah FIR and to do so may be willing to provide 3 KW transmitting equipment for the Sana'a International Airport installation. Also, a possible willingness to provide equipment for assuring adequate direct voice communications between Taiz-Sana'a and Hodeida-Sanaa. (It is believed the equipment contemplated for this service would be similar to the Collins/Hammarland equipment provided by SAG for the Sana'a Airport two years ago, and not used by YAR). Pursuant to this the SAG believes technical assistance will be required to install, operate and maintain any equipment provided and, they propose to provide such assistance at Sana'a only. The proposal is to provide 10 SAG personnel to the Sana'a International Airport, presumably to work with the FRG team for the first two years and then to continue after departure of the FRG team if continued assistance is needed. The proposal includes 2 Air Traffic Control Specialists, 1 ATC Specialist for pilot briefings, 2 Communication Operators; one to function as watch supervisor for RTTY circuit, and one as Operator on direct speech circuits, 1 Electronic Technician, 1 Fire and

Rescue Officer, 2 Meteorological Specialists one of whom would be a meteorological instrument technician and, 1 Airport Administration Specialist.

The proposal includes the possibility of providing minimal fire and and rescue equipment for Sana'a International Airport.

The SAG also proposes training of YARG personnel at one of the SAG aviation training facilities, at Jeddah or Dhahran. Training at these facilities is conducted in the English language and nine months of English language instruction is provided to those participants requiring same.

The Jeddah facility provides instruction for Communication Operators, Air Traffic Control Specialists, Meteorologists, Fire and Rescue Officers and Teleprinter repair. The Dhahran facility provides instruction for basic radio technicians, maintenance of radio navigational aids, telephone technician and electro-mechanics.

The SAR has in the past made some items of equipment available to the YARG, either on loan or grant basis. The locator facility (low-powered NDB) presently operating at Sana'a is on loan and, some HF point-to-point communications equipment at the Sana'a Airport is on a grant from SAR. This latter equipment is not being utilized.

d. Others

An NDB has been given to YARG for installation at the Taiz-airport by Djibouti Airlines, with an offer to assist in its installation. No action has been taken and the equipment has not been installed.

X. Conclusions and Recommendations

1. Airports

The heavy construction equipment and vehicles needed to accomplish the recommended landing area improvements are not available to local contractors in the YAR. Two major construction projects now underway, paving Sana'a-Taiz and Sana'a-Saadah roads, are by foreign contractors. The estimated completion date for these two projects is January 1976. For the airport projects it is recommended that the equipment and vehicles listed in Section VI.A of this report be provided, with the Highway Authority furnishing personnel to operate and maintain the equipment and vehicles and local contractors providing the bulk of the tradesmen and construction workers. Detailed project design and supervision should be provided by the technical personnel recommended in Section VI.B.1 and 2 of this report.

A. Taiz Airport

Completion of phase I of the Taiz Province development plan (see Section II of this report) to ICAO Standards will be sufficient to adequately handle the current and projected aviation activity at Taiz. After evaluating various possible methods of accomplishing the completion of phase I, it is concluded that the lowest cost investment is by having the Taiz District Highway Authority supervise the work, assisted by a Technical expert noted above. The work then to be accomplished by using a combination of local contractors and Highway Authority personnel, with Highway Authority personnel operating and maintaining the construction equipment and vehicles. This is the same procedure that was used for the original development of the existing Taiz Airport.

Specifically, the basic recommended improvements are:

(1) paving of the 400 meter overrun on approach end runway 01.
(2) paving of the terminal apron area
(3) paving of the hangar ramp area and a connecting taxiway to the terminal apron.
(4) completion of the aircraft hangar.
(5) re-shaping and enlargement of the landing strip along each side of runway 01-09 to meet ICAO width standards
(6) provision of technical expertise to assist the YARG in properly designing and constructing these improvements.

B. Domestic Airports (Barat, Ma'areb, Saadah and Al Beida) The recommended improvements at each of these airports are:

(1) Construction of a paved runway designed for aircraft with operational characteristics similar to DC-6 aircraft.
(2) Construction of a 39x12 meter airport building to house navigational aid, communications, meteorological and electrical power generating equipment, Civil Aviation Authority and Airline operational facilities.
(3) Construction of a 30x45 meter terminal apron and connecting taxiway.
(4) Provision of a water supply.

2. Fire and Rescue Equipment

Provision of the type of equipment is recommended as follows:

A. Taiz Airport (Index II- see Part III.F of this report)

1 ea. Dry Chemical truck, lightweight (300 lbs.)
1 ea. Water/Foam truck, 1000 gallon
(Airport falls between Index I and Index II category as frequency of Index II size aircraft is expected to be low for several years following 400 meter extension to runway.)

B. Domestic Airports (Index I)

1 ea. (at each airport) Dry Chemical truck, lightweight (300 lbs.) skid-mounted on pick-up truck

C. Sana'a Airport (Index II)

1 ea. Dry Chemical truck

3. Navigation Aids

The provision of VOR/DME at the three International Airports, i.e., Sana'a, Taiz, and Hodeida is recommended. It appears possible that adequate enroute navigational service can be provided to aircraft within most of YAR airspace by such facilities at these three locations. However, a detailed investigation is required to determine if this is true or not. It should be noted that the VOR presently programmed for Sana'a is a TVOR type, 50 watts, and may not provide adequate coverage for enroute navigational purposes.

The VOR/DME is recommended as it appreciably increases the safety factor for aircraft approaches and landings at airports so equipped and, permits development of the safest and best, except for ILS, terminal instrument approach procedures. Also, it permits the establishment of safe air carrier routes in mountainous areas where there are insufficient facilities for checking the aircraft position and permits the establishing of fixes for crossing altitudes (for terrain clearance in climb after takeoff) when required.

Further, it is recommended that NDB's be provided at all airports in YAR to provide service to aircraft not equipped to use VOR/DME. The power output of these NDB's should be sufficient to assure their use as enroute navigational aids. Also, these facilities will permit instrument approaches to those airports where the terrain permits such approaches.

4. VHF Air/Ground Communications

Each airport served by commercial aircraft should have a means of communicating with aircraft approaching the airport. Therefore, it is recommended that a single channel of reliable VHF A/G communication equipment, capable of providing a minimum coverage of 25 miles, be provided for Taiz, Hodeida, Barat, Saadah and Al Beida. And, two channels at Sana'a, one for aerodrome control and one for approach control purposes. At the smaller airports where runway maintenance is minimal, livestock and people cross runways at will, etc., the communication service is needed to keep incoming pilots informed of the runway and weather conditions.

5. HF Point-to-Point Communications

Reliable equipment should be provided for the P/P communications requirements in YAR. Such communications should be established in accordance with ICAO ANP's. At present, these call for circuits between Sana'a - Jeddah and Sana'a - Aden using RTT. Also, for a direct speech circuit between Taiz - Aden and MAS circuits Taiz - Aden and Taiz - Asmara. (Note: These requirements may be revised following the recent decision to include YAR airspace within the Jeddah FIR). In view of the need for a specialized operator (telegraphy) for an MAS circuit, it is recommended that efforts be directed toward improvements to the direct speech circuit and if satisfactory operations are attained, to eliminate the requirement for the MAS circuit.

For domestic (internal YAR) operations it is recommended that direct voice communications be established between each of the airports served by commercial aircraft. Upon availability of suitable airport facilities at Barat, Saadah, Ma'areb and Al Beida, reliable equipment for establishing or maintaining such communications should be provided at these locations, as well as at Sana'a, Taiz and Hodeida.

6. Meteorological Instruments

The provision of basic meteorological instruments to each airport is extremely desirable. It is recommended that barometers, wind indicators and thermometers be provided for Sana'a, Taiz and Hodeida, and wind indicators and thermometers for all other locations.

7. Test Equipment, spare parts, tools

An adequate supply of spare parts, test equipment and tools is essential for reliable continued operation of all electronics equipment and should be provided to each location where equipment is installed. Adequate space for accomplishing maintenance and repair is needed, to include a work bench and storage for test equipment, tools, and spare parts.

8. Electrical Generating Equipment

The addition of a second 100KVA engine-generator isrecommended for Taiz Airport, and units of an estimated 5KW capacity at airports other than Sana'a, Taiz, and Hodeida. This 5KW covers only the estimated electrical power requirement for an NDB, VHF A/G and HF P/P communications and is an absolute minimum for these purposes. The actual electrical power requirement at each location should be determined prior to proceeding with procurement.

9. Training

The training programs proposed by ICAO, FRG and SAG should provide the YARG with the required number of trained personnel in the administrative, fire protection and air traffic control fields. Some refresher training should be provided for presently employed electronic and electro-mechanical techbician personnel and, additional personnel should be trained in these fields. Also, advanced training for a supply specialist may be desirable.

10. Remarks

A portion of the equipment required for the foregoing recommendations may be available by rehabilitating and relocating some of the equipment presently installed at Sana'a, Taiz and Hodeida. The feasibility of such rehabilitation and continued usage thereafter may require the evaluation by and services of a well-qualified electronic technician on a full-time basis and with access to needed spare parts, funds for procuring essential parts and adequate test equipment.

Some of the needed equipment may be procured with funds from UNDP if the current request for same is approved.

The program for Sana'a International Airport under the FRG loan is providing sufficient equipment to fulfill the foregoing recommendation for that location except for domestic point-to-point communications. As noted previously, the VOR facility may not provide the coverage required for enroute navigational purposes. Also, satisfactory operation of the AFTN circuit to Jeddah may be marginal using an omni-directional antenna.

The providing of certain other equipment, including VOR/DME, will require additional funding.

STATEMENT OF BASIC OPERATIONAL REQUIREMENTS AND PLANNING CRITERIA MIDDLE EAST AND SOUTHEAST ASIA REGIONS

GENERAL (Applicable to both International Commercial Air Transport and International General Aviation)

Operating Parameters

The types of Civil Aircraft that should be taken into account in the development of facilities, services and procedures are:

AIRCRAFT TYPES USED IN INTERNATIONAL AIR TRANSPORT OPERATIONS

Antonov AN24

BAC/SUD Aviation Concorde

Boeing B707
Boeing B707 Series 300B, 300C, 312B, 320B, 320C

Boeing 720
Boeing 720B
Boeing 727
Boeing 727C
Boeing 747

British Aircraft BAC111
British Aircraft VC10-1100
British Aircraft Super VC10-1150

Canadair Yukon CL44

Convair Liner 340
Convair Metropolitan 440

Convair 880
Convair 990

Douglas Dakota DC3
Douglas Skymaster DC4
Douglas Liftmaster DC6
Douglas Jetliner DC8
Douglas Jet Trader DC8
Douglas Series 33, 50, 60, 61, 62, 63
Douglas DC9
Douglas DC9 Series 10, 30, 41

Fokker Friendship F.27

Handley Page Herald H.P.R.7

Hawker Siddeley Avro 748
Hawker Siddeley De Havilland Comet 4 106
Hawker Siddeley De Havilland Trident 121

Ilyushin Moskva IL18
Ilyushin IL62

Lockheed Starliner 1649
Lockheed Electra 188

Nihon YS 11

Nord Aviation Super Broussard 260

Sud Aviation Caravelle SM210

Tupolev TU104
Tupolev Rossiya TU114
Tupolev TU124
Tupolev TU54

Vickers Viscount VC2-700
Vickers Viscount VC2-800

The operating characteristics of the civil aircraft listed above except helicopters, that should be taken into account in the development of facilities, services and procedures are:

Climb performance will differ considerably for the various aircraft types ranging from 2.5 to 20 metres per second (500 to 4,000 feet per minute)

Cruising speeds will range:

a) reciprocating engines 100K up to 300K

b) turbine engines up to 500K

Cruising levels will range:

a) reciprocating engines - up to FL 250

b) turbo-prop engines - up to FL 350

c) turbo-jet engines - up to FL 450

Descent performance will vary from 2.5 metres per second (500 feet per minute) for unpressurized aircraft to 25 metres per second (5,000 feet per minute) for pressurized aircraft.

Note: Performance figures for military aircraft are not available but in some cases they are considerably in excess of those quoted above.

For Concorde operations the following preliminary performance data is to be used:

Climb performance
- 9,000 fpm up to 10,000 ft.
- 2,500 fpm from 10,000 to 30,000 ft. then progressively decreasing to 200 fpm when reaching 50,000 ft.

For ATC purposes it may be necessary to give an advance notice at the beginning of climb to indicate that a 5,000 ft. altitude difference is possibly necessary for levulling off at specified cruising level.

Cruising level	- FL approximately 600
Cruising level speed	- Mach 2.2 at LST - 15, 2.05 at LST ZERO degrees, 2.0 at LST + 5, 1.95 at LST + 10.
Descent performance	- 2,500 fpm from FL 600. In emergency 6,000 to 8,000 fpm.

Planning for facilities and services, in addition to meeting the operational requirements, should take into account the need for:

efficiency in operation;

economy in equipment and personnel;

with due consideration being given to capability for future expansion without major redesign or replanning.

Air navigation facilities, services and procedures should be planned to meet the requirements of all types of aircraft engaged, or planned to be engaged, in the region during the next five years in international civil operations, listed in the approved table of aircraft operations, except that planning should not be necessarily undertaken in respect of aerodromes used only by operators of the State in which the aerodrome is located unless such planning is required to protect the integrity of the plan.

International scheduled Airline Operators should be enabled to exercise operational control in accordance with Annex 6.

The workload in the cockpit is a factor to be taken into account when prescribing facilities, services and procedures for the Region.

Planning for facilities and services should normally provide for their availability on a 24-hour basis. Where in certain cases part time availability would suffice, a brief description of the circumstances should be given.

Reports of slush, snow, water, etc., including their effect on braking action, of operational significance remaining on aerodrome pavements should be disseminated to all directly concerned. Such reports should meet the following criteria:

be transmitted without delay;

be of sufficient frequency to provide knowledge of the current situation;

contain an indication of the intention of the authorities concerning removal; and

provide notification when the conditions previously reported have ceased to exist.

Planning for approach and landing aids should take into account possible future requirements for Facility Performance CAT II ILS and related ground environment facilities at all international aerodromes where, although CAT II operations are not planned as immediate requirements, they are nevertheless contemplated for the future.

AERODROMES

International Commercial Air Transport Operations

Regular aerodromes and principal alternates should be determined to meet the needs of the flights listed in the agreed table of aircraft operations. When studying the requirements for alternate aerodromes within the region, the guiding principle should be that, to the greatest practicable extent, the requirements for alternate aerodromes be satisfied by regular international aerodromes.

Physical characteristics and visual aids should be determined for each regular and alternate aerodrome required for international operations.

In cases where extension or development of an aerodrome to meet infrequent critical operations would entail disproportionate expenditures, alternative solutions should be explored.

Note: If it is found that the full operational requirements cannot be met at an aerodrome then the maximum practicable development to facilitate operations should be recommended and the relevant reasons for this included in the report.

At alternate aerodromes the characteristics should be determined in accordance with the landing requirements of the diverted critical aircraft and the take-off requirements for the aircraft for a flight to the aerodrome of intended destination.

Note: Where more than one alternate aerodrome is available the requirements should be based on the types of aircraft each is intended to serve.

International General Aviation

Aerodromes, in addition to those required for international commercial air transport operations, should be determined to meet the needs of the flights listed in the agreed table of aircraft operations.

Physical characteristics should be determined for each aerodrome to meet at least the needs of the most commonly used aircraft operated or intended to be operated at the aerodrome by IGA.

AIR TRAFFIC SERVICES

The Air Traffic Services system and procedures should:

permit aircraft to fly, as nearly as practicable, the optimum flight path, in both the horizontal and vertical planes, from the point of departure to the point of intended landing;

cater for the requirements of all aircraft*;

permit the most efficient use to be made of the airspace and aerodromes by all users and also secure the most expeditious handling and flow of the various types of traffic.

Controlled airspace should be established around all international aerodromes where approach control service is provided and should encompass at least the climb to cruising level and the descent from cruising level of departing and arriving aircraft. Controlled airspace should also be established to encompass the entire en-route portion of IFR flights, except where the type and density of traffic clearly do not justify such establishment..

Flight information regions and the control areas therein should be large enough to ensure an efficient and economical regional system.

Air traffic advisory service should only be considered as a temporary expedient in those cases where the lack of adequate facilities or personnel precludes the immediate establishment of air traffic control service. Air traffic advisory service should not be recommended as part of the plan.

The lower limit of control areas should be established so as to allow adequate space for VFR flights to operate below control areas, taking into account the flight paths likely to be used by aircraft under air traffic control.

* Including local domestic and military traffic in so far as it may affect international traffic.

Air-ground communications particularly position reporting should be reduced to the minimum compatible with ATS requirements. All compulsory reporting points should, where practicable, be defined by static-free radio navigation aids.

Direct pilot-controller static-free voice communications should be provided where practicable, particularly in terminal areas and on high density routes.

Where aircraft may be using different systems for navigation and position determination within the same controlled airspace, the ground facilities involved should, in so far as practicable, be located and oriented to enable a fully integrated air traffic control structure to be established.

Primary radar should be provided as an essential element of air traffic control where traffic density and/or the multiplicity of converging or crossing routes create problems.

Secondary surveillance radar should be provided wherever it is needed to improve the safe and expeditious handling of air traffic.

TELECOMMUNICATIONS

Aeronautical Fixed Service (AFS) Planning and Engineering

The AFS recommended should be designed to meet the stated requirements of ATS, SAR, MET, AIS and airline operating agencies for printed or speech communications.

It may be necessary for States in their national planning to provide for aerodromes, used by international general aviation, to have ready access to the AFTN.

Aeronautical Mobile Service (AMS) Planning

Air-ground communication facilities should be recommended to meet rapidly and reliably the agreed requirements for air traffic control as well as, to the extent required, all classes of traffic acceptable on the AMS. These facilities should employ VHF where practicable, including use of extended range VHF or other suitable techniques; otherwise HF operation should be recommended.

If overloading of air-ground channels has occurred or is expected to occur, due to request-reply meteorological traffic, suitable VOLMET Broadcasts should be recommended.

Aerodromes having a significant volume of international general aviation traffic should be served by stations of the AMS and such stations should operate on frequencies within the bands normally used by aircraft constituting this traffic.

Selective Calling System (SELCAL)

Selective calling (SELCAL) devices should be employed, wherever possible and necessary, on HF and VHF/GP frequencies at aeronautical stations.

Frequency Assignment Plans

Frequency assignment plans should be prepared for mobile service facilities in the HF and VHF aeronautical mobile (R) bands on the basis of agreed frequency/geographical separation criteria. There is a requirement for allotment of VHF channels for operational control purposes which should be made in accordance with Annex 10.

RADIONAVIGATION AIDS

International Commercial Air Transport Operations

En-Route Aids

The en-route aids to be recommended should provide navigation assistance to the extent necessary to permit en-route navigation on the agreed air traffic services route network with the accuracy required; VOR supplemented as necessary by DME should be installed as the primary aid for this purpose.

The use of self-contained navigational devices is an increasing practice which may ultimately reduce requirements for long range navigational aids. At the present time there is still a requirement on some overwater routes for these aids which can be met by long range NDB or LORAN.

Terminal Area Aids

The terminal area aids to be recommended should permit navigation for approach, holding and departure to be carried out with the accuracy required. The primary aid should be VOR, which should be so located as to permit the most efficient approach and air traffic control procedures and to give the pilot maximum assistance in adhering to requisite patterns. NDB should be used for holding when the provision of VOR for the purpose is not possible or practicable. Consideration should be given to the provision of DME in association with VOR to ensure ATC procedural flexibility and/or improve navigational accuracy.

Where an indication of the boundaries of TMA is necessary and this is not provided by the principal navigational aids, locators and/or VHF markers, preferably the former, should be provided for this purpose.

Aids to Approach and Landing

The requirements for ILS should be assessed in terms of the provisions of Annex 10, Part I, Chapter 2 (Paragraph 2.1.1.1 COM/OPS) bearing in mind that irrespective of the existence of other facilities, the provision of this aid is often considered necessary for the safe operation of turbojet aeroplanes in all operating conditions. It should be noted that the CAT I requirement may, in some locations need to be met by the provision of Localizer or Glide Slope Equipment meeting the CAT II facility performance specifications of Annex 10.

Co-operative arrangements for the flight testing of radionavigation aids should be recommended where flight testing on a national basis would be impracticable or uneconomic.

Frequency Assignment Plans for Radionavigation Aids in LF/MF and VHF Bands

Frequency assignment plans should be prepared for aids in the LF/MF and VHF navaid bands on the basis of agreed planning criteria.

International General Aviation

Short Distance Aids

Appropriate aids for short-distance navigation should be provided to serve the additional aerodromes referred to in paragraph 21 where the density of traffic and the meteorological conditions so warrant, due account being taken of the airborne equipment carried by aircraft. These aids should as appropriate be located so as to permit instrument approaches.

METEOROLOGY

The aeronautical meteorological offices should be designated so as to:

provide briefing and documentation for the first flight stage, or as agreed with the operators concerned, for more than one stage;

enable the most efficient use to be made of the available meteorological data.

Arrangements should be made for meteorological watch to be provided for each FIR and/or UIR, and for relevant meteorological information to be supplied to the related ACC and FIC. Arrangements should also be made to designate main or dependent meteorological offices in order to ensure that ACC are provided with necessary meteorological information.

Any area forecast system to be provided should be in accordance with the principles expressed in MET/OPS Recommendation 9/1 (MET/OPS Divisional Meeting 1964), and should cater for the particular characteristics of the Region concerned.

1, forecasts for the same purpose should not be produced by more than one MET Office if users can be satisfied by a common service, assuming it is technically practicable and reasonably economical.

The ground exchange of operational meteorological information should satisfy the requirements of the pilot-in-command and the operator's local representative, before and during flight, as stated in the following table, with due regard to the need of economy in the volume of routine operational meteorological traffic to be exchanged on AFTN circuits:

Type of information	Required coverage and/or period of validity of information to be available	
Routine and selected special reports	At departure aerodrome	For aircraft in flight
For departure aerodrome and alternates	For all flights. Exchange involved only for reports of alternate aerodromes	During first 2 hours *) of flight
For final aerodrome and alternates	For flights not exceeding 2 hours *) flying time	During last 2 hours *) of flight
For significant observation stations (routine reports only)	Along and adjacent to route up to distance corresponding to 2 hours*) flying time	Along and adjacent to route up to distance from aircraft corresponding to 2 hours *) flying time
Air-reports	For whole route	Appropriate special air reports for route ahead
SIGMET information	For route ahead up to distance corresponding to 2 hours *) flying time	For route ahead up to distance from aircraft corresponding to 2 hours *) flying time

*) With possible exceptions for certain routes

(These values are subject to regional determination)

Aerodrome forecasts and amendments	As per PANS-MET 2.5.2.4.2.4 for validity periods appropriate to the flight	As at departure aerodrome, but forecasts are required to be available only as long as appropriate
Pressure values	Exchange requirements as per PANS-MET 2.5.9	
Landing forecasts	No exchange requirements	For aerodrome of intended landing during last hour of flight
Area forecasts	For flights for which the entire service is not provided by the local meteorological office	No exchange requirements
Upper wind and temperature forecasts	No exchange requirements	As per PANS-MET 2.5.3.8 and 2.5.1.9.2.2

The following categories of operational meteorological messages passed over a meteorological operational telecommunications network should achieve transit times not greater than the values indicated, on 95% of occasions:

SIGMET messages.....		5 minutes*
Amendments to aerodrome forecasts ...		5 minutes*
Aerodrome reports)		
Landing forecasts)	from 0 to 550 NM	5 minutes*
Selected special reports)	from 550 to 1100 NM	10 minutes*

*) These values are subject to regional determination

Aerodrome forecasts originated by meteorological offices in the Region should be available, at all locations at which they are required, at least 30 minutes before their period of validity commences. Transit times of aerodrome forecasts originated by meteorological offices outside the Region should take account of those established by the other Regions concerned so that these messages reach their destinations before the periods of validity commence.

Runway visual range observations should be made when the visibility is equal to or less than 1,500 metres or a higher value agreed locally.

Reports of temperature and dew point should be made available as required for take-off purposes.

Landing forecasts should be of the trend type as detailed in PANS-MET, 4th Edition, paragraph 2.7.2.2.2.

The meteorological information supplied should be adequate to serve flights to the levels specified in paragraph 1 c).

States should plan for the introduction of SST aircraft operations by maintaining appropriate climatological records on surface and upper air information up to 30,000 metres (100,000 feet).

At least the following meteorological information should be available or easily procurable for each flight departing from any aerodrome having a significant volume of international general aviation traffic:

route information concerning winds and temperatures at appropriate levels and weather likely to affect the safety of flight, including indications of low cloud and other phenomena causing low visibility;

information concerning weather at aerodromes of departure and destination and at relevant alternate aerodromes.

SEARCH AND RESCUE

Planning for search and rescue service should take into account, to the maximum practicable extent, existing facilities even if they are provided for purposes not connected with search and rescue.

AERONAUTICAL INFORMATION SERVICES AND AERONAUTICAL CHARTS

The designation of International NOTAM Offices and their areas of responsibility should be based on maximum efficiency in the dissemination of aeronautical information by telecommunications and on optimum use of the AFTN.

Arrangements for the international exchange of NOTAM, AIS documents and aeronautical charts should be examined to ensure their adequacy to meet the needs of all forms of international civil aviation.

Arrangements for the transmission of NOTAM Class I including the utility of introducing a collective address system should be examined with a view to recommending measures to ensure that adequate and timely information is available.

PART I

AERODROMES

1. INTRODUCTION

1.1 This part sets out the ICAO Air Navigation Plan for aerodrome facilities and services in the Middle East and South East Asia Regions.

1.2 The Plan refers only to basic facilities. The relevant Standards and Recommended Practices which describe these facilities in more detail and other unspecified facilities are contained in Annex 14 - Aerodromes.

1.3 Guidance material also useful in implementing the facilities can be found in Doc 7920-AN/865 - Aerodrome Manual and Doc 8796-AN/891 - Airport Master Planning Manual.

1.4 Background information of importance in the understanding and effective application of the Plan is contained in the Report of the Middle East/South East Asia Regional Air Navigation Meeting (Doc 8801-MID/SEA (1968) on Agenda Items 1, 4, 5, 6, 7 and 20, supplemented by information appropriate to portions of the MID and SEA Regions which are contained in the Reports of the other Regional Air Navigation Meetings listed in the Preface (page 0-5).

1.5 The following paragraphs reflect the Recommendations agreed by the Middle East/South East Asia Regional Air Navigation Meeting (1968) that require action by States.

2. AERODROMES REQUIRED FOR INTERNATIONAL AVIATION (Table AGA 1)

2.1 Physical Characteristics

2.1.1 The requirements indicated in Table AGA 1 constitute the plan for the physical characteristics of aerodromes and alternate aerodromes required for international scheduled air transport, non-scheduled air transport and general aviation operations -
MID/SEA (1968), REC 5/6.

2.1.2 Where the existing aerodrome characteristics exceed international requirements, States should ensure that the full characteristics are maintained -
MID/SEA (1968), REC 5/1.

2.2 Planning and Development

2.2.1 After making a careful assessment of the long term future requirements of aerodromes, States should arrange to take the necessary steps through the acquisition of land, city planning and zoning, etc., to safeguard the future operation of the aerodromes and to provide for foreseeable needs -
MID/SEA (1968), REC 5/3.

2.2.2 The runway length and pavement strength figures in Table AGA 1 should be reviewed by the competent authority in consultation with the operators concerned when making plans for aerodrome development -
MID/SEA (1968), REC 5/4.

2.2.3 The efficiency of taxiway systems at busy aerodromes should be reviewed to ensure that the optimum runway capacity is obtained -
MID/SEA (1968), REC 5/2.

2.2.4 The adequacy of terminal buildings and associated facilities should be examined with a view to the accommodation of anticipated increases in passenger and freight arising from more frequent operations and/or the introduction of high capacity aeroplanes -
MID/SEA (1968), REC 5/5.

2.3 Application

The improvements that are required for both increases in runway length and pavement strength should be effected not later than the dates assigned in Table AGA 1 in accordance with the priorities shown in Appendix A to Part 20 of the Middle East/South East Asia RAN Meeting Report (Doc 8801-MID/SEA (1968)) -
MID/SEA (1968), REC 20/14.

2.4 Maintenance of Aerodromes

2.4.1 Consideration should be given to the establishment of preventive maintenance programmes and to provide adequately trained personnel to ensure that aerodrome facilities are maintained in their proper condition -
MID/SEA (1968), REC 7/9.

2.4.2 At aerodromes where animals or people stray onto the aerodrome, suitable fencir should be installed and maintained -
MID/SEA (1968), REC 7/8.

2.4.3 When work is being done on the strip or when temporary hazards exist, an endeavour should be made to follow the guidance material in Part 3, Third Edition of the Aerodrome Manual -
MID/SEA (1968), REC 7/10.

2.4.4 States which experience heavy rainfall should use advanced techniques for improving the drainage characteristics of runways and increasing braking action -
MID/SEA (1968), REC 7/11.

2.5 Visual Aids

2.5.1 The requirements indicated in Table AGA 1 constitute the plan for visual ground aids for aerodromes serving international aviation -
MID/SEA (1968), REC 6/4.

2.5.2 Where existing visual aids at aerodromes exceed international requirements, States should continue to maintain these aids -
MID/SEA (1968), REC 6/3.

2.5.3 VOR checkpoint markings should be provided on all aerodromes where such points are established -
MID/SEA (1968), REC 6/1.

2.5.4 Suitable apron guidance should be provided to assist aircraft manoeuvring on the apron, particularly at locations where turbine-engined aircraft operations are planned -
MID/SEA (1968), REC 6/2.

2.6 Application

The required visual aids should be provided not later than the dates assigned in Table AGA 1 in accordance with the priorities shown in Appendix B to Part 20 of the Middle East/South East Asia RAN Meeting Report (Doc 8801-MID/SEA (1968)) -
MID/SEA (1968), REC 20/15.

3. CRASH FIRE AND RESCUE EQUIPMENT AT AERODROMES

3.1 Application of the guidance material in Annex 14 on rescue and fire fighting services should be continued in determining the scale of protection and equipment to be provided at aerodromes -
MID/SEA (1968), REC 7/1.

3.2 An immediate endeavour should be made to plan for rescue and fire fighting services to meet the needs of new high capacity and supersonic aircraft where so indicated in Table AGA 1 -
MID/SEA (1968), REC 7/2.

3.3 Consideration should be given to the provision of launches or other appropriate vessels or amphibious vehicles suitable for rescue purposes, together with adequately trained personnel at all aerodromes having over-water approaches or take-offs.

3.4 The following guidance material on provision of water rescue service should be used for all aerodromes specified in paragraph 3.3:

1) Water rescue capability should be provided as part of the established aerodrome rescue and fire fighting service when a significant portion of approach/departure operations is over water within a distance of 8 nautical miles from the runway end.

2) Boats* provided for water rescue service should:

   a) have the capability for shallow water operation;

   b) be designed to suit local area conditions;

   c) be located on the aerodrome when the aerodrome borders the water; or if located off the aerodrome preferably be under the control of the aerodrome rescue and fire fighting service;

   d) in any case be located so as to give minimum access time to the area to be covered by the service;

   e) be equipped with 2-way radio communication, life rafts and life preservers related to the requirements of the critical aircraft; and

   f) have as high a speed as practicable.

3) Personnel provided should be adequately trained and drilled for water rescue service.

*Note: Though boats are the normal rescue vessel, the requirement could be met by helicopter or air-cushion vehicle, etc. -
MID/SEA (1968), REC 7/3.

4. BIRD HAZARD REDUCTION

4.1 Employment of Ornithologists

States with aerodromes where there is bird hazard problem should engage an ornithologist to investigate the need for bird hazard reduction services at aerodromes and where appropriate, prepare recommendations for overcoming the hazard -
MID/SEA (1968), REC 7/7.

CITY/AERODROME USE COORDINATES ° ' "	ALTERNATE AERODROMES or CITIES FOR WHICH AERODROME IS AN ALTERNATE	ELEV.m / TEMP C	RUNWAY PHYSICAL CHARACTERISTICS				
			NR / TYPE	SLOPE %	AIRCRAFT LENGTH m	CL	AIRCRAFT PAVEMENT STRENGTH 1000 kg
1	2	3	4	5	6	7	8
YEMEN ARAB REPUBLIC							
HODEIDAH/Hodeidah	ADEN/Intl TAIZ/Taiz	11 / 37	04/22 N-INSTR		Comet 4C 3000	B	Comet 4C AUW 85
REG - S							
1445N 4259E			04/22		3000		AUW 39
SANA'A/Sana'a	ADEN/Intl HODEIDAH/Hodeidah	2200 / 22	18/36		B707-320B 3250	C	B707-320B AUW 119
REG - S							
1531N 4411E			18/36	0.5	3250		LCN 55
TAIZ/Taiz	ADEN/Intl HODEIDAH/Hodeidah	1200 / 29	13/31 N-INSTR		DC3 1220	C	DC3 AUW 12
REG - S							
1335N 4402E			13/31		1200		

RADIO AIDS				LIGHTING AIDS										MARKING AIDS								REMARKS
ILS	DME	VOR	L	PA	SA	VA	AV	R	C	TD	TX	B	O	D	C	T	TD	S	FD	TX	O	
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
														0	0	0			0	0	0	
														✗	✗	✗			✗	✗	✗	✗ P 2/73
						0		0			0	0	0	0	0	0				0		
						✗		✗			✗	✗	✗	✗	✗	✗				✗		CWY 18-200,36-1000 ✗ X -/73
														0	0	0				0	0	
														ø	ø	ø				ø	ø	ø P Nil Replaced by - Remplacé par - Reemplazado por: TAIZ/Ganad *DC3 acceptable - aceptable Closed to civil air traffic, replaced by - Fermé à l'aviation civile, remplacé par - Cerrado al tráfico aéreo civil, reemplazado por: TAIZ/Ganad

TABLE COM 2 - AERONAUTICAL MOBILE SERVICE

TABLEAU COM 2 - SERVICE MOBILE AERONAUTIQUE

TABLA COM 2 - SERVICIO MOVIL AERONAUTICO

EXPLANATION OF TABLE

Column

1 Name of Station.

2 Functions for which frequencies are required, using abbreviations and identifiers as listed in the "Explanation of functions and symbols" below.

3 Total number of channels required for stated function or combination of functions.

4 The area or distance within which each required channel is to be used. the sector to be served covers an area of 90 degrees centred on the direction given (e.g. E, W, NW, etc.).

5 Recommended radio frequency of facility for
6 the function(s) shown in Column 2 arranged
7 by protection height as follows:
&
8

Column 5: up to 1,200m/4,000 ft (S/T)
Column 6: up to 3,050m/10,000 ft (I)
Column 7: up to 7,600m/25,000 ft (L)
Column 8: up to 13,700m/45,000 ft; for SST up to 19,800m/65,000 ft (U) [Where extended range coverage is required it is annotated ER].

9 Frequencies of facility providing HF radiotelephony en-route communications (selected from the Allotment Plan in Appendix 27 to the ITU Radio Regulations).

10 Supplementary information.

Where the service is operating on a non-recommended frequency, the existing frequency is shown in this column when it is deemed of interest to provide supplementary information, but this does not imply endorsement on the part of ICAO.

Explanation of functions and symbols.

ACC-L Area control service up to 7,600m/25,000 ft.
ACC-LU Area control service up to 13,700m/45,000 ft.
ACC-SR Area radar control service up to height indicated by L, LU or U.
ACC-U Area control service from 6,000m/20,000 ft up to 13,700m/45,000 ft.
APP-I Approach control service up to 3,050m/10,000 ft.
APP-L Approach control service up to 7,600m/25,000 ft.
APP-LU Approach control service up to 13,700m/45,000 ft.
APP-PAR T Precision approach radar service up to 1,200m/4,000 ft.
APP-SR Approach surveillance radar service up to height shown by I, L, LU or U.
APP-U Approach control service from 6,000m/20,000 ft up to 13,700m/45,000 ft.
FIS Flight information service up to height shown by I, L, LU or U.
GP General purpose communication up to height shown by I, L, LU or U.
SMC-S Aerodrome surface movement control.
TWR Aerodrome control service.
VOLMET Meteorological information for aircraft in flight.

LEGEND

Underlining has been used where the service is not implemented or when the service is provided on a non-recommended frequency.

In those cases where more than one function is combined in one ATS radio control position, the frequency concerned is listed only in that column corresponding to the highest requirements in service range and height.

The figures in parentheses after the frequencies in columns 7 and 8 relate to the area of use of the frequency concerned as shown in Charts COM 3 and 4.

In some cases the frequencies assigned to ACC are operated at locations different from the location of the ACC, either as "remote sectors" or, where the provision of direct pilot-controller communications are not yet feasible, by means of air-ground communication stations. These remote locations are shown against the frequency concerned in column 9.

LOCATION	FUNCTION	NO. OF CHANNELS	SERVICE RANGE	FREQUENCIES VHF S/T	VHF I	VHF L	VHF U	HF	REMARKS
1	2	3	4	5	6	7	8	9	10
YEMEN ARAB REPUBLIC									
HODEIDAH/Hodeidah	TWR APP-I	1 1	25 150	118.1	121.1/				/ P Nil
SANA'A	TWR SMC-S APP-I	1 1 1	25 AD 50	118.1 121.6	119.7				
TAIZ/Taiz	TWR APP-I	1 1	25 150	118.3/	124.7/			118.1	/ P 4/72 / P Rem

TABLE COM 3 - RADIONAVIGATION AIDS

TABLEAU COM 3 - AIDES RADIO A LA NAVIGATION

TABLA COM 3 - AYUDAS PARA LA RADIONAVIGATION

EXPLANATION OF TABLE

Column

1 Name of station.

2 Frequency assigned to recommended VOR. "DME" indicates that a co-located Distance Measuring Equipment, operating on the paired DME channel, is recommended.

3 Distance (in NM) and altitude (in feet) to which the signal from the facility is protected (K = thousands of feet).

4 Localizer frequency of recommended ILS.

5 Category I type ILS is indicated by "I" and Category II type ILS by "II". Under the Category is shown the runway which is or will be equipped with the ILS concerned. Indication of Category refers to the standard of performance to be achieved and maintained in accordance with ICAO Annex 10 specifications and not to the specifications of the equipment installed, which is not necessarily the same.

6 Frequency assigned to recommended non-directional radio beacon (NDB).

Column

7 Recommended rated coverage of NDB (expressed in nautical miles), underlined if existing coverage is inadequate.

Note: Rated coverage is defined as "the area surrounding an NDB within which the strength of the vertical field of the ground wave exceeds the minimum value specified for the geographical area in which the radio beacon is located".

8 Frequency assigned to recommended locator (L); recommended rated coverage 25 nautical miles.

9 Supplementary information.

Where the facility is operating on a non-recommended frequency, the existing frequency is shown in this column when it is deemed of interest to provide supplementary information, but this does not imply endorsement on the part of ICAO.

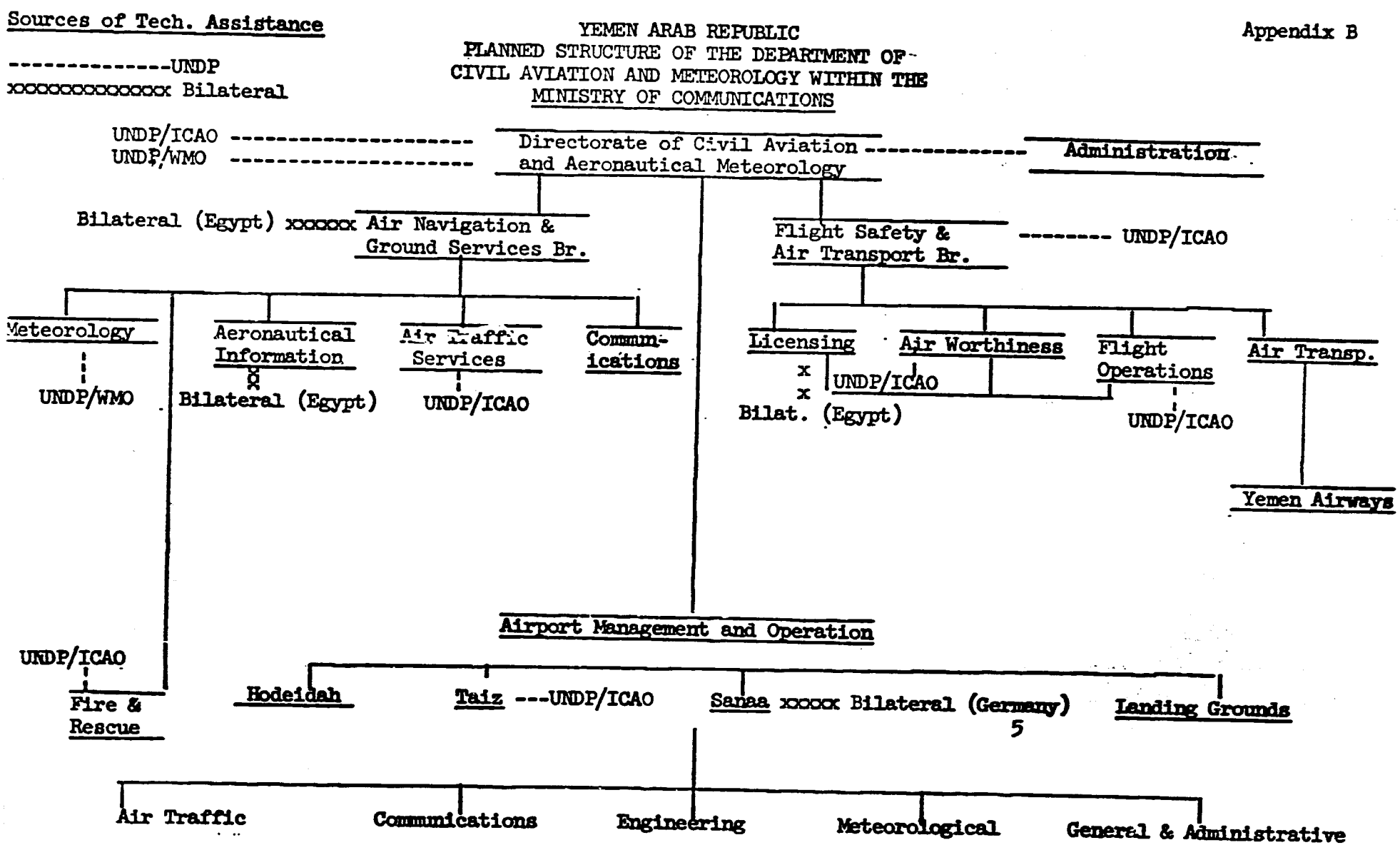
LEGEND

_____ : Indicates the facility has not been implemented.

STATION ESTACION	VOR DME		ILS		NDB		L	REMARKS OBSERVATIONS OBSERVACIONES
	MHz	COVER COUVERTURE COBERTURA	MHz	CAT. & RWY	kHz	COVER COUVERTURE COBERTURA	kHz	
1	2	3	4	5	6	7	8	9
YEMEN ARAB REPUBLIC								
HODEIDAH					575/	150		/525
SANA'A	113.1				395	150	375	*Coverage and range to be determined - Couverture & distance à être déterminées - Cobertura y distancia para ser determinadas
TAIZ					267	100		

Appendix B

YEMEN ARAB REPUBLIC
PLANNED STRUCTURE OF THE DEPARTMENT OF CIVIL AVIATION AND METEOROLOGY WITHIN THE MINISTRY OF COMMUNICATIONS



YARG Central Planning Organization
"Statistical Year Book 1972"

71. Transportation of Passengers & Cargoes by Yemen Airways 1967-1972

YEAR	CARGO IN TONS	PASSENGERS IN 000
1967	35.4	11.4
1968	174.3	24.3
1969	295.1	33.5
1970	496.1	34.8
1971 *	**298.2	41.1
1972 ***	**153.1	14.0

* Nine months only
** Cargo with excess luggage and postage
*** Three months only
Source: Yemen Airways Corporation

72. Transportion of Passengers & Cargoes by Yemen Air (1971) by month

MONTH	POSTAL (in tons)	EXCESS BAGGAGE (in tons)	CARGO (in tons)	PASSENGERS (00)	FREQUENCY OF MOVEMENT OF AIRCRAFTS
1971	3.7	67.0	247.7	964	2273
April	...	....	.....	42	105
May	...	....	.....	46	135
June	...	....	.....	54	283
July	...	9.8	28.7	53	334
August	...	11.8	45.0	64	296
Sept.	...	11.9	33.3	62	332
October	...	12.1	24.8	51	300
November	1.5	9.7	56.3	40	227
December	2.2	11.7	50.6	52	261
1972	5.1	26.9	120.1	141	719
January	2.1	9.9	48.4	54	257
February	1.4	7.2	24.2	41	227
March	1.6	9.8	47.5	46	235

Source: Yemen Airways Corporation

73. Number of Passengers Carried by Yemen Airways During June 1971 - March 1972

LINES	Mar.	Feb.	Jan.	Dec.	Nov.	Oct.	Sept.	Aug.	July	June
Taiz-Sana'a-Taiz	519	449	652	432	499	574	566	605	557	542
Taiz-Hodeidah-Taiz	15	27	22	58	32	48	32	63	93	123
Sana'a-Hodeidah-Sana'a	9	59	22	33	16	23	33	35	49	44
Sana'a-Barad-Sana'a	221	139	122	193	104	93	158	256	252	300
Sana'a-Sadaa-Sana'a	220	215	266	437	327	371	485	632	315	435
Sana'a-Aden-Sana'a	336	309	375	363	306	381	412	495	463	383
Taiz-Aden-Taiz	1381	1172	1665	1512	1217	1673	1875	1995	1558	1381
Hodeidah-Aden-Hodeidah	273	273	292	285	230	321	378	366	278	286
Taiz-Djibouti-Taiz	187	254	243	253	183	150	215	321	350	344
Sana'a-Asmara-Sana'a	91	87	107	143	44	96	119	93	68	101
Taiz-Asmara-Taiz	23	72	67	65	18	47	51	30	22	38
Hodeidah-Asmara-Hodeidah	59	44	79	56	43	68	62	160	177	91
Sana'a-Kawait-Sana'a	129	63	88	93	69	136	92	107	61	129
Taiz-Kuwait-Taiz	88	109	90	58	63	122	110	92	124	278
Sana'a-Dahran-Sana'a	---	---	---	5	89	28	48	51	6	53
Taiz-Dahran-Taiz	---	---	---	27	7	34	163	46	4	70
Taiz-Cairo-Taiz	30	139	123	47	87	113	106	161	128	157
Sana'a-Cairo-Sana'a	85	113	289	153	176	198	260	254	213	247
Sana'a-Dohra-Sana'a	43	25	42	3	---	---	---	---	---	---
Taiz-Dohra-Taiz	98	67	100	61	---	---	---	---	---	---
Hodeidah-Cairo-Hodeidah	---	---	---	--	---	---	2	1	8	---
Sana'a-Jeddah-Sana'a	207	147	307	381	195	263	434	245	267	186
Taiz-Jeddah-Taiz	541	334	418	561	317	343	512	332	226	204
Cairo-Jeddah-Cairo	---	11	3	3	2	---	36	61	38	29
TOTAL	45555	4108	5372	5222	4024	5142	6159	6401	5267	5431

74. Frequency of Yemen Airways Aircrafts Touching Airports by Governorates

Month/ Yr.	BARAT			SAADA			HODEIDAH			TAIZ			SANA'A		
	Over night Halt	Arrival from outside country	Arrival from Within	Overnight Halt	Arrival from Outside cntry	Arrival from Within	Overnight Halt	Arrival from Outside cntry	Arrival from Within	Overnight Halt	Arrival from Outside Country	Arrival from Within	Overnight Halt	Arrival from Outside Country	Arrival from Within
1971	--	--	80	--	---	133	---	207	180	1309	359	403	120	289	422
1972	--	--	24	--	---	43	1	41	32	--	482	---	57	117	406
January	--	--	4	--	---	9	---	---	---	--	106	---	18	6	41
February	--	--	4	--	---	7	1	9	9	--	90	---	4	42	19
March	--	--	4	--	---	7	---	---	---	--	79	---	13	48	30
April	--	--	4	--	---	5	---	---	---	--	92	---	12	12	45
May	--	--	4	--	---	7	---	17	13	--	115	---	4	4	35
June	--	--	4	--	---	8	---	15	10	--		---	6	5	36

Source - Yemen Airways Corp.

75. Postal Correspondence 1970 - 71
(A) Internal Mail, (Number 000)

ITEMS	1971		1970	
	FREE	PAID	FREE	PAID
Letters and Postcards	---	420.0	4.0	339.0
Newspapers and Magazines	---	29.0	---	8.0
Registered mails	---	84.0	11.0	39.0
Other items	---	.6	---	.5
TOTAL	---	533.6	15.0	386.5

Source: Ministry of Communications

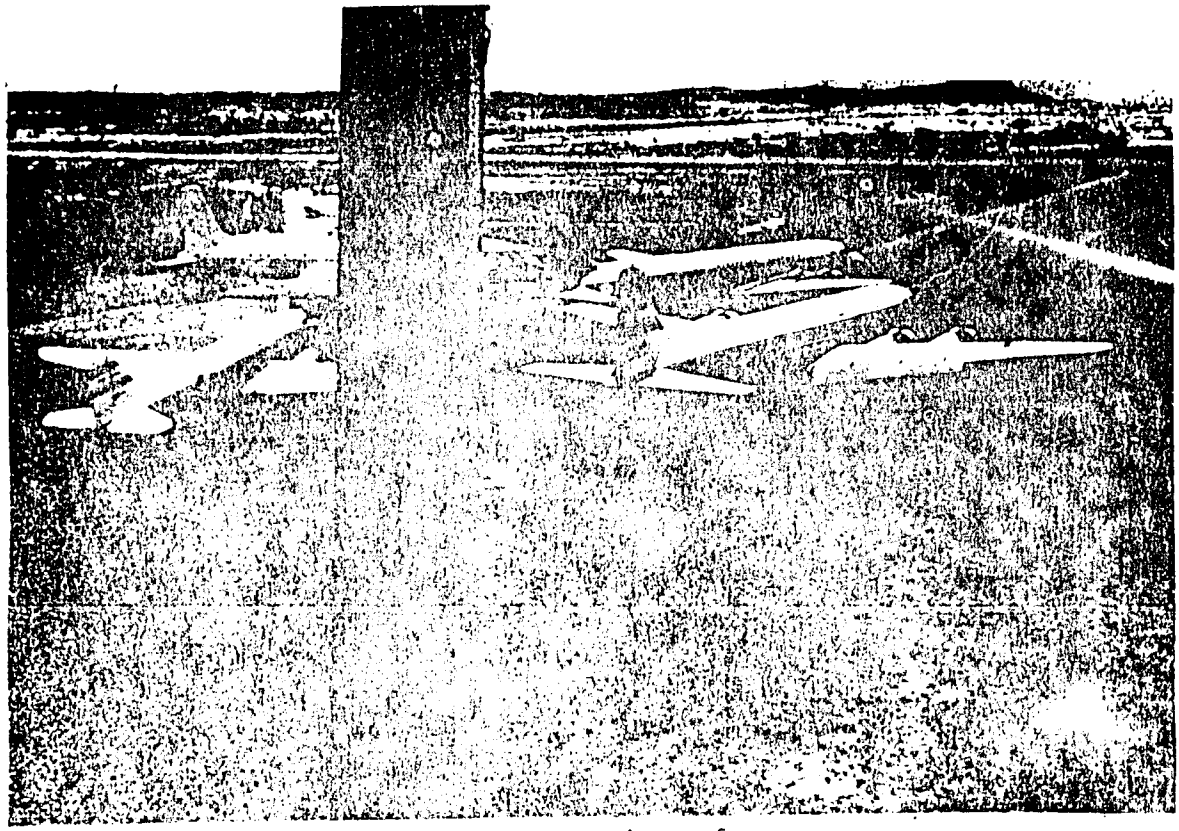
75. (B) External Mail (Number in 000)

ITEMS	1971		1970	
	Surface	Airmail	Surface	Airmail
	Dispatched			
Letters and Postcards	---	116	130	656
Newspapers and Magazines	---	27	---	29
Registered Mails	---	1311	.7	655
Other Items	---	.7	---	26
TOTAL	---	1454.7	130.7	1366
	Received			
Letters and Postcards	---	1876	201	720
Newspapers and Magazines	---	1556	---	192
Registered mails	---	2489	120	714
Other Items	---	13	---	90
TOTAL	---	5927	321	1719

Source: Ministry of Communications

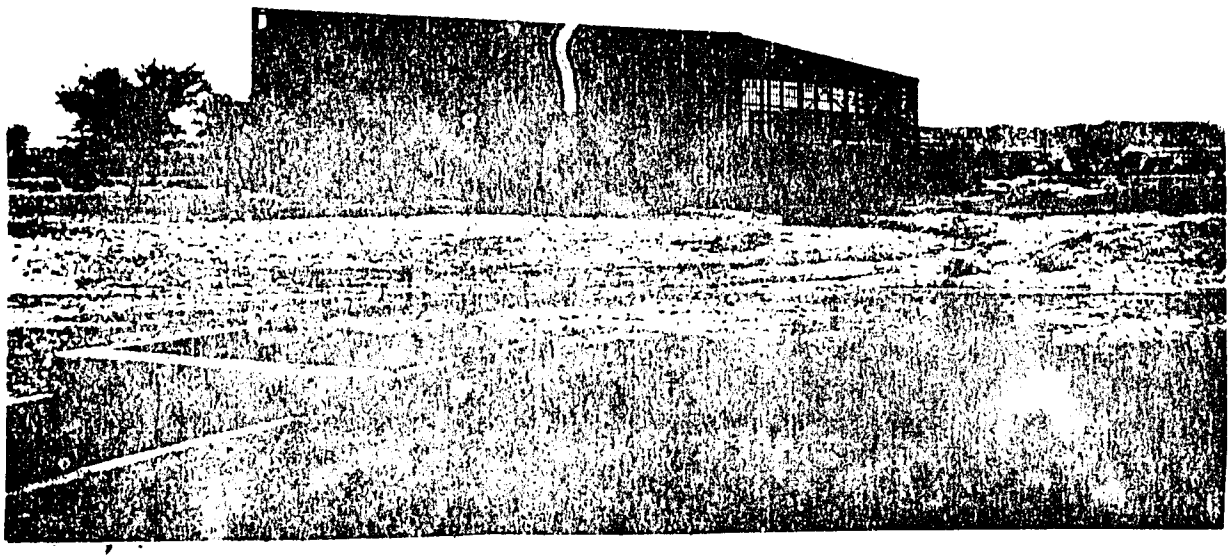
Taiz Airport, N-S runway looking South

Taiz Airport, N-S runway looking North

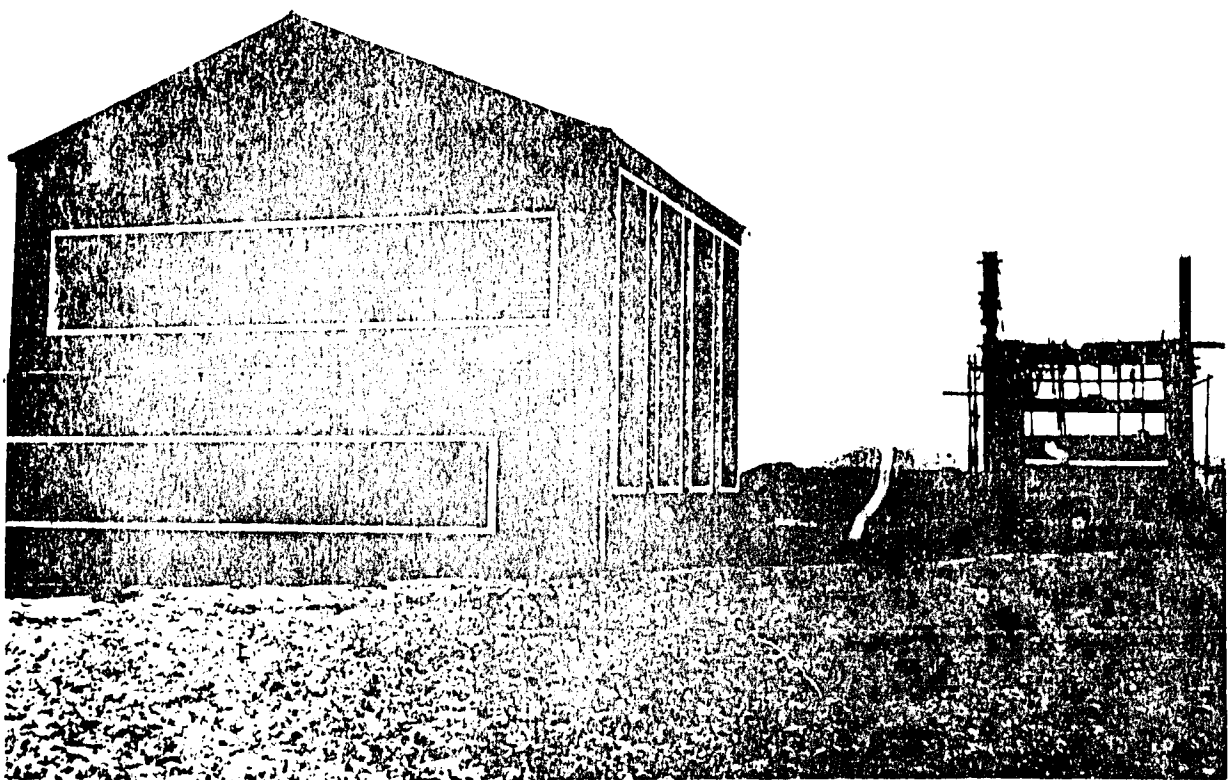


Taiz Airport, Control tower view of apron

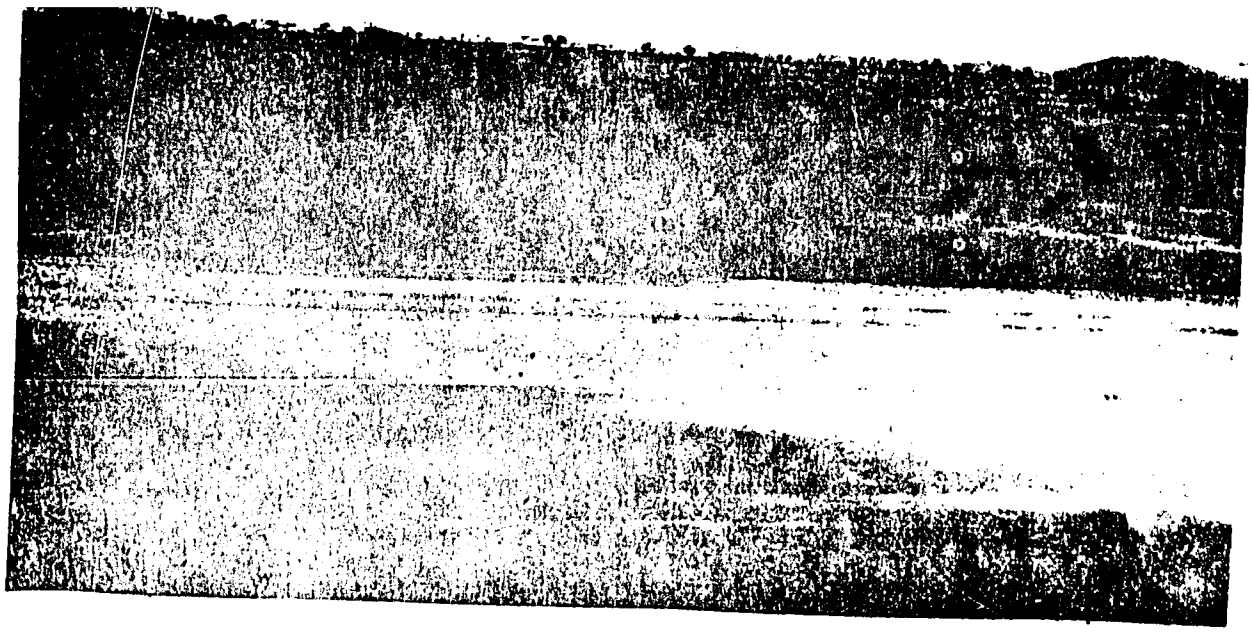
Taiz Airport, Control tower view on new cargo building



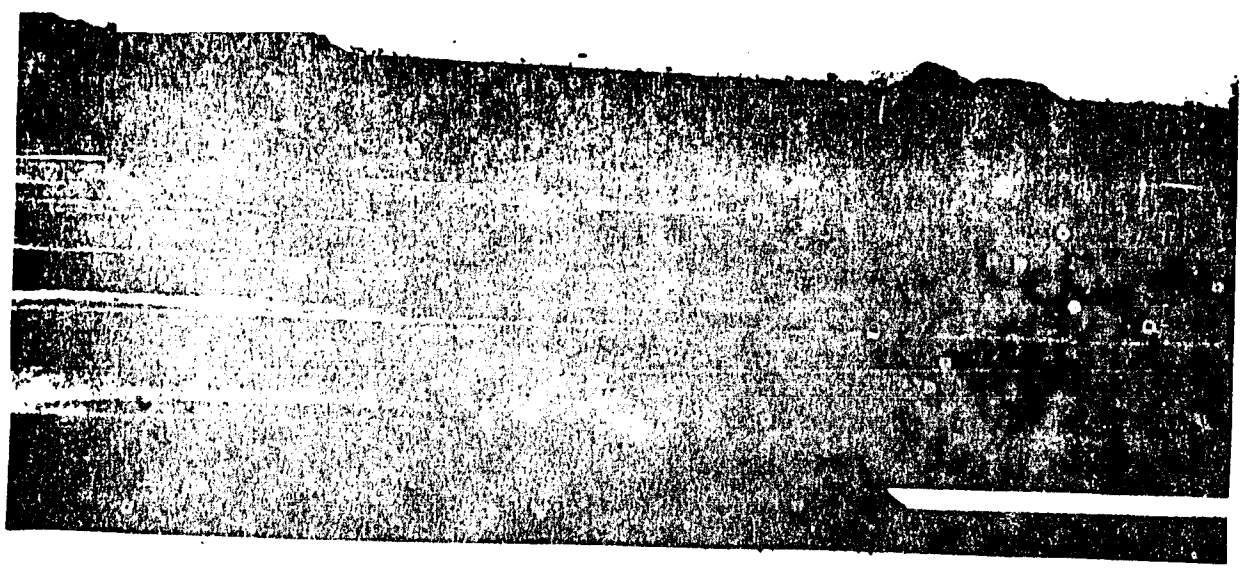
Taiz Airport, Partially complete aircraft hanger



Taiz Airport, Diesel electric generator building

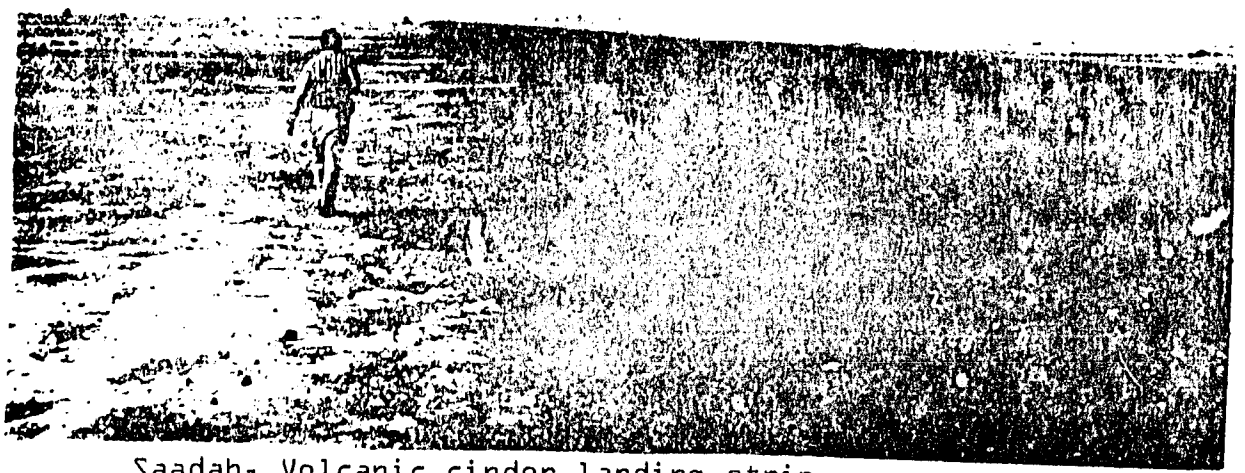


Taiz Airport, Future Instrument Runway, West Approach



Taiz Airport, Future Instrument Runway, East Approach

Ma'areb, Sand and Clay landing strip



Saadah, Volcanic cinder landing strip

Airline Flights to YARG August 1973
Source "International Edition, Official Airline Guide"

1. Sanaa:

FROM / DAY	AIRLINE	AIRCRAFT
Aden, South Yemen Sat.	YARG	DC-3
Asmara, Ethiopia Sat.	YARG	DC-3, 6
Barat, YARG Wed . Fri.	YARG	DC-3
Gizan, Saudi Arabia Sat.	Saudi	B-737
Jeddah, Saudi Arabia Mon., Wed., Sat., Sun.	Saudi	B-737
Saada, YARG Tues., Fri.	YARG	DC-3
Taiz, YARG Daily except Sat.	YARG	DC-3, 6

2. Hodeidah:

Aden, South Yemen Mon., Wed.	YARG	DC-3
Ankara, Turkey Tues.	Aeroflot	Y-18
Asmara, Ethiopia Tues.	YARG	DC-3, 6
Cairo, Egypt Wed.	Aeroflot	Y-18
Gizan, Saudi Arabia Sat.	Saudi	B-737
Jeddah, Saudi Arabia Sat.	Saudi	B-737
Mogadishu, Somali Sat.	Aeroflot	Y-18

FROM /DAY	AIRLINE	AIRCRAFT
Moscow, USSR Tues.	Aeroflot	Y-18
Taiz, YARG Tues, Mon.	YARG	DC-3,6

3. Taiz:

Aden, South Yemen Daily	YARG, Alyemda	DC-3,6
Asmara, Ethiopia Tues, Fri. Sat.	YARG, Ethiopian	DC-3, 6
Assab, Ethiopia Fri., Sun.	Ethiopian	DC-6
Djibouti, French Somali Mon., Thur., Sat. Sun.	YARG, Djibouti	DC-3
Doha, Qatar Arabia Wed.	YARG	DC-6
Hodeidah, YARG Mon. Tues.	YARG	DC-3, 6
Jeddah, Saudi Arabia Mon. Thurs.	YARG	DC-6
Kuwait, Kuwait Wed.	YARG	DC-6
Saudi, YARG Daily except Fri.	YARG	DC-3, 6

APPENDIX F

A detailed listing of air navigational, communications, meteorological, electrical power generating and test equipment recommended for each airport in the YAR, follows:

1. Air Navigational Aids
   a. Sana'a. VOR/DME (VOR, 50w, being installed under FRG loan and DME is under consideration)
      NDB (FRG loan program placing two NDB's permitting dual ADF approaches)
      VHF/DF (Being installed under FRG loan program)
      VASI (" " " " " ")

   b. Taiz. VOR/DME
      NDB, with antenna system
      VASI-4

   c. Hodeida. VOR/DME
      NDB, with antenna system
      VASI-4

   d. Barat. NDB, with antenna system

   e. Saadah. NDB, with antenna system

   f. Al Beida. NDB, with antenna system

   g. Ma'areb. NDB, with antenna system

2. VHF Air/Ground Communications
   a. Sana'a. Requirements being met by FRG loan program

   b. Taiz. 2 ea. VHF Transmitter, 50watt (1 main, 1 standby)
      2 ea. VHF Receiver, (1 main, 1 standby)
      2 ea. Antenna, VHF, omnidirectional, (1 transmit, 1 receive)
      2 ea. Microphone. (1 for spare)
      1 ea. Loudspeaker

   c. Hodeida. 2 ea. VHF Transmitter, 50 watt, (1 main, 1 standby)
      2 ea. VHF Receiver, (" " " ")
      2 ea. Antenna, VHF, omnidirectional. (1 transmit, 1 receive)
      2 ea. Microphone (1 for spare)
      1 ea. Loudspeaker

   d. Barat. 1 ea. VHF Transmitter, 50 watt
      1 ea. VHF Receiver
      2 ea. Antenna, VHF, omnidirectional (1 transmit, 1 receive)#
      1 ea. Microphone
      1 ea. Loudspeaker

   e. Saadah. same as Barat

f. Al Beida. Same as Barat.

g. Ma'areb. Same as Barat. # one antenna will suffice if an antenna transfer relay is used. Separate antennas are recommended to eliminate the potentially troublesome coaxial relay.

3. Point-to-Point Communications

a. Sana'a. Equipment needed for establishing necessary international service is being provided under the FRG loan program.
1 ea. Transmitter, HF, SSB, 500W (for domestic circuit)
1 ea. Receiver, HF, SSB, (" " ")
1 ea. Antenna system

b. Taiz. 1 ea. Transmitter, HF, SSB, 500W, 4-6 channel, crystal controlled
3 ea. Receiver, HF, SSB. (1 for Aden, 1 for Asmara, 1 for domestic)
1 ea. Antenna system, with multicoupler and antenna switch
1 ea. Microphone
3 ea. Loudspeakers

c. Hodeida. 1 ea. Transmitter, HF, SSB, 500W, 4-6 channel, crystal controlled
1 ea. Receiver, HF, SSB
1 ea. Antenna System
1 ea. Microphone
1 ea. Loudspeaker

d. Barat. Same as for Hodeida

e. Saadah. Same as for Hodeida

f. Al Beida. Same as for Hodeida

g. Ma'areb. " " " "

4. Meteorological Instruments

a. Sana'a. Necessary instruments and equipment being provided under FRG loan

b. Taiz. 1 ea. Barometer (atmospheric pressure measuring instrument)
1 ea. Wind indication system (wind direction and velocity)
1 ea. Thermometer, centigrade

c. Hodeida. Same as for Taiz

d. Barat. 1 ea. Wind indication system (Wind direction and velocity)
1 ea. Thermometer, centigrade

e. Saadah. Same as for Barat

f. Al Beida. Same as for Barat

g. Ma'areb. Same as for Barat

5. Test Equipment and Tools

a. Sana'a. Adequate test equipment and tools being provided under FRG loan.

b. Taiz.
- 2 ea. Volt-ohm- milliameter
- 1 ea. Tube checker
- 1 ea. Audio Oscillator
- 1 ea. Frequency Meter, HF/VHF
- 1 ea. Megger
- 1 ea. Ammeter, clamp-on
- 1 set. Hand tools

c. Hodeida.
- 2 ea. Volt-ohm-milliameter
- 1 ea. Tube checker
- 1 ea. Signal generator, Rf, HF/VHF
- 1 ea. Audio Oscillator
- 1 ea. Frequency meter, HF/VHF
- 1 ea. Oscilloscope
- 1 ea. Megger
- 1 ea. Ammeter, Clamp-on
- 1 set Tools Hand

d. Barat.
- 1 ea. Volt-ohm-ammeter
- 1 ea. Tube checker
- 1 ea. Signal generator RF, HF/VHF
- 1 ea. Audio Oscillator
- 1 ea. Frequency Meter, HF/VHF
- 1 set Hand Tools

e. Saadah. Same as for Barat

f. Al Beida. Same as for Barat

g. Ma'areb. Same as for Barat

The above lists only the minimum requirement of test equipment and, takes into consideration that presently at Taiz. In addition to the above, determination should be made of test equipment needed for properly maintaining diesel driven engine-generator equipment.

6. Electrical Power Equipment

a. Sana'a . Adequate equipment being provided under FRG loan project.

b. Taiz. 1 ea. 100KVA engine-generator, diesel, 400-230V, 30-4W, 50HZ
1 ea. Power distribution system from power house to terminal building and to various air navigational aid facilities. Preferably an underground cable with required associated transformers.

c. Hodeida. The need for engine-generator(s) for emergency stand-by power should be determined.

d. Barat. 1 ea. Engine-generator, 240/120W, 10, 50hz, est. 5KW. (Size dependent upon electronics equipment installed this location. Allowance should be made for about 1.5KW for building and operation of test equipment)

e. Saadah. Same as for Barat

f. Al Beida. Same as for Barat

g. Ma'areb. Same as for Barat

For Taiz the engine-generator listed above is additional to, and equal to, the 100KVA unit presently installed at Taiz airport. Upon installation of a second 100KVA unit, the 20KVA unit presently installed can be removed for use at some other location.

Also, at Taiz, two 860KVA engine-generators now incompletely installed and not operating should be made available for other use, or disposition as determined most advantageous to the YARG.