KINGDOM OF MOROCCO

FEASIBILITY STUDY REPORT

ON

THE NADOR NEW AIRPORT CONSTRUCTION PROJECT

MAIN REPORT

May 1984

Japan International Cooperation Agency

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P R E F A C E

In response to the request of the Government of the Kingdom of Morocco, the Government of Japan decided to conduct a feasibility study on the Nador New Airport Construction Project and entrusted the study to the Japan International Cooperation Agency (JICA).

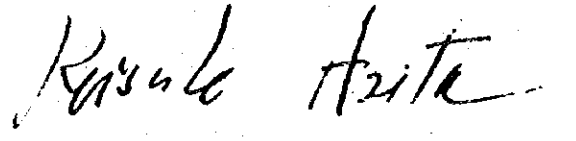
JICA sent to Morocco a study team headed by Mr. Hisaaki HATA, Nippon Koei Co., Ltd. in November 1983, under the guidance of the Supervisory Committee chaired by Mr. Yoshimori YASUDA, Director of the Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport of Japan.

The team conducted a field survey in Morocco and held discussions with the officials concerned of the Government of Morocco on the Project. Subsequently, further analyses were made in Japan and the present report has been prepared.

I hope that this report will serve for the development of the Project, and also contribute to the promotion of friendly relations between our two countries.

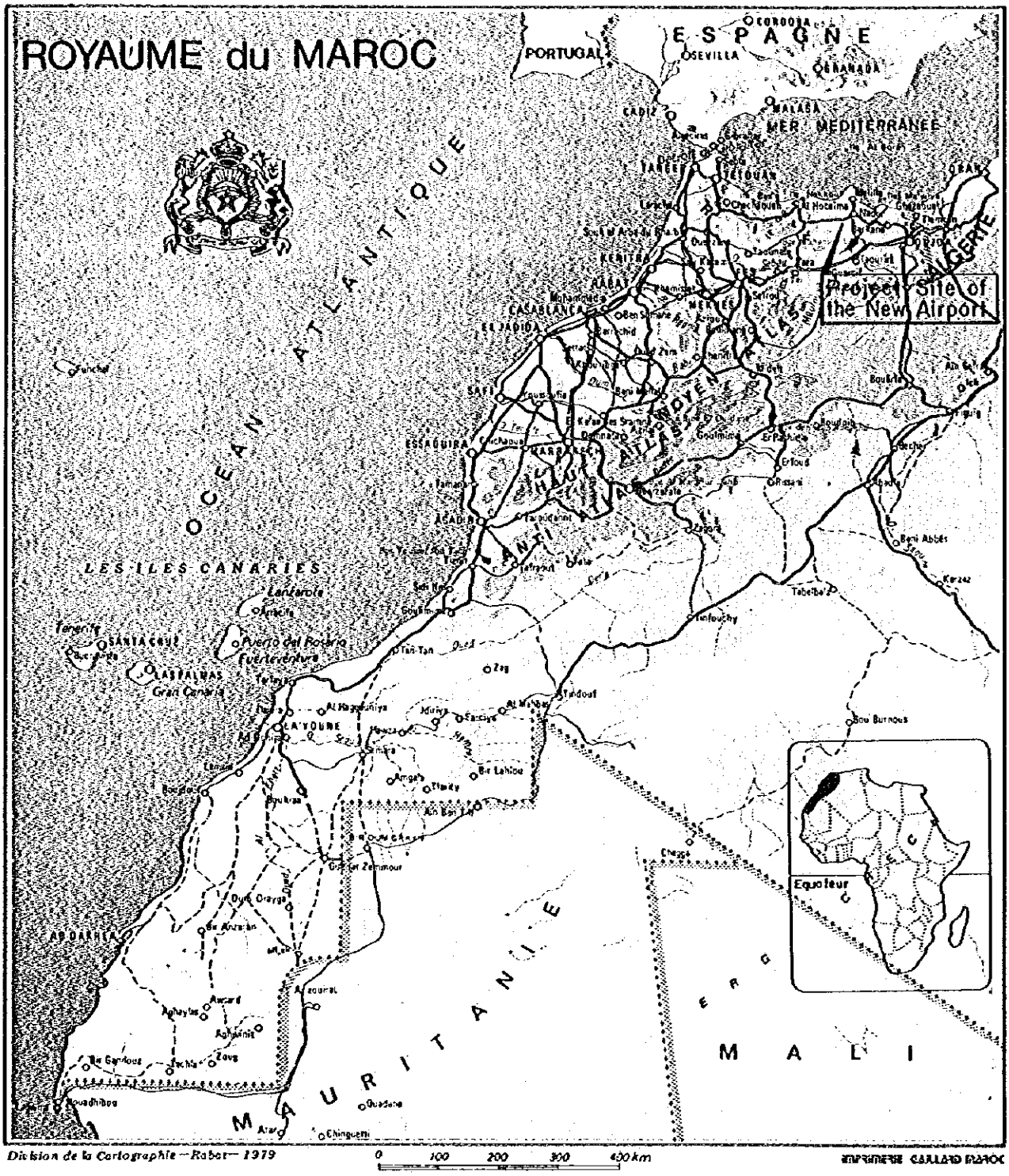
I wish to express my heartfelt appreciation to the officials concerned of the Government of the Kingdom of Morocco for their close cooperation extended to the team.

Tokyo, May 1984

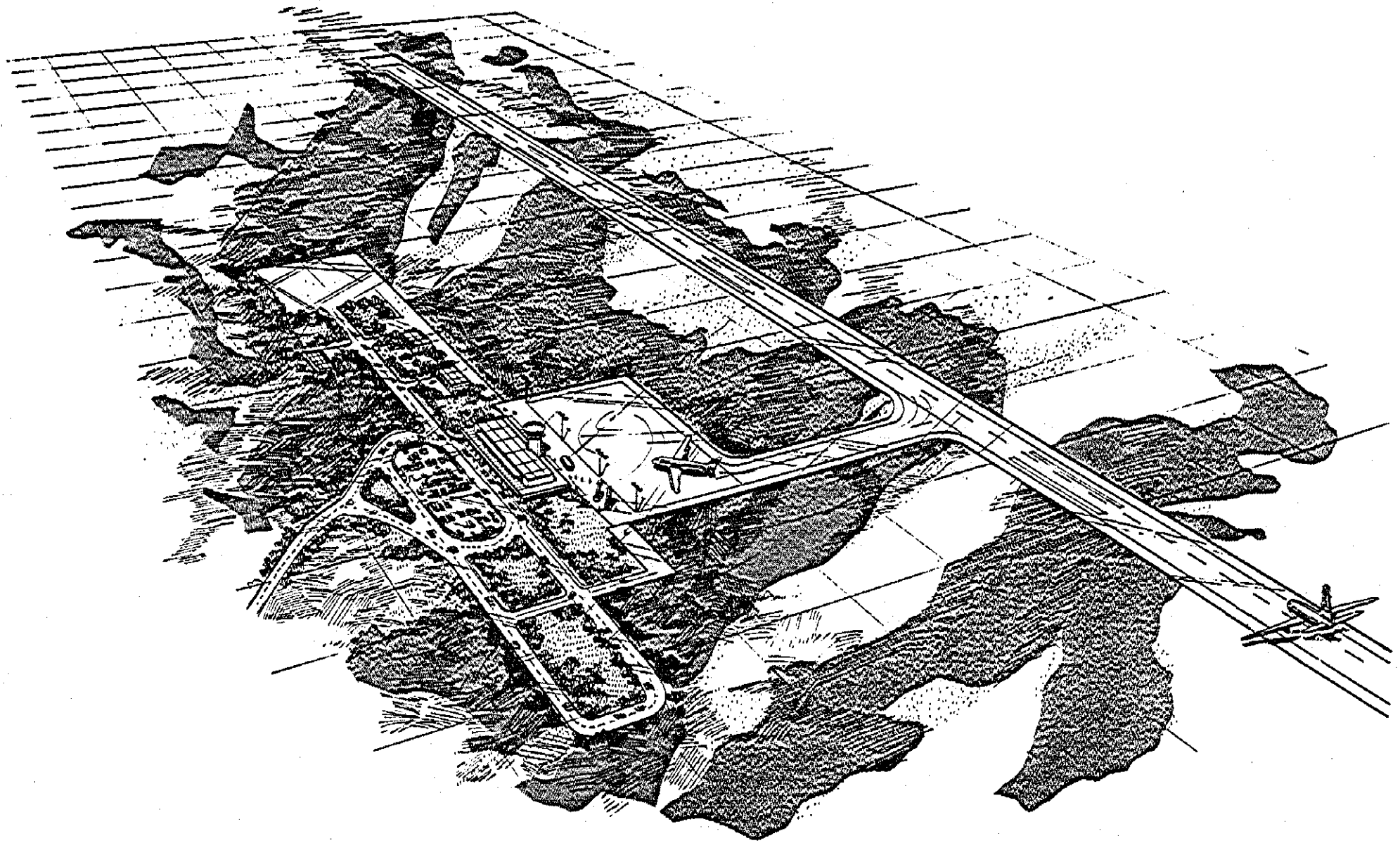


Keisuke ARITA
President
Japan International Cooperation Agency

LOCATION MAP

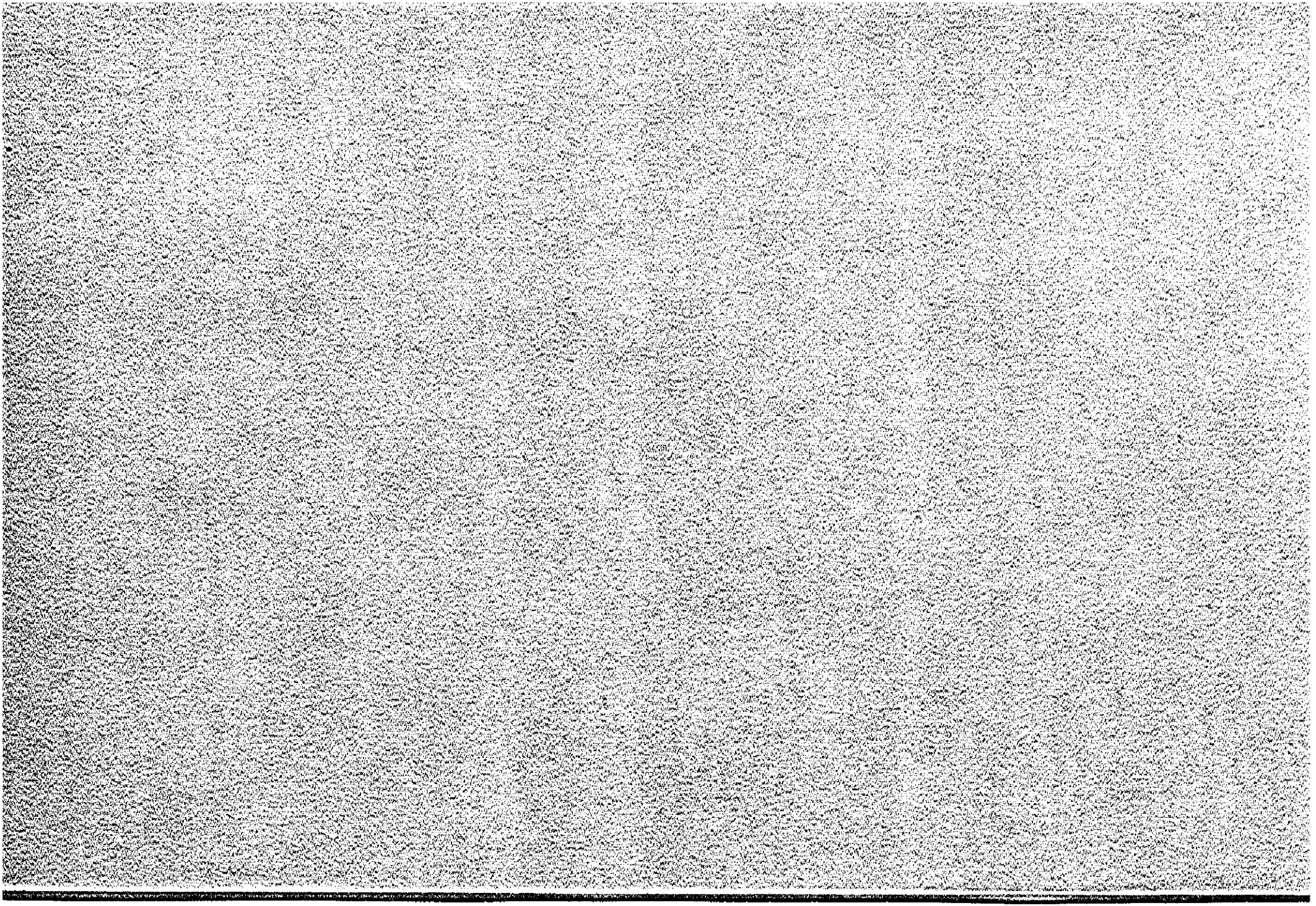


Source : The Ministry of Transport, Kingdom of Morocco



PERSPECTIVE VIEW OF THE NADOR NEW AIRPORT

SUMMARY AND CONCLUSION



SUMMARY AND CONCLUSION

SUMMARY

1. Introduction

The needs for a new airport at Nador have been felt for many years. The inconveniences caused to travellers in and out of Nador, who are forced to use either Oujda-Angads or Al Hoceima Airports have impaired the social and economic activities in the Region. To remedy this situation, the Government of the Kingdom of Morocco requested the Government of Japan in 1982 to provide necessary assistance in undertaking a feasibility study for the construction of a new airport at Nador. Complying with this request, the Japanese Government appointed the Japan International Cooperation Agency (JICA) for the execution of the feasibility study.

The primary purpose of the present Feasibility Study is to make a comprehensive evaluation of the Nador New Airport Construction Project (the Project) from the technical, financial and economic points of view.

2. The Study

Under an agreement signed in April 1983, JICA dispatched a Study Team to Morocco in November of the same year. The field investigation lasted two (2) months from November 1983 to January 1984. An Interim Report was submitted to the Government of Morocco at the end of the field survey. Further studies were made in Japan on the basis of obtained information and data, and from the results of the field survey.

A draft Final Report incorporating the results of studies, outlining the concept and schedule of construction as well as analysing the financial and economic aspects of the Project was submitted to the Moroccan Government in late March 1984. Based on the comments by authority concerned of Morocco on the above report and subsequent detailed discussions in Japan with its representative, this Feasibility Study Report was finalised in line with the conclusions agreed upon by both Japanese and Moroccan parties involved.

3. The Background

Morocco with an area of 710,850 km^2 is located on the north western tip of the African Continent. Its population is about 20.5 million with an annual growth rate of 2.6%. About 57% of the population live in rural areas. The Gross Domestic Product (GDP) of Morocco in 1981 was DH77.5 billion or about US$12.5 billion. The per capita GDP is about US$630.

The Oriental Region in the eastern part of Morocco comprises the three (3) Provinces of Nador, Oujda and Figuig. The population of Nador Province was about 593,000 in 1982. Nador City, the provincial capital has a population of about 62,000. There are a commercial port and an industrial complex under construction. An ironworks complex will start operation this year. The main activities involve agricultural production which absorbs about 38% of the active population.

The proposed Nador New Airport is located some 26 km south-east of Nador City along Route P39 between Selouane and Tistoutine.

4. Air Traffic Projection

Air traffic demands have a close relationship with the level of economic activities. The growth of Morocco's GDP is estimated to be 4.5% per year on an average until the year 2000. As the economic activities of the country intensify and the individual income rises, so does the time value of Moroccans. More economic and cultural interchanges will occur. The emphasis, in the current Five-Year Development Plan, was placed on the development of the Oriental Region in which Nador Province is called to play an important role, and all these factors put together will create new demands of air traffic for the new airport.

Taking all the factors involved into account, the forecast of air traffic volumes by assumed air route for the Nador New Airport was made by means of a statistical procedure employing correlation between forecast of air passengers by airport and GDP, assumed increase rate of air passengers etc. The target year was fixed to be the year 2000.

It is calculated that by the year 2000, the air traffic demand of the Nador New Airport will reach between 380,000 and 510,000 passengers. The handling volume of air cargo is estimated to be 835 tons in 2000 and to increase up to 2,116 tons by the year 2015.

5. The Requirements

The facilities required for the new airport were planned to conform to ICAO's and FAA's Standards and Recommended Practices for Aerodromes. The new airport is categorized in Code Number 4 and Code Letter D and E specified in ICAO ANNEX 14. The runway is planned for servicing A type aircraft.

The length of the runway has been determined at 2,700 metres to meet the operational requirements of B-727-200 type aircraft. The width of the runway strip is 300 metres as usually applied for precision approach runway of category I. The taxiway is to be constructed at a right angle with the center line of the runway. Its width will be 30 metres. Turning-pads are to be provided at both ends of the runway. The apron for nose-in and self maneuvering-out of aircraft movement will be 210 metres wide to accommodate simultaneously three (3) aircraft.

The passenger terminal building is designed for use as both domestic and international terminal. Its floor space will be 4,800 m^2 on the estimate of 250 PAX/hour at peak hour. The ground handling and parking of aircraft in the apron will be of linear-stand type. Handling of incoming and departing passengers will be made on the ground floor level.

The terminal building will be a two-storied building. The first floor will accommodate administration offices, the control tower and the meteorological and telecommunication facilities (1,200 m^2).

An access road will connect National Road P39 to the terminal and parking area. The parking area will be 7,200 m^2 with a parking capacity for 205 vehicles.

The airfield lighting system will be provided in accordance with the specifications in ICAO ANNEX 14 for precision approach runway of category I.

Rescue and fire fighting vehicles will be provided in conformity with the requirements of Category 7 of ICAO Recommendations.

Features of the required facilities of the Nador New Airport are outlined hereunder:

- Runway Strip	2,820 m x 300 m
- Runway Orientation	2,700 m x 45 m N 78° 16'E
- Taxiway	227 m x 30 m (Exit Taxiway)
- Apron	23,100 m^2 (3 berths)
- Terminal Building	6,000 m^2
- Parking area	7,200 m^2 (205 cars)
- Others	Rescue & Fire-fighting, Service Utilities, etc.

6. Airport Facilities

The airport terminal will be provided with all the facilities as mentioned previously and other amenities as required for an international airport. The runway orientation of N 78° E was set from topographical and meteorological conditions. The apron and terminal areas are located to the north of the runway.

The approach lighting system (ALS) will be installed for Runway 08, and a simplified approach lighting system (SALS) for Runway 26. Main navigation aids such as GP, MM, OM will be provided for Runway 08, and NDB LLZ, for Runway 26. VOR/DME will be provided on the south for security and convenience of maintenance of the facilities.

Power supply will come from the existing 30 kV transmission line. An independent 400 kV generating plant will be installed for emergency use. A water tank with pumping system will be employed for water supply. A sewage treatment plant will be installed.

Radio navigational aids, communication and meteorological facilities will be provided as shown below.

Facilities & Equipment	Number
- ILS (LLZ.BP.OM.MM)	1 set
- VOR/DME	1 set
- NDB	1 set
- VHF Transmitter and Receiver	3 sets
- Direct Hot Line System	1 set
- Teletype (NOTAM & Weather Data)	2 sets
- RVR (Runway Visual Range)	1 set
- Meteorological Observation Equipment	1 set
- Facsimile Receiver	2 sets

7. Flight Operations

Based on the computer analysis of the results of test made by the ICAO CRM (Collision Risk Model), it was determined to set the ILS for the approach procedures for Runway 08, which is considered as the main runway of the Nador New Airport. Two types of initial approach procedures were designed for the VOR/DME-ILS approach. One is the DME-ARCS and the other is the BASE TURN in the initial approach segment. The disadvantage of the latter is that BASE TURN has a longer final segment. In case where VOR/DME is out of service or for aircraft without VOR/DME, then the NDB-ILS approach procedures will be applied.

Regarding Runway 26, the VOR/DME approach procedures will be applied. In the final approach, both VOR and DME will be used in order to maintain necessary clearance from the east side obstacles. When VOR/DME is out of service or when no VOR/DME receivers are installed in aircraft, the NDB approach procedures will be applied. NDB location shall be so determined as to avoid falling within the range of action of the existing radio broadcasting tower.

8. Environmental Aspects

No serious problem is anticipated with regard to the environment due to the presence of the new airport. Considering its location, 26 km from Nador City, and with no agglomeration nearby, except for the villages of Djebel El Arouit and Tistoutine some 3 km and 10 km away respectively, nuisance from aircraft noise will cause no major problem.

As sewage water will be treated by the sewage treatment plant, there will be no water pollution. The number of aircraft likely to use the airport is somewhat limited and will not cause major air pollution.

As to the ecological problem, no particular species of fauna or flora exist in the area as to cause worries.

9. Construction Schedule and Cost Estimate

No major problems are anticipated in the construction works and access to the site. The initial construction works are scheduled to take three (3) years and extension works of the terminal building and car parking area will be carried out in two (2) years, the 14th and 15th years from the commencement of the project construction.

Total cost of construction inclusive of extension works is estimated at about US$27.5 million consisting of US$18.3 million in foreign currency and US$9.2 million equivalent in local currency.

Conversion rate between US Dollar, Dirham and Yen was based on the exchange rates of US$1.00 = DH8.06 = ¥235 as of mid January 1984 .

10. Financial Analysis

The financial analysis made by means of calculating the cash-flow of financial costs and benefits of the Project resulted in a Financial Internal Rate of Return (FIRR) of 2.1%. This value is considered as normal in usual cases of such public undertakings which are similar in scale and nature to the Nador New Airport Project.

A sensitivity analysis of the Project's FIRR under certain alternative assumptions has resulted in the following values:

Variation		Project Cost -10%	±0%	+10%
FIRR Value in case of:				
- Present tariff	± 0%	3.9%	2.1%	0.5%
- - " -	+10%	5.7%	3.8%	2.1%
- - " -	+20%	7.4%	5.3%	3.6%

11. Economic Evaluation

The Economic Internal Rate of Return (EIRR) obtained from the cost-benefit analysis based on the calculation of project economic costs and direct tangible economic benefits is 22.2% in case of middle traffic forecast. It is judged from this value that the Nador New Airport Project is economically viable as far as the general Moroccan economy is concerned.

The sensitivity analysis shows the following EIRR values:

Variation		Project Cost -10%	±0%	+10%
EIRR Value	High traffic forecast	27.1%	25.7%	24.4%
	Middle traffic forecast	23.4%	22.2%	21.1%
	Low traffic forecast	20.1%	19.0%	18.0%

12. Organization and Administration

It is recommended to set up a project office consisting of representatives of the Administration of Air Bureau and of the Regional Office of the Ministry of Transport for the implementation of the Project. After the completion of the new airport, it is recommended to establish a separate administrative organization for effective management and operation of the airport.

CONCLUSION

As a result of the studies of technical, financial and economic feasibilities of the Nador New Airport Construction Project, the follow- ing conclusions have been reached:

1. For the implementation of the Project, no substantial technical difficulty is expected.

2. On the financial standpoint, the Project will yield a profitability not so high according to the calculation of financial internal rate of return (FIRR). This is, however, the usual case of most of airport construction projects around the world.

3. An economic internal rate of return (EIRR) of 22.2% has resulted from the economic cost-benefit analysis. It is, therefore, concluded that the Project is economically feasible from the national economic point of view.

4. In line with the national policy to reduce the regional disparities and in view of the favorable location of Nador City and its vicinity as one of the most promising development center of the Region, the construction of the new airport at Nador is indispensable and will undoubtedly contribute to the socio-economic development of the Region.

TABLE OF CONTENTS

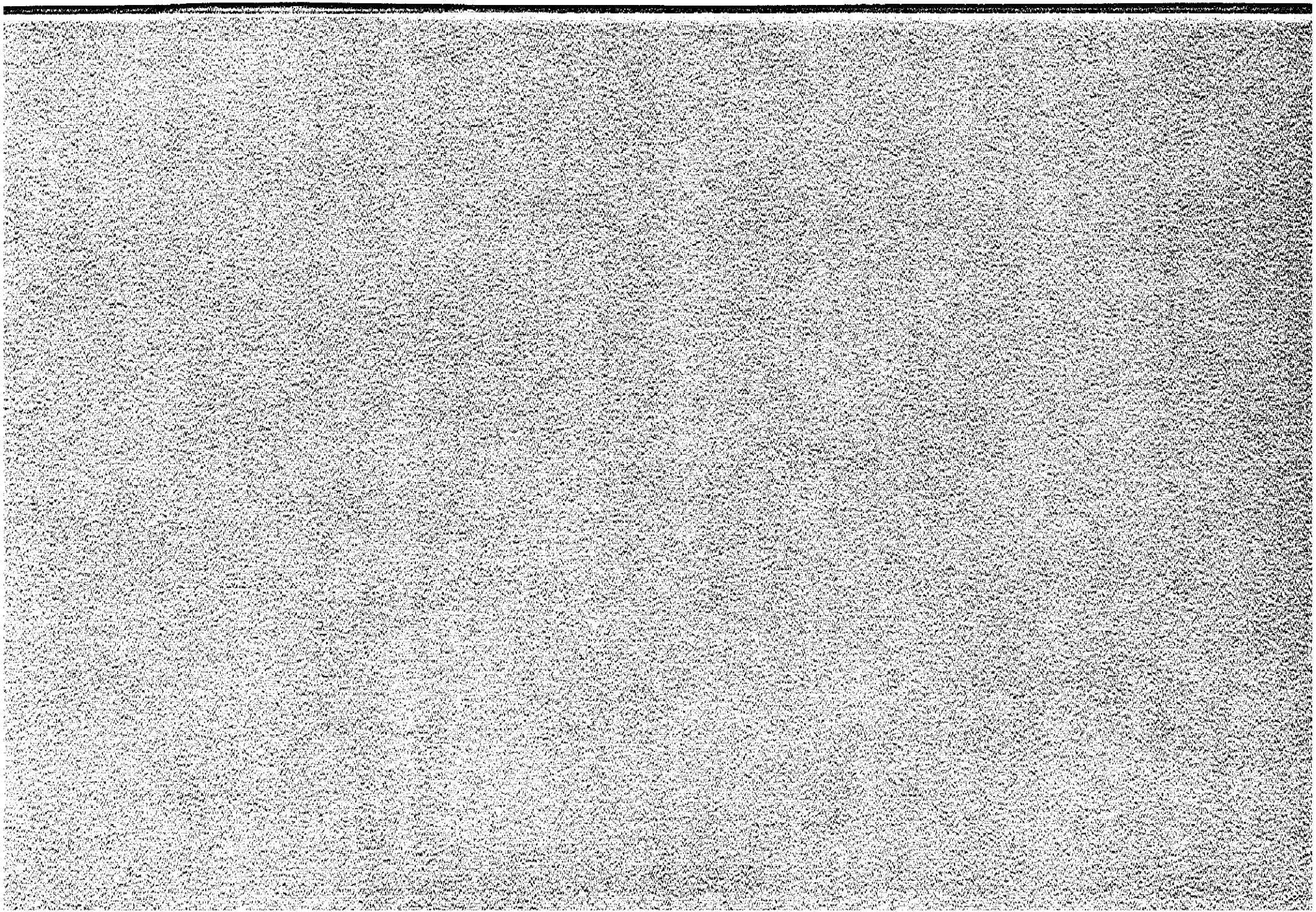


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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIXES
(SEPARATE VOLUME)

ABBREVIATIONS

A

AAB Administration of Air Bureau (Administration de l'Air)

ABN Aerodrome Beacon (Phare d'Aérodrome)

ACC Area Control Center (Centre de Contrôle Régional)

AGL Approach Guidance Lights (Feux de Circuit d'Aérodrome)

AIP Aeronautical Information Publication
(Publication d'Information Aéronautique)

ALS Approach Lighting System
(Dispositif Lumineux d'Approche)

ALT Altitude

AP Apron (Aire de Trafic)

AWY Airway (Voie Aérienne)

C

CBR California Bearing Ratio (Indice Portant de Californie)

CIQ Customs, Immigration and Quarantine
(Douane, Immigration et Quarantine)

CRM Collision Risk Model (Modele de Risque d'Abordage)

D

DME Distance Measuring Equipment
(Equipement de Mesure de Distance)

E

ESWL Equivalent Single Wheel Load
(Charge Equivalente par Roue Simple)

F

FAA Federal Aviation Agency (U.S.A.)

FAF Final Approach Fix (Repère d'Approche Finale)

G

GDP Gross Domestic Product (Produit Intérieur Brut)

GP Glide Path (Alignement de Descente)

I	IAS	Indicated Air Speed (Vitesse Indiquée)
	IATA	International Air Transport Association (Association du Transport Aérien International)
	ICAO	International Civil Aviation Organization (Organisation de l'Aviation Civile Internationale)
	ID	Identifier/Identification/Identify (Objet d'identification/Identification/Identifier)
	IF	Intermediate Approach Fix (Repère d'Approche Intermédiaire)
	ILS	Instrument Landing System (Système d'Atterrissage aux Instruments)
	IMC	Instrument Meteorological Conditions (Conditions Météorologiques de Vol aux Instruments)
J	JCAB	Japan Civil Aviation Bureau (Direction de l'Air du Japon)
	JICA	Japan International Cooperation Agency (Agence Japonaise de Coopération Internationale)
K	KSR	Key Board Send and Receive (Tableau d'émission et de reception)
L	LLZ	Localizer (Radiophare d'Alignement de Piste)
	LOC	Locally/Location/Located (Localement/Situation/Situé)
M	MDA	Minimum Descent Altitude (Altitude Minimum d'Atterrissage)
	MET	Meteorological (Météorologique)
	MM	Middle Marker (Radioborne Intermédiaire)
	MOC	Minimum Obstacle Clearance (Limite Minimum de Franchissement d'Obstacles)

N	NAVAIDS	Aids to Air Navigation (Aide à la Navigation Aérienne)
	NDB	Non-Directional Radio Beacon (Radiophare Non Directionnel)
	NOTAM	Notice to Airmen (NOTAM)
O	OCH	Obstacle Clearance Height (Hauteur de Franchissement d'Obstacles)
	OM	Outer Marker (Radioborne Extérieure)
	O&M	Operation and Maintenance (Exploitation et Entretien)
	ONCF	National Office of Railways (Office National des Chemins de Fer)
	ONE	National Office of Electricity (Office National de l'Electricité)
	ONEP	National Office of Drinking Water (Office National de l'Eau Potable)
	ONT	National Office of Transport (Office National des Transports)
	OPS	Operations (Exploitation)
P	PANS	Procedures for Air Navigation Services (Procédures pour les Services de Navigation Aérienne)
	PAX	Passenger (Passager)
Q	QFE	Height from Ground Level (Hauteur a partir du Niveau du Sol)
	QNH	Altitude from Sea Level (Altitude au-dessus du Niveau de la Mer)
R	RAI	Royal Air Inter
	RAM	Royal Air Morocco (Royal Air Maroc)
	RVR	Runway Visual Range (Portée Visuelle de Piste)
	RWY	Runway (Piste)

S	SALS	Simplified Approach Lighting System (Dispositif Lumineux d'Approche Simplifié)
	SONACID	Nador Ironworks Complex (Complexe Sidérurgique de Nador)
T	THR	Threshold (Seuil de Piste)
	TWY	Taxiway (Voie de Circulation)
V	VAR	Visual-Aural Range (Radiophare d'Alignement Audio-Visuel)
	VHF	Very High Frequency (Très Hautes Fréquences)
	VIS	Visibility (Visibilité)
	VMC	Visual Meteorological Conditions (Conditions Météorologiques de Vol à Vue)
	VOR	VHF Omnidirectional Radio Range (Radiophare Omnidirectionnel VHF)
W	WECPNL	Weighted Equivalent Continuous Perceived Noise Level (Niveau Pondéré de Bruit Perçu Continu Equivalent)

UNITS OF MEASUREMENT (UNITÉS DE MESURE)

Length (Longueur)

kilometre	km
metre	m
centimetre	cm
millimetre	mm
nautical mile	nm

Area (Surface)

square metre	m^2
hectare	ha

Velocity (Vitesse)

metre per second	m/s
kilometre per hour	km/h
knot	kt

Volume

cubic metre	m^3
litre	l
millilitre	ml

Weight (Poids et Masse)

kilogramme	kg
ton	t
pound	lb

Time (Temps)

hour	hr
minute	min
second	s

Power (Energie)

ampere	A
volt	V
kilovoltampere	kVA
hertz	Hz
watt	W
kilowatt	kW
megawatt	MW
gigawatthour	GWh

Temperature (Température)

degree Celsius	^{o}C

Angles

degree	o
minute	'(min)
second	"(sec)

UNITS OF MONEY (UNITES DE MONNAIE)

Dirham	DH
US Dollar	US$
Japanese Yen	¥