Philippines

"Nationwide Air Navigation Facilities Modernization Project (II)"

Project Summary

Borrower	Government of Republic of the Philippines
Executing Agency	Air Transportation Office, Department of Transportation and Communications,
Exchange of Notes	December 1985
Date of Loan Agreement	May 1986
Final Disbursement Date	December 1995
Loan Amount	¥7,595 million
Loan Disbursed Amount	¥7,297 million
Procurement Conditions	General Untied (Partial Untied for consulting portion)
Loan Conditions	Interest Rate: 3.5% Repayment Period: 30 years (10 years for grace period)

<Reference>

(1) Currency: Peso

(2) Exchange Rate / Consumer Price Index (CPI: 1991=100)

	1987	1988	1989	1990	1991
JP¥／US$	144.64	128.15	137.96	144.79	134.71
Peso／US$	20.57	21.10	21.74	24.31	27.48
CPI	71.8	78.1	87.6	100.0	118.7

	1992	1993	1994	1995	1996
JP¥／US$	126.65	111.20	102.21	94.06	108.78
Peso／US$	25.51	27.12	26.42	25.71	26.22
CPI	129.3	139.1	151.7	164.0	177.8

(4) Fiscal Year: January 1 ~ December 31

[Abbreviations]

(i) Organizations and General Terminology on Aviation

DOTC Department of Transportation and Communications

ATO Air Transportation Office

PMO Project Management Office

ICAO International Civil Aviation Organization
One of the specialized agencies in the United Nations established based on the Chicago Treaty (International Civil Aviation Treaty) of 1944. Aiming for safe and orderly development of international civil aviation, and sound and economic operation of international air transportation, this organization conducts various activities related to technical, legal, and other issues, with economic issues added to its functions recently.
The ICAO Headquarters is located in Montreal, Canada, and it had 185 member countries as of December 1998.

ACC Area Control Center
A body responsible for air route control and entry control upon flights in its designated district.

FIR Flight Information Region
A region designated by ICAO, within which a nation holds responsibility for air traffic control. FIR includes the skies over the international waters adjoining the

national air space of the country in question.

(ii) Plan/Program

LRMP Long Range Modernization Program

CAMP Civil Aviation Master Plan

(iii) Aviation System, Equipment

1. En-route Air Traffic Control (ATC) system

RCAG Remote Center Air Ground Communication

AMS Aeronautical Mobile Service Facilities

FDPS Flight Data Processing System

2. Terminal ATC System

TRACON Traffic Control Facilities

ASR Airport Surveillance Radar
Detects aircraft in the air space within approximately 110 km of the airport. Used for terminal radar control including departing and entering aircraft guidance and setting the distance between aircrafts.

ARSR Air Route Surveillance Radar
Detects the position of aircrafts in the air space within approximately 370 km of the radar site. Used for air route control using radars, including aircraft guidance and setting the distance between aircrafts.

SSR Secondary Surveillance Radar
Used in combination with ARSR or ASR. Aircraft, upon receiving a query signal from this device, emits a response signal (specific to each aircraft) from the ATC transponder on the aircraft. The aircraft ID, altitude and emergency status are displayed on the display panel of the ground radar.

TRDPS Terminal Radar Data Processing System

3. Aeronautical Communication System

FSS Flight Service Station

ATMS Automatic Teletype Message Switching System

AFTN Aeronautical Fixed Telecommunication Network
International telecommunications network that links international airports, control organizations, and airline companies around the globe.

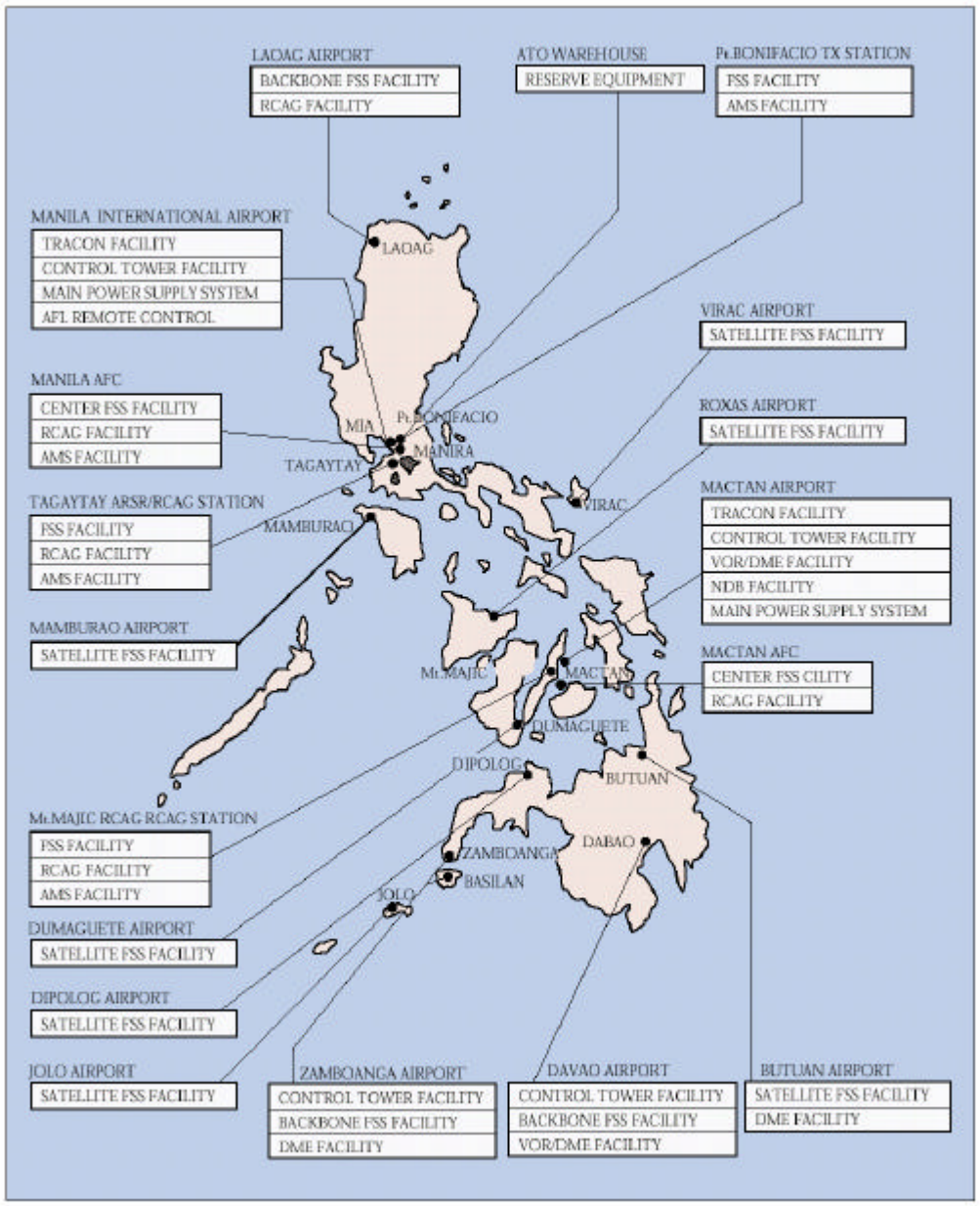
4. Air Navigation Aids

VOR	VHF Omnidirectional Radio Range
DME	Distance Measuring Equipment
ILS	Instrument Landing System
NDB	Non Directional Radio

5. ALF Airfield Lighting Facilities

1. Project Summary and Comparison of Original Plan and Actual

Figure 1 Project Site



1.1 Project Site

The project locations are: Manila International Airport, Mactan International Airport, 11 regional airports (Butuan, Davao, Dipolog, Dumaguete, Jolo, Laoag, Mamburao, Puerto Princessa, Roxas, Virac, Zamboanga), Pt. Bonifacio TX Station, Manila Area Control Center (hereunder, ACC), Mactan Area Control Sub-Center (hereunder, sub-ACC), the Mt. Majic Remote Center Air Ground (hereunder, RCAG) and Tagaytay RCAG. (See Figure 1.)

1.2 Project Summary and ODA Loan Portion

This project aims to realize safe and smooth navigation of airplanes in the Philippines by newly providing or renovating air navigation equipment mainly at the 13 airports and air navigation facilities within the Manila flight information region (Manila International Airport, Mactan (Cebu) International Airport, etc.).

The project scope consists of the procurement and installation of the required equipment, and related consulting services. The ODA loan covers the entire foreign currency portion of the project cost.

1.3 Background

1.3.1 Need for the Project

The Philippines is of the of the world's foremost island nations, with approximately 70 million citizens living on more than 7,000 islands. Thus, as economy grows and incomes rise, development of the transportation sector has always been given a high priority among national development plans. Within the sector, the aviation sector is recognized as one of requirements for economic development for its speed, regularity and amenity. It is expected to play an increasingly important role for passenger and cargo transport, thus rapid enhancement of this sector was in need.

Air navigation administration in the Philippines belongs to the Air Transportation Office (ATO) under the Department of Transportation and Communications (DOTC). ATO is responsible for preparing the Civil Aviation Master Plan (hereunder, CAMP). The Philippines's Medium-Term Development Plan specifies as targets the provision of airport facilities, modernization of air navigation facilities and aeronautical communication facilities, and improvement of disaster prevention capabilities based on this CAMP.

ATO prepares the Long Range Modernization Plan (hereunder, LRMP) for air navigation facilities based on CAMP. LRMP was drafted in 1981, as part of the Nationwide Air Navigation Facilities Expansion Project (1) (a project preceding this project. Hereafter referred to as the "Phase 1 Project"). LRMP is a long-term plan until the year 2000 designed to cope with growing air transport demand, and the increasing sophistication of airplane installed equipment, as well as to secure safe air navigation. It is divided into 4 phases, I to IV, due to budget limitations. The first phase of LRMP corresponds to Phase I Project and this project corresponds to Phase II.

The Phase 2 Project (this project) was planned slated as completion in 1990, however, the implementation period was extended and consequently Phase 3 project started only in 1995. This project was designed to newly provide or renovate air navigation equipment at airports and air navigation facilities that were not covered by the Phase 1 Project. It had an extremely high urgency for the Philippines, whose coverage of air navigation facilities was still relatively low.

The Phase 3 Project is also being implemented with a Japanese ODA loan. As of March 2000, it is still under implementation. The detailed scope of the Phase 4 Project has not been fixed yet. Table 1 provides an outline of Phase 1, Phase 2, and Phase 3 Projects.

1.3.2 History

History of the project is as follows.

1977	December	The Philippine government requested the "Nationwide Air Navigation Facilities Expansion Project" as one of the 7th ODA candidate projects. The subject of the request consisted of modernization of nationwide air traffic control systems, expansion and modernization of major airports (13 locations) and communication bases (21 locations), modernization of equipment at major regional airports (6 locations), and procurement of fire engines and other equipment.
1978	November	Exchange of Notes and signing of Loan Agreement on above-mentioned project
1981	May	Drafting of Long Range Modernization Program (targeted for 1981- 2000) by consultants
1985	February	Request of "Nationwide Air Navigation Facilities Modernization Project (II)" as one of the 13th ODA Loan candidate projects by the Philippine government
	May	Visit to the Philippines by the Japanese government mission
	Jun.~Jul.	Visit to the Philippines by JBIC Appraisal Mission
	October	13th ODA Loan Pledge
	December	Exchange of Notes
1986	May	Loan Agreement signing

Table 1 Outline of LRMP Phase 1 to Phase 3 Projects

Facility / Phase	Traffic control facilities	Air navigation radio facilities	Ground-to-air communication facilities
Before I		Verification of aircraft's position through naked eye reckoning and celestial body observation	
I (1981~1985)	● Enable traffic controllers to verify the position of airplanes by using radars. Tagaytai Air route surveillance radar (covering part of Luzon Island) Manila Terminal radar (Manila Airport entry control)	● Enable pilots to know their position through air navigation radio facilities (radio beacons), and perform solo flights. ● Enable air controllers to know the position of pilots through radio traffic.	● Provision of ground-to-air communication facilities principally in Manila surroundings
II (1986~1995)	● Introduction of terminal radar control to Mactan Airport ● Installation of control towers at Manila International Airport and Mactan Airport ● Expansion of communication networks between airports (FSS backbone stations)	● Installation of category -1 ILS and DVOR/DME at Mactan Airport ● Installation of DVOR/DME and NDB at other airports	● Installation of RCAG at Laoag ● Expansion of radio wave coverage in northern part of Luzon Island ● Renovation of ground-to-air communication facilities at Mt.Majic on Cebu Island
III (1996~2000)	● Construction of control towers at 5 airports ● Renovation and performance enhancement of equipment at existing control towers	● Installation and renovation of VOR/DME at 10 locations ● Installation of NDB at 1 location	● Installation of RCAG on Parawan Island, Bararan Island, and Dabao (expansion of VHF wave coverage of Manila ACC)

1.4 Comparison of Original Plan and Actual Result

1.4.1 Project Scope

Project Site	Plan		ACTUAL	
1. Butuan Airport	DME	1 set	Same as left	1 set
			FSS (Addition)	
2. Davao Airport	TRACON	1 set	Cancelled	
	Control Tower	1 set	Same as left	1 set
	(VFR Communication)			
	FSS	1 set	Same as left	1set
	VOR/DME	1 set	Same as left	1set
3. Dipolog Airport	None		FSS (Addition)	1 set
4. Dumaguete Airport	None		FSS (Addition)	1 set
5. Ft. Bonifacio TX Station	FSS	1 set	Same as left	1 set
			AMS (Addition)	1 set
6. Jolo Airport	None		FSS (Addition)	1 set
7. Laoag Airport	FSS	1 set	Same as left	1 set
		1 set	RCAG (Addition)	1 set
8. Laoag RCAG	RCAG	1 set	Cancelled	
9. Mactan Airport	TRACON	1 set	Same as left	1 set
	Control Tower	1 set	Same as left	1 set
	(VFR Communication)			
	VOR/DME	1 set	Same as left	1 set
	ILS	1 set	Same as left	1 set
	ALF	1 set	Cancelled	
			NDB (Addition)	1 set
10. Mactan Sub ACC	RCAG	1 set	Same as left	1 set
	FSS	1 set	Same as left	1 set

11. Mr. Majic RCAG	AMS RCAG	1 set 1 set	Same as left Same as left	1 set 1 set
12. Mamburao Airport	None		FSS (Addition)	1 set
13. Manila International Airport	TRACON Control Tower (VFR Communication)	1 set 1 set	Same as left Same as left	1 set 1 set
14. Manila ACC	AMS RCAG FDPS FSS AFTN	1 set 1 set 1 set 1 set 1 set	Same as left Same as left Cancelled Same as left Cancelled ATMS (Addition)	1 set 1 set 1 set 1 set
15. Puerto Princesa Airport	ALF	1 set	Cancelled	
16. Roxas Airport	None		FSS (Addition)	1 set
17. Tagaytay RCAG	AMS RCAG FSS	1 set 1 set 1 set	Same as left Same as left Same as left	1 set 1 set 1 set
18. Virac Airport	None		NDB (Addition)	1 set
19. Zamboanga Airport	Control Tower (VFR Communication) FSS DME	1 set 1 set 1 set	Same as left Same as left Same as left RCAG (Addition)	1 set 1 set 1 set 1 set
20. ATO Warehouse	None		3 sets of DME, VHF transceivers for ground-to-air communications, HF transceivers etc.	1 set

1.4.2 Implementation Schedule

Item	Initial Plan (Period)	Actual (Period)	Difference	Notes
(1) System design and detailed design	Apr. 1986 – Dec. 1986 (9 months)	Mar. 1987 – Aug. 1987 (6 months)	-3 months	
(2) Bidding	Jan. 1987 – Dec. 1987 (12 months)	Jul. 1988 – Apr. 1992 (46 months)	34 months	Delay (of 18 months) caused by interruption due to lawsuit from disqualified contractors
(3) Equipment production and delivery	Jan. 1988 – Oct. 1988 (10 months)	May 1992 – Nov. 1992 (6 months)	-4 months	
(4) Construction of buildings	Jan. 1988 – Dec. 1988 (12 months)	May 1992 – Dec. 1993 (19 months)	7 months	Delay caused by changes in project locations in response to project environment changes
(5) Installation of equipment	Nov. 1988 – Sep. 1989 (11 months)	Dec. 1992 – Sep. 1994 (22 months)	11 months	
(6) Training	Dec. 1988 – Feb. 1989 Jul. 1989 – Sep. 1989 (Total 6 months)	Dec. 1992 – Apr. 1993 (5 months)	-1 month	
(7) Project completion	Sep. 1989	Sep. 1994	60 months extension	

1.4.3 Project Cost

Item	① Plan (at the time of appraisal)		② Actual		Difference (②−①)	
	Foreign currency (¥ 1 million)	Local currency (1,000 pesos)	Foreign currency (¥ 1 million)	Local currency (1,000 pesos)	Foreign currency (¥ 1 million)	Local currency (1,000 pesos)
1. Equipment	5,730	—	5,304	44,355	▲426	+44,355
2. Construction of buildings and installation	989	14,686	1,227	57,966	+238	+43,280
3. Training	11	—	34	—	+23	—
4. Consulting service	644	10,457	732	20,937	+88	+10,480
5. Others (management cost, land acquisition cost etc.)	—	10,246	—	6,200	—	▲4,046
Total	7,374	35,389	7,297	129,458	▲77	+94,069
6. Contingency	221	2,514	—	—	▲221	▲2,514
Total including contingency	7,595	37,903	7,297	129,458	▲298	+91,555

(Note) 1. The entire foreign currency portion was covered by ODA loan.

2. Exchange rate: Plan: 1 Peso = ¥14.0 (1985), Actual: 1 Peso = ¥3.9 (September 1995)

2. Analysis and Evaluation

2.1 Evaluation on Project Implementation

2.1.1 Project Scope

The project scope is the installation and renovation of air navigation equipment. Implementation of consulting services to provide technical support for the above contents was also planned.

(1) Installation and renovation of equipment
Equipment for the following systems was procured and installed.
(a) Air route control system (improvement of remote ground-to-air communication system, etc.)
(b) Terminal control system (renovation of airport surveillance radar, etc.)
(c) Air communication system (improvement of flight service station, etc.)
(d) Air navigation aid facilities (installation of VHF omnidirectional radio range facilities, etc.)
(e) Airfield lighting facilities (installation of simplified entry lighting facilities, etc.)
(f) Other related equipment

(2) Consulting services
TOR consists of detailed design, bidding assistance, construction supervision, and related projects surveys (scope reviews, financial study, maintenance center study, and traffic volume study). The service amount is 402 M/M (foreign 229 M/M, local 173 M/M).

The equipment covered by JBIC loan was changed in part compared to the plan at the appraisal stage. First, the most urgent facilities to be covered by the ODA loan in particular (Flight data processing system (hereunder, FDPS) and airfield lighting system (hereunder, ALF) of Mactan Airport and Puerto Princesa Airport) were removed from the scope of the project, because it revealed that the lawsuits from disqualified contractors brought about the delays in the procurement, which will be mentioned later, which were then covered by other funds. Also, due to changes in the project locations, superannuation of existing equipment, and changes of the environment at project locations, the Air Transportation Office (ATO) requested and implemented their changes. These changes were made inevitably in response to changes in conditions and they are considered appropriate for achieving the aims of the project.

The major change contents and their reasons are listed below.

(1) Davao Airport: Cancellation of traffic control facilities (hereunder, TRACON)
Reason: Under the initial plan, the airport surveillance radars (hereunder, ASR) and secondary surveillance radars (hereunder, SSR) that were in use at the Zamboanga Airport were to be repaired and relocated to Davao Airport. This relocation was cancelled due to the fact that demand at Davao Airport did not grow as much as expected and that the equipment in question

had become deteriorated and would not have had a long period of service even after rehabilitation.

(2) Dipolog Airport: Addition of flight service station (hereunder, FSS)
Reason: This addition was decided because, regardless of regular flight service at Dipolog Airport, there were no communication facilities for communications between airplanes and ground stations, and between ground stations.

(3) Laoag Airport: Change in installation location of remote center air ground communication facilities (hereunder, RCAG)
Reason: As a result of the scope review had suffered, it was found that Mount Cabuyo location had poor land communications conditions and significant earthquake damage. Thus it was decided to install the facilities on the Laoag Airport premises instead.

(4) Virac Airport: Addition of non-directional radio beacon (NDB)
Reason: There being no aid facilities like radio beacons, many flight cancellations were made in bad weather conditions, NDB was decided to be installed on strong demand from the local. The addition of an NDB enabled the determination of the airport location even under poor weather conditions, expanding takeoff and landing conditions , and improving the service rate.

(5) Zamboanga Airport: Addition of RCAG on Basilan Island
Reason: Under the initial plan, a RCAG was to be installed on a mountain north of the Airport, but due to the deterioration of access roads, it was decided to install it on a hill on Basilan Island 50 km south of Zamboanga.

(6) Emergency power supplies at each airport facilities (Addition)
Reason: It was decided to replace existing facilities that were deteriorated due to aging and worsening power supply situation during the procurement period, and to switch to a full-time power supply (from 15 KVA to 125 KVA diesel engine and generators).

As described above, changes in the equipment to be provided and installed were decided in order to ensure consistency with the progress status of other projects and related facilities plans. These changes were suitable and inevitable in view of changing conditions.

The extension of the implementation schedule caused the consulting service amount to increase from 402 M/M to 572 M/M, however the service TOR itself remained as planned.

2.1.2 Implementation Schedule

Consulting services had initially been planned to commence in April 1986, but actually commenced in March 1987, which is an 11-month delay. Thereafter, a number of factors added on during the procurement and the construction stages, causing the completion of construction to end in September 1994 rather than in September 1989, a 60-month (5-year) delay. Figure 2 shows major implementation schedule items and accomplishments in bar chart form.

The major causes behind the 60-month delay in the implementation are as follows.

(1)	Delay in consultant selection start		11 months
	(System/detailed design time reduction)	-3 months	
(2)	Study of bidding methods		8 months
(3)	Interruption and delay caused by lawsuit by a disqualified bidder		34 months
	(materials and equipment procurement period reduction)	-3 months	
(4)	Extension in civil works due to site changes		7 months
(5)	Extension in installation work due to site changes		11 months
	(Training period reduction)	-1 month	
	(Others)	-4 months	
	Total		60 months

The following is an analysis of whether the factors (risks) for the extension of the implementation schedule were under any control of ATO.

Delay by (1) was caused by political and administrative confusion following the change from the Marcos administration to the Aquino administration (in February 1987), thus ATO cannot be held accountable for this delay.

Delay by (3) was caused by a lawsuit by a disqualified contractor that lasted one and a half years, a factor that was not under the control of ATO.

Delays by (4) and (5) were caused by project location changes due to project environment changes resulting from the passage of time. These delays cannot be attributed to ATO.

Thus the major factor that was under the control of ATO was factor (2). This was due to the facts that P/Q and bidding documents were not sufficiently prepared, which arose out of the lack of experience in procedures on ATO side. Equipment procurement methods were studied under consulting services, and the consultants recommended a direct contract from the viewpoint that it was desirable to standardize the equipment for maintenance. However, DOTC decided to implement international competitive bidding from the viewpoint that international competitive bidding should be held for whatever part possible. Delays were caused during the examination stage for a bidding method, due to the need for a formal request to be submitted by ATO, and for DOTC to examine this request. However, the delay duration caused by these factors was a total of 8 months, or just 1/7 of the total delay of 60 months. That is to say, 80% of the extension of the implementation schedule of this project was due to factors beyond ATO's control and could not have been avoided.

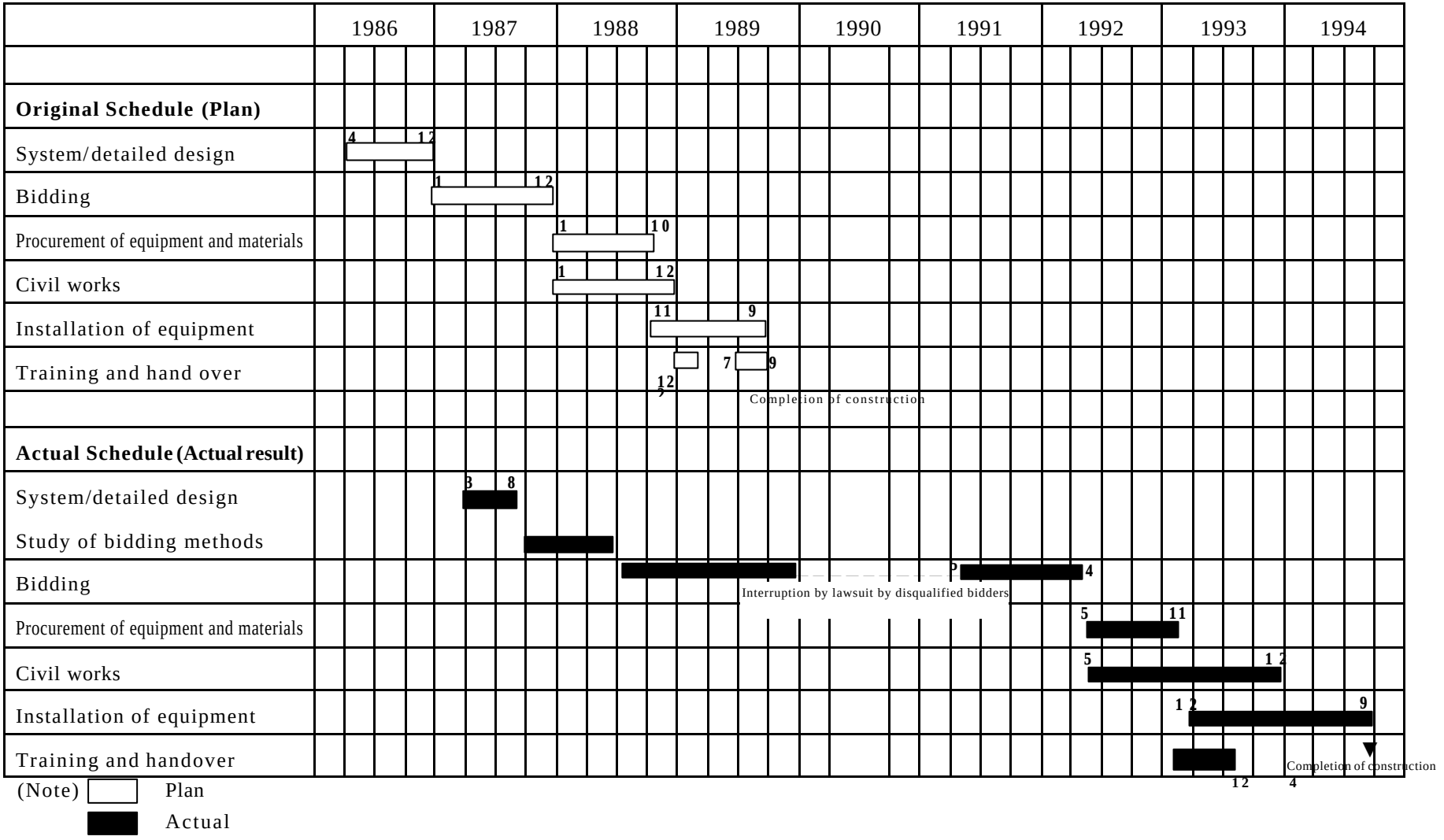
Factor (3) (lawsuit by disqualified contractor) deserves special mention. The details are as follows.

In November 1989, as the result of opening bidding procedures for equipment, a Filippino company was declared disqualified by the Bidding Committee due to its incompleteness in bidding documents. However, the company asserted that it had offered the lowest price. In January 1990, it filed a suit on the grounds that the Bidding Committee's decision had been unfair.

This lawsuit went all the way up to the Supreme Court, and in May 1991, the Supreme Court turned down the lawsuit of the company, judging in favor of DOTC.

The L/A disbursement closing date for this project was May 1991, but due to the delays in the implementation schedule, it was extended to December 1995.

Figure 2 Project Implementation Schedule



2.1.3 Project Cost

The total funds required for this project, including contingency, was estimated as ¥7,595 million for the foreign currency portion, and 37.903 million pesos (¥531 million) for the local currency portion, and the ODA loan covered the entire foreign currency portion.

In the end, the foreign currency portion was ¥7,297 million, 4% lower than the planned amount. The total project cost was 99% of the total planned amount excluding ¥221 million in contingency, disbursed almost as planned.

On the other hand, the local currency portion was 129.458 million pesos (¥501 million), or a 340% increase over the planned amount. The main reasons for this increase was the fact that the equipment installation cost and the consulting service cost increased because of inflation and the extension of the service period due to the extension in the implementation schedule. The Philippine government provided the entire local currency portion. It was provided in a timely manner, thus no particular problem occurred in this regard.

2.1.4 Implementation Scheme

(1) Executing Agency

The executing agency for this project was the Air Transportation Office (ATO) within the Department of Transport and Communications (DOTC). Figure 3 shows the organization chart of ATO. It consists of DOTC Assistance Secretary, one Executive Director, five sections (Administration, Finance & Management, Aviation Safety, Airways Navigation Service and Air Traffic Service) and six staff/external organization with a total number of 1,041 staff members. Airports in the Philippines are under ATO's administration except for Manila International Airport and Mactan (Cebu) International Airport which are separately independent from ATO as public corporations.

The Project Management Office (PMO) was established within ATO for the implementation of this project. PMO was responsible for actual work of procurement and execution management. PMO was also given directions and supervised by the Executive Committee, headed by a director of ATO.

The PMO, headed by a project officer (ATO navigation facility commissioner), consists of 5 ATO engineers and 2 DOTC administrative officers. The Executive Committee consists of 5 members, the ATO director who serves as the committee chairman, the vice-director, the engineering operations manager, the financial administration manager, and the planning department manager, who make decisions based on the results of studies at PMO.

Following the detailed design by the consultants, private-sector suppliers took care of the fabrication, transportation, and installation of the equipment on a turnkey basis[1]. PMO obtained the advice of consultants at every implementation stage regarding evaluations, inspections, and

[1] The contractors were wholly responsible from the fabrication of the equipment and its transportation, and the construction of the buildings to house this equipment, to the installation of the equipment.

supervision. The ATO engineers and local consultants formed technical working groups at each site and performed project supervision under the direction of PMO.

As mentioned earlier, this project experienced significant delays in the implementation schedule at the preparation stage, but most of the causes were not under the control of ATO and could not have been avoided. The performance of ATO is not considered to have been inferior to that of the other organizations.

(2) Consultant

This project required the following consulting services as TOR.

(i) System design and detailed design
(ii) Preparation of bidding documents and bidding assistance
(iii) Construction supervision
(iv) Related project surveys (consist of four components; scope reviews, financial study, maintenance center study, and traffic volume study)

The consultants performing services that were hired for the Phase 1 project were rehired on a direct contract basis for the Phase 2 project (this project). The service amounts were as follows.

Item	Japanese	Local	Total
Design and bidding assistance	143 M/M	120 M/M	263 M/M
Construction supervision	100 M/M	117 M/M	217 M/M
Related project surveys	63 M/M	26 M/M	92 M/M
Total	306 M/M	266 M/M	572 M/M
(Reference) Initial estimate	(229)	(173)	(402)

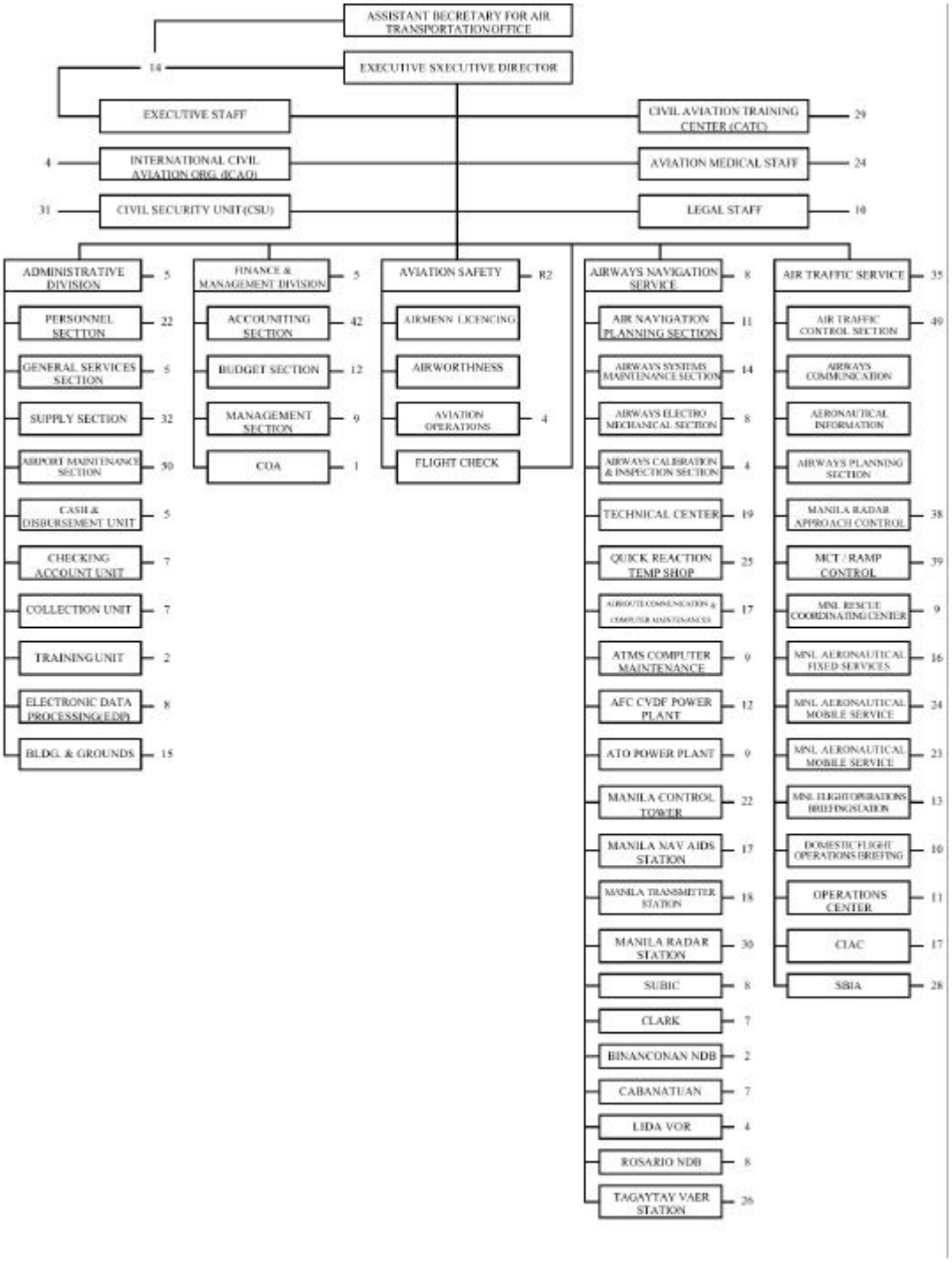
The extension of the service period due to delays in the implementation schedule resulted in a 170 M/M (approximately 30%) increase compared to the initially planned figure.

According to ATO, the performance of the consultants in this project was satisfactory, and no problems caused by the consultants were identified.

(3) Contractor

The contractors were selected through international competitive bidding and consisted principally of Japanese (trading) firms. In this project, no particular problems were discerned regarding implementation schedule delay or maintenance problems caused by contractors.

Figure 3 Organization Chart of ATO



2.2 Evaluation on Operation and Maintenance

2.2.1 Operations and Maintenance Scheme

Operation and management following the completion of this project (installation of equipment) are the responsibility of the Airways Navigation Service (ANS) Department of ATO (see Figure 3). The ANS Department currently has approximately 150 skilled engineers working on sites, which is considered a sufficient number.

The training of employees is also fulfilling. ATO, with the support of ICAO, has established the Civil Aviation Training Center (CATC) in March 1987. This center performs regular training of young technicians, air-traffic controllers, and communication operators, prior to their hiring by ATO. The Center also has re-education and specialized course programs for engineers, designed to offer trainings to enable smooth operation and maintenance of newly introduced equipment and facilities.

The contractors also performed plant training for future O&M technicians during the implementation period of this project, and the transfer of technologies required for equipment operation and maintenance were carried out. Some of the employees who have received training are promoted or transferred, but since every site is allocated with such trained employees, such promotions or transfers do not immediately impair operation and maintenance.

The Air Traffic Service (ATS) Department of ATO is responsible for air-traffic control operations. The training of controllers uses a part of the ICAO curriculum, which is implemented by the above-mentioned CATC. Coordination among control authorities at various airports is being satisfactorily conducted. Moreover, the relationship between ANS and ATS is maintained well, and daily coordination of work between the two organizations is conducted smoothly.

The number of employees at Manila International Airport and Mactan International Airport recorded during this ex-post evaluation survey was as follows. A sufficient number of employees have been secured.

Department	Manila ACC and Control Tower (Note)	Mactan Sub ACC and Control Tower
ANS Dept.	68 persons	87 persons
ATS Dept.	88 persons	73 persons
Management Dept.	–	9 persons
Temporary employees	–	10 persons
Total	156 persons	179 persons

(Note) Excluding radar sites

2.2.2 Operation Status

The equipment and facilities introduced through this project were installed at major airports throughout the Philippines as well as air route monitoring radar and communications stations. They are generally all operating satisfactorily, and are used on a daily basis for air navigation safety operations. In particular, all the major equipment installed at the Manila International Airport and the Mactan International Airport, which were visited on this evaluation mission, were operating satisfactorily. According to ATO, the introduced equipment are being suitably operated and maintained based on the manufacturer's manuals and the standards of ICAO, and efforts are being made to ensure a satisfactory operating state at all times.

2.2.3 Operations and Maintenance

(1) Spare Parts Supply

Spare parts for maintenance are stocked at the ANS Repair, Calibration and Depot Center. In addition, ATO has established Centralized Spare Parts Supply Depot in order to raise the facilities and equipment maintenance efficiency.

However, the major equipment have been produced by foreign manufacturers, and the procurement of spare parts therefore involves some difficulties. Regardless of the high necessity of parts procurement, procurements from manufacturers who supplied parts and equipment during the Phase 1 project are being conducted on an extremely limited scale.

The main reasons for this situation are that air navigation related equipment are not manufactured in large quantities for the general market, but are instead manufactured when ordered for specific projects. Therefore manufacturers do not keep all spare parts in stock. When parts become needed, such as in a case of equipment failure, parts may have to be newly manufactured. Adding to this, the procurement of parts is done, in principle, through bidding, which involves a complicated procedure. Per procurement rules of the Philippine government, all goods and services must be procured through bidding in principle. However, in the case of spare parts for special equipment such as air navigation facilities and equipment involved in this project, a direct contract is sometimes preferable. However, the procurement of goods through direct contract by the government invites a risk of connivance between the government and the supplier. Accordingly ATO, in order to avoid unnecessary misunderstandings and criticisms, procures parts through bidding in spite of the fact that it is fully aware of the necessity of rapid procurement through direct contracts.

Parts that could not be procured are obtained as equivalent parts from local companies, or, since the majority of the equipment are dually furnished, with one unit provided for actual service and another unit for backup purposes, parts from the backup unit are used for maintaining the unit in actual service, resulting in the unavailability of actually usable backup units.

In order to solve these problems, a maintenance survey was conducted as part of consulting services for this project. Based on the results of this survey, the establishment of a maintenance center was included as part of the Phase 3 project. This maintenance center, which is expected to

perform centralized management of the supply of parts, the repair of equipment, measurements using test equipment, and monitoring of the operation status of air navigation facilities.

(2) Maintenance Budget Allocations

Maintenance expenses for air navigation facilities including the part covered by this project, from the viewpoint of assuring safe airplane traffic has never been subject to sharp reduction. There are no particular problems regarding budget allocations. Under the present budget system, spare parts can be procured when needed. The maintenance budget has been considerably increased, from 34 million pesos during the Phase 1 project, to between 80 million and 90 million pesos for this project.

(3) Dual Equipment System

Air navigation facilities and equipment are furnished in a dual configuration, not just in the Philippines, but generally throughout the world. When an equipment covered by this project breaks down, the operation is automatically switched to the backup unit. Moreover, recent equipment comes with an automatic diagnosis function that notifies the parts that have failed, and thus the failure can be simply remedied by replacing the indicated parts.

It is regrettable that, as previously mentioned, that the single operation (with no backup) period is protracted in the Philippines due to the fact that the procurement of spare parts takes a long period of time. The establishment of the above-cited maintenance center is expected to bring about a considerable improvement of this situation.

(4) Notification upon Occurrence of Air Navigation Facilities and Equipment Failures

Upon occurrence of an air navigation facility failure, notification is made to the related parties through NOTAM (notice to airmen)[2]. While there are cases when notification from the maintenance personnel is somewhat late, the information is relayed with a fair degree of accuracy. On the other hand, periodic flight inspections using special inspection airplanes are required in order to check whether the required performance level is being maintained, but since the airplanes are not maintained properly, the test is not conducted with regularity.

[2] A type of communication system whereby air navigation facilities, tasks, methods, and danger-related air navigation information, is distributed to the parties who require this information via teletype lines. In the air navigation field, this system is widely known by the name NOTAM.

2.2.4 Revenue and Expenditure Situation

Table 2 shows the overall revenue and expenditure of ATO, while Table 3 shows the revenue and expenditure of the air navigation facilities division.

Revenue from air navigation facilities fees accounts for the greatest part of ATO's total revenue. For example, of the 655 million pesos in revenue for fiscal 1997, revenue from the use of facilities accounted for 576 million peso, or 88%.

Airlines pay facilities usage fees in exchange for receiving information required for navigation, takeoff and landing in each control zone. ATO has the policy of gradually raising its facilities usage fees, and it had long expected the enhancement of its facilities to be promptly completed through this project.

	1988 ~ Oct. 1995	Nov. 1995 ~ Dec. 1999	Jan. 2000 ~
Overfly	$100/flight	$125/flight	$334/flight*
Inbound/Outbound	$150/flight*	$187/flight*	$400/flight*

* Note: The simple average was used for usage fees for which the amount differs depending on the airport scale and type of airplane.

From 1994, adding to the above-noted revision of facilities usage fees, the number of international overfly and inbound/outbound traffic has greatly increased (74,929 flights in 1994 → 100,157 flights in 1996), resulting in revenue from passenger user fees of 576 million pesos in 1999, a 210% increase over the 576 million pesos in passenger user fees collected in 1997.

Since the revenue of ATO is entirely remitted to the national treasury, revenue from facilities usage fees is a valuable source of foreign currency. It is expected to contribute even more importantly to fiscal revenue in the future.

Table 2 Income and Expenditures in the Overall ATO

(In Thousand Pesos)

REVENUES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Government Services	5,684	6,478	7,504	10,453	4,314	5,658	7,779	9,981	14,799	22,771	33,691	56,508
Government Bus. Operations	91,537	98,306	107,868	128,366	143,724	190,724	194,223	249,467	272,109	397,987	464,081	590,739
Fines and Penalties	53	62	49	109	70	597	725	68	75	262	357	348
Miscellaneous	913	1,784	5,026	2,513	1,060	86	74	511	1,076	2,183	6,477	7,499
	98,187	106,630	120,447	141,432	149,168	196,538	202,301	260,027	287,559	423,203	504,606	655,094
EXPENDITURES												
Personal Services	64,988	107,924	107,912	131,001	160,244	123,546	212,100	225,039	281,397	281,397	433,578	519,749
Maintenance & Operating Expenses	64,249	83,133	89,924	109,634	103,633	113,851	134,988	144,142	116,985	149,834	258,560	298,486
Equipment Outlay-COE	-	-	-	1,762	-	-	-	-	2,521	6,030	18,768	680
Capital Outlay-Infra	-	-	-	-	79,519	10,764	125,580	165,261	98,969	83,996	51,399	470,982
	129,237	191,037	197,836	242,397	343,396	248,161	472,668	534,442	499,872	608,161	762,305	1,289,897

Table 3 Income and Expenditures in the Air Navigation Facilities Division of ATO

(In Thousand Pesos)

INCOME	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Class B Messages	3	1	-	-	-	4	81	-	1	9	-
NOTAM / AIP	121	187	138	135	250	169	175	125	316	302	357
ANF	96,645	106,185	126,305	143,450	188,650	192,863	247,805	270,190	394,794	455,946	575,970
	96,769	106,373	126,443	143,585	188,900	193,036	248,061	270,315	395,113	456,257	576,327
EXPENDITURES											
Repairs and Maintenance of ANF											
04-HEAD OFFICE	4,109	15,647	29,654	14,993	18,617	26,038	19,906	22,178	24,859	54,484	73,119
04-AREA CENTER	-	-	-	-	-	-	-	-	-	-	-
	4,109	15,647	29,654	14,993	18,617	26,038	19,906	22,178	24,859	54,484	73,119

2.3 Project Effects and Impacts: Evaluation on the Impact

2.3.1 Impact Categories and Their Classification

The assumed impacts of the project at the time of were as follows.

(1) Improved airplane flight safety
(2) Improved services for airline passengers
(3) Increased revenue from air navigation facility usage fees (acquisition of foreign currency)
(4) Raised airline earnings

Among the impacts that were not particularly mentioned at the time of appraisal was the impact of technology transfer to the ATO staff. (1), (2), and the technological impact are classified as qualitative impacts, while (3) and (4) are classified as quantitative impacts.

2.3.2 Qualitative Effects

(1) Improved Safety

Various air navigation facilities were provided through this project, mainly (i) communication facilities for communications between an aircraft and a ground station, and between ground stations that enable more accurate and faster supply of weather information and airplane position information required for aircraft navigation, (ii) landing and takeoff assistance facilities that improve the landing and takeoff accuracy of airplanes, (iii) radio beacons required to help pilots know the position of their planes, and (iv) various facilities for the automation of part of air-traffic control tasks. All these categories of facilities contribute to improving the safety of air transportation and have the potential of increasing air traffic all the while guaranteeing its safety. Particularly in the Philippines, where typhoons frequently occur, flights using pilot vision are considerably restricted, and thus the role played by these facilities is extremely important.

The facilities provided through this project contribute to raising the overall standard of air navigation systems in the Philippines. An example of this impact is the establishment of aeronautical radio stations that provide fixed lines to the Manila ACC, which has enabled faster and more reliable sending and receiving of flight plan and atmospheric information. Another example is the addition of automatic processing functions in control facilities at the Cebu Mactan Airport, which has resulted in an improvement of aircraft processing performance and a reduction of load on control towers. Another example is the servicing and renovation of radio beacons at Davao and a number of other airports, which has made it easier for airplanes to know their position and has reduced the load on pilots.

Through this project, the areas that used to be insufficiently covered with regard to radio communications and ground-to-air communications in the southwest and south of the Philippines has been expanded. The following is an overview of the air navigation facilities and equipment functions by representative equipment type that have contributed to expanding coverage and, in turn, improving safety.

Air navigation equipment and facilities	Purpose & Functions	Installation Site
VOR	Enables continuous indication of magnetic north from VOR facilities for all aircraft within the effective range distance using VHF. By installing VOR facilities at key locations on air routes, aircraft can accurately navigate along air routes. Moreover, since VOR facilities use the VHF band, the impact of thunderstorms and other atmospheric phenomena is minimal, and flight courses can be indicated accurately.	Davao Airport Mactan Airport Butuan Airport
NDB	NDBs are established at key locations along air routes as well as at airports. NDBs emit non directional medium and long radio waves. Using an automatic direction finder on the airplane, airplanes can detect the direction of the ground facilities (NDBs).	Mactan Airport Virac Airport
DME	A distance query radio wave is sent forth from an aircraft to DME station on the ground using the fact that the propagation speed of radio waves is fixed, and the aircraft can continuously measure its distance from the ground station based on the time that has elapsed from the emission of the radio wave until the airplane receives it.	Zamboanga Airport Davao Airport Mactan Airport Butuan Airport
FSS	Whereas control facilities perform active control of airplanes, an FSS is a facility that simply communicates various types of information (runway conditions, weather information, etc.) to airplanes. FSS are installed in airports where air traffic is too low to warrant the installation of control facilities.	Butuan Airport Dipolog Airport Dumaguete Airport Pt. Bonifacio Airport Jolo Airport Laoag Airport Mactan Sub ACC Mamburao Airport Manila Area Control Sub-Center Roxas Airport Tagaytay RCAG Zamboanga Airport

AMS	Assures ground-to-air communications for airplanes that are flying over the ocean. Consist of TX equipment on board planes, ground receiver/emitter, ground lines, and AMS terminals. Planes flying over an ocean are under ACC control, but the ACC controller can directly communicate only with airplanes that are within VHF wave cover. Communications with airplanes flying over the ocean are intermittently done via AMS. AMS communication contents consist of air route and altitude change requests, fixed point passage time reports and other information items required for air navigation control, as well as weather information regarding air routes, departure times, passage information, and other notification items to airplane operators. The renovation of these facilities contributes to raising communication reliability and reducing the load of communications officers.	Ft. Bonifacio Airport Mt. Majic RCAG Manila Area Control Sub-Center Tagaytay RCAG
RCAG	A VHF air route air-to-ground communication facility that is remote controlled by the Area Control Center (ACC). Enable direct communication between airplanes in remote locations and control facilities.	Laoag Airport Mactan Sub ACC Mt. Majic RCAG Manila Area Control Sub-Center Tagaytay RCAG Zamboanga RCAG
ILS	Indicates the proper course to airplanes that are approaching airports. It consists of a localizer that indicates deviations from the middle of the runway, a grid path that indicates the proper approach angle, and markers or DME that indicates the distance from the end of the runway.	Mactan Airport
ATMS	Main system of the Manila AFTN center, one center configuring the Aeronautical Fixed Telecommunication Network (AFTN), which is a worldwide air navigation network. Sends flight plan information (aircraft number, flight route, elevation, points of departure and arrival, passage times, etc.) it receives from all over the world as needed to related domestic sections, or relays this information to the specified AFTN center, or that sends information emitted domestically to countries all over the world. ATMS furthermore has a function to exchange information between points within the Philippines.	Manila Area Control Sub-Center

A quantitative measurement of the impact on safety improvement is difficult due to the fact that the number of accidents is too small to be able to serve as an effective benchmark. The fact that the sample of instances that can be used for an analysis by cause is insufficient. However, improvements in the servicing of navigation facilities and their safety can be said to have stimulated more demand for air transportation. An example illustrating this point is the number of flights within the control zone in question, which has been rising since the completion of this project in 1994.

Transition in the Number of Airplane Flights

	1994	1995	1996
International Line	37,811	39,876	46,590
Domestic Line	232,851	246,099	272,094
Total	270,662	285,975	318,684

The following table lists the number of accid ents for all aircraft by year between 1994 and 1998. The majority of airplanes involved in accidents are small aircraft. The majority of accidents are caused by piloting errors on the part of the pilot, with not a single accident being reported to have been caused by air navigation facilities.

Number of Aircraft Accidents (Within Philippine Air Zone)

	1994	1995	1996	1997	1998
Number of accidents	14	11	12	14	16

According to the data listed in the above table, regardless of the large increase in flights in the Philippines over the past few years, there have been zero instances of accidents involving medium-sized or large-sized airplanes. This attests to the efficacy of this project in the area of air navigation safety.

(2) Improvement in Airline Passenger Service

The introduction of ILS is reported to have improved flight regularity, with a smaller number of delayed and cancelled flights at the Mactan (Cebu) International Airport. Moreover, control tasks, which used to be performed manually, are now performed by high-performance radars, computers, and other sophisticated equipment, which contribute to reducing the time between landings and takeoffs. Also, (although this part was removed from the ODA loan scope) the introduction of ALF at regional airports has made night flights possible, and it is now possible to offer air transportation services according to passenger needs.

(3) Improvement in Technical Level

The training of employees regarding the operation, repair, and maintenance of the facilities and equipment introduced through this project is reported to have raised the technical level of ATO

employees.

2.3.3 Quantitative Effects

(1) Increase of Usage Revenue in Air Navigation Safety Facilities (acquisition of foreign currency)

As mentioned with regard to revenue in section 2.2.4, revenue from the use of air navigation facilities has considerably grown thanks to the higher standard of facilities, which is also helping the Philippines to earn more foreign currencies.

Transition in the Usage Revenue of Air Navigation Safety Facilities

	1994	1995	1996	1997
Facilities usage revenue (1,000 peso)	270,190	394,794	455,946	575,970
(Dollar equivalent amount) (US$ 1,000)	10,227	15,356	17,389	19,544

(2) Raised Airline Earnings

For the same reason as in (1) above, airlines have seen expenses caused by delayed or cancelled flights decline. They are surmised to have increased earnings through more efficient operations, including an increased number of flights and the implementation of night flights. However, quantitative analysis could not be done because data from airline companies could not be obtained.

2.3.4 Impact on the Environment

This project was basically a project targeted at existing airports and stations. No negative impact on the social environment and the natural environment has been observed.

Comparison of Original Plan and Actual

1. Comparison of Original Plan and Actual

Evaluation Item	Plan	Actual	Difference
Project Scope (JBIC portion)			
Equipment	DME: 2 airports 2 sets	Same as left	-
	TRACON: 3 airports 3 sets	2 airports 2 sets	▲ 1 airport 1 set
	Control Tower: 4 airports 4 sets	Same as left	-
	FSS: 7 airports 7 sets	12 airports 12 sets	5 airports 5 sets
	VOR/DME: 2 airports 2 sets	Same as left	-
	RCAG: 5 airports 5 sets	6 airports 6 sets	1 airport 1 sets
	ILS: 1 airport 1 set	Same as left	-
	ALF: 2 airports 2 sets	Cancelled	▲ 2 airports 2 sets
	AMS: 3 airports 3 sets	4 airports 4 sets	1 airport 1 set
	AFTN: 1 airport 1 set	Cancelled	▲ 1 airport 1 set
	ATMS: None	1 airport 1 set (addition)	1 airport 1 set
	FDPS: 1 airport 1 set	Cancelled	▲ 1 airport 1 set
	NDB: None	2 airports 2 sets (addition)	2 airports 2 sets
Consultant	Detailed design, bidding assistance, construction supervision, special study	Same as left	-
Implementation Schedule			
Start of construction	April 1986	March 1987	11 months delay
Completion of construction	September 1989	September 1994	60 months delay
Project Cost (Note)			
Total Project Cost	¥ 8,125 million	¥ 7,798 million	▲¥ 327 million
Foreign currency	¥ 7,595 million	¥ 7,297 million	▲¥ 298 million
(JBIC portion)	(¥ 7,595 million)	(¥ 7,297 million)	▲¥ 298 million
Local currency	37.903 million pesos (¥ 530 million)	128.458 million pesos (¥ 501 million)	90.555 million pesos (▲¥ 29 million)

(Note) Exchange Rate
At the time of plan (1985): ¥ 14.0 Actual (1995): ¥ 3.9