

(4) **Solid Waste Disposal**

An incinerator will be installed in the airport in the Short-term Modernization Plan so as to treat all inflammable waste by an incinerator.

3.1.5 Aeronautical Ground Light System

A CGL system shall be installed to the Runway 20 before 2003. CGL shall consist of several flood light fixtures installed on a parallel line from the runway and on the extension line of the runway threshold. CGL will perform to indicate the direction of the runway and the location of the threshold by flood lights, so that the pilot will be able to clearly recognize the location. All installation sites of the CGL lighting are located inside of the airport site so that the system can be easily installed.

**3.2 Airport Management Study**

The following points are required to be taken into consideration in the airport's management modernization.

(1) **Strengthening the Airport Management System**

- a. Clarification of airport activities by establishment of Job description and departmental decrees
- b. Organizing activities and Personnel through the institution of discussions, communication, instructions and reports
- c. Standardization for planning, design, construction, operation and maintenance of an airport
- d. Regular training to maintain the level of the expertise
- e. Provision of vehicles, facilities and equipment for the operation and maintenance of the airport
- f. Facilities and spare parts management systems
- g. Precise topographic survey in order to identify each coordinate of the locations concerned

(2) **Personnel Management**

Developing and improving the current human resources instead of increasing the number of personnel.

(3) **Security Control**

Fencing of the airport, and introducing a security check system in the terminal buildings

(4) **Search and Rescue**

Establishment of a SAR organization in DCA

(5) **Facilitation**

Improvement of facilitation from the present condition such as the partial congestion in the existing international terminal building

### 3.3 Environmental Impact Study

Through screening and scoping in the Initial Environmental Examination, aircraft noise is selected as the environmental factor to be considered. The noise is expressed as a Weighted Equivalent Continuous Perceived Noise Level (WECPNL) of the ICAO index of noise exposure level, which takes into account the peak noise level and the duration of noise exposure.

The results of the simulation are summarized as follows;

- the extent of aircraft noise in the future is estimated not to increase from the present one.
- there are and will be areas which will suffer from serious noise levels outside the airport.
- the total area affected by aircraft noise with WECPNL more than 70 and 75 at present, and in the year 2003 and 2010 are as follows:

Year	WECPNL	Area (ha)	
		More than 70	More than 75
	present	830	390
	2003	1,000	480
	2010	970	470

In order for TIA to exist together with the surrounding communities in harmony, with aircraft noise in particular it is recommended to consider aircraft noise abatement measures.

### 3.4 Project Implementation Schedule and Cost Estimates

#### 3.4.1 Project Implementation Schedule

The implementation schedule of the Short-term Modernization Plan is shown in Figure 3.4.1.

#### 3.4.2 Project Cost

The cost of the Short-term modernization plan is shown in Table 3.4.1. The total cost of the project is estimated to be about 7,400 million Rupee (US\$ 150 million).

**Figure 3.4.1 Project Implementation Schedule of Major Works for Ground Facilities Improvement Plan**

Year	1994	1995	1996	1997	1998	1999	2000
Feasibility Study	■						
Financial Arrangement		■					
Engineering Service			■				
Tendering				■			
Construction							
1 Construction of Hangar and Maintenance Apron					■		
2 Demolition of Existing Hangars						■	
3 Construction of New Cargo Terminal Building						■	
4 Demolition of Existing Cargo Terminal Building							■
5 Construction of New Passenger Terminal Building					■		
6 Conversion of Existing International Terminal Building to Domestic Use						■	
7 Demolition of Existing Domestic Passenger Terminal Building						■	
8 Expansion of Passenger Terminal Apron					■	■	
9 Construction of Other Facilities Isolated Aircraft Parking Position Perimeter Road and Security Fence Terminal Road and Car Park Airport Utilities Lighting					■	■	■

**Table 3.4.1 Cost Estimates for the Short-term Modernization Plan of Ground Facilities**

Item	Local Portion Amount (US\$1,000)	Foreign Portion Amount (US\$1,000)	Total Amount (US\$1,000)
<b>A. Construction Cost</b>			
<b>1. Civil Works</b>			
a. Passenger Terminal Apron	4,314	16,600	20,914
b. Aircraft Maintenance Apron	414	1,290	1,704
c. Isolated Aircraft Parking Position	772	2,066	2,838
d. Perimeter Road	216	579	795
e. Security Fence	31	83	114
f. Terminal Road and Car Park	307	819	1,126
Sub Total	6,054	21,437	27,491
<b>2. Architectural Works</b>			
a. International Terminal Building	4,875	37,625	42,500
b. Domestic Terminal Building	540	2,160	2,700
c. Cargo Terminal Building	781	5,282	6,063
d. Aircraft Maintenance Hangar	3,900	35,100	39,000
e. Relocation of Royal Enclosure	78	522	600
Sub Total	10,174	80,689	90,863
<b>3. Airport Utilities</b>			
a. Electrical Power Supply	115	2,179	2,294
b. Water Supply	41	785	826
c. Sewage Disposal	440	661	1,101
d. Solid Waste Disposal	18	165	183
Sub Total	614	3,790	4,404
<b>4. Others</b>			
a. Fire Engine	0	1,500	1,500
b. Lighting	129	302	431
Sub Total	129	1,802	1,931
Total Construction Cost	<b>16,971</b>	<b>107,718</b>	<b>124,689</b>
B. Physical Contingency (10% of construction cost)	1,697	10,772	12,469
C. Engineering Services (10% of Items A + B)	1,372	12,344	13,716
<b>Total of Project Cost</b>	<b>20,040</b>	<b>130,834</b>	<b>150,874</b>

Exchange Rate : US\$ 1.0 = Rs.49.0 = Yen 109  
Rs 1.0 = Yen 2.3

### **3.5 Economic Analysis**

#### **3.5.1 Purpose of Economic Analysis**

The main purpose of the economic analysis is to show the effect of the Short-term Modernization Plan for Tribhuvan International Airport (TIA) from the nation's economic well-being viewpoint, and to examine the economic viability of the Project.

#### **3.5.2 Basic Assumptions on the "With Project" and the "Without Project" cases**

The economic analysis is conducted by comparing the project costs and the project benefits between the "with" and "without" project situations.

"With project" means the implementation of the investment for the proposed short-term airport modernization plan.

"Without project" means the condition without such an investment for airport improvement works, and in this case the saturation conditions for the international and domestic passengers terminals facilities are evaluated as follows:

- The international passengers terminal facilities are evaluated to be saturated in 1999.
- The domestic passengers terminal facilities are evaluated to be already saturated at present.

In this economic analysis, the incremental analysis is made on the basis of the incremental benefits and the incremental costs which are the difference between those in the "with Project" and the "without Project" cases respectively.

#### **3.5.3 Project Benefits**

The following quantified project benefits are assumed:

- a) Benefits due to accommodation of overflowing Nepalese domestic passengers
- b) Benefits due to accommodation of overflowing Nepalese international passengers
- c) Benefits due to accommodation of overflowing foreign domestic passengers
  - c-1) International airfare to be paid to Royal Nepal Airlines and departure tax by international passengers
  - c-2) Expenses generated other than domestic airfares in Nepal by foreign visitors
- d) Benefits due to accommodation of overflowing foreign international passengers
- e) Benefits due to accommodation of overflowing foreign airline aircraft

### 3.5.4 Project Costs

The investment costs for the Short-term Modernization Plan for Tribhuvan International Airport are estimated as the economic costs applying the conversion factor (0.88) to the estimated financial costs, and are disbursed in 1996 - 2000.

The economic operation and maintenance costs are estimated for the "Without Project" and the "With Project" cases.

### 3.5.5 Economic Evaluation

The calculation results for the economic evaluation indicators, i.e. EIRR (Economic Internal Rate of Return), NPV (Net Present Value) and B/C (Benefit Cost Ratio) are summarized as below. The annualized cash flow is shown in Table 3.5.1.

- EIRR : 17.1%
- NPV : 2,362 (Rs. million)
- B/C : 1.47

(Note: NPV and B/C : at 12% discounted rate)

As the opportunity cost of capital in Nepal is estimated to be approximately 12%, the above value of EIRR shows that this Project can be evaluated as economically viable.

#### Qualitative Economic Benefits

Besides the quantified economic benefits previously mentioned, the following qualitative economic effects treated as unquantified benefits in this economic analysis are expected to be also realized from the implementation of the Project:

- Upgrade of passenger service levels in the passenger terminal building by improvement of the passenger handling facilities (i.e. possible reduction of passenger processing time in the passenger terminal building).
- Possible higher efficiency of air cargo handling by the improvement of air cargo handling facilities, which will contribute to control quality and to promote exports.
- Additional short-term job creation effects during the period of construction works.
- Additional long-term job creation effects for operational staff by expanding of passengers terminal buildings.
- Favorable impression effects for foreign visitors to Nepal by upgrading the national gateway, and resultant incentive effects to international tourism development.
- Enhancing the national pride effects for Nepalese through developing a symbolic infrastructure for the national entrance and exit abroad.

By the sensitivity test, in the severest case (costs +20% and benefits -20%), the calculation results show a slightly lower value than the level of 12%.

**Table 3.5.1 Economic Cash Flow for EIRR Calculation**

EIRR : 17.1%  
 B/C : 1.47  
 NPV : 2,362 (Rs. million)  
 (Discounted Rate = 12%)

							(Rs. 1,000)
Year		Benefits	Costs			Total Costs	Net Cash Flow
			Invest.	O/M (With)	O/M (Without)		
1	1995		0			0	0
2	1996		295,717			295,717	-295,717
3	1997		0			0	0
4	1998		3,483,061			3,483,061	-3,483,061
5	1999		1,637,741			1,637,741	-1,637,741
6	2000	409,316	1,089,168	126,342	50,160	1,165,350	-756,034
7	2001	564,740		126,984	50,160	76,824	487,916
8	2002	779,182		127,662	50,160	77,502	701,680
9	2003	1,075,051		128,366	50,160	78,206	996,845
10	2004	1,483,266		129,096	50,160	78,936	1,404,330
11	2005	2,046,487		129,862	50,160	79,702	1,966,785
12	2006	2,046,487		129,862	50,160	79,702	1,966,785
13	2007	2,046,487		129,862	50,160	79,702	1,966,785
14	2008	2,046,487		129,862	50,160	79,702	1,966,785
15	2009	2,046,487		129,862	50,160	79,702	1,966,785
16	2010	2,046,487	470,180	129,862	50,160	549,882	1,496,605
17	2011	2,046,487		129,862	50,160	79,702	1,966,785
18	2012	2,046,487		129,862	50,160	79,702	1,966,785
19	2013	2,046,487		129,862	50,160	79,702	1,966,785
20	2014	2,046,487		129,862	50,160	79,702	1,966,785
21	2015	2,046,487		129,862	50,160	79,702	1,966,785
22	2016	2,046,487		129,862	50,160	79,702	1,966,785
23	2017	2,046,487		129,862	50,160	79,702	1,966,785
24	2018	2,046,487		129,862	50,160	79,702	1,966,785
25	2019	2,046,487		129,862	50,160	79,702	1,966,785
26	2020	2,046,487	4,165,392	129,862	50,160	4,245,094	-2,198,607
27	2021	2,046,487		129,862	50,160	79,702	1,966,785
28	2022	2,046,487		129,862	50,160	79,702	1,966,785
29	2023	2,046,487		129,862	50,160	79,702	1,966,785
30	2024	2,046,487	-3,612,095	129,862	50,160	-3,532,393	5,578,880
Total Costs (Initial)			6,505,687				
Total Costs			7,529,164	3,235,690	1,254,000	9,510,854	

### **3.6 Financial Analysis**

#### **3.6.1 Purpose of Financial Analysis**

The principal objective of the financial analysis is to evaluate the financial viability of the implementation of the short-term Tribhuvan International Airport (TIA) Modernization Plan (the Project) from the viewpoint of the management body of TIA.

#### **3.6.2 Basic Assumptions on the "With Project" and the "Without Project" cases**

The basic assumptions for the "With Project" and the "Without Project" cases are made similarly in the economic analysis.

#### **3.6.3 Financial Revenues**

The financial revenues are estimated for the following revenue items:

- Aircraft landing/navigation charges
- Passenger service charges (Airport tax)
- Entrance fee
- Parking fee
- Oil throughput
- Space rental
- Advertisements
- Others

#### **3.6.4 Project Costs**

The estimated financial investment costs for the Short-term Modernization Plan for Tribhuvan International Airport are disbursed in 1996 - 2000.

The financial operation and maintenance costs are estimated for the "without" and "with" Project cases.

#### **3.6.5 Financial Evaluation**

For the FIRR (Financial Internal Rate of Return) calculation, incremental revenue, investment costs for Short-term Modernization Plan and incremental operation and maintenance costs are included into factors.

As a result, the FIRR shows a negative value (-6.2%).

##### **Examination of Revenue Level**

As the value of the FIRR of the Base Case shows a negative value, the examination of varying revenue levels compared with the base level revenue is tried, and the trial results of the sensitivity test are summarized as follows:

The turning point to positive value of FIRR is about +40% revenue to base level; and for attaining a FIRR value over the assumed loan's interest rate (1.0%), a revenue level increase of approximately 50% is required.



In case of the tariff levels rising by 50% from the base level (year 1993), the estimated average annual growth rates of tariff levels for the period of seven (7) years during 1993 - 2000 are equivalent to about 6%.

The details of FIRR calculation for Base Case is shown in Table 3.6.1.

### 3.6.6 Evaluation

As mentioned previously in Section 3.5, the results of economic analysis are favorable. On the other hand, as observed in this Section, the results of financial analysis (for base case) are not optimistic.

Basically, this Project is not so commercially attractive. For a total evaluation of the Project, however, the economic analysis results should be appraised. In other words, it can be emphasized that an airport project as an important transport infrastructure can be generally justified by the economic benefits from the viewpoint of national welfare such as the convenience for Nepalese air passengers and increases of foreign currency income.

Accordingly, it can be considered that the Project is viable from an overall appraisal viewpoint.

When considering reasonable tariff level raising, the financial aspect will show a turn for the better.

**Table 3.6.1 Financial Cash Flow for FIRR Calculation**

FIRR : -6.2%

(Rs. 1,000)

Year	Revenues			Costs				Net Cash Flow
	(With)	(Without)	(Incremental)	Invest.	O/M (With)	O/M (Without)	Total Costs	
1 1995				0			0	0
2 1996				336,042			336,042	-336,042
3 1997				0			0	0
4 1998				3,958,024			3,958,024	-3,958,024
5 1999				1,861,069			1,861,069	-1,861,069
6 2000	549,478	503,573	45,905	1,237,691	143,570	57,000	1,324,261	-1,278,356
7 2001	576,708	503,573	73,135		144,300	57,000	87,300	-14,165
8 2002	605,287	503,573	101,714		145,070	57,000	88,070	13,644
9 2003	635,282	503,573	131,709		145,870	57,000	88,870	42,839
10 2004	666,615	503,573	163,042		146,700	57,000	89,700	73,342
11 2005	699,493	503,573	195,920		147,570	57,000	90,570	105,350
12 2006	699,493	503,573	195,920		147,570	57,000	90,570	105,350
13 2007	699,493	503,573	195,920		147,570	57,000	90,570	105,350
14 2008	699,493	503,573	195,920		147,570	57,000	90,570	105,350
15 2009	699,493	503,573	195,920		147,570	57,000	90,570	105,350
16 2010	699,493	503,573	195,920	534,296	147,570	57,000	624,866	-428,946
17 2011	699,493	503,573	195,920		147,570	57,000	90,570	105,350
18 2012	699,493	503,573	195,920		147,570	57,000	90,570	105,350
19 2013	699,493	503,573	195,920		147,570	57,000	90,570	105,350
20 2014	699,493	503,573	195,920		147,570	57,000	90,570	105,350
21 2015	699,493	503,573	195,920		147,570	57,000	90,570	105,350
22 2016	699,493	503,573	195,920		147,570	57,000	90,570	105,350
23 2017	699,493	503,573	195,920		147,570	57,000	90,570	105,350
24 2018	699,493	503,573	195,920		147,570	57,000	90,570	105,350
25 2019	699,493	503,573	195,920		147,570	57,000	90,570	105,350
26 2020	699,493	503,573	195,920	4,733,400	147,570	57,000	4,823,970	-4,628,050
27 2021	699,493	503,573	195,920		147,570	57,000	90,570	105,350
28 2022	699,493	503,573	195,920		147,570	57,000	90,570	105,350
29 2023	699,493	503,573	195,920		147,570	57,000	90,570	105,350
30 2024	699,493	503,573	195,920	-4,104,661	147,570	57,000	-4,014,091	4,210,011
Total Costs (Initial)				7,392,826				
Total Costs				8,555,861	3,676,910	1,425,000	10,807,771	

## **4. TECHNICAL STUDY OF URGENT PROJECT**

### **4.1 Scope of the Urgent Project**

The installation of ASR/SSR is selected as an Urgent Project to be initiated in the early stage of the Urgent Improvement Plan. Construction of a training facility which is required for radar controllers and maintenance technicians' training is also required.

The Basic Design for practical construction and the human resource development plan concerning the Basic Design are described in the following sections.

### **4.2 Basic Design**

#### **4.2.1 Design Condition for the Radar System**

The design conditions for the radar system are as follows:

(1) Specific coverage requirements

- Navigation fixes

All of the navigational fixes and air routes within the terminal area are desired to be located within the line of sight (LOS) of the selected radar site.

- Runway approach/departure coverage

Coverage of the final approach should be provided up to the missed approach point, and departure aircraft should be picked up for at least 1 NM from the exiting runway threshold (probably 300 feet above the extended runway surface).

(2) Requirements for facilities construction

The following items should be considered in terms of the construction costs and maintainability:

- Extensive and/or unusual road construction or improvements
- Special installation of a water system and/or electrical power
- Requirements for a remote control and monitoring cable or microwave link
- Grading, landscaping or other property improvements
- Drainage
- Road access

(3) Technical requirements

It is desirable to keep the minimum separation between the ASR/SSR antenna and any above ground structure and radio generating equipment such as radio navigation aids and communication facilities. The ground clutter effect, lobbing, and large reflection objects which may cause false targets should be analyzed.

#### **4.2.2 Site Selection**

The radar operation building is preferably to be located near the current operating facility, but the location of the transmitter and receiver facilities shall be decided in consideration of radar coverage, siting conditions and construction conditions.

The construction site for the radar equipment building was studied based on the design criteria. The locations of alternative sites are as follows:

- Mt. Phulchauki Site
- Mt. Nagarkot Site
- Changunarayan Site
- Torebhir Site
- Airport Site

The most suitable site was selected on the airport site. At this site, part of the radar coverage is screened by Mt. Phulchauki and Chandragili, but surveillance for approaches from the south is possible.

#### 4.2.3 Facility Plan

##### (1) Basic Function of Airport Surveillance Radar

The Airport Surveillance Radar (ASR) system, which consists of a primary radar and secondary beacon radar will be divided into two parts; one is the radar head for the transmitting and receiving of the radar signals and beacon signals. The second part is the operation unit with signal analyzing, processing and display for operations.

The following performances shall be considered for the system design.

##### - Radar Coverage

The requirements of radar coverage shall be satisfied with the following conditions at 25,000 feet vertical coverage and 60 nautical miles in the azimuth range.

- |                          |   |                  |
|--------------------------|---|------------------|
| - Target Reflection Area | : | 2 m <sup>2</sup> |
| - Detection Probability  | : | more than 80 %   |
| - False Alarm Rate       | : | 10 <sup>-6</sup> |

##### - Measures for clutter

Special measures for the occurrence of ground clutter shall be considered due to the topographical conditions of the Kathmandu Valley. The following measures shall be studied.

- application of MTD (moving target detection) based on the I.Q. logic.
- elimination of reflection by ground obstacles by STC.

##### - Warning by Secondary Radar Signal

The following warning functions shall be provided by the processing signal data processing of the secondary radar.

- MSAW (Minimum Safe Altitude Warning)
- CN (Conflict Alert)

(2) Outline of the Specifications for ASR and SSR

- ASR

Output power	:	500 KW
Frequency	:	S band (2,700 ~ 2,900 MHz)
Type of Amplifier Tube	:	Klystron
Noise Figure	:	Less than 4.0 dB
Range Resolution	:	Not more than 200m at 25 NM
Azimuth Resolution	:	Not more than 1.5 degrees at 25 NM
Accuracy	:	Not more than 50m and 0.5 degrees

- SSR

Interrogation modes (ground-to-air)

Mode A	-	to elicit transponder replies for identification and surveillance. (8 ± 0.2 microseconds)
Mode C	-	to elicit transponder replies for automatic Pressure - altitude transmission and surveillance. (21 ± 0.2 microseconds)

The performance and characteristics shall conform with the ICAO, Annex 10 specification.

4.2.4 Implementation Plan

The implementation program of the Project is shown in Figure 4.2.1.

4.2.5 Project Cost

The Project Cost for the Urgent Project is as follows:

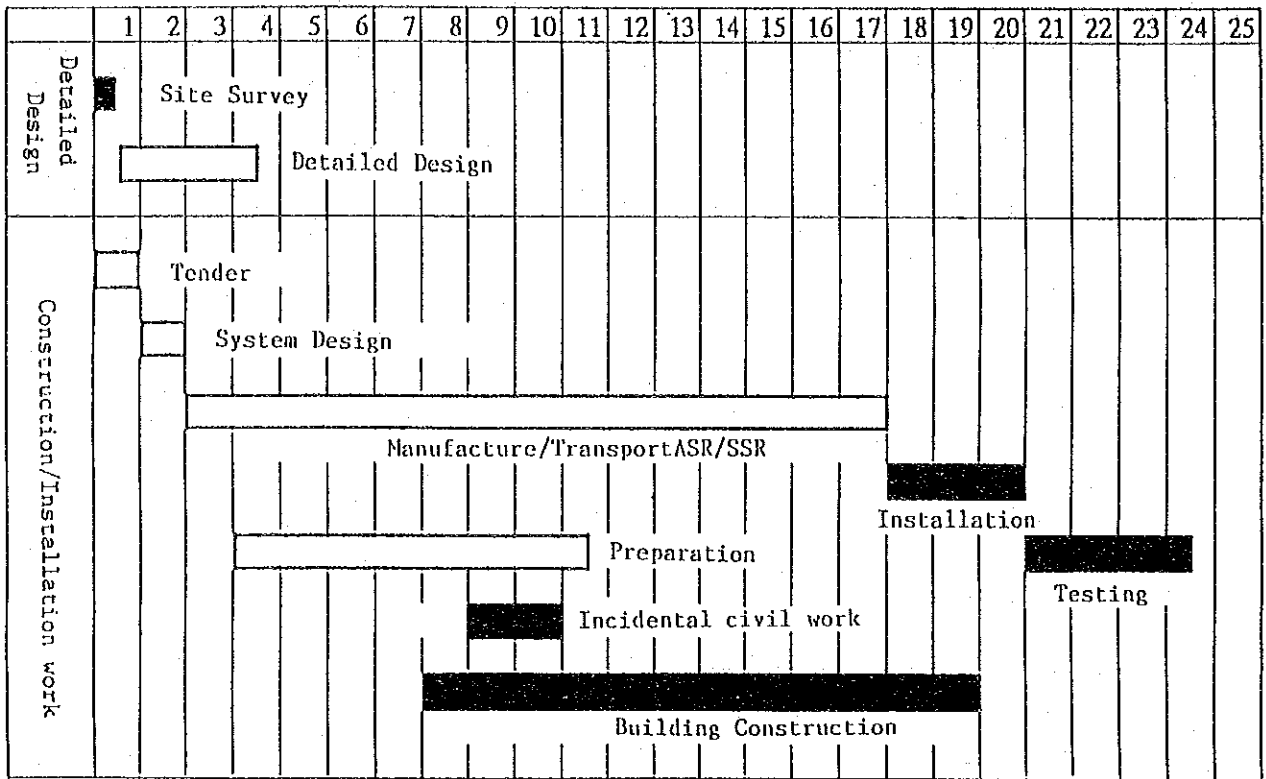
ASR/SSR and training facility	27,000 thousand US dollar
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4.3 **Human Resource Development Plan**

4.3.1 Training Demand

By the commencement of radar monitoring at TIA, the following number of personnel will have completed the suitable training.

Operation	-	operation	:	6 (2 per shift)
	-	supervisor	:	3 (1 per shift)
	-	TIA instructor	:	3
	-	CATC instructor	:	2
	-	<u>DCA staff</u>	:	<u>2</u>
		<b>TOTAL</b>	:	<b>16</b>



**Figure 4.2.1 Project Implementation Program**

Maintenance	- Radar head	: 6 (2 per shift)
	- Processor	: 6 (2 per shift)
	- TIA instructor	: 3
	- CATC instructor	: 2 (1 for radar head, 1 for processor)
	- <u>DCA staff</u>	: <u>3</u>
	TOTAL	: 20

**4.3.2 Time frame of the training**

The training will be basically scheduled in the sequence as shown in Table 4.3.1.

Table 4.3.1 Time Frame of the Training

	Preparation Phase			Hand-over Phase	Familiarization Phase	Operation Phase of the Reader Monitoring
	Manufacturing	Transport	Installation (KTM)			
EQUIPMENT				Facility Hand-over (KTM)		
			Flight Test			
OPERATION	Instructor Training (oversea)		Approach Radar Control Training (Oversea)	Hand-over Training (KTM)	Familiarization Training (KTM)	Training of the Backup Personnel Management Training
	Air space Adjustment Radar Procedures (KTM or Oversea)					Brush-up Training (KTM)
MAINTENANCE	Basic Training (KTM)	Vendor Training (Oversea)	Radar Maintenance Training (KTM)	Hand-over Training (KTM)	Familiarization Training (KTM)	Training of the Backup Personnel Management Training
	Instructor Training (Oversea)					Brush-up Training (KTM)
ASSISTANCE	Technical Assistance by International Experts					

#### 4.4 Technical Evaluation

By the Urgent Project, the direct effect on safe operation at the airport is expected as shown in the following table.

**Table 4.4.1 Effect of the Urgent Project**

The Present Situation and Problems	The Methods Taken by This Project	The Effect of the Project and the Degree of Implementation
<p>1. The air traffic control system at Tribhuvan International Airport is based on predetermined procedure controls previously issued. This method specifies the aircraft position, direction, height, etc. and when they are difficult to confirm from the ground, and when the aircraft cannot identify its own position, grave accidents may occur.</p>	<p>The Kathmandu Terminal Control Area (25 NM radius) will be provided with terminal radar which can monitor this area. An ancillary building to accommodate the radar equipment and a radar operations building will also be provided.</p>	<p>It will be possible to determine the aircraft's position, direction, and altitude at night and in times of low visibility from the ground with the radar. The radar will permit the aircraft to be controlled and monitored from the ground at all times. Accidents due to the mistaken identity of aircraft can be prevented.</p>
<p>2. There are high hills on the approach and departure routes at Tribhuvan International Airport, and should the aircraft take an incorrect approach, takeoff, or incorrect heading, it will encounter problems, But these decisions are at the moment left up to the pilot to make.</p>	<p>With the secondary radar, the height of individual aircraft will be monitored automatically and shown on the radar display.</p>	<p>The aircraft's altitude will be monitored by the radar controllers who will notice any irregular display, and can pass on instructions to alter his height or rate of ascent or descent.</p>
<p>3. If an aircraft flies at a wrong altitude, corrections cannot be made, since flying altitude cannot be confirmed from the ground.</p>	<p>The function of Minimum Safe Altitude Warning (MSAW) will be added to the radar data processing equipment.</p>	<p>A warning is indicated on the radar display if an aircraft has descended or is expected to descend below the minimum descent altitude.</p>
<p>4. The air space is overcrowded due to the increase of departing and arriving aircraft at the airport so that near misses are a serious matter.</p>	<p>The direction and altitude of each aircraft is forecasted in the processing of radar signal, and a conflict alarm will be made if necessary.</p>	<p>If the air traffic controller confirms the alarm, he will give the instruction to the aircraft to change altitude and/or heading, so that a near miss can be prevented.</p>
<p>5. Existing training facilities of CATC are superannuated and small, and the equipment is inadequate. Especially there are no facilities for training of the required staff for the radar operations mentioned above.</p>	<p>Practical training facilities for radar operations shall be established.</p>	<p>Training for the radar controllers and maintenance staff can be executed by Nepalese in their own country.</p>



## 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

The report studied the Modernization Plan for the long-term modernization of Kathmandu International Airport aiming at the year 2010 and the Feasibility Study on the Short-term Modernization aiming for the year 2003, in view of air safety and ground facilities improvements.

The conclusions of the Feasibility Study are summarized as follows;

#### (1) Technical Aspects

The Short-term modernization plan within the framework of the Modernization Plan consists of urgent and necessary improvements of facilities and equipment at the airport. These are indispensable to secure air safety and a higher level of the service at the airport and will be selected as being cost-effective.

#### (2) Environmental Aspects

The environmental impact assessment indicates that there will not be any expected serious influences caused by the project as a whole. However, it will be necessary in the future to introduce exact land use control around the airport, in order for TIA to be in harmony with the surrounding communities, particularly concerning aircraft noise problems.

#### (3) Economic and Financial Aspects

The project cost is estimated to be Rs. 7,358 million.

The economic and financial analysis gives the following results.

EIRR		17.1 %
NPV	Rs.	2,400 million
B/C		1.48
FIRR (Base Case)		-6.2%
FIRR (Raising Tariff Case)		1.8 %

The economic indexes imply healthy and good conditions from the view point of the national economy of Nepal. On the other hand, the financial ones show the low level of financial viability of the project because of low revenues and high costs. As the project of TIA modernization is related with the social-economic infrastructure, it is natural to show such low figures, in a sense of public works. In addition, this level will be able to be improved by the application of some measures such as the raising the airport tariffs and/or decreasing the sizes of buildings.

The economic and financial analysis shows the feasibility of the project.

Consequently, it is confirmed that the short-term modernization plan is feasible from the technical, environmental and economic/financial viewpoints.

It is also confirmed that the Urgent Project is technically feasible through the technical evaluation.

As a whole, the Short-term Modernization Plan and the Urgent Project will also contribute to enhance and improve the following performances in the national and regional fields, even though these values are not able to be clearly calculated in the analysis.

- a. improvement of air safety
  - enhancement of the reliability of air transport
  - increase of air transport demand
  - increase of foreign tourists
  - promotion of tourism industry and industries concerned
  - increase of national and regional income
- b. enhancement of comfort of airport users by solving congestion and improving services, which are a requisite of an international airport
- c. promotion of exports and imports in terms of quick and smooth cargo handling
- d. enhancement of domestic air transport and improvement of domestic air transport safety in terms of airport facility development
- e. modernization of Nepalese air transport

## **5.2 Recommendations**

### **(1) Project Implementation**

In order to implement the project as scheduled in this Study, the following measures are recommended.

- a. National and regional consensus for the project implementation should be obtained.
- b. The preparatory and coordination works for the project implementation are advisable to be taken among the parties concerned.
- c. Financial arrangements for project implementation should be prepared, including construction of new aircraft maintenance hangars because this is the first step in the terminal development sequence.
- d. In view of the economic and financial analysis, a proper tariff raising measure in future should be sought, and construction funds to be obtained should have a low interest rate wherever possible.

### **(2) Urgent Improvement Plan**

As the Exchange of Notes on grant aid for a radar system and associated facilities was conducted between the Nepalese and Japanese Governments on January 1994, the Urgent Project has been started. In addition to the radar system (ASR/SSR) installed by the Urgent Project, continuous execution of the all of the urgent improvement plans as a package of the Plan which include additional SSR, LDA/DME and the relocation of the existing CATC is very important to secure and improve the air safety at TIA for achievement of the original objective of technical cooperation.

### (3) Human Resources Development

In accordance with the airport modernization, modern systems and new equipment are planned to be introduced. This implies the necessity of higher handling capacities to support these modernized systems in airport operations and management. Therefore human resources development is strongly advised.

To develop the necessary human resources by themselves in Nepal is a primary policy. However, it is expected to that international technical assistance will be utilized at the beginning of the development. As CATC is the core institute of human resources development, it is expected to improve and strengthen its condition.

### (4) Radar Approach Control

The purpose of radar control at TIA is to improve and secure the safety of aircraft operations, particularly at the stage of approach to the airport.

At the same time, special attention is required because this is the first time that a radar system has been installed and operated in Nepal.

In this context, the transition of radar control from monitoring to full scale control should be carefully performed with the confirmation of the requisite conditions of (a) obtaining full familiarity with radar operations and techniques by the Nepalese staff, (b) sufficient and adequate training for the staff, and (c) satisfactory radar coverage.

The transition should be affirmatively and steadily performed by spending enough time and utilizing international technical assistance fully.

### (5) Operation and Maintenance of Radar

A radar system will be installed and operated for the first time in Nepal so as to improve and secure the safety of aircraft operations. It is clearly required for the radar system to be kept under the normal condition of regular operations and good maintenance at all times. Therefore it is strongly recommended to secure a number of staff and to train them to provide these operations and also to have an adequate budget to sustain these.

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