

DEPARTMENT OF CIVIL AVIATION  
MINISTRY OF TRANSPORT AND COMMUNICATIONS  
THE REPUBLIC OF THE UNION OF MYANMAR

**THE PREPARATORY SURVEY  
FOR  
THE PROJECT FOR THE IMPROVEMENT  
OF AIRCRAFT SURVEILLANCE SYSTEM  
IN  
THE REPUBLIC OF THE UNION OF  
MYANMAR  
FINAL REPORT**

**March 2019**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

**NIPPON KOEI CO., LTD.  
JAPAN AIRPORT CONSULTANTS, INC.**

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## PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Consortium consist of Nippon Koei CO., Ltd. and Japan Airport Consultants, INC.

The survey team held a series of discussions with the concerned officials of the Government of Republic of the Union of Myanmar, and conducted a field investigation. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Republic of the Union of Myanmar for their close cooperation extended to the survey team.

March, 2019

Itsu ADACHI  
Director General,  
Infrastructure and Peacebuilding Department  
Japan International Cooperation Agency



## Summary

### 1. Background of the Project

Currently, there are 34 airports in Myanmar with civil aviation operation. Three of these are international airports, namely: Yangon International Airport, Nay Pyi Taw International Airport, and Mandalay International Airport. Air traffic demand in Myanmar has been rapidly increasing each year. The annual passenger volume for the Yangon International Airport in 2017 was around 5.73 million. In 2005, it was only at around 1.43 million, which shows that the annual passenger volume increased approximately four times from 2005 to 2017. In addition, annual passenger growth rate is expected to be at 7% to 8% per year (refer to demand forecast result conducted by DCA in 2012).

Based on the “Master Plan of National Transportation”, which is developed with support from Japan International Cooperation Agency (JICA) and approved by the cabinet in December 2015, the Government of Myanmar has proceeded to develop the airport facilities in order to meet International Civil Aviation Organization (ICAO) standards and requirements. However, the current aerodrome and en-route surveillance systems are not sufficient, which makes it difficult to accommodate future high traffic demand efficiently. There is no Primary Surveillance Radar (PSR) in the Yangon International Airport, which is the center of air traffic transportation in Myanmar. In addition, PSR is out of service in the Mandalay International Airport. Therefore, non-radar approach control service is provided in both airports. It leads to low airport capacity and causes the occurrence of over work load time in the airports. Due to the current situation, there is a concern about maintaining aviation operational safety and efficiency. Furthermore, the airspace around the Nay Pyi Taw International Airport is the largest in Myanmar since approximately 80% of domestic flights (6,000 flights/year) fly through this air route. Nevertheless, the airspace below 15,000 feet is out of coverage to two en-route radars, which are installed in the Yangon and the Mandalay international airports. Under this condition, separation cannot be shortened, and the increase in traffic demand cannot be managed.

From consideration above, the Government of Myanmar requested the cooperation for “the Improvement of Aircraft Surveillance System in the Republic of the Union of Myanmar” to the Government of Japan as a Grant Aid.

## 2. Contents of the Project

In response to the request from the Government of Myanmar, the Government of Japan decided to conduct a preparatory study of the Project. JICA dispatched a study team to Myanmar from 10 July to 6 May 2018. The team held discussions with DCA and confirmed the contents of the request. They then conducted a field study, confirmation of organization for operation and maintenance, and preliminary planning of facilities and equipment. Subsequently, the team conducted an outline design after returning to Japan, and prepared an Outline Design Report. The mission was again dispatched to Myanmar from 3 to 7 December 2018 to explain the contents of the report and to confirm the scope of work.

The team subsequently executed an outline design after returning to Japan, and prepared a Final Report.

Outline of the facilities and equipment included in the Project are shown in Table - 1.

**Table -1 List of Equipment to be Procured**

No.	Item	Site	Q'ty
1	Airport Surveillance Radar / Secondary Surveillance Radar (ASR/SSR)	Yangon Intl' Airport	1 set
		Mandalay Intl' Airport	1 set
2	Secondary Surveillance Radar (SSR)	Nay Pyi Taw International Airport	1 set
3	Multi-sensor Data Processing System (MSDPS)	Yangon Air Traffic Management Center	1 set
4	Voice Communication Control System (VCCS)	Yangon Air Traffic Management Center	1 set
5	Radar Control Training Simulator	Yangon Air Traffic Management Center	1 set
6	VHF Air-ground Communication System	Yangon Air Traffic Management Center	1 set
		Mandalay International Airport	1 set
		Nay Pyi Taw International Airport	1 set

## 3. Project Implementation Schedule

Necessary periods for implementation of the Project are 2.0 months for detailed design, 2.5 months for tender. Also, required period for procurement is 14 months for Airport Safety equipment and 7 months for Airport security equipment in total.

#### 4. Project Evaluation

##### (1) Quantitative Effectiveness

The targeted year for quantitative effectiveness expected from the execution of the Project is assumed to be in 2024, which is three years after 2021, when the Project is completed.

The quantitative effectiveness is assumed based on social and economic surveys, and technical investigation, as shown in Table - 2.

**Table -2 Summary of Quantitative Effectiveness**

Indexes	Baseline (2017)	Target (2024)
Radar Approach Control in Yangon and Mandalay International Airport (%)	0	100
Ability of Aircraft Surveillance for the Airspace around Nay Pyi Taw International Airport under 15,000 feet	0	100

##### (2) Qualitative Effectiveness

The indexes of qualitative effectiveness of this Project are summarized as follows:

- By doing approach radar control in Yangon and Mandalay International Airport, the safety and efficiency of aircraft operation will be improved.
- The efficiency of air traffic operation in aerodrome will be improved in Yangon and Mandalay International Airport.
- The safety of aircraft operation around Nay Pyi Taw International Airport will be improved.

Based on the above, it is determined that the Project is appropriate, and its validity will also be expected.



## **The Preparatory Survey for the Project for Improvement of Aircraft Surveillance System in the Republic of The Union of Myanmar**

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## Abbreviations

A/P	Authorization to Pay
ACC	Area Control Center
ADS-B	Automatic Dependent System - Broadcast
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATM	Air Traffic Management
ATMC	Air Traffic Management Center
B/A	Banking Arrangement
CNS	Communication, Navigation and Surveillance
CWP	Controller Working Position
DCA	Department of Civil Aviation
FDD	Flight Data Display
ICAO	International Civil Aviation Organization
JCAB	Japan Civil Aviation Bureau
JICA	Japan International Cooperation Agency
MD	Minutes of Discussion
MSDPS	Multi Sensor Data Processing System
SIM	Simulator
RDD	Radar Data Display
SSR	Secondary Surveillance Radar
VCCS	Voice Communication Control System
VHF A/G	Very High Frequency Air to Ground Communication
VSAT	Very Small Aperture Terminal



# **1. BASIC CONCEPT OF THE PROJECT**





# **1 BASIC CONCEPT OF THE PROJECT**

## **1.1 Background of the Project**

Currently, there are 34 airports in Myanmar with civil aviation operation. Three of these are international airports, namely: Yangon International Airport, Nay Pyi Taw International Airport, and Mandalay International Airport. Air traffic demand in Myanmar has been rapidly increasing each year. The annual passenger volume for the Yangon International Airport in 2017 was around 5.73 million. In 2005, it was only at around 1.43 million, which shows that the annual passenger volume increased approximately four times from 2005 to 2017. In addition, annual passenger growth rate is expected to be at 7% to 8% per year.

Based on the “Master Plan of National Transportation”, which is developed with support from Japan International Cooperation Agency (JICA) and approved by the cabinet in December 2015, the Government of Myanmar has proceeded to develop the airport facilities in order to meet International Civil Aviation Organization (ICAO) standards and requirements. However, the current aerodrome and en-route surveillance systems are not sufficient, which makes it difficult to accommodate future high traffic demand efficiently. There is no Primary Surveillance Radar (PSR) in the Yangon International Airport, which is the center of air traffic transportation in Myanmar. In addition, PSR is out of service in the Mandalay International Airport. Therefore, non-radar approach control service is provided in both airports. It leads to low airport capacity and causes the occurrence of over work load time in the airports. Due to the current situation, there is a concern about maintaining aviation operational safety and efficiency. Furthermore, the airspace around the Nay Pyi Taw International Airport is the largest in Myanmar since approximately 80% of domestic flights (6,000 flights/year) fly through this air route. Nevertheless, the airspace below 15,000 feet is out of coverage to two en-route radars, which are installed in the Yangon and the Mandalay international airports. Under this condition, separation cannot be shortened, and the increase in traffic demand cannot be managed.

From consideration above, the Government of Myanmar requested the cooperation for “the Improvement of Aircraft Surveillance System in the Republic of the Union of Myanmar” to the Government of Japan as a Grant Aid.

## 1.2 Natural Condition

### 1.2.1 Topographical Condition

Topographic survey was carried out on ASR/SSR and SSR site in order to get topographic information necessary for facility placement plan.

**Table 1-1 Outline of Topographic Survey**

Airport	Survey Site	Range(m <sup>2</sup> )
Yangon International Airport	ASR/SSR Site	10,000
Mandalay International Airport	ASR/SSR Site	10,000
Nay Pyi Taw International Airport	SSR Site	10,000

#### (1) Yangon International Airport

The ASR/SSR Site of Yangon International Airport will be installed at approx. 2000 m from runway edge 03 and approx. 220 m northwest from runway center. There is a gradient from the runway to the planned position of the antenna tower of the ASR/SSR. The level of antenna tower position is approx. 6 m higher than the level at runway. Low grasses are growing throughout the site, but it seems not to be the obstacles that exert radio interference.



**Photo 1-1 ASR/SSR Site (1)**

(Source : The Study Team)



**Photo 1-2 ASR/SSR Site (2)**

#### (2) Mandalay International Airport

The ASR/SSR Site of Mandalay International Airport will be installed at approx. 750 m from runway edge 35 and approx. 330 m west from runway center. The site is beside the maintenance road. Shrubs were overgrown at the site and cut down by Mandalay International Airport operation company before the survey. There is a gradient from maintenance road to the planned position of the antenna tower of the ASR/SSR. The level of antenna tower position is approx. 2 m higher than the level at runway. Installation of security fence around the airside is undergoing. Confirming the fence position might be necessary before radar installation since fence will be installed near the radar site.



**Photo 1-3 ASR/SSR Site (1)**

(Source: The Study Team)



**Photo 1-4 ASR/SSR Site (2)**

(3) Nay Pyi Taw International Airport

The SSR Site of Nya Pyi Taw International Airport will be installed at approx. 1,000 m south from terminal building. There is unpaved road in the west and south of the site. In the south of the road, fence is installed at the boundary of military area. The site has a small slope and relatively flat. Low grasses are covering the site. Some trees and weeds with height of approx. 1.5m are growing at the site but it seems not to be the obstacle to that exert radio interference.



**Photo 1-5 SSR Site**

(Source: The Study Team)



**Photo 1-6 Surround of the Site**

### 1.2.2 Ground Condition

Geotechnical investigation was carried out on ASR/SSR and SSR site in order to get ground condition necessary for facility placement plan.

**Table 1-2 Outline of Geotechnical Investigation**

Airport	Investigation Site	Survey Contents
Yangon International Airport	ASR/SSR Site	Standard Penetration Test and Laboratory Test
Mandalay International Airport	ASR/SSR Site	Standard Penetration Test and Laboratory Test
Nay Pyi Taw International Airport	SSR Site	Standard Penetration Test and Laboratory Test

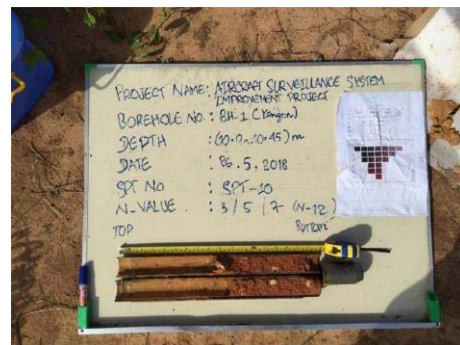
#### (1) Yangon International Airport

Type of the soil at the site is silty sand with clay except 3 m depth. Silty sand with trace gravel is found at 3 m depth. N value of Standard penetration Test is around 15 to 25. Standard Penetration Test condition and bore log are shown below.





**Photo 1-7 Boring Work**

(Source: The Study Team)



**Photo 1-8 Test Record**

EUNTAC TECHNOLOGIES		CLIENT: Nippon Koei Co., Ltd										
		PROJECT: Aircraft Surveillance System Improvement										
		LOCATION: Yangon Airport										
PROJECT NO:		BOREHOLE NO: BH-1										
DRILLING DATE STARTED: 25/05/2018		BOREHOLE DIA: 100 mm										
DRILLING DATE COMPLETED: 26/05/2018		CORE DIA:										
PREPARED BY: SNMH		DRILLING METHOD: Rotary										
		WATER LEVEL:										
		REDUCED LEVEL: 26.098										
		NORTHING: 1872261.152										
		EASTING: 194844.584										
Description	Graphic Log	Depth (m) (Thickness)	Redwood Level (m)	Scale	SPT (N-Value)	Soils	Gravel	Depth (m)	Rock	Grain Size Analysis	Shear Strength	Atterberg
Loose to Medium Dense, Reddish Brown, Low Plasticity, Silty SAND with some Clay	X	(2.45)		1	8/30 (2/2/3)	SP11	1.00-1.45			0/63/38/19		1.84 10.15 41 20
	X		23.65	2	29/30 (5/10/18)	SP12	2.00-2.45					
Medium Dense, Reddish Brown, Low Plasticity, Silty SAND with trace Gravel	X	(1.00)		3	16/30 (6/7/9)	SP13	3.00-3.45					
	X		22.65	4	19/30 (5/8/11)	SP14	4.00-4.45					
Medium Dense, Reddish Brown, Low Plasticity, Silty SAND with some Clay	X	(5.00)		5	19/30 (5/7/12)	SP15	5.00-5.45					
	X		17.65	6	16/30 (4/8/8)	SP16	6.00-6.45			1/84/24/11		1.81 24.93 36 18
	X		12.65	7	20/30 (5/6/10)	SP17	7.00-7.45					
Medium Dense, Reddish Brown, Low Plasticity, Silty SAND with trace Gravel	X	(1.00)		8	22/30 (6/8/14)	SP18	8.00-8.45					
	X		16.65	9	15/30 (6/6/9)	SP19	9.00-9.45					
Medium Dense, Reddish Brown, Low Plasticity, Silty SAND with trace Clay	X	(5.00)		10	12/30 (3/5/7)	SP110	10.00-10.45					
	X		11.65	11	16/30 (5/7/9)	SP111	11.00-11.45					
	X			12	17/30 (6/8/10)	SP112	12.00-12.45			0/71/20/9		1.95 17.26 34 22
	X			13	21/30 (6/8/13)	SP113	13.00-13.45					
Medium Dense, Yellowish Brown to Reddish Brown, Low Plasticity Silty SAND with trace Clay	X	(4.00)		14	25/30 (5/10/15)	SP114	14.00-14.45					
	X		7.65	15	24/30 (6/11/13)	SP115	15.00-15.45					
Medium Dense, Yellowish Brown, Non Plastic Silty SAND with trace Clay	X	(2.00)		16	20/30 (6/6/12)	SP116	16.00-16.45			0/86/25/9		1.98 23.88 34 18
	X			17	18/30 (5/7/11)	SP117	17.00-17.45					
	X			18	16/30 (5/7/8)	SP118	18.00-18.45					
	X			19	19/30 (5/7/13)	SP119	19.00-19.45					
Borehole terminated at 20.45m	X		5.65	20	17/30 (5/7/10)	SP120	20.00-20.45			0/78/16/8		2.03 21.5
	X			21								

LEGEND:  
 - Standard Penetration Test (SPT)  
 - Silty SAND

(Source: The Study Team) **Figure 1-1 Borehole Log (Yangon International Airport)**

(2) Mandalay International Airport

Type of the soil at the site is silty sand with gravel up to 8 m depth. Sandy silt is found at 9 to 11 m depth and silty clay is found below 12 m depth. N value of Standard Penetration Test at silty sand layer (1 to 8 m depth) is below 20 except 8 m depth. N value at sandy silt layer (9 to 11 m depth) is around 30 and it is 50 at 9 m depth. N value at silty clay layer (below 12 m depth) is above 30 except 18 m depth. Especially, at 19 m depth, N value reach to 50. In general, layers with large and small N values alternatively appear. Standard Penetration Test condition and bore log are shown below.





Photo 1-9 Boring Work

Photo 1-10 Test Record

(Source: The Study Team)

Description		Graphic Log	Depth (m)	Reduced Level (m)	Scale	SPT (N-Value)	Bores / (S)	Legend	Type No.	Depth (m)	Rock	Grain Size Analysis	Shear Strength	Back Density	Water Content	Atterberg Limit (%)																			
												G/SA/S/C	C	φ	(%)	LL	PL																		
Dense, Brown, High Plasticity Silty SAND with some Clay and trace Gravel		[Symbol]	(3.45)	84.78	1	11/30 (4/4/7)	SPT1	1.00-1.45	11/30 (4/4/7)	1.00-1.45																									
																		[Symbol]	2	12/30 (3/5/7)	SPT2	2.00-2.45	12/30 (3/5/7)	2.00-2.45											
																																	[Symbol]	3	10/30 (3/4/6)
Medium Dense, Brown, Low Plasticity Silty SAND with Gravel		[Symbol]	(3.00)	81.78	4	16/30 (5/7/9)	SPT4	4.00-4.45	16/30 (5/7/9)	4.00-4.45		3/51/34/12			1.93	14.8	62	29																	
																			[Symbol]	5	80.78	13/30 (3/6/7)	SPT5	5.00-5.45	13/30 (3/6/7)	5.00-5.45									
Very Dense, Brown, Low Plasticity, Silty SAND with Gravel		[Symbol]	(1.00)	80.78	7	16/30 (4/7/9)	SPT7	7.00-7.45	16/30 (4/7/9)	7.00-7.45																									
Medium Dense, Brown, Low Plasticity, Silty SAND with some Gravel																				[Symbol]	(1.00)	79.78	8	25/30 (1/3/15/10)	SPT8	8.00-8.45	25/30 (1/3/15/10)	8.00-8.45		16/61/16/5					
Very Stiff, Brown, Low Plasticity, Silty SAND with some Clay and Gravel		[Symbol]	(1.00)	78.78	9	25/30 (4/9/16)	SPT9	9.00-9.45	25/30 (4/9/16)	9.00-9.45																									
Hard, Brown, Low Plasticity, Silty SAND with some Clay and Gravel																				[Symbol]	(2.00)	76.78	10	50/23 (10/28/22)	SPT10	10.00-10.38	50/23 (10/28/22)	10.00-10.38							
Dense, Reddish Brown, low Plasticity, Silty SAND with some Clay and trace Gravel		[Symbol]	(1.00)	75.78	11	30/30 (1/15/15)	SPT11	11.00-11.45	30/30 (1/15/15)	11.00-11.45		10/33/49/17																							
Hard, Brown, High Plasticity Silty CLAY with trace Sand																				[Symbol]	(1.00)	74.78	12	37/30 (10/15/22)	SPT12	12.00-12.45	37/30 (10/15/22)	12.00-12.45							
Very Stiff, Brown, High Plasticity, Silty CLAY with trace Sand		[Symbol]	(3.00)	71.78	13	35/30 (9/18/19)	SPT13	13.00-13.45	35/30 (9/18/19)	13.00-13.45		0/8/32/60																							
																				[Symbol]	14	70.78	14	17/30 (3/7/10)	SPT14	14.00-14.45	17/30 (3/7/10)	14.00-14.45							
		[Symbol]	15	71.78	15	23/30 (5/11/12)	SPT15	15.00-15.45	23/30 (5/11/12)	15.00-15.45																									
Hard, Brown, High Plasticity, Silty CLAY with trace Sand																				[Symbol]	(1.00)	70.78	16	20/30 (6/6/11)	SPT16	16.00-16.45	20/30 (6/6/11)	16.00-16.45							
		[Symbol]	17	70.78	17	34/30 (7/17/17)	SPT17	17.00-17.45	34/30 (7/17/17)	17.00-17.45																									
Very Stiff to Hard, Brown, High Plasticity, Silty CLAY with trace Sand																				[Symbol]	(3.00)	70.78	18	21/30 (7/8/13)	SPT18	18.00-18.45	21/30 (7/8/13)	18.00-18.45							
		[Symbol]	19	67.78	19	50/22 (10/25/25)	SPT19	19.00-19.37	50/22 (10/25/25)	19.00-19.37																									
Borehole terminated at 20.45m																				[Symbol]	(3.00)	67.78	20	36/30 (10/16/20)	SPT20	20.00-20.45	36/30 (10/16/20)	20.00-20.45							
		[Symbol]	21	67.78	21																														

(Source: The Study Team)

Figure 1-2 Borehole Log (Mandalay International Airport)

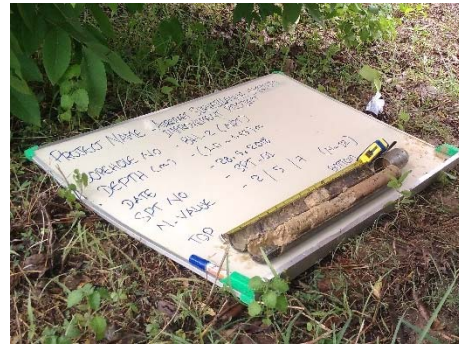
(3) Nay Pyi Taw International Airport

Type of soil up to 6m depth is sandy clay and over 7m depth is sand. The N values of Standard Penetration Test is basically over 20 and some part of N value is less than 20. However, all layers have at least more than 10 of N value, and it can be said that no soft ground in the radar site. Test condition of the site work and borehole log are shown below.



**Photo 1-11 Boring Work**

(Source: The Study Team)



**Photo 1-12 Test Record**





### **1.3 Environmental and Society Consideration**

According to Guideline for Environmental and Social Consideration (April 2010) issued by JICA, it is necessary to conduct the environmental and social consideration survey which study, predict, and evaluate the possibility of the affection of the Project to environment and local society, and suggest mitigation plan of the affection.

However, the scope of the Project is within the airport site, and it can be judged that there are basically no affections of the Project to environment and local society, based on the study to each item such as public health, landscape, global warming, air pollution, water pollution, soil pollution, waste, noise, and vibration.

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## **2. CONTENTS OF THE PROJECT**



## **2 CONTENTS OF THE PROJECT**

### **2.1 Basic Concept of the Project**

#### **2.1.1 Priority and Project Objective**

The objective of this project is to contribute to the enhancement of the functions of the aviation sector in Myanmar through the reinforcement of aircraft operational safety and capacity in the Yangon, Mandalay, and Nay Pyi Taw international airports, and in each terminal airspace through the improvement of aircraft surveillance systems in Myanmar.

Priority of project is to contribute to the stability of public welfare and better living for the nation through improvement the ability of transportation infrastructure and realizing sustainability growth in Myanmar.

#### **2.1.2 Basic Policies of the Survey**

Basic policies of this project are to deploy optimum facilities and equipment to achieve the above objectives and realize aircraft operational safety and efficiency. The contents of this project will support that air traffic management operation and systems follow ICAO standard.

This project provides the aircraft surveillance systems for improvement of aircraft operational safety and capacity in three international airports and surrounding airspace in those airports.

## **2.2 Outline Design of Japanese Assistance**

### **2.2.1 Design Policy**

#### **(1) Design Principle**

Based on the system for procurement in the project, airport surveillance radars, en-route surveillance radars, and radar data processing systems make up the aircraft surveillance systems which will be installed to enhance the safety of aircraft flying in the vicinity of the Yangon, Mandalay, and Nay Pyi Taw international airports, as well as to strengthen the capacity for handling aircraft. To achieve this, the systems will be designed in accordance with the basic principles described below.

Since the procured equipment, including the radar apparatus, are Japanese products, a radar system optimal for Myanmar will be designed based on Japan Civil Aviation Bureau (JCAB) equipment specifications and those proposed by Japanese manufacturer. Particular consideration will be given to the ease of operation and maintenance for the system.

During the field survey, the contents of the Minutes of Discussion, which confirms the requests from Myanmar side, were verified in the Technical Memorandum. This memorandum was created based on the findings of the field survey and also provides the general basis for implementing these design principles.

#### **(2) Natural Conditions**

The design of aeronautical radio navigation facilities and air traffic control facilities should be based on the natural environment conditions of the country (e.g., earthquakes: vibration; typhoons: wind force; weather: outside temperature/humidity) and should follow the design standards of Myanmar. However, no official standards have been set yet.

The northern part of Myanmar is a temperate zone, while the central and southern regions are classified as tropical zones. Therefore, the climate is generally characterized by high temperatures and high humidity. In line with this, the year is divided into the rainy season (end of May to mid-October), the dry season (end of October to February), and the hot season (March to mid-May). In Yangon, the average high and low temperatures are 30 °C and 26 °C in the rainy season, 32 °C and 19 °C in the dry season, and 36 °C and 24 °C in the hot season. The average monthly rainfall amount in the rainy season is approximately 550 mm in Yangon and 150 mm in Mandalay.

In Myanmar, there have not been any disasters caused by large earthquakes thus far, but the country has been impacted by cyclones moving north from the Bay of Bengal. Because of this, the environmental conditions for the equipment and materials used in this preparatory survey will, in principle, follow the design standards of Japanese air traffic control and safety facilities, which take into account summer temperatures, rainfall, passage of typhoons in Japan, as well as earthquake resistance strength. In addition, the policy for commercial off-the-shelf (COTS) products for PCs, etc., will be to use the design standards of the manufacturer.

(3) Socioeconomic Conditions

This project will bring in new equipment for air traffic control facilities. For the rough design, there are no particular issues to be considered with regard to lifestyle, history/cultural traditions, religion, architectural style, or economic conditions.

(4) Construction Circumstances/Procurement Conditions/Commercial Practices

Air traffic control equipment is universal throughout the world, forming a part of airport infrastructure. Therefore, as a basic policy, the procured equipment specifications will follow ICAO international standards, equipment specifications established by JCAB, and equipment specifications recommended by Japanese manufacturer.

(5) Utilization of Local Contractors and Consultants

Local contractors specializing in construction and electrical works, who possess common and skilled labors, and electricians will be utilized. Although there is no electrical contractor specializing in CNS/ATM system works, local contractors may be employed for equipment installation and wiring, under the supervision of engineers dispatched from the main contractor in Japan or elsewhere.

(6) Operation and Maintenance

The air traffic control equipment procured for the Project will be, in principle, the same type of system as the equipment currently being operated and maintained by Myanmar. At the DCA, the existing equipment is being operated and maintained on a daily basis, and normal operations are conducted smoothly. In addition, at the Civil Aviation Training Institute, air traffic controller trainees and maintenance personnel trainees are continually being developed. Furthermore, all operation and maintenance personnel take annual refresher courses and receive training on operational and technical aspects, thereby enhancing their knowledge and maintaining a level of technical expertise that is on par with the global standard. Based on the on-site on-the-job training (OJT), they also acquire experience and practical learning on matters including accident response and repair methods. Because of this, it is thought that the current technical capacity of operation and maintenance personnel is at a sufficient skill level.

Since the operational procedures and maintenance methods for the newly procured equipment and existing equipment will differ, initial operating guidance conducted by an engineer dispatched from the manufacturer is planned.

(7) Design Grade of Facilities and Materials

The ICAO standards and recommendations shall apply to the functional specifications of major systems and equipment to be procured under the project. With regard to the standards related to quality and environment, the specifications of Japan Civil Aviation Bureau (JCAB) will apply. For the quality in particular, any commercial off-the-shell (ready-made) products should be utilized to reduce

maintenance costs after commencement of the operations, as is a worldwide trend in CNS/ATM systems development.

(8) Method of Construction/Procurement and Work Scheduling

The project will be implemented within the restricted areas and the controlled access areas of the three airports. For radar facility construction, considerations will be made to prevent the timing of civil engineering work, including radar building construction and radar tower foundation construction, from coinciding with the rainy season. Additionally, with regard to the timing of equipment manufacturing, transport, installation, adjustments, and tests for the three airports, after assessing the critical path of the entire project, the period necessary for procurement management will be minimized, and the delivery of each system to their respective sites will be coordinated at a local site so that work overlap (crowding) is avoided at the three airports.



## 2.2.2 Basic Plan (Construction Plan/Equipment Plan)

### (1) Scrutinizing Requests from Myanmar and Subsequent Changes

Table 2-1 shows the comparison between the original requests from Myanmar and the results of the site survey.

**Table 2-1 List of the Requested Items and Evaluation Result/Subsequent Changes**

Minutes of Discussion (16 May 2018)	Technical Memorandum (5 June 2018)	Final
<b>1. Yangon International Airport</b>		
ASR/SSR Antenna Tower, Radar Building	ASR/SSR Antenna Tower, Radar Building	No Change
MSDPS	MSDPS	No Change
RDD/FDD (ATMC/Tower)	RDD/FDD (ATMC/Tower)	No Change
Radar Control Training Simulator	Radar Control Training Simulator	No Change
Voice Communication Control System (VCCS)	VCCS	No Change
Approach Console	Approach Console	No Change
Interface preparation in existing MSDPS for new Nay Pyi Taw SSR	Preparation for connecting new Nay Pyi Taw SSR to new MSDPS	No Change
Providing interface of Yangon/ Mandalay SSR to existing MSDPS	Preparation interface of Yangon/ Mandalay SSR for existing MSDPS	No Change
VHF Air-Ground Comm. System for Approach Control	VHF Air-Ground Comm. System for Approach Control	No Change
<b>2. Mandalay International Airport</b>		
ASR/SSR Antenna Tower, Radar Building	ASR/SSR Antenna Tower, Radar Building	No Change
(MSDPS)	(MSDPS)	No Change
VHF Air-Ground Comm. System for Approach Control	VHF Air-Ground Comm. System for Approach Control	No Change
RDD/FDD (Tower)	RDD/FDD (Tower)	No Change
<b>3. Nay Pyi Taw International Airport</b>		
SSR	SSR	No Change
(MSDPS)	(MSDPS)	No Change
RDD/FDD (Tower)	RDD/FDD (Tower)	No Change
VHF Air-Ground Comm. System for Approach Control	VHF Air-Ground Comm. System for Approach Control	No Change

(2) Whole Plan

1) Airport Surveillance Radar/Secondary Surveillance Radar System

The radar system in Japan has adopted the system of the Federal Aviation Administration (FAA) in the United States of America (USA). With this and Japan's unique high-quality control as bases, a system focusing on the ease of operation and maintenance will be created. There are two companies in Japan for manufacturing of air traffic control radar, i.e., NEC Corporation and Toshiba Corporation. The equipment specifications for these two companies are in line with JCAB specifications, but the system will be built from each company's proprietary system design. Because of this, based on equipment specifications proposed by NEC and Toshiba, the overall system will be built with a radar system optimal for Myanmar, giving particular consideration to ease of operation.

For the installation location of the radar facilities at each airport, the following requirements will be taken into account:

- A location where DCA can maintain facilities, taking the future plans of each airport into consideration;
- A location where flight courses can be monitored through airport approach and departure procedures;
- A location not less than 450 m away from obstacles such as hangars, control towers, and terminal buildings, if possible;
- In principle, radar antenna will be placed at a location and height that does not protrude from airport obstacle limitation surfaces;
- A location that can be reached via access roads within the airport, in consideration of easy facility maintenance; and
- A location that takes into account incidental facilities for the radar data transmission route and the power lead-in route.

2) Radar Data Processing System

This system, which forms the core of the radar system, processes data received from Yangon and Mandalay airport surveillance radars and Nay Pyi Taw en-route surveillance radar in an integrated manner, displays the aircraft target on the radar data processing system, and supplies it to the terminal radar approach control and en-route radar control. However, DCA has requested a system that can also process and display aircraft target data from the Automatic Dependent Surveillance-Broadcast (ADS-B).

Therefore, consideration will be given to equipment specifications for ADS-B signal data processing capabilities, in addition to normal radar data. This will be further studied under the name of Multi-sensor Data Processing System (MSDPS).

Further, the MSDPS will interface with existing Aeronautical Fixed Telecommunication Network / ATS Message Handling System (AFTN/AMHS), which was installed in Yangon ACC, to

process flight plan information of all aircrafts flying in the terminal control area, and has the function of displaying aircraft identification on the aircraft target obtained from the radar.

3) Approach Control Console/Radar Data Display/Flight Data Display

The number of approach control consoles will be set by taking into consideration the number of handling aircraft which will be controlled and processed at each airport in the future, as well as DCA's future plans for separating approach control and departure control functions.

Both Yangon and Mandalay international airports will have two radar control consoles and two coordination consoles for a four-console system. The Nay Pyi Taw International Airport will have one radar control console and one coordination console for a two-console system.

For each display system, the radar control console will be equipped with a radar data display in a size that takes human machine interface (HMI) into account (normally 28-inch or wide-screen displays). A flight data display will also be installed in the coordination console, showing the flight plan for aircraft take-off and landing. Additionally, in the control tower where aerodrome control takes place, one radar data display and one flight data display will be installed to facilitate coordination with the approach/departure control.

A diagram of the entire equipment configuration of the radar systems for the three airports, combining items 1), 2) and 3) described above, is shown in Figure 2-1.

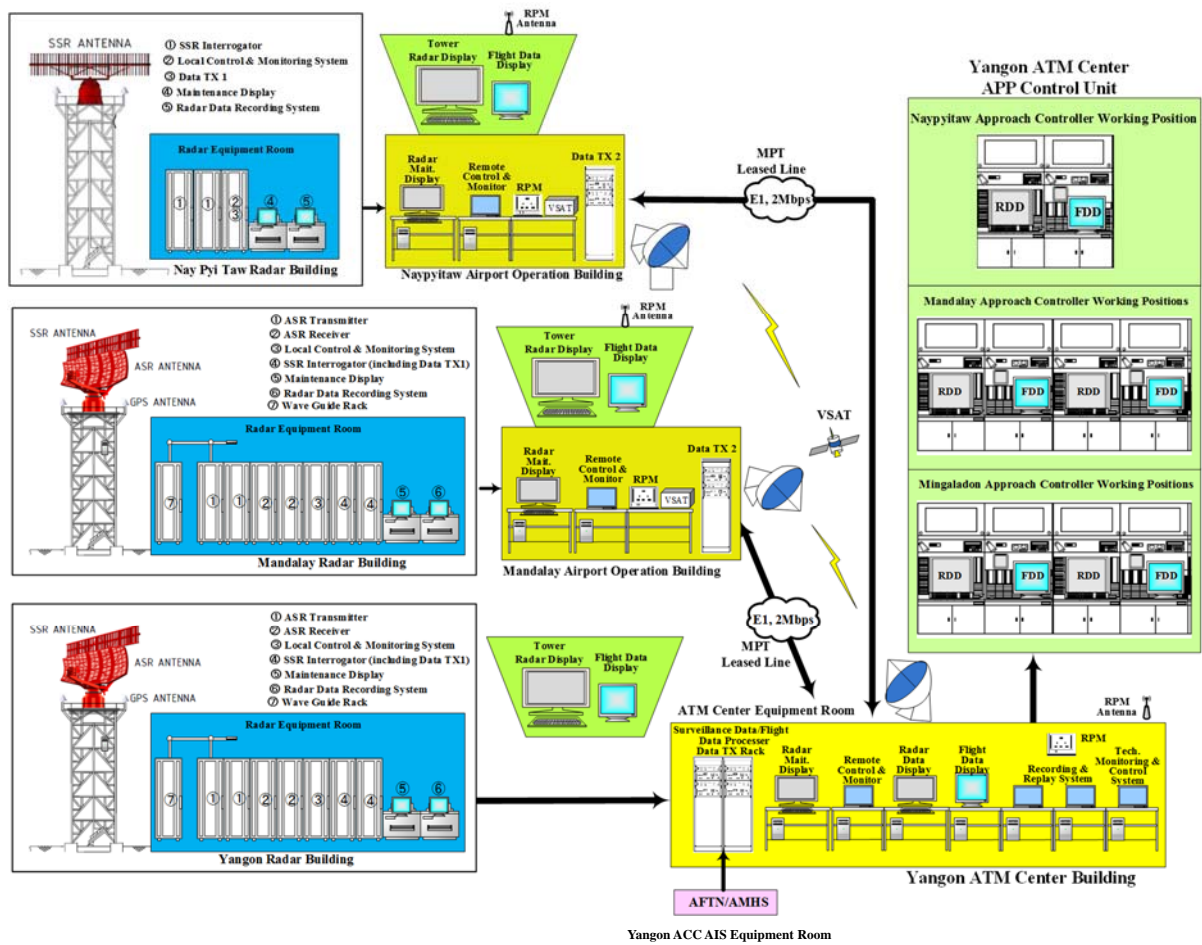


Figure 2-1 Radar System Diagram for the Three Airports

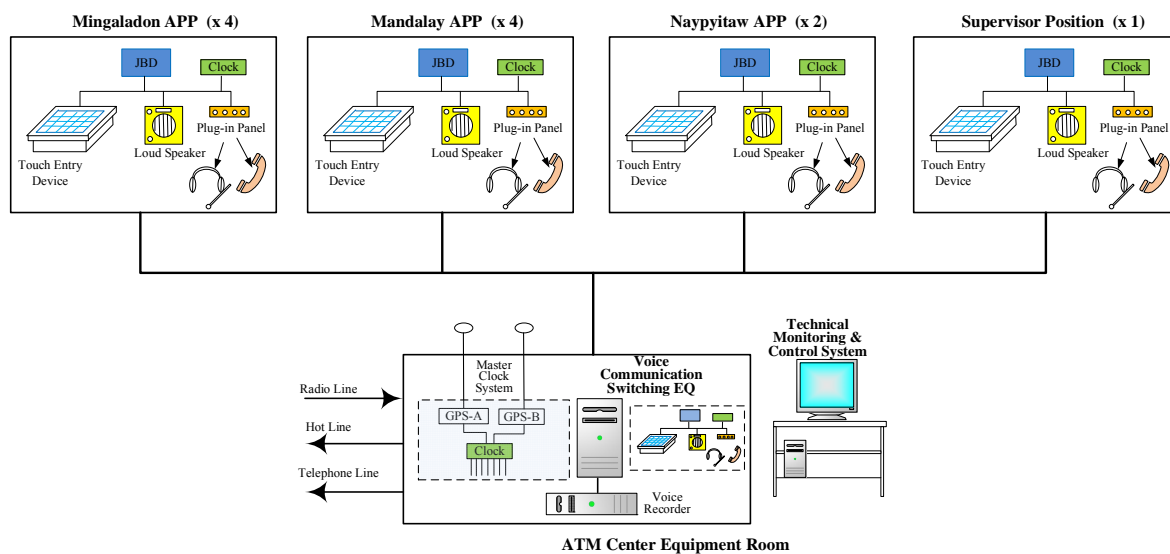
#### 4) Voice Communication Control System (VCCS)

The voice communication control system is necessary for implementing terminal radar control for the Yangon, Mandalay, and Nay Pyi Taw international airports in an integrated manner at the approach control room in Yangon ATMC.

The channel capacity of the system will be sufficient enough to integrally cover the control communications of the three airports and will have voice communication control functions (i.e., radio system, telephone system, voice recording system, and clock for control). The channel capacities of the system are listed as follows:

- Number of controller working position: 11 positions
- Radio control lines: At least six frequencies
- Public telephone lines: At least five channels
- Hotline telephone lines: At least five channels
- Internal telephone lines: At least ten channels

A diagram of the basic equipment configuration for the voice communication control system is shown in Figure 2-2.



**Figure 2-2 VCCS Diagram**

### 5) Radar Control Training Simulator

Approach control for aircraft at the Yangon and the Nay Pyi Taw international airports does not currently use a radar. Instead, non-radar control is performed from the control tower for which fixed passage times are set for each aircraft's arrival route and are noted on flights strips. At the Mandalay International Airport, approach controllers are assigned to the control tower from where they control the approach of aircraft while monitoring the radar data display. In the future, when terminal radar control for each airport is conducted by the Yangon Air Traffic Management Center (ATMC), it will be important for terminal radar controllers to take refresher courses. It will also be important to install training equipment to allow them to improve their skills and to acquire terminal radar control certification.

The equipment configuration will include a four-console system with two radar control consoles and two coordination consoles, as well as two pseudo-pilot consoles (including one for the instructor). Furthermore, this simulator system will be equipped with a function for backing up the approach control system in operation, designed thus to provide a failsafe for the actual system.

A diagram of the basic equipment configuration for the radar control training simulator is shown in Figure 2-3.

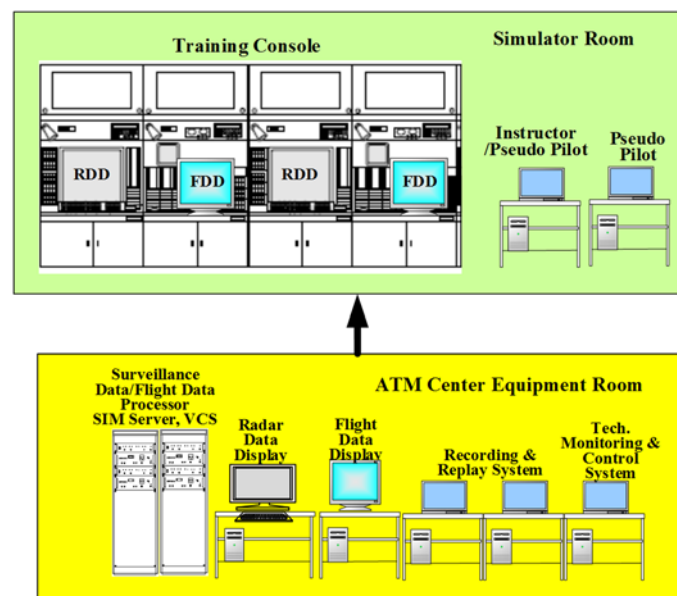


Figure 2-3 Radar Control Training Simulator System Diagram

### 6) VHF Air-ground Communication System

For the VHF air-ground communication system used by the approach control at the Yangon, Mandalay, and Nay Pyi Taw international airports, it is necessary to install a VHF radiotelephone transmitter/receiver equipped with a remote control and monitoring module to allow remote operations from Yangon ATMC. Since the old-type VHF transmitter/receiver currently in use cannot be equipped with this module, the equipment configuration will allow for the introduction of a system where remote control and monitoring is possible. Myanmar side will prepare VSAT equipment, satellite links, and dedicated terrestrial channels to use as the remote control channels.

A diagram of the basic equipment configuration for the VHF air-ground communication system provided for approach control at the three airports is shown in Figure 2-4.

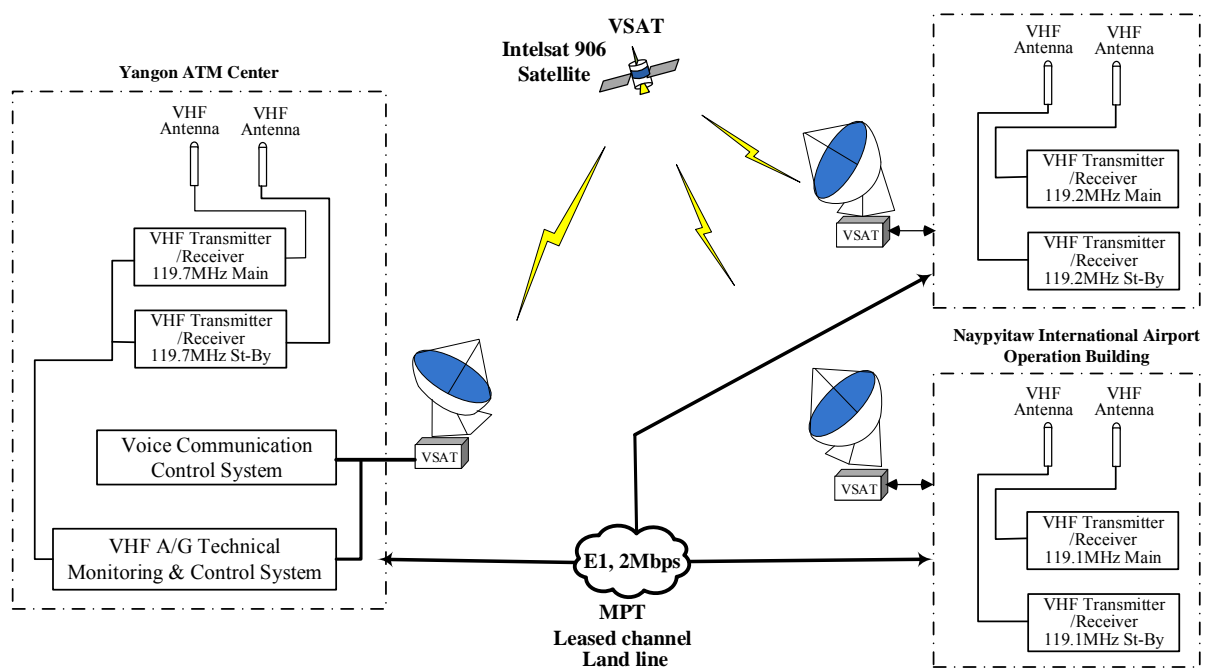


Figure 2-4 VHF Air-ground Communication System Diagram

(3) Equipment Plan

1) Yangon International Airport

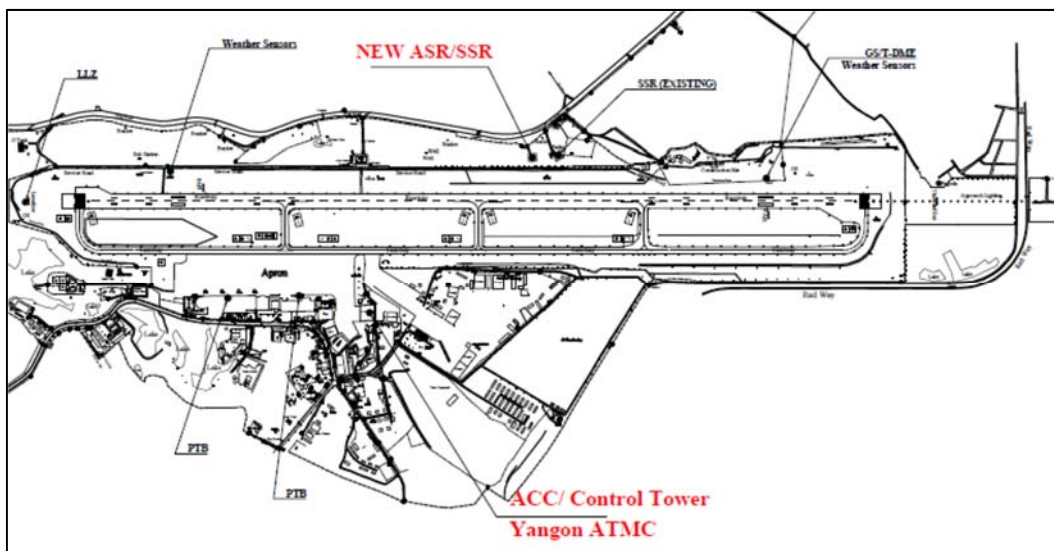
a) Airport Surveillance Radar/Secondary Surveillance Radar System (ASR/SSR)

The major equipment configuration of ASR/SSR system is shown in Table 2-2.

**Table 2-2 ASR/SSR Major Equipment Configuration**

No.	Equipment	Qty.	Unit	Place	
1	ASR/SSR Antenna	1	set	Radar Site	
2	ASR Transmitter	1	set		
3	ASR Receiver	2	sets		
4	SSR Interrogator	2	sets		
5	Local Control and Monitoring System	1	set		
6	Maintenance Display (Local)	1	set		
7	Radar Data Recording System	1	set		
8	Wave Guide	1	set		
9	Dehydrator	1	set		
10	GPS Clock Receiver	2	sets		
11	Power Distribution Box	1	set		
12	Data Transmission System 1	1	set		
13	Remote Control Wireless System	1	set		
14	Uninterruptible Power Supply	1	set		
15	Engine Generator	1	set		
16	Radar Tower	1	set		ATMC Equipment Room
17	Radar Building	1	set		
18	Remote Control and Monitoring System (ASR/SSR)	1	set		
19	Maintenance Display (Remote)	1	set		
20	Radar Performance Monitor	1	set		
21	Data Transmission System 2	1	set		
22	Remote Control Wireless System	1	set		

Based on the coordination with DCA, the ASR/SSR facility will be located near the existing SSR site as shown below.



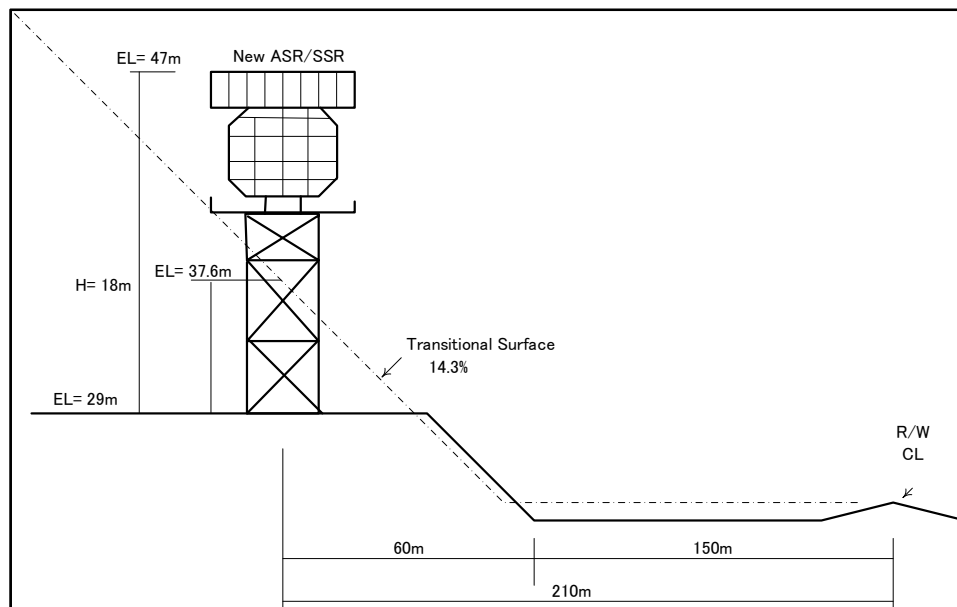
**Figure 2-5 Yangon International Airport Facility Layout Plan**



The location of the ASR/SSR facilities is 6 m higher than the height of the runway. A portion of the ground is already protruding from the transitional surface, which is an obstacle limitation surface. Considering the conditions surrounding this area (e.g., trees and nearby structures), to secure an unobstructed view from the radar in the direction of aircraft approach and departure, the height of the ASR/SSR antenna will be studied at a minimum of 18 m in order to fully establish the radar's performance.

As shown in Figure 2-6, if the ASR/SSR antenna height is set at 18 m, it will protrude from the transitional surface by approximately 9 m. Within this area, an en-route surveillance radar SSR has already been installed at a height of 12 m above the ground level. That facility itself is protruding from the transitional surface.

Because of this, the study team asked DCA to make a special exemption for the new ASR/SSR facilities as an airport obstacle. As a result of deliberation, DCA decided to make this exemption (see Appendix: Request and Letter of Approval).



**Figure 2-6 Relation between Obstacle Limitation Surface and ASR/SSR**

The installation policies for the requested equipment at the radar site and points for attention are as follows:

- There is shrubbery and leftover soil on the land to be used for the radar site. Since its removal is the responsibility of Myanmar side, it is necessary to coordinate with DCA for this removal prior to construction of the radar building and radar tower.
- Since Myanmar side will prepare the power supply point to the radar site, attention must be given to electricity lead-in work at the site, including checking the power supply route and supplied power panel capacity.
- For the route of the remote control fiber optic cable to be laid from the ATMC building to the radar site, it is necessary to adequately coordinate with DCA and the Yangon

Aerodrome Company Limited (YACL), paying attention to the installation of the cable and conduit line without any obstructions to airport normal operations.

b) Multi-sensor Data Processing System (MSDPS)

The major equipment configuration of MSDPS is shown in Table 2-3.

**Table 2-3 MSDPS Major Equipment Configuration**

No.	Equipment	Qty.	Unit	Place
1	Surveillance Data Processor	2	sets	ATMC Equipment Room
2	Flight Data Processor	2	sets	
3	Network Communication System	2	sets	
4	GPS Clock Receiver	2	sets	
5	Recording and Replay System	2	sets	
6	Technical Monitoring and Control System	2	sets	
7	Radar Data Display	1	set	
8	Flight Data Display	1	set	
9	Power Distribution Box	1	set	
10	RDD Console	2	sets	ATMC APP Control Unit Mingaladon Approach Control
11	FDD Console	2	sets	
12	Supervisor Console (common for 3 airports)	1	set	
13	Radar Data Display	3	sets	
14	Flight Data Display	3	sets	ATMC APP Control Unit Mandalay Approach Control
15	RDD Console	2	sets	
16	FDD Console	2	sets	
17	Radar Data Display	2	sets	
18	Flight Data Display	2	sets	ATMC APP Control Unit Nay Pyi Taw Approach Control
19	RDD Console	1	set	
20	FDD Console	1	set	
21	Radar Data Display	1	set	
22	Flight Data Display	1	set	Control Tower
23	Radar Data Display	1	set	
24	Flight Data Display	1	set	

The outline of the system diagram for ASR/SSR, MSDPS, console and display system at the Yangon International Airport is shown in Figure 2-7.

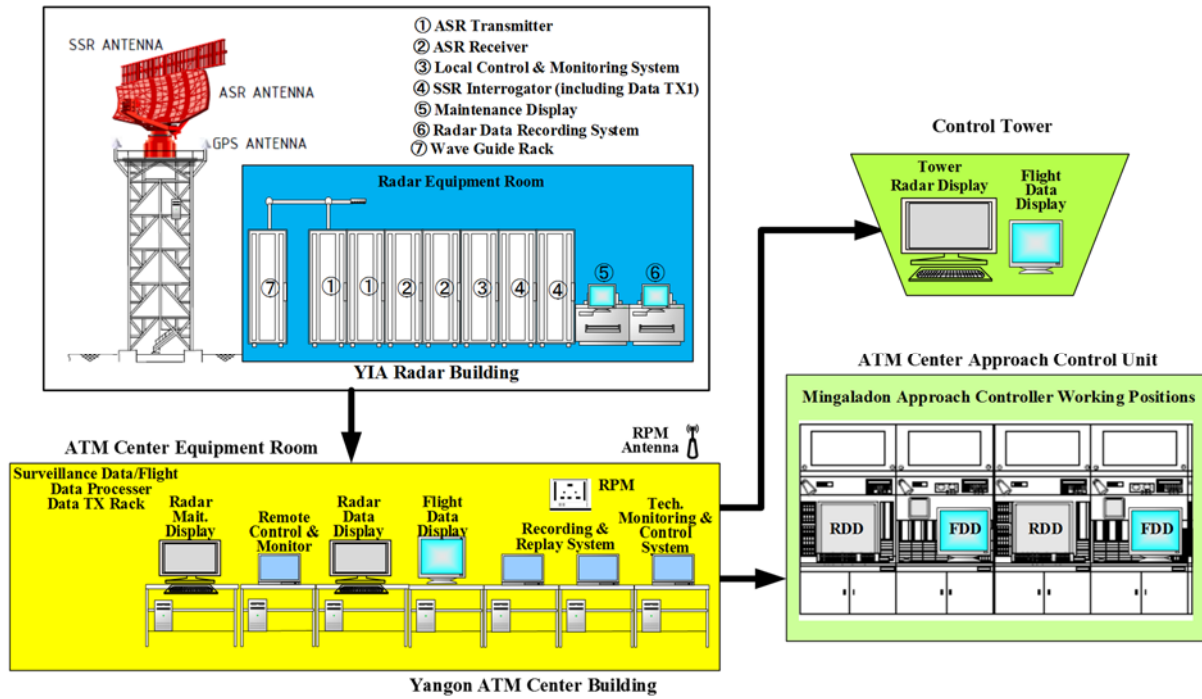


Figure 2-7 ASR/SSR, MSDPS, Console, Display System Diagram at the Yangon International Airport

c) Voice Communication Control System (VCCS)

The major equipment configuration of VCCS is shown in Table 2-4.

**Table 2-4 VCCS Major Equipment Configuration**

No.	Equipment	Qty.	Unit	Place
1	Voice Communication Switching Equipment	1	set	ATMC Equipment Room, APP Room
2	Controller Working Position	11	sets	
2-1	Touch Entry Device	12	ea	
2-2	Plug-In-Panel	12	ea	
2-3	Loudspeaker	24	ea	
2-4	Footswitch	12	ea	
3	Technical Monitoring and Control System	1	set	
4	Master Clock System	1	set	
4-1	Master Clock Unit	1	set	
4-2	Desk Mount Slave Clock	11	ea	
5	Voice Recorder	1	set	
6	Accessory	—	—	
6-1	Headset	24	ea	
6-2	Handset	11	ea	

d) Radar Control Training Simulator (SIM)

The major equipment configuration of SIM is shown in Table 2-5.

**Table 2-5 SIM Major Equipment Configuration**

No.	Equipment	Qty.	Unit	Place
1	Surveillance Data Processor	2	sets	ATMC Equipment Room
2	Flight Data Processor	2	sets	
3	SIM Server	2	sets	
4	Network Communication System	2	sets	
5	GPS Clock Receiver	2	sets	
6	Recording and Playback System	2	sets	
7	Technical Monitoring and Control System	2	sets	
8	Radar Data Display	2	sets	ATMC Simulator Room
9	Flight Data Display	2	sets	
10	Instructor / Pseudo Pilot Workstation	1	set	
11	Pseudo Pilot Workstation	1	set	
12	Voice Communication Control Unit and Workstation	1	set	
13	Voice Communication Panel	4	sets	
14	RDD Console	2	sets	
15	FDD Console	2	sets	

e) VHF Air-ground Communication System (VHF A/G)

The major equipment configuration of VHF A/G is shown in Table 2-6.

**Table 2-6 VHF A/G Main Equipment Configuration**

No.	Equipment	Qty.	Unit	Place
1	VHF Air-ground Transmitter/Receiver (Main and Standby)	2	sets	ATMC Equipment Room
2	VHF Antenna	2	sets	
3	Technical Monitoring and Control System	1	set	

The installation policies for the requested equipment at the Yangon ATMC building equipment room and approach control room (radar, MSDPS, VCCS, SIM, VHF equipment) as well as the points for attention are discussed below:

- The power supply necessary for the requested equipment will be prepared by Myanmar side, but it is necessary to pay attention to the power capacity and power system types required for each system equipment (3-phase 4-wire system, single-phase 2-wire system).
- The requested equipment and the DCA-procured equipment will be installed in the ATMC equipment room and the ATC control room. Therefore, coordination with DCA for specific installation location of the equipment will be necessary.
- The antenna for VHF air-ground communications will be installed on the roof of the ATMC building. Attention must be given so that the shortest route is selected when laying the coaxial cable to the antenna and so that cable loss is minimized.

2) Mandalay International Airport

The major equipment configuration of ASR/SSR, Display, and VHF A/G system is shown in Table 2-7.

**Table 2-7 ASR/SSR, Display, and VHF A/G Major Equipment Configuration**

No.	Equipment	Qty.	Unit	Place
1	ASR/SSR Antenna	1	set	Radar Site
2	ASR Transmitter	1	set	
3	ASR Receiver	2	sets	
4	SSR Interrogator	2	sets	
5	Local Control and Monitoring System	1	set	
6	Maintenance Display (Local)	1	set	
7	Radar Data Recording System	1	set	
8	Wave Guide	1	set	
9	Dehydrator	1	set	
10	GPS Clock Receiver	2	sets	
11	Power Distribution Box	1	set	
12	Data Transmission System 1	1	set	
13	Remote Control Wireless System	1	set	
14	Uninterruptible Power Supply	1	set	
14	Engine Generator	1	set	
15	Radar Tower	1	set	
16	Radar Building	1	set	
17	Remote Control and Monitoring System (ASR/SSR)	1	set	
18	Maintenance Display (Remote)	1	set	
19	Radar Performance Monitor	1	set	
20	Data Transmission System 2	1	set	
22	Remote Control Wireless System	1	set	
21	Power Distribution Box with UPS	1	set	
22	VHF Air-ground Transmitter/Receiver (main and standby)	2	sets	Control Tower
23	VHF Antenna	2	sets	
24	Radar Data Display	1	set	
25	Flight Data Display	1	set	

As a result of the coordination with DCA, ASR/SSR facilities will be installed at the following locations. The height of the radar tower will be 20 m, taking obstacle limitation surfaces into consideration.

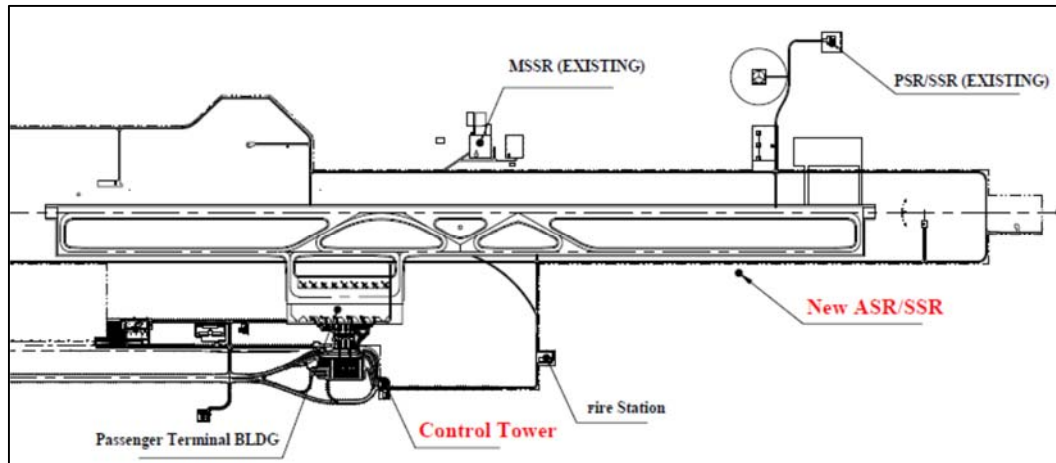


Figure 2-8 Mandalay International Airport Facility Layout Plan

The outline of the system diagram for ASR/SSR, MSDPS, Console and Display system at the Mandalay International Airport is shown in Figure 2-9. (Except VHF A/G)

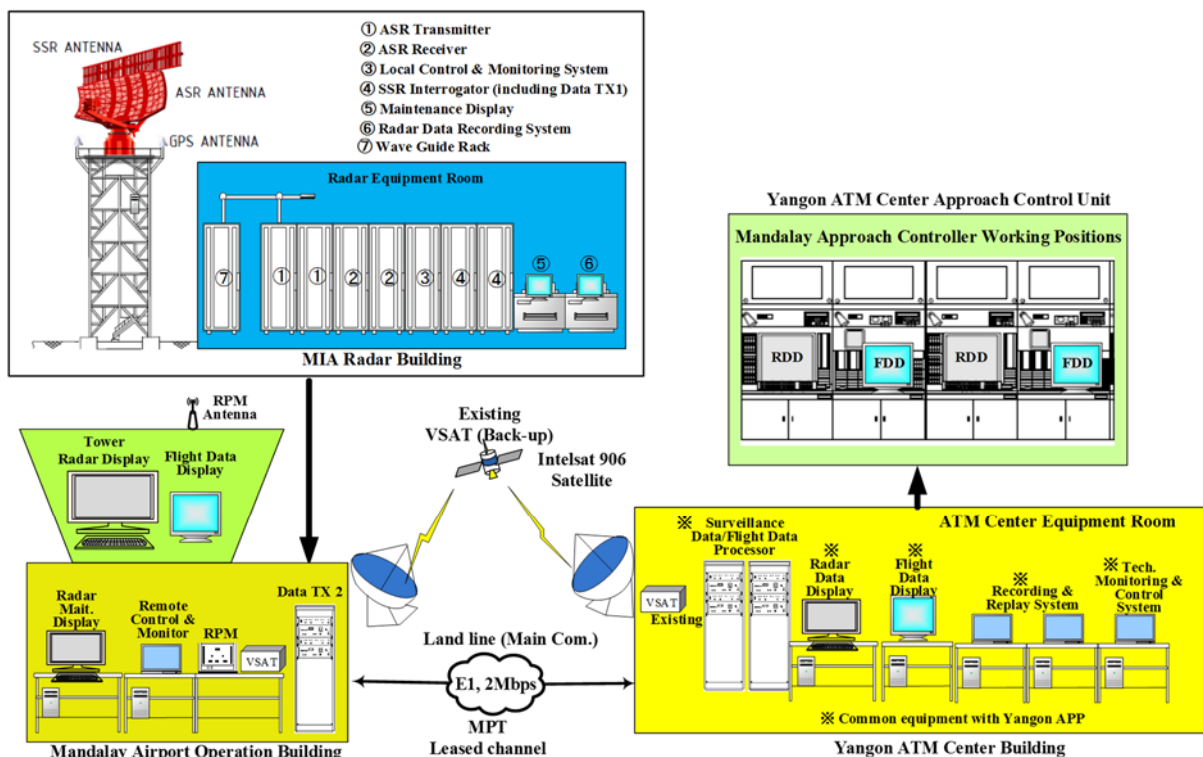


Figure 2-9 ASR/SSR, MSDPS, Console, Display System Diagram for the Mandalay International Airport

The installation policies for the requested equipment at the Mandalay International Airport and the points for attention are as follows:

- The construction of the access road (with length of approximately 30 m) from the airport perimeter road to the entrance of the site is the responsibility of Myanmar side. Attention must be given to ensure that there are no obstacles when the requested equipment is delivered to the site.
- Since Myanmar side will prepare the power supply point to the radar site, attention must be given to electricity lead-in work at the site, including checking the power supply route and supplied power panel capacity.
- For the route of the remote control fiber optic cable to be laid from the ATC operation building to the radar site, it is necessary to adequately coordinate with DCA and the Mandalay International Airport management company, paying attention to the installation of the cable and conduit without any obstructions to the normal operations at the airport.
- The requested equipment such as the radar remote control system will be placed in the equipment room on the first floor of the ATC operations building. However, since equipment currently not in use has been stored in this room, the requested equipment will be installed after the removal or relocation of this existing equipment, which is within the scope of Myanmar's responsibilities. In addition, providing the necessary electrical power for this equipment is also the responsibility of Myanmar side.



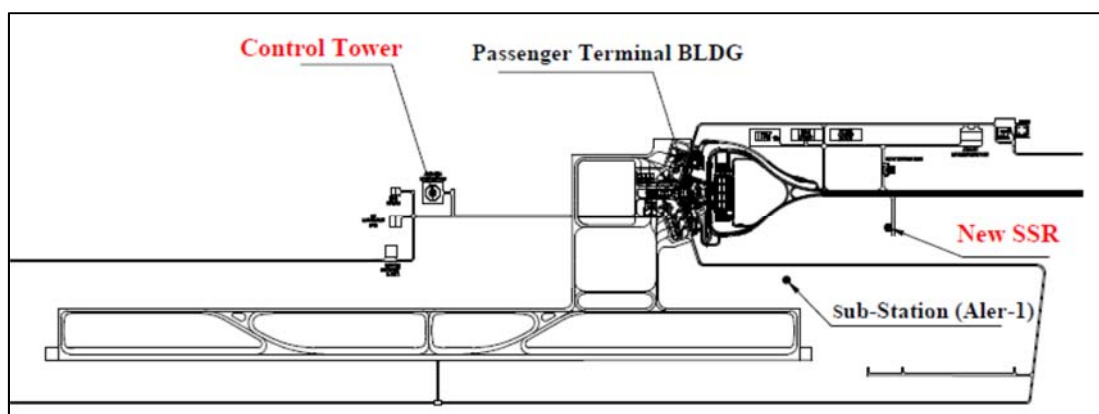
3) Nay Pyi Taw International Airport

The major equipment configuration of SSR, Display, and VHF A/G system is shown in Table 2-8.

**Table 2-8 SSR Major Equipment Configuration**

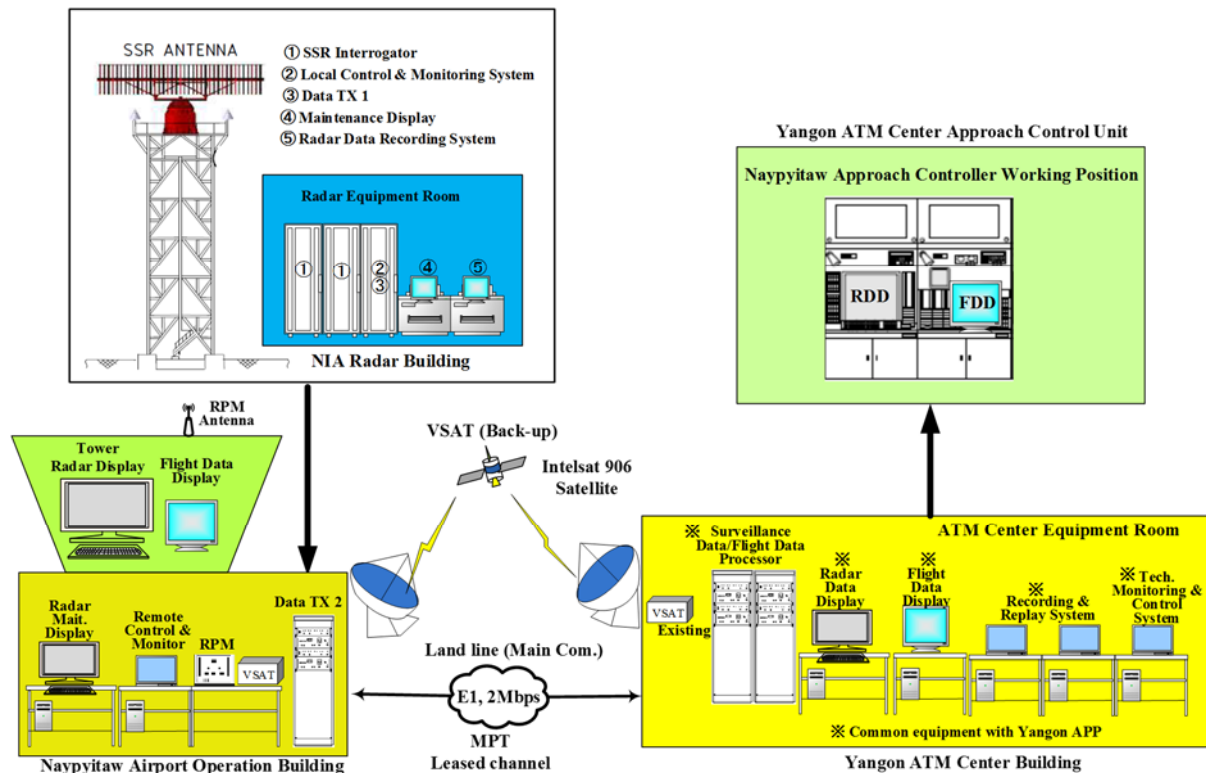
No.	Equipment	Qty.	Unit	Place
1	SSR Interrogator	2	sets	Radar Site
2	Local Control and Monitoring System	1	set	
3	Maintenance Display (Local)	1	set	
4	Radar Data Recording System	1	set	
5	GPS Clock Receiver	2	sets	
6	Power Distribution Box	1	set	
7	Data Transmission System 1	1	set	
8	Remote Control Wireless System	1	set	
9	Uninterruptible Power Supply	1	set	
10	Engine Generator	1	set	
11	Radar Tower	1	set	
12	Radar Building	1	set	
13	Remote Control and Monitoring System (ASR/SSR)	1	set	ATC Operation Building Equipment Room
14	Maintenance Display (Remote)	1	set	
15	Radar Performance Monitor	1	set	
16	Data Transmission System 2	1	set	
17	Remote Control Wireless System	1	set	
18	Power Distribution Box with UPS	1	set	
19	VHF Air-ground Transmitter/Receiver (main and standby)	2	sets	Control Tower
20	VHF Antenna	2	sets	
21	Radar Data Display	1	set	
22	Flight Data Display	1	set	

As a result of the coordination with DCA, the SSR facility will be located as shown in the figure below. The height of the radar tower will be 25 m, considering site surrounding conditions such as the trees and the passenger terminal building.



**Figure 2-10 Nay Pyi Taw International Airport Facility Layout Plan**

The outline of the system diagram for SSR, MSDPS, console and display system at Nay Pyi Taw International Airport is shown in Figure 2-11 (except VHF A/G).



**Figure 2-11 SSR, MSDPS, Console, Display System Diagram for Nay Pyi Taw International Airport**

The installation policies for the requested equipment at the Nay Pyi Taw International Airport and the points for attention are as follows:

- The land to be used for the radar is covered with trees and weeds, and the removal of which is the responsibility of Myanmar side. It is necessary to coordinate with DCA to ensure the removal.
- Since providing the power supply to the radar site is the responsibility of Myanmar side, attention must be given to electricity lead-in work at the site, including checking the power supply route and the supplied power panel capacity.
- For the route of the remote control fiber optic cable to be laid from the ATC operation building to the radar site, it is necessary to adequately coordinate with DCA and the Nay Pyi Taw Airport management company, paying attention to the installation of the cable without any obstruction to normal operations at the airport.
- Although there is a designated radio equipment room downstairs from the control tower, there is not enough space to install the requested equipment, such as the radar remote control system. Because of this, DCA is planning to renovate a separate space downstairs for the radar equipment room. Therefore, prior to delivering the requested equipment,

attention must be given to ensure that the new equipment room is complete with air conditioning units and lighting fixtures. Furthermore, providing the necessary electrical power for the requested equipment is also a responsibility of Myanmar side.

(4) Equipment Specification

The equipment to be procured, the major equipment configuration, and its equipment specification are presented below.

1) Airport Surveillance Radar/Secondary Surveillance Radar System (ASR/SSR)

**Table 2-9 ASR/SSR Major Equipment Specification**

<b>Purposes</b>					
Airport Surveillance Radar (ASR) and Secondary Surveillance Radar (SSR) are used for the radar control at the Yangon International Airport and the Mandalay International Airport by detecting aircraft within their terminal airspaces. ASR/SSR transmits radar target report to the new Multi Sensor Data Processing System (MSDPS) at the Yangon Air Traffic Management Center (ATMC) for approach control for Yangon TMA and Mandalay TMA					
<b>Equipment Configuration</b>					
No.	Description	Yangon		Mandalay	
		Radar Bldg.	ATM EQ Room	Radar Bldg.	OPR Room
1	ASR/SSR Antenna	1		1	
2	ASR Transmitter	1		1	
3	ASR Receiver	2		2	
4	SSR Interrogator	2		2	
5	Local Control and Monitoring System	1		1	
6	Maintenance Display (Local)	1		1	
7	Radar Data Recording System	1		1	
8	Waveguide	1		1	
9	Dehydrator	1		1	
10	GPS Clock Receiver	2		2	
11	Power Distribution Box	1		1	
12	Uninterruptible Power Supply	1		1	
13	Remote Control and Monitoring System		1		1
14	Maintenance Display (Remote)		1		1
15	Radar Performance Monitor		1		1
16	Data Transmission System 1	1		1	
17	Data Transmission System 2		1		1
18	Remote Control Wireless System	1	1	1	1
19	Power Distribution Box with UPS				1
20	Engine Generator	1		1	
21	Radar Tower (12 m)	1			
22	Radar Tower			1	
<b>Specification</b>					
<b>1. General Requirements</b>					
<b>1.1 Environment Conditions</b>					
ASR/SSR shall be designed to be operated under following environment conditions (except COTS):					
(1)	Temperature	: -0°C ~ +40 °C (Indoor), -30 °C ~ +50 °C (Outdoor)			
(2)	Relative Humidity	: ≤ 95% (Indoor), 100% (Outdoor), No condensing			
(3)	Wind Loading	: 45 m/s (Operation), 60 m/s (Non-operation)			
<b>1.2 Power Requirements</b>					
(1)	Power Voltage	: 220 VAC single-phase, 220/380V AC three-phase			
(2)	Frequency	: 50 Hz			
(3)	Power Consumption	: to be designed to minimize			
<b>1.3 Design Criteria for the Parts</b>					
(1)	Metal material, bolts, and other metal parts of outdoor equipment shall be durable material for anti-corrosion.				

- (2) The equipment shall be connected with connectors.

**1.4 Safety**

- (1) ASR/SSR shall be designed to be safe for human and equipment under conditions of installation, operation, and maintenance. Protection measures shall be provided to avoid unexpected access to moving mechanical devices such as gear, fan and belt, and metal parts with high voltage and high current.
- (2) There shall not be dangerous sharpen parts on cabinet and doors.
- (3) The toxic or combustible materials shall not be used for any parts of the System.
- (4) Fuse or circuit breakers shall be used to protect human and equipment against over current.
- (5) All cables (except optic fiber) installed between outdoor and indoor shall be protected by lightning protection devices.

**1.5 Reliability and Maintainability**

Critical parts of the System shall meet following requirements:

- (1) MTBF : more than 5,000 hours
- (2) MTTR : shall not exceed 30 minutes at the LRU level

**1.6 Special Tool**

- (1) The Supplier shall provide special tools which are required for maintenance by user.
- (2) Special tool is defined as dedicated tools which are not available commercially.

**2. Function Requirements**

**2.1 General**

- (1) ASR shall be designed to radiate S-band RF power through its antenna system, receive and process reflected signal from aircraft, and consequently detect moving targets.
- (2) ASR transmitter shall be operated with S-band signal and shall be fully solid state transmitted constructed by semiconductor devices. Final stage of power amplifier shall be multiple configurations. ASR Transmitter shall be operated without operation interruption, even if one power amplifier module is in abnormal condition.
- (3) ASR receiver shall be capable of rejecting or suppressing clutter, wide-band interference of operational frequency, CW jamming, and pulse jamming.
- (4) ASR receiver shall be capable of detecting and digitizing radar echo of rain and sending six level weather data.
- (5) SSR shall be designed to radiate L-band RF power through SSR Antenna, receive and process replied signal from transponder of aircraft, and consequently detect moving targets.
- (6) SSR shall comply with ICAO Annex 10.
- (7) SSR shall provide Mode S capability and support Elementary Surveillance (ELS) and Enhanced Surveillance (EHS). SSR shall acquire and transmit following data:

ELS	Aircraft identity	
	Transponder Capability Report	
EHS	Altitude in 25-ft intervals	
	Flight status (airborne/on the ground)	
	SI code capability	
	BDS 2.0	Aircraft identification
	BDS 3.0	ACAS active RA
	BDS 4.0	Selected Vertical Intent
EHS	BDS 5.0	Track and Turn Report Roll Angle True Track Angle Ground Speed Track Angle Rate True Airspeed
	BDS 6.0	Heading and speed Report Magnetic Heading Indicated Airspeed/Mach no. Vertical Rate (Barometric Altitude Rate)

- (8) Target data detected by SSR shall be combined with target data and weather data from ASR, when ASR is available. The target data shall be transmitted as plot and track in ASTERIX data format Cat 1, 2, 34, 48, and the weather data shall be transmitted in ASTERIX data format Cat 8.
- (9) Remote Control and Monitoring System shall continuously monitor the status of each equipment and automatically switchover if operational channel is in abnormal condition.

2) Secondary Surveillance Radar System (SSR)

**Table 2-10 SSR Major Equipment Specification**

<b>Purposes</b>				
Secondary Surveillance Radar (SSR) is installed at the Nay Pyi Taw International Airport and used for detecting aircraft within En-route airspaces. The SSR transmits radar target report to the automation system (Top Sky-ATC) at Yangon ATM Center for area control.				
<b>Equipment Configuration</b>				
No.	Description	Nay Pyi Taw airport		
		Radar Bldg.	OPR Room	CTRL TWR
1	SSR Antenna	1		
2	SSR Interrogator	2		
3	Local Control and Monitoring System	1		
4	Maintenance Display (Local)	1		
5	Radar Data Recording System	1		
6	GPS Clock Receiver	2		
7	Power Distribution Box	1		
8	Uninterruptible Power Supply	1		
9	Remote Control and Monitoring System		1	
10	Maintenance Display (Remote)		1	
11	Radar Performance Monitor		1	
12	Data Transmission System 1	1		
13	Data Transmission System 2		1	
14	Remote Control Wireless System	1	1	
15	Power Distribution Box with UPS		1	
16	Engine Generator	1		
17	Antenna Tower (25 m)	1		
<b>Specification</b>				
<b>1. General Requirements</b>				
<b>1.1 Environment Conditions</b>				
SSR shall be designed to be operated under following environment conditions (except COTS):				
(1)	Temperature	: -0°C ~ +40 °C (Indoor), -30 °C ~ +50 °C (Outdoor)		
(2)	Relative Humidity	: ≤ 95% (Indoor), 100% (Outdoor), No condensing		
(3)	Wind Loading	: 45 m/s (Operation), 60 m/s (Non-operation)		
<b>1.2 Power Requirements</b>				
(1)	Power Voltage	: 220 VAC single-phase, 220/380 VAC three-phase		
(2)	Frequency	: 50 Hz		
(3)	Power Consumption	: to be designed to minimize		
<b>1.3 Design Criteria for the Parts</b>				
(1)	Metal material, bolts and other metal parts of outdoor equipment shall be durable material for anti-corrosion.			
(2)	The equipment shall be connected with connectors.			
<b>1.4 Safety</b>				
(1)	SSR shall be designed to be safe for human and equipment under conditions of installation, operation, and maintenance. Protection measures shall be provided to avoid unexpected access to moving mechanical devices such as gear, fan and belt, and metal parts with high voltage and high current.			
(2)	There shall not be dangerous sharpen parts on cabinet and doors.			
(3)	The toxic or combustible materials shall not be used for any parts of the System.			
(4)	Fuse or circuit breakers shall be used to protect human and equipment against over current.			
(5)	All cables (except optic fiber) installed between outdoor and indoor shall be protected by lightning protection devices.			
<b>1.5 Reliability and Maintainability</b>				
Critical parts of the System shall meet following requirements:				
(1)	MTBF	: more than 5,000 hours		

- (2) MTTR : shall not exceed 30 minutes at the LRU level

**1.6 Special Tool**

- (1) Supplier shall provide special tools which are required for maintenance by user.  
(2) Special tool is defined as dedicated tools which are not available commercially.

**2. Function Requirements**

**2.1 General**

- (1) SSR shall be designed to radiate L-band RF power through SSR antenna, receive and process replied signal from transponder of aircraft, and consequently detect moving targets.  
(2) SSR shall comply with ICAO Annex 10.  
(3) SSR shall provide Mode S capability and support ELS and EHS. SSR shall acquire and transmit following data:

ELS	Aircraft identity Transponder Capability Report Altitude in 25 ft intervals Flight status (airborne/on the ground) SI code capability	
	BDS 2.0	Aircraft identification
EHS	BDS 3.0	ACAS active RA
	BDS 4.0	Selected Vertical Intent
	BDS 5.0	Track and Turn Report Roll Angle True Track Angle Ground Speed Track Angle Rate True Airspeed
	BDS 6.0	Heading and speed Report Magnetic Heading Indicated Airspeed/Mach no. Vertical Rate (Barometric Altitude Rate)

- (4) Target data detected by SSR shall be combined with target data and weather data from ASR, when ASR is available. The target data shall be transmitted as plot and track in ASTERIX data format Cat 1, 2, 34, 48, and the weather data shall be transmitted in ASTERIX data format Cat 8.  
(5) Local Control and Monitoring System and Remote Control and Monitoring System shall continuously monitor status of each equipment and automatically switchover if operational channel is in abnormal condition.

3) Multi-sensor Data Processing System (MSDPS)

**Table 2-11 MDSPS Major Equipment Specification**

<b>Purposes</b>						
Multi-sensor Data Processing System (MSDPS) provides terminal air traffic control environment for air situation awareness and safety enhancement for Mingaladon (Yangon), Mandalay, and Nay Pyi Taw approach control by processing track/plot data from Airport Surveillance Radar and Secondary Surveillance Radar.						
<b>Equipment Configuration</b>						
No.	Equipment	YIA			MIA	NIA
		ATM EQ Room	ATM CTRL Room	CTR L TWR	CTR L TWR	CTRL TWR
1	Surveillance Data Processor	2				
2	Flight Data Processor	2				
3	Network Communication System	2				
4	GPS Clock Receiver	2				
5	Recording and Replay System	2				
6	Technical Monitoring and Control System	2				
7	Radar Data Display (EQ)	1				
8	Flight Data Display (EQ)	1				
9	Radar Data Display (SV)		1			
10	Flight Data Display (SV)		1			
11	Radar Data Display (Yangon APP)		2			
12	Flight Data Display (Yangon APP)		2			
13	Radar Data Display (Mandalay APP)		2			
14	Flight Data Display (Mandalay APP)		2			
15	Radar Data Display (Nay Pyi Taw APP)		1			
16	Flight Data Display (Nay Pyi Taw APP)		1			
17	Radar Data Display (Yangon TWR)			1		
18	Flight Data Display (Yangon TWR)			1		
19	Radar Data Display (Mandalay TWR)				1	
20	Flight Data Display (Mandalay TWR)				1	
21	Radar Data Display (Nay Pyi Taw TWR)					1
22	Flight Data Display (Nay Pyi Taw TWR)					1
23	RDD Console (Yangon APP)		2			
24	FDD Console (Yangon APP)		2			
25	RDD Console (Mandalay APP)		2			
26	FDD Console (Mandalay APP)		2			
27	RDD Console (Nay Pyi Taw APP)		1			
28	FDD Console (Nay Pyi Taw APP)		1			
29	Supervisor Console (APP SV)		1			
30	Power Distribution Box	1				
31	Radar Interface Equipment (RIE)					
31-1	Leased Line Interface Modem	2			1*	1*
31-2	VSAT Interface Modem	2			1*	1*
31-3	Radar Data Splitter	1				

YIA: Yangon International Airport  
MIA: Mandalay International Airport  
NIA: Nay Pyi Taw International Airport  
\*: Operation room of each airport



## **Specification**

### **1. General Requirements**

#### **1.1 Environment Conditions**

MSDPS shall be designed to be operated under following environment conditions (except COTS):

- (1) Temperature : -0°C ~ +40 °C (Indoor), -30 °C ~ +50 °C (Outdoor)
- (2) Relative Humidity : ≤ 95% (Indoor), 100% (Outdoor), No condensing
- (3) Wind Loading : 45 m/s (Operation), 60 m/s (Non-operation)

#### **1.2 Power Requirements**

- (1) Power Voltage : 220 VAC single-phase, 220/380 VAC three-phase
- (2) Frequency : 50 Hz
- (3) Power Consumption : to be designed to minimize

#### **1.3 Reliability and Maintainability**

Critical parts of the system shall meet following requirements:

- (1) MTBF : more than 5,000 hours
- (2) MTTR : shall not exceed 30 minutes at the LRU level

### **2. Function Requirements**

#### **2.1 General**

- (1) MSDPS shall be installed at the ATMC in Yangon International Airport and used for terminal air traffic control.
- (2) MSDPS shall provide Mode S operation (supporting transponder level 2) and a capability for ELS and EHS.
- (3) MSDPS shall be able to receive the data in ASTERIX format (CAT1/2, 34/48, CAT8, CAT19, and CAT 21).
- (4) Control and Monitoring of the MSDPS shall be performed at ATMC in Yangon International Airport.
- (5) MSDPS is stipulated as the principal system of air situation awareness and air traffic control safety enhancement. The MSDPS shall be a state-of-art system designed for air traffic management tasks.
- (6) MSDPS shall be able to process, track, or plot data from surveillance radar such as ASR/SSR.
- (7) Hardware components shall be COTS and field-proven commercially available products. Custom hardware components shall not be used in the system.
- (8) MSDPS shall be open architecture for future expandability or customization.

4) Voice Communication Control System (VCCS)

**Table 2-12 VCCS Major Equipment Specification**

<b>Purposes</b>			
VCCS is used to connect the air traffic controllers to voice communications such as radio telephony and telephone network to guide the aircraft pilot and make calls both internally within airport and externally. With a VCCS, the controllers can communicate through both radio and telephone using a single work station called a controller working position (CWP).			
<b>Equipment Configuration</b>			
No.	Equipment	Yangon	
		ATM EQ Room	ATM CTRL Room
1	Voice Communication Switching Equipment	1	
2	Controller Working Position	1	11*
2-1	Touch Entry Device	1	11
2-2	Plug-In-Panel	1	11
2-3	Loudspeaker	2	22
2-4	Footswitch	1	11
3	Technical Monitoring and Control System	1	
4	Master Clock System	1	
4-1	Master Clock Unit	1	
4-2	Desk Mount Slave Clock	1	11
5	Voice Recorder	1	
6	Accessory		
6-1	Headset		24
6-2	Handset		11
* CWP shall be installed at following workstations of MSDPS:			
<ul style="list-style-type: none"> <li>• 2 Radar Data Displays and 2 Flight Data Displays, Mingaladon (Yangon) Approach</li> <li>• 2 Radar Data Displays and 2 Flight Data Displays, Mandalay Approach</li> <li>• 1 Radar Data Display and 1 Flight Data Display, Nay Pyi Taw Approach</li> <li>• 1 Supervisor workstation</li> </ul>			
<b>Specification</b>			
<b>1. General Requirements</b>			
<b>1.1 Environment Conditions</b>			
VCCS shall be designed to be operated under following environment conditions (except COTS):			
(1)	Temperature	: -0 °C ~ +40 °C (indoor), -30 °C ~ +50 °C (outdoor)	
(2)	Relative Humidity	: ≤ 95% (indoor), 100% (outdoor), no condensing	
(3)	Wind Loading	: 45 m/s (operation), 60 m/s (non-operation)	
<b>1.2 Power Requirements</b>			
(1)	Power Voltage	: 220 VAC single-phase, 220/380 VAC three-phase	
(2)	Frequency	: 50 Hz	
(3)	Power Consumption	: to be designed to minimize	
<b>1.3 Reliability and Maintainability</b>			
Critical parts of the System shall meet following requirements:			
(1)	MTBF	: more than 5,000 hours	
(2)	MTTR	: shall not exceed 30 minutes at the LRU level	
<b>2. Function Requirements</b>			
<b>2.1 General</b>			
(1)	VCCS shall uninterruptedly switch voice communication lines for air traffic control by actions at Touch entry device of Controller working positions.		
(2)	VCCS switching function shall be fully dual configuration and provide automatic switchover in case of failure.		
(3)	A VoIP-based VCCS shall be required for controlling (switching) and interfacing digital and analog air-to-ground VHF radio telephony and inter-facility telephone voice communications used for the air traffic control operation		
(4)	Voice Communication Switch Equipment shall be functionally separated into different modules.		

- (5) VCCS architecture shall be capable of accommodating a sufficient number of simultaneous voice paths to carry the maximum offered voice traffic.
- (6) VCCS shall support characteristics of analogue radio communications such as push-to-talk and channel selection.
- (7) VCCS shall be able to listen to multiple channels at once for incoming calls, and when multiple connections are ongoing at the same time, the sound from them shall be mixed together and played through the same speakers.

5) Radar Control Training Simulator (SIM)

**Table 2-13 SIM Major Equipment Specification**

<b>Purposes</b>			
Radar Control Training Simulator System provides air traffic controller training environment for Approach control using Radar Data Display and Flight Data Display.			
<b>Equipment Configuration</b>			
No.	Equipment	Yangon	
		ATM EQ Room	ATM SIM Room
1	Surveillance Data Processor	2	
2	Flight Data Processor	2	
3	SIM Server	2	
4	Network Communication System	2	
5	GPS Clock Receiver	2	
6	Recording and Replay System	2	
7	Technical Monitoring and Control System	2	
8	Radar Data Display		2
9	Flight Data Display		2
10	Instructor/Pseudo Pilot Workstation		1
11	Pseudo Pilot Workstation		1
12	Voice Communication Switch		1
13	Voice Communication Panel		4
14	RDD Console		2
15	FDD Console		2
<b>Specification</b>			
<b>1. General Requirements</b>			
<b>1.1 Environment Conditions</b>			
SIM shall be designed to be operated under following environment conditions (except COTS):			
(1)	Temperature	: -0 °C ~ +40 °C (Indoor), -30 °C ~ +50 °C (Outdoor)	
(2)	Relative Humidity	: ≤ 95% (Indoor), 100% (Outdoor), No condensing	
(3)	Wind Loading	: 45 m/s (Operation), 60 m/s (Non-operation)	
<b>1.2 Power Requirements</b>			
(1)	Power Voltage	: 220 VAC single-phase, 220/380 VAC three-phase	
(2)	Frequency	: 50 Hz	
(3)	Power Consumption	: to be designed to minimize	
<b>1.3 Reliability and Maintainability</b>			
Critical parts of the system shall meet following requirements:			
(1)	MTBF	: more than 5,000 hours	
(2)	MTTR	: shall not exceed 30 minutes at the LRU level	
<b>1.4 Compatibility</b>			
(1)	SIM shall be equal to the operational MSDPS at Yangon International Airport for effective training and operation.		
<b>2. Function Requirements</b>			
<b>2.1 General</b>			
(1)	SIM shall provide a capability to perform training of air traffic control by using Radar Data Display (RDD) and Flight Data Display (FDD) which are identical with operational MSDPS.		
(2)	SIM shall be capable of creating exercise scenarios for simulating various air situations and recheck		

- activities by trainees.
- (3) RDD and FDD shall be usable for the real operation as a part of MSDPS for emergency backup operation.
  - (4) SIM shall be capability to increase and decrease the number of RDD/FDD without upgrading software and run the exercise at the same time.
  - (5) Each RDD/FDDS shall have workstation, monitor, and input devices.
  - (6) SIM shall provide recording and replay function for lecture.
  - (7) Parameters of the exercise scenario shall be changeable during an exercise.
  - (8) SIM Server shall generate radar data and flight data.
  - (9) PSP shall create the exercise scenario and control simulated aircrafts during an exercise.
  - (10) Simulated aircraft shall be controllable by PSP.

6) VHF Air-ground Communication System (VHF A/G)

**Table 2-14 VHF A/G Major Equipment Specification**

<b>Purposes</b>						
Air-Ground Communication System is used for VHF radio communication channel between air traffic controller and pilot on the Terminal Radar Approach Control at Yangon, Mandalay, and Nay Pyi Taw.						
<b>Equipment Configuration</b>						
No	Equipment	Yangon	Mandalay		Nay Pyi Taw	
		ATM EQ Room	OP Bldg. EQ	CTR L TWR	OP Bldg. EQ	CTR L TWR
1	VHF Air-Ground Transmitter/Receiver	2	2		2	
2	VHF Antenna	2	2		2	
3	Technical Monitoring and Control System	1				
<b>Specification</b>						
<b>1. General Requirements</b>						
<b>1.1 Environment Conditions</b>						
VHF Air-Ground Communication System shall be designed to be operated under following environment conditions (except COTS):						
(1) Temperature : -0 °C ~ +40 °C (indoor), -30 °C ~ +70 °C (Outdoor)						
(2) Relative Humidity : ≤ 95% (Indoor), 100% (Outdoor), No condensing						
(3) Wind loading : 45 m/s						
<b>1.2 Power Requirements</b>						
(1) Power Voltage : 220 VAC single-phase, 220/380 VAC three-phase						
(2) Frequency : 50 Hz						
(3) Power Consumption : to be designed to minimize						
<b>1.3 Reliability and Maintainability</b>						
Critical parts of the system shall meet following requirements:						
(1) MTBF : more than 5,000 hours						
(2) MTTR : shall not exceed 30 minutes at the LRU level						
<b>2. Technical Specification</b>						
<b>2.1 General</b>						
(1) The VHF transmitter/receiver shall be designed to be remote and locally controlled, and all necessary interface equipment shall be supplied and installed.						
(2) Transmitter/Receiver shall be contained in a 19-inch wide rack or cabinet together with other necessary equipment.						
(3) For Transmitter, Automatic Level Compensation (ALC) circuit shall be provided for increasing average modulation degree without causing over modulation.						
(4) Operating frequency shall be selectable by switch-programmable synthesizer.						
(5) Built-in meter or display shall be provided on front panel for routine checking of RF Output Power, Power Supply, Modulation depth, and Reflection Power.						
(6) For Receiver, Squelch on-off switch and squelch level control, including squelch terminal, shall be provided.						
(7) Built-in speaker shall be provided with volume control.						

### **2.2.3 Outline Design Drawing**

Refer to the outline design drawing attached at the end of this report.

### **2.2.4 Implementation Plan**

#### **2.2.4.1 Implementation Policy**

##### **(1) Implementation Policy**

As this project will be implemented under the framework of Japanese grant aid, the implementation policy will consist of the following items:

- In order to contribute to the regional economy stimulation, the creation of employment opportunities and the promotion of technical transfer, local workers, and materials will be used to the greatest extent possible for project implementation.
- The base time for construction work will be from 8:00 a.m. to 5:00 p.m. The work will not be conducted at night, unless there are unavoidable circumstances such as construction delays caused by rain.
- The installation of equipment will be done in a manner that does not disrupt airport operations.

##### **(2) Procurement Policy**

- The procurement contractor will be selected through open bidding, for which Japanese companies with certain qualifications are eligible. For bidding, the successful bidder will be generally determined after negotiations with the lowest bidder, upon which they will enter into a procurement contract with Myanmar.
- All equipment and systems procured for the Project will be Japanese products due to various conditions including the fact that these equipment and systems are not manufactured in Myanmar, that manufacture/procurement is possible in Japan, and that the necessity of procurement from a third country has not arisen.
- Based on the contract, the equipment procurement contractor will supply, deliver, and install the necessary equipment. They will also provide technical guidance to Myanmar side regarding operation and maintenance of the procured equipment. In addition, the procurement contractor, manufacturer, and sales agent will be instructed to secure a supply system for the spare parts and consumables needed for each piece of equipment so that it may be used continuously after procurement. Support will also be provided so that services may be received; these services include technical guidance, free repairs if within the warranty period, and repairs with a fee if after the warranty period.
- The responsible agency for procurement on Myanmar side is DCA, which is in charge of maintenance work for CNS/ATM facilities. The scope of procurement for the project is a one-package procurement because identical CNS/ATM systems will be used.

#### **2.2.4.2 Implementation Conditions**

There are no regional characteristic or legal aspects specific to Myanmar that could affect equipment procurement for the project.

##### **(1) Implementation Conditions**

Items to note for project implementation are discussed below.

##### **1) Respecting Labor Standards**

When the construction company hires workers, they will observe the labor standards and laws of Myanmar, respect appropriate hiring conditions and practices, prevent conflict with workers, and ensure their safety.

##### **2) Free Passage in Construction Zones for Work Personnel and Vehicles**

As a specific measure for allowing the smooth entrance and exit of construction personnel and equipment during the construction period, these personnel will carry an identification card issued by each airport.

##### **3) Safety Management**

The construction sites are located within restricted areas or controlled access areas of the airports. Since the inspections necessary for construction personnel entering restricted or controlled access areas of the airport are part of admission control, methods for admission control during construction will be determined upon coordination with DCA and officials from each airport. Furthermore, for entry of construction vehicles as well as equipment and materials delivery, schedules will be shared with airport personnel in advance and will be considered such that airport operations are not disrupted.

##### **(2) Procurement Conditions**

After project implementation, it is extremely important that appropriate operation and maintenance methods for the procured equipment are conveyed so that they can be operated appropriately and continuously, contributing to the airport's terminal radar control and en-route air traffic control. Therefore, equipment installation engineers who are proficient at handling the equipment should be chosen, and they should dedicate a sufficient amount of time to explain its use (operational techniques, simple repair skills, and inspection methods). This should be done while confirming that the personnel on the receiving side has a thorough understanding of the explanation.



### 2.2.4.3 Scope of Works

#### (1) Scope of Works

Table 2-15 shows the demarcation of project scope between Japanese and Myanmar sides regarding procurement and installation under the Project.

**Table 2-15 Demarcation of the Scope of Works**

Project to be Covered by Japanese Grant Aid	Project to be Covered by Myanmar Side
<p>1. Procurement, installation, and adjustment of target equipment</p> <p>(1) Airport Surveillance Radar/Secondary Surveillance Radar (ASR/SSR)</p> <p>(2) Secondary Surveillance Radar (SSR)</p> <p>(3) Multi-sensor Data Processing System (MSDPS)</p> <p>(4) Voice Communication Control System (VCCS)</p> <p>(5) Radar Control Training Simulator (SIM)</p> <p>(6) VHF Air-ground Communication System (VHF A/G)</p> <p>2. Maintenance Education and Training of Equipment</p> <p>3. Marine and Inland Transportation of Equipment</p> <p>4. Flight Inspection of the Equipment</p>	<p>1. Site preparation, design, and construction work</p> <p>(1) Land clearing such as cutting trees and removing bushes, and construction of access road and security fence for radar site</p> <p>(2) Removal, temporary installation, or dismantling of existing equipment for securing installation space of new equipment</p> <p>(3) Provision of power supply source and remote control line (landline and satellite channel) for new equipment</p> <p>2. Coordination and application formalities with relevant organization</p> <p>(1) Tax exemption and customs clearance of the equipment</p> <p>(2) Application formalities for establishment of radio station</p> <p>(3) Applying and assigning of ASR frequency to/by radio committee</p> <p>(4) Applying and assigning Interrogator Identification Code to/by ICAO Asia and Pacific Regional Office</p> <p>(5) Integration new radar data into en-route MSDPS (Top Sky-ATC) manufactured by Thales (technical coordination with Thales)</p> <p>3. Transportation, storage, recycling, and disposal of dismantled equipment</p> <p>4. Allocation of counterpart personnel</p> <p>5. Participation of equipment installation and adjustment, including trial operation and site acceptance test</p>

(2) Procurement/Installation

Japanese side will be responsible for the following tasks regarding project consulting and equipment procurement/installation:

1) Consultant work

- Creation of specification sheets for project equipment and bidding documents.
- Cooperation regarding equipment procurement/installation, company selection, and contracts.
- Supervision of equipment delivery, installation, operational instruction, and maintenance guidance.

2) Equipment procurement/installation

- Procurement of project equipment and transport and move-in to the target facility.
- Installation, test run, and adjustments of project equipment.
- Explanation/guidance on operation and maintenance methods for project equipment.

Myanmar side will be responsible for the following tasks regarding the removal of existing equipment and tax exemptions:

- Removal of existing equipment.
- Purchasing equipment that should be procured by Myanmar side.
- Provision of support for ensuring swift customs and inland transport procedures for equipment imported from Japan (or another foreign country) through verified contracts.
- Provision of necessary immigration/visa support for Japanese personnel entering and staying in Myanmar who are engaged in work related to project implementation.
- Provision of all necessary costs apart from those under the responsibility of Japanese side.

#### **2.2.4.4 Consultant Supervision**

##### **(1) Scope of Consultant Supervision**

Upon receiving verification of the construction contract from the Government of Japan, the Consultant will issue an order to the construction company for the commencement of work and will also begin the supervision work. For supervision work, the Consultant will report on the construction progress conditions directly to DCA and the local JICA office. The Consultant will also provide suggestions and improvement measures to the construction company regarding work progress, quality, safety, administrative affairs related to payment, as well as technical aspects of construction. In addition, the Consultant will deliver reports to, coordinate with, and hold discussions with the Embassy of Japan in Myanmar, if necessary. The main content of supervision work is explained below.

##### **1) Review and Approval of Equipment Specifications and Work Execution Plans**

The Contractor shall submit equipment specifications and drawings to the Consultant prior to the start of manufacturing. The Contractor shall also submit the working drawings, the work execution plan, and the schedule to the Consultant. The Consultant will review the specifications and drawings submitted by the Contractor and will approve or reject them in accordance with the contract.

##### **2) Test and Inspection of Equipment Manufacture**

The Consultant will inspect if the equipment has been manufactured by the Contractor in accordance with the contract by observing factory tests or inspecting test reports and other related documents submitted by the Contractor.

##### **3) Prior Confirmation and Coordination for Equipment Storage Yard**

The Consultant will confirm the status of each site and the coordination with Myanmar side to ensure that they have done the preparation of equipment/material storage yard, the construction of building to house the equipment, and the renovation as required by the contract.

##### **4) Installation Supervision**

The Consultant will supervise the quality, safety, and schedule control for the equipment installation works, including transportation by the Contractor in accordance with the contract.

##### **5) Final Inspection**

The Consultant will witness and inspect tests for equipment installation, approve or reject the works in accordance with the contract, and instruct compiling test data, including checking of test results by manufacturers.

6) Inspecting Tests on Completion and Issuing Taking-Over Certificate

The Consultant will observe and inspect the tests on completion to be carried out by the Contractor and will approve or reject the works in accordance with the contract. When all of the works have been completed and have satisfactorily passed any tests on completion, the taking-over certificate will be issued by the Consultant. The Consultant will also coordinate with DCA on the due process to taking-over of the equipment from the Contractor to DCA.

7) Inspection before Expiration of Manufacturer Guarantee Period

One year after the completion of all equipment installation, Consultant inspects that the equipment works as planned and/or initial failure does not occur.

8) Implementation Structure of Consultant Supervision

The roles of the engineers necessary at each stage of construction are shown in Table 2-16.

**Table 2-16 Assignment and Role of Consultant Supervision**

Assignment	Term	Role
Japanese Staff		
Leader/Procurement Supervision Engineer (Inspection and Taking-over)	Temporary on site	<ul style="list-style-type: none"> <li>• Overall supervision of project quality and schedule;</li> <li>• Coordination with Myanmar side and contractor; and</li> <li>• Supervision for inspection on completion of entire system and taking-over.</li> </ul>
Procurement Supervision Engineer (Radar Building and Radar Antenna Tower)	Temporary on site	<ul style="list-style-type: none"> <li>• Supervision for construction of radar building and radar antenna tower.</li> </ul>
Procurement Supervision Engineer (inspection before expiring of manufacturer's warranty period)	Temporary on site	<ul style="list-style-type: none"> <li>• Inspection before expiring of manufacturer's warranty period for project completion.</li> </ul>
Procurement Supervision Engineer (Radar Surveillance System)	Temporary on site	<ul style="list-style-type: none"> <li>• Review and approval of manufacturing specifications of the radar surveillance system; and</li> <li>• Supervision of equipment installation and inspection, quality, and schedule control.</li> </ul>
Procurement Supervision Engineer (Radar Data Processing System)	Temporary on site	<ul style="list-style-type: none"> <li>• Review and approval of manufacturing specifications of the radar data processing system; and</li> <li>• Supervision of equipment installation and inspection, quality, and schedule control.</li> </ul>
Procurement Supervision Engineer (Communication System)	Temporary on site	<ul style="list-style-type: none"> <li>• Review and approval of manufacturing specifications of the communication system; and</li> <li>• Supervision of equipment installation and inspection, quality, and schedule control.</li> </ul>
Inspection Engineer (inspection)	Temporary in Japan	<ul style="list-style-type: none"> <li>• Factory inspection and acceptance.</li> </ul>
Local Staff		
Resident Procurement Supervision Assistant	Temporary on site	<ul style="list-style-type: none"> <li>• Assistance for Procurement Supervision Engineer.</li> <li>• Coordination between the work done by Myanmar side and this Project; and</li> <li>• Supervision of equipment installation and inspection, quality, and schedule control.</li> </ul>

(2) Procurement Supervision

Based on the policies of the grant aid implemented by the Government of Japan and following the intent of the basic design, the Consultant will form an integrated team to engage in the project, including implementation design work, and then will smoothly implement operations. The procurement supervision plan policies for the project are listed as follows:

1. To aim for the completion of equipment installation without delay, keeping in close contact with the personnel in-charge at the relevant agencies of both countries.
2. To provide swift and appropriate guidance/recommendations from an impartial standpoint to equipment procurement/installation companies and other relevant parties.
3. To provide appropriate guidance/recommendations on making adjustments for the suitable placement of equipment in the space available and on the operation and management of equipment after its handover.
4. After all the works are completed and upon confirming that contractual conditions have been met, the Consultant will be present at the time of facility/equipment handover and will obtain acknowledgment of receipt from Myanmar side for the completion of supervision work.

#### **2.2.4.5 Quality Control Plan**

(1) Compliance with JCAB and ICAO Standard

The CNS equipment/system specifications and performance should meet relevant JCAB and/or ICAO requirements.

(2) Approval of Shop Drawings Submitted by Equipment Manufacturer

The Contractor will be required to prepare and submit the equipment specifications, the work schedule, and the work execution plan. The Consultant will review and ensure that equipment performance and installation complies with the contract documents.

(3) Factory Inspection

The Consultant will conduct factory inspections to review and confirm that the major systems and equipment manufactured by the Contractor comply with the contractual requirements. The Consultant may alternatively require the Contractor to submit the test data for review and confirmation of the compliance with the contractual requirements. The major systems and equipment will only be approved for transportation and shipment to the sites after the Consultant's confirmation.

(4) Quantity Inspection Prior to Packing

Prior to packing the procured items, the Consultant together with the Contractor will carry out inspection in the packaging factory of manufacturers to confirm that quantities of such items are in compliance with the contract.

(5) Quantity Inspection Prior to Shipping

A third-party organization entrusted by the Consultant will carry out inspection together with the Contractor to confirm that quantities for shipment are in compliance with the contract.

(6) Final Inspection

The Consultant together with the Contractor will carry out final inspection on equipment for which adjustment for individual and a group of equipment after connection is completed. During the final inspection, engineers dispatched from manufactures will operate the equipment in order to collect testing data for final acceptance and to confirm the number and the performance of the equipment.

(7) Flight Inspection

The Consultant together with authorized representatives of DCA will entrust a qualified organization to carry out flights inspection to confirm that the radar systems meet the performance requirements stipulated in the contract.

(8) Tests on Completion and Taking-over

After completion of installation and adjustment of the systems and equipment as well as initial training for equipment operation and maintenance by the Contractor, the Consultant and the Contractor as well as authorized representatives of DCA will jointly conduct final inspection on the results of the tests on completion and any other test results as applicable. If found satisfactory, all of the equipment and systems procured and installed under the project will be accepted by DCA, and a taking-over certificate will be issued by the Consultant.

(9) Inspection before the Expiration of Manufacturer Guarantee Period

One year after the completion of all equipment installation, Consultant inspects that the equipment works as planned and/or initial failure does not occur.

#### **2.2.4.6 Procurement Plan**

The equipment transport schedule consists of the time for transport and the number of days for customs procedures, which is planned for a total of approximately five weeks.

##### **(1) Transport Route**

The equipment procured for the project will be Japanese products transported from Japan to Myanmar (Yangon). The time necessary for transport is approximately one month. The following route options are available:

- Sea transport portion (approximately three weeks): Japan to Yangon Port
- Land transport portion (several days): Yangon Port to each airport

##### **(2) Customs Procedures**

Based on the time required for the Contractor to apply and for the authorization procedures to clear the relevant agencies on Myanmar side, approximately one week will be given as the number of days for customs procedures.

During the one-year defect liability period, the Contractor shall be responsible for the repair of the systems and equipment at its own cost. The number of spare parts and units of the major systems and equipment should be computed based on the Mean Time Between Failures (MTBF) data of the manufactures for the two-year period.

#### **2.2.4.7 Operational Guidance Plan**

In principle, the radars and other equipment have the same functions as the existing radar system; however, initial training for the equipment operation/maintenance/repair and new functions specific to the new radar systems are essential for DCA personnel. The initial training will be provided by engineers, who will have actually conducted the adjustment of systems and equipment dispatched from manufactures in Japan or elsewhere. The training will be in the form of on-the-job training (OJT) of DCA personnel for several days.



#### **2.2.4.8 Soft Component Plan**

##### (1) Soft Component Goals

The goals of the soft component are to realize such DCA conditions on radar operation and maintenance to make sure that the operation of the new radar system installed through this project is smoothly transferred from the existing radar system and that the ability for sustainable operation and maintenance is developed. The specific goals are as follows:

- 1) Goal 1: Upgrading ability of operation and maintenance for the radar.
- 2) Goal 2: Upgrading ability of spare parts management for the radar.
- 3) Goal 3: Upgrading ability of planning of operation transition.
- 4) Goal 4: Upgrading ability of planning of system transition and troubleshooting.
- 5) Goal 5: Upgrading safety management ability of operation transition to the terminal radar control.
- 6) Goal 6: Upgrading safety management ability of operation and maintenance work for the radar.

##### (2) Instructors and Trainees

Air traffic controllers and air traffic control engineers with experience at JCAB will conduct lectures and exercises to controllers in-charge of terminal radar control in the Yangon and the Mandalay International Airports and to CNS personnel in-charge of maintenance and management of equipment.

##### (3) Activities

- 1) For Goal 1: to lecture on the operation and maintenance system and the practical job of JCAB, and to instruct about the operation manual and maintenance inspection manual preparation.
- 2) For Goal 2: to lecture on how to implement spare parts management by JCAB, and to instruct about articles management manual and spare parts supply management manual preparation.
- 3) For Goal 3: to lecture on the concept of Japanese operation transition plan, and to instruct about the transition plan table (draft) preparation.
- 4) For Goal 4: to lecture on the concept of Japanese radar system transition plan, and to instruct about the transition plan table (draft) preparation.
- 5) For Goal 5: to lecture on safety management related to the maintenance of JCAB, and to instruct risk assessment of risk identification and its mitigation measures preparation.
- 6) For Goal 6: to lecture on safety management related to the operation of JCAB, and to instruct risk assessment of risk identification and its mitigation measures preparation.

(4) Schedule

**Table 2-17 Soft Component Implementation Schedule**

Month		1	2	3	4	5	6	7
Year/Month		Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021	Mar. 2021
Grant Procurement	Aid	Setup/Installation			████████████████████			
		Initial Operation/Guidance				████████████████		
		Acceptance Inspection/Handover						████
Activities	Goal 1	CNS Personnel				██████████		
	Goal 2	CNS Personnel					██████████	
	Goal 3	Air Traffic Controller						▨▨▨▨
	Goal 4	CNS Personnel						▣
	Goal 5	Air Traffic Controller					▨▨▨▨	
	Goal 6	CNS Personnel						▣

### 2.2.4.9 Implementation Schedule

The project implementation schedule is shown in Table 2-18.

**Table 2-18 Project Implementation Schedule**

(Month)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Detailed Design	■	(Site Survey)																		
		□ (Work in Japan)																		
			■	(Approval of Tender Documents)																
				■	(Tender Evaluation)		(Total 4 months)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Equipment Procurement				□ (Preparation of Shop Drawing)																
								□ (Equipment Manufacturing)												
				■ (Shipping Antenna Tower)								■ (Shipping Equipment)								
		■ (Construction of Radar Antenna Tower & Building)																		
											□ (Installation)		■							
											□ (Adjustment & Test Run)				■					
		□ (Total 19 months)									□ (Explanation/Guidance for Equipment)				■					
															□ (Commissioning & Taking Over)					

## **2.3 Obligations of Recipient Country**

### **2.3.1 General Obligation of Myanmar**

#### **(1) Banking Arrangement (B/A) and Authorization to Pay (A/P) • Payment of Commission**

The Government of Myanmar needs to promptly draw up an arrangement with a bank in Japan to open a special account to which the funds granted by the Government of Japan will be deposited and from which payments will be made to Japanese contractor. The Government of Myanmar also needs to issue the Authorization to Pay (A/P) that is needed for Japanese contractor to receive the payments. The Government of Myanmar shall bear commissions to Japanese bank for banking services based on the B/A.

#### **(2) Exemption of Taxes and Duties on Imported Equipment and Material**

The Government of Myanmar shall ensure that there will be exemption from customs duties and taxes, which may be imposed with respect to the import of the equipment and products.

#### **(3) Entrance to the Site and Construction Permit**

DCA shall obtain entrance and construction permits for the Contractor to execute the works.

#### **(4) Removal of Existing Equipment for Installation of New Equipment**

DCA shall remove the existing equipment, to secure necessary spaces for the installation of the new equipment.

#### **(5) Taxes and Fiscal Levies for Procurement of Materials and Services**

The Government of Myanmar shall bear the internal taxes and other fiscal levies which may be imposed with respect to the purchase of the products and services without using the grant.

#### **(6) Temporary Yard**

DCA shall provide, at its own expense, adequate spaces at the sites necessary for the Contractor to temporarily store materials, equipment, etc.

#### **(7) Provision of Commercial Power at the Site**

DCA shall provide commercial power for the procured equipment at each site for proper operation after taking-over the equipment.

#### **(8) Improvement of Existing Main Power Distribution Network**

DCA shall improve and provide the power distribution system and line to the sites at its own expense.

### 2.3.2 Responsibility of the Works to be Implemented by Myanmar Side

Table 2-19 shows the list of specific obligations of Myanmar side at each airport.

**Table 2-19 Specific Obligations of Myanmar Side at Each Airport**

Site	Equipment	Obligations of Myanmar Side
<b>Yangon International Airport</b>		
ASR/SSR site	Site area	<ul style="list-style-type: none"> <li>• Land clearing, such as cutting trees and removing bushes, and construction of access road</li> <li>• Provision of power supply source</li> <li>• Construction of security fence, water supply, and toilet</li> </ul>
ATMC equipment room, approach control room, radar simulator room and control tower	Radar System Equipment	<ul style="list-style-type: none"> <li>• Securing of installation space for new equipment and provision of power supply</li> </ul>
ATMC equipment room	MSDPS equipment	<ul style="list-style-type: none"> <li>• Provision of leased line and VSAT satellite channel between Yangon and Mandalay, Yangon and Nay Pyi Taw</li> </ul>
<b>Mandalay International Airport</b>		
ASR/SSR site	Site area	<ul style="list-style-type: none"> <li>• Land clearing, such as cutting trees and removing bushes, and construction of access road</li> <li>• Provision of power supply source</li> <li>• Construction of security fence, water supply, and toilet</li> </ul>
ATC operation building GF and control tower	Radar System Equipment	<ul style="list-style-type: none"> <li>• Securing of installation space for new equipment and provision of power supply</li> </ul>
<b>Nay Pyi Taw International Airport</b>		
SSR site	Site area	<ul style="list-style-type: none"> <li>• Land clearing, such as cutting trees and removing bushes, and construction of access road</li> <li>• Provision of power supply source</li> <li>• Construction of security fence, water supply and toilet</li> </ul>
ATC operation building 9F and control tower	Radar System Equipment	<ul style="list-style-type: none"> <li>• Securing of installation space for new equipment and provision of power supply</li> </ul>

## 2.4 Project Operation and Maintenance Management Plan

### 2.4.1 Air Traffic Services

When the radar approach control for the three airports at the Yangon ATMC starts its operation after installation of the ASR to the Yangon and Mandalay International Airports and the SSR to the Nay Pyi Taw International Airport, it seems that the number of air traffic controllers should be increased as follows.

**Table 2-20 Required Number of ATC Personnel**

Position	Required Number (1 Crew)	Crew x Shift (person)	Total
Supervisor	Supervisor: 1	1 x 4shift = 4	36
Mingaladon (Yangon) Terminal Radar Approach Control	Radar Control: 2 Coordinator: 2	4 x 4 = 16	
Mandalay Terminal Radar Approach Control	Radar Control: 1 Coordinator: 1	2 x 4 = 8	
Nay Pyi Taw Approach Control	Radar Control: 1 Coordinator: 1	2 x 4 = 8	

(Source: DCA)

As for the terminal radar service, the required number of ATC personnel for one crew of Yangon international airport is four staff, which consists of two controllers and two coordinators.

As per Mandalay and Nay Pai Taw international airport, the required number of ATC personnel of one crew is two persons, who are assigned as radar controller and coordinator. In addition, one supervisor is assigned for managing two radar approach control area and one approach control area.

Four crews are needed for 24-hour operations. This means 28 (i.e.,  $7 \times 4 = 28$ ) staff in total will be required for terminal radar service.

On the other hand, four approach controllers in the Yangon International Airport and three approach controllers in the Mandalay International Airport will not provide their service at those airports after the implementation of the Yangon ATMC.

As a result, 29 ATC personnel will be needed in the ATMC when radar approach control for the three airports at the Yangon ATMC starts. DCA needs to train 29 rated staff until March 2021, which is the date for transfer of the systems under this project. This means DCA needs to train an average of 10 new ATC staff per year for the coming three years.

## 2.4.2 Maintenance Services

DCA plans to increase the CNS personnel, as shown in the following table, for smooth maintenance and management of the airport radar to be installed at the Yangon and the Mandalay international airports and the en-route surveillance radar to be installed at the Nay Pyi Taw International Airport.

In this plan, day workers and shift workers at each site are arranged so that they can respond promptly when troubles for the equipment occur.

**Table 2-21 Number of Increase for CNS Staff**

Airport Name	Main Additional Equipment	Scheduled Increase by Qualification (Shift Worker)	Scheduled Increase by Qualification (Day Worker)		
		RM1*	AE**	TS***	RM1
Yangon International Airport	PSR/SSR, MSDPS	4	1	1	1
Mandalay International Airport	PSR/SSR	4	1	1	1
Nay Pyi Taw International Airport	SSR	4	1	1	1
Total		12	3	3	3

\* RM1: Radio Mechanic Grade 1

(Source : DCA)

\*\* AE: Assistant Engineer

\*\*\* TS: Technical Supervisor

Even though the same number of additional staff for each site is planned as shown above, since different equipment will be installed in each site, DCA can reconsider the placement of additional personnel when they start operations.

The contents of the maintenance management for the new airport surveillance radar and the en-route surveillance radar to be installed are basically in accordance with the operation and maintenance work of the en-route surveillance radar, which is currently being operated. Periodic inspection and replacement work indicated from manufacturers are necessary. Therefore, it is necessary for DCA to make plans and maintain and manage them based on the manufacturer's work procedures.

As the operation status of the airport surveillance radar and the en-route surveillance radar will be shown at the remote monitoring control device to be installed at the airport office, the CNS personnel can always keep checking the operation status for the equipment through the device. It is necessary to exchange failed parts indicated on the monitoring control device.

For proper maintenance and management, it is necessary to check the performance of radar equipment using measuring instruments and other equipment at regular intervals and to conduct periodic replacement of parts as preventive maintenance.

The radar equipment is basically composed of duplexes to ensure reliability, but special attention is required especially for grasping the operating condition of single configuration equipment such as antenna and rotary joint.

Also, since the multi-sensor data processing system will be installed at the Yangon International Airport together with the airport surveillance radar, maintenance and management for this equipment is also required. Since the operation status of each component of the multi-sensor data processing system is indicated on the monitoring terminal, the CNS personnel needs to grasp the operation status of the equipment through the terminal.

The personnel in charge of equipment maintenance and management by this project will be composed of personnel in charge of maintenance and management work for the current CNS equipment and new recruitment personnel. New personnel will take basic training at CATI (Civil Aviation Training Institute) after employment. DCA has training program, such as On the Job Training (OJT) etc., and it is carried out at the site office and that maintenance and management for CNS equipment is implemented as well.



## 2.5 Project Cost estimation

### 2.5.1 Initial Cost Estimation

#### (1) Japanese Side

The estimated project cost to be borne by Japanese side is discussed in the main report of the preparatory survey of the project.

#### (2) Myanmar Side

##### 1) Preparation for Radar Site in the Three Airports

It is estimated that the total preparation cost will be KYT 16.23 million (approximately USD 12,000) for site clearance and for the installation of the security fence and ancillary facilities, including water supply and toilet, and improvement power supply in the radar sites of the three airports.

##### 2) Banking Commission

It is estimated that the cost of opening a bank account will be KYT 37.27 million (approximately JPY 3 million), which is necessary for the remittance of Japanese grant aid.

#### (3) Condition for the Cost Estimates

##### 1) Cost Estimate Time

The applied cost estimate time for this project is June 2018, which is based on the “Preparatory Survey Design/Cost Estimate Manual for Equipment (July 2017)”.

##### 2) Exchange Rate

The average exchange rate ((a) and (b)) is applied for a period of three months, from 1 March 2018 to 31 May 2018. In this case, (a) is calculated using the TTS (Telegraphic Transfer Selling rate) rate of Mitsubishi UFJ Bank, and (b) is taken from the Reference Exchange Rate of Central Bank of Myanmar.

(a) USD 1 = JPY 108.75

(b) KYT 1 = JPY 104.55

## 2.5.2 Operation and Maintenance Cost

In the project, the increase of the number of CNS personnel will be required as a result of the installation of the airport surveillance radar and the en-route surveillance radar at each of the Yangon, Mandalay, and Nay Pyi Taw international airports. For this reason, DCA plans to increase 7 to 8 CNS personnel per site. In addition, air traffic controller needs to hire for starting radar approach control in Yangon and Mandalay International Airport and approach control in Nay Pyi Taw International Airport. The expected increase in cost and the planned increase in the number of air traffic controller and CNS personnel per site are shown in Table 2-22.

**Table 2-22 Increasing Cost with the Additional CNS Personnel**

Item		Cost per Personnel (KYT)/year	Number	Total (KYT)/year
Cost	ATCO*	280,000 x 12 (3,360,000)	32	107,520,000
	Supervisor	300,000 x 12 (3,600,000)	4	14,400,000
	RM1	216,000 x 12 (2,592,000)	15	38,880,000
	AE	275,000 x 12 (3,300,000)	3	9,900,000
	STO	234,000 x 12 (2,808,000)	3	8,424,000
Subtotal				179,124,000
Other Cost		90,000×12 (1,080,000)	57	61,560,000
Total				<b>240,684,000</b>

(Source: DCA)

### **3. PROJECT EVALUATION**



### **3 PROJECT EVALUATION**

#### **3.1 Preconditions**

It is understood that there is no need to acquire a new site because all activities for this Project will be executed in the three international airports (Yangon, Mandalay, Nay Pyi Taw). Moreover, any permission necessary prior to construction can be approved and issued by airport operators and DCA since the objective of the Project is to install aircraft surveillance radar and supplement facilities

The obligations of Myanmar are as follows;

- a) Land clearing, such as cutting trees and removing bushes
- b) Construction of access road
- c) Construction of security fence
- d) Removal of existing equipment for installation of new equipment
- e) Provision of commercial power at the site and communication line for remote control (land line and satellite communication)
- f) Execute necessary procedures for the Project

These matters had been fully understood by DCA, and are to be executed before the commencement of the Project.

#### **3.2 Necessary Input by the Recipient Country**

It is necessary for DCA who mainly manage these airports to tackle the following important matters in order for the Project to progress and provide good results:

(1) Consistent Maintenance Expenditure

The maintenance costs are paid by DCA budget. Even though the maintenance costs are deemed to increase to cover the new equipment, the magnitude of expenditure is expected to be minimal. It is deemed necessary for DCA to consistently secure a maintenance budget.

(2) Improvement of Understanding and Ability on Safety and Efficiency in International Airport

International Civil Aviation Organization (ICAO) is developing international roadmap of air traffic management operations and systems. Furthermore, ICAO considers developing the guidance material of minimum air traffic management systems which are required to guarantee aircraft operational safety.

According to these international trends, it is necessary for Myanmar to improvement the safety of aircraft operations and the ability of aircraft surveillance in Yangon and Mandalay International Airport, which air transportation demands increase, and key point of domestic flight where is around Nay Pyi Taw International Airport. Moreover, the improvement of air traffic operational efficiency is important factor for maximizing the airport capacity and increasing the usability for passengers. The improvement of safety and efficiency by DCA, which are correspond with international trends, realize effective utilization of facilities, which are provided by this Project.

(3) Human Resource Development for Maintenance

ICAO proceeds to establish international standard of Air Traffic Safety Electronics Personnel (ATSEP) for achieving appropriate maintenance of air navigations systems. This standard includes programs for training of ATSEP and maintaining necessary skill of maintenance for air navigation systems. Based on these trends of international standards, it is necessary factors for improving of the safety of aircraft operations that learning the method for maintaining air navigation systems appropriately, avoiding occurrence of system troubles and faults and resolving those issues immediately.

As per the above mentioned, it is deemed necessary for DCA to consistently proceed skill improvement program of maintenance by ATSEP.

### **3.3 Important Assumptions**

In order for that this Project to progress and continue to provide good results, important assumptions are as follows:

- Ministry of Transport and Communications that is superior organization of DCA understand the Project.

### **3.4 Project Evaluation**

#### **3.4.1 Relevance**

(1) The Subject of Benefit

The direct subject for benefit of the Project is the aircraft, passenger and air cargo which utilize the three international airports including Yangon International airport, while the entire Myanmar nation is the beneficiary on the society and economy by trade and international exchange indirectly.

(2) Project Objective

The objective of the Project is to improve the safety of aircraft operations and enhance the ability of air traffic management by installing aircraft surveillance radars in three international airports and deploying aircraft surveillance systems in Yangon Air Traffic Management Center. The Project will be able to contribute to the stability of public welfare and better living for the nation through improvement the ability of transportation infrastructure and realizing sustainability growth in Myanmar.

(3) Consistency with Medium and Long Term Objectives

Based on Myanmar National Transport Development Plan (MYT-Plan), the development vision is established in each transportation sector. In case of aviation sector, five development visions in the Plan include following targets:

- a) Enhance the safety and efficiency of Yangon metropolitan airport as main gate for international passenger demands which increase sharply.
- b) Establish national air traffic management systems which could adopt to increase domestic passenger demands by the growth of population and economic.
- c) Modernize air traffic control systems, which follow ICAO global air traffic management plan, for providing the safe and efficient aviation services.

The Project will be able to contribute to achieve medium and long term objectives in Myanmar through realizing the improvement the safety and efficiency of aircraft operations, the correspondence to increasing demand of domestic passengers and the modernization of air traffic control systems.

(4) Consistency with Japan's ODA Policy

As an economic assistance policy for Myanmar, which is revised in April 2012, the aim of policy consists of support to three fields. The Government of Japan stated the "support of an infrastructure required for continuous economic growth, creation of social system, etc."

The Project contributes sustainable economic growth by installation of aircraft surveillance

radars in three international airports and improvement the safety of aircraft operations and enhancement the ability of air traffic management thorough system deployment. These contents of the Project are consistent with aid policies and plans of the Government of Japan.

### 3.4.2 Effectiveness

#### (1) Quantitative Effectiveness

The targeted year for quantitative effectiveness expected from the execution of the Project is assumed to be in 2024, which is three years after 2021, when the Project is completed.

The quantitative effectiveness is assumed based on social and economic surveys, and technical investigation, as shown in Table 3-1.

**Table 3-1 Summary of Quantitative Effectiveness**

Indexes	Baseline (2017)	Target (2024)
Radar Approach Control in Yangon and Mandalay International Airport (%)	0	100
Ability of Aircraft Surveillance for the Airspace around Nay Pyi Taw International Airport under 15,000 feet	0	100

(Source: The Study Team)

#### (2) Qualitative Effectiveness

The indexes of qualitative effectiveness of this Project are summarized as follows:

- By doing approach radar control in Yangon and Mandalay International Airport, the safety and efficiency of aircraft operation will be improved.
- The efficiency of air traffic operation in aerodrome will be improved in Yangon and Mandalay International Airport.
- The safety of aircraft operation around Nay Pyi Taw International Airport will be improved.

Based on the above, it is determined that the Project is appropriate, and its validity will also be expected.



## **Appendix**

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the  
Recipient Country
4. Minutes of Discussions
5. Soft Component Plan
6. Other Relevant Data
7. References

## 1. Member List of the Study Team

### 1.Member List of the Study Team

Responsible Service	Name	Corporation
Overview	Hiroyuki UEDA	Senior Director for Transportation Sector Japan International Cooperation Agency (JICA)
Cooperation Planning	Kenji MURATA	Transportation and ICT Group Infrastructure and Peacebuilding Department (Current: Finance Department) Japan International Cooperation Agency (JICA)
Project Manager/Aircraft Surveillance System Planning	Masaaki UEHARA	Nippon Koei Co., Ltd.
Assistant Project Manager/Aircraft Surveillance System Planning (Data Processing & Display) (1)	Yasushi INOUE	Nippon Koei Co., Ltd.
Aircraft Surveillance System Planning (Surveillance System)	Yukimi TAJIMA	Japan Airport Consultants, Inc
Aircraft Surveillance System Planning (Data Processing & Display) (2)	Takashi IBE	JAPAN RADIO AIR NAVIGATION SYSTEMS ASSOCIATION
Aircraft Surveillance System Planning (Communication System)	Toshihiko TAKEMOTO	JAPAN RADIO AIR NAVIGATION SYSTEMS ASSOCIATION
Radar Approach Control	Hideki SUGAI	Nippon Koei Co., Ltd.
Procurement & Installation Plan/ Estimation	Hiroshi HISAMATSU	Nippon Koei Co., Ltd.
Natural Condition Survey	Misaki MORIKI	Nippon Koei Co., Ltd.

## 2. Study Schedule

## 2. Study Schedule

### 【First Field Study Schedule】

Day	Date	Week	Overview	Cooperation Planning	Project Manager	Assistant Project Manager	Aircraft Surveillance System Planning			Radar Approach Control	Procurement and Installation Plan / Estimation	Natural Condition Survey		
							Surveillance System	Data Processing and Display	Communication System					
1	5/13	Sun	Narita → Yangon (*except Project Manager)								—	—		
2	14	Mon	Explanation and Discussion for the Inception Report / Explanation for Grant Project								—	—		
3	15	Tue	Minutes Advance Concertation								—	—		
4	16	Wed	Minutes Concertation/ Signature								—	—		
5	17	Thu	Field Study (Nay Pyi Taw Airport)								—	—		
6	18	Fri	From Yangon	Field Study (Nay Pyi Taw Airport)								—	—	
7	19	Sat	To Narita	Travel Day								—	—	
8	20	Sun	—	—	Field Study (Mandalay Airport)								—	—
9	21	Mon	—	—	Field Study (Yangon Airport) / DCA Concertation								—	—
10	22	Tue	—	—									—	—
11	23	Wed	—	—									—	—
12	24	Thu	—	—									—	—
13	25	Fri	—	—	—	Data Collection / Report Creation			—	To Yangon Preparation				
14	26	Sat	—	—	—	Field Study (Yangon Airport) / DCA Creation			—	Travel Day				
15	27	Sun	—	—	—	Field Study (Yangon Airport) / DCA Creation			To Yangon Preparation	Field Study (NPT)				
16	28	Mon	—	—	—	Field Study / DCA Creation	From Yangon			Preparation	Field Study (Mandalay)			
17	29	Tue	—	—	—		To Narita							
18	30	Wed	—	—	—		—	—	—	—	Preparation			
19	31	Thu	—	—	—		—	—	—	—	Field Study (Mandalay)			
20	6/1	Fri	—	—	—	Data Collection / Report Creation	—	—	—	Data Collection / Report Creation				
21	2	Sat	—	—	—		—	—	—		—			
22	3	Sun	—	—	—	Field Study	—	—	—	Field Study				
23	4	Mon	—	—	—	Field Study	—	—	—	Field Study				
24	5	Tue	—	—	—	Field Study	—	—	—	Field Study				
25	6	Wed	—	—	—	Field Study	—	—	—	Field Study				
26	7	Thu	—	—	—	JICA Report	—	—	—	JICA Report				
27	8	Fri	—	—	—	Report Creation	—	—	—	Report Creation				
28	9	Sat	—	—	—	Report Creation	—	—	—	Report Creation				
29	10	Sun	—	—	—	From Yangon	—	—	—	From Yangon				
30	11	Mon	—	—	—	To Narita	—	—	—	To Narita				

### 【Second Field Study Schedule】

Day	Date	Week	Overview	Cooperation Planning	Project Manager	Assistant Project Manager	Aircraft Surveillance System Planning	
1	12/3	Mon	Narita → Yangon				—	Narita → Yangon
2	4	Tue	Explanation / Concertation for Corporative Preparation Report (draft)					
3	5	Wed	Minutes Advance Concertation					
4	6	Thu	Minutes Concertation / Signature					
5	7	Fri	From Yangon			—	From Yangon	
6	8	Sat	To Narita			—	To Narita	

### 3. List of Parties Concerned in the Recipient Country

### 3.List of Parties Concerned in the Recipient Country

Organization	Title	Name
DCA: Department of Civil Aviation	Director General	U Min Lwin
	Deputy Director General	U Aung Kyaw Tun
	Director (ANSD)	U Soe Paing
	Deputy Director General / General Manager (ANSP)	U Ye Htut Aung
	DGM (CNS), ANSP	U Sai Win Myint
	Deputy General Manager (ATM), ANSP	U Aung Myint Thein
	Deputy Director (CNS), ASND	U Win Maw
	Deputy Director (ANSD)	U Thein Naing
	Assistant General Manager (NAV & ACC)	U Aung Myo
	Assistant General Manager (Comm & Sur)	U Zaw Min Oo
	Assistant General Manager (HF & Data Comm)	U Kyaw Zay Ya
	Executive Engineer (Radar)	U Htet Arkar
	Assistant General Manager (ATM), ANSP	U Aung Zaw Thein
	Assistant General Manager (HR), ANSP	U Soe Naing
	Assistant General Manager (SMS), ANSP	U Tin Maung Kyi
Assistant General Manager (YIA), ANSP	U Ye Htin Maw	
Embassy of Japan in Myanmar	Minister Counsellor	Ichiro MARUYAMA
	Counsellor	Kazuyuki TAKIMI
	First Secretary	Yoshimasa KASAI
JICA Myanmar Office	Deputy Director General	Kotaro NISHIGATA
	Representative	Shinji YASUI

## 4. Minutes of Discussions



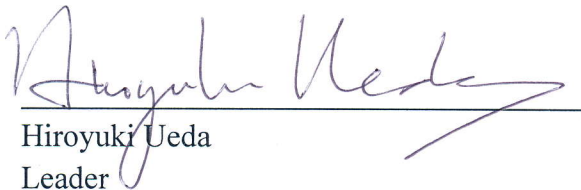


**Minutes of Discussions**  
**on**  
**the Preparatory Survey**  
**for**  
**the Project for Improvement of Aircraft Surveillance System**

Based on the several preliminary discussions between the Government of the Republic of the Union of Myanmar (hereinafter referred to as “Myanmar”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”), JICA dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as “the Team”) of the Project for Improvement of Aircraft Surveillance System (hereinafter referred to as “the Project”) to Myanmar.

The Team held a series of discussions with the officials of the Government of Myanmar and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Yangon, 16<sup>th</sup> May 2018



Hiroyuki Ueda

Leader

Preparatory Survey Team

Japan International Cooperation Agency

Japan



Min Lwin

Director General

Department of Civil Aviation

Ministry of Transport and Communications

The Republic of the Union of Myanmar

## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to improve safety of aircraft operations and enhance capacity of air navigation services in the vicinity of three international airports, Yangon, Mandalay and Nay-Pyi-Taw by upgrading aircraft surveillance system at those airports, thereby contributing to enhancement of civil aviation in Myanmar.

### 2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for Improvement of Aircraft Surveillance System”.

### 3. Project Site

Both sides confirmed that the sites of the Project are Yangon, Mandalay and Nay-Pyi-Taw International Airports, which are shown in Annex 1.

### 4. Responsible Authorities for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. The Department of Civil Aviation (hereinafter referred to as “DCA”) will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization chart of DCA is shown in Annex 2.

4-2. The line ministry of the Executing Agency is Ministry of Transport and Communications (hereinafter referred to as “MOTC”). The MOTC shall be responsible for supervising the Executing Agency on behalf of the Government of Myanmar.

5. Items requested by the Government of Myanmar

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Myanmar are as follows:

Scope of the Project
<p><b>1. Yangon International Airport</b></p> <p><u>Radar Site</u></p> <p>1-1. Airport Surveillance Radar (ASR)/Secondary Surveillance Radar (SSR)</p> <p>1-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Management Center (ATMC)</u></p> <p>1-3. Multi Sensor Data Processing System (MSDPS)</p> <p>1-4. Approach Control Consoles for Yangon, Mandalay and Nay-Pyi-Taw</p> <p>1-5. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>1-6. Voice Communication Control System (VCCS)</p> <p>1-7. Radar Control Training Simulator</p> <p>1-8. Provision of Nay-Pyi-Taw SSR Data with En-route MSDPS</p> <p>1-9. Provision of Yangon new SSR and Mandalay new SSR Data with En-route MSDPS as backup system</p> <p>1-10. VHF Air to Ground Communication System for Approach Control</p> <p><u>Air Traffic Control Tower</u></p> <p>1-11. Radar Data Display (RDD) and Flight Data Display (FDD)</p>
<p><b>2. Mandalay International Airport</b></p> <p><u>Radar Site</u></p> <p>2-1. Airport Surveillance Radar (ASR)/Secondary Surveillance Radar (SSR)</p> <p>2-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Control Tower</u></p> <p>2-3. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>2-4. VHF Air to Ground Communication System for Approach Control</p>
<p><b>3. Nay-Pyi-Taw International Airport</b></p> <p><u>Radar Site</u></p> <p>3-1. Secondary Surveillance Radar (SSR)</p> <p>3-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Control Tower</u></p> <p>3-3. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>3-4. VHF Air to Ground Communication System for Approach Control</p>

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

5-3. The Government of Myanmar shall submit an Official Application Form with cover letter of the Project to the Government of Japan through a diplomatic channel by the end of September 2018.

The format of the application and letter will be arranged among relevant authorities of



Japan and Myanmar.

## 6. Procedures and Basic Principles of Japanese Grant

- 6-1. The Myanmar side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project.
- 6-2. The Myanmar side agreed to take the necessary measures, as described in Annex 4, for smooth implementation of the Project. The contents of the Annex 4 will be elaborated and refined during the Preparatory Survey and agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report. The contents of Annex 4 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement (hereinafter referred to as "G/A").
- 6-3. As for the monitoring of the implementation of the Project, JICA requires Myanmar side to submit the Project Monitoring Report, the form of which is attached as Annex 5.

## 7. Schedule of the Survey

- 7-1. The Team will proceed with further survey in Myanmar until 10<sup>th</sup> June 2018.
- 7-2. An official Application Forms with cover letter to the Government of Japan will be submitted by the end of September 2018.
- 7-3. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Myanmar in order to explain its contents around middle of November 2018.
- 7-4. If the contents of the draft Preparatory Survey Report are accepted and the undertakings for the Project are fully agreed by the Myanmar side, JICA will finalize the Preparatory Survey Report and send it to Myanmar around February 2019.
- 7-5. The above schedule is tentative and subject to change.

## 8. New Yangon Air Traffic Management Center (ATMC)

- 8-1. The Myanmar side explained to the Team that new enroute radar control system is planned for ATMC to replace existing system at Yangon ACC, and estimated completion of the new system would be end of 2020.
- 8-2. The Myanmar side ensured that the requested equipment stated in 5-1 of this Minutes of Discussions shall not overlap with the equipment to be procured by the Myanmar side for the ATMC.

## 9. Environmental and Social Considerations

- 9-1. The Myanmar side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance

with the JICA Guidelines for Environmental and Social Considerations (April 2010).

- 9-2. Both sides confirmed that the Project is categorized as “C” in the JICA Guidelines because the Project is not located in a sensitive area, nor has it sensitive characteristics, nor falls into sensitive sectors under the Guidelines, and its potential adverse impacts on the environment are not likely to be significant.

#### 10. Technical Assistance (Soft Components)

The Myanmar side requested the Team the following technical assistance as Soft Components under the Project.

- Training Radar Approach Controllers
- Training Maintenance Staff
- Modification of Airspace
- Safety Assessment

The Team took note the requests from Myanmar side, and would continue technical assessment for the soft component.

#### 11. Other Relevant Issues

- 11-1. The Myanmar side shall, at its own expense, provide the Team with the following items in cooperation with DCA and other organizations concerned:

- (1) Data and information related to the Preparatory Survey;
- (2) Counterpart personnel;
- (3) Suitable office space with necessary equipment and services;
- (4) Credentials or identification cards;
- (5) Entry permits necessary for the Team members to conduct field surveys;
- (6) Support in obtaining other privileges and benefits, if necessary;
- (7) Security-related information as well as measures to ensure the safety of the Team;
- (8) Information as well as support in obtaining medical service.

- 11-2. The Myanmar side agreed to ensure that customs duties, internal taxes and other fiscal levies which may be imposed in Myanmar with respect to the purchase of the products and the services be exempted.

- 11-3. The Myanmar side understood the principle of the Japan's Development Cooperation Charter, which stresses that ODA must not be utilized for military purpose or promoting international conflicts, and agreed to ensure that neither the equipment and facility to be procured under the Project nor air traffic control data collected by the equipment under the Project will be used for any military purposes.

- 11-4. Both sides agreed that the contents of the Preparatory Survey Report excluding cost estimation of the Project will be disclosed to the public after completion of the Preparatory Survey. All the contents of the Preparatory Survey Report including cost

estimation of the Project will be disclosed to the public after the contract for construction/supply of the Project facilities/equipment is concluded. Nevertheless of the above, both can discuss the parts of the Preparatory Report that should not be disclosed to the public from security aspect, and exclude those parts from disclosure before the Preparatory Report is published.

11-5. To avoid accidents on site during the implementation of the Project, the Myanmar side agreed to cause the consultant and the contractor to enforce safety measures such as setting safety assurance to the site, providing information for security control to public, and deploying adequate security personnel, based on the JICA Guidance for the Management of Safety for Construction Works in Japanese ODA Projects (September 2014), which has been published on JICA's website shown below.

[https://www.jica.go.jp/english/our\\_work/types\\_of\\_assistance/c8h0vm00008zx0m8-att/guidance\\_en.pdf](https://www.jica.go.jp/english/our_work/types_of_assistance/c8h0vm00008zx0m8-att/guidance_en.pdf)

11-6. The Myanmar side shall provide security measures for all concerned Japanese nationals working for the Project, if deemed necessary.

Annex 1: Project Site

Annex 2: Organization Chart of DCA

Annex 3: Japanese Grant

Annex 4: Major Undertakings to be taken by the Government of Myanmar

Annex 5: Project Monitoring Report (template)

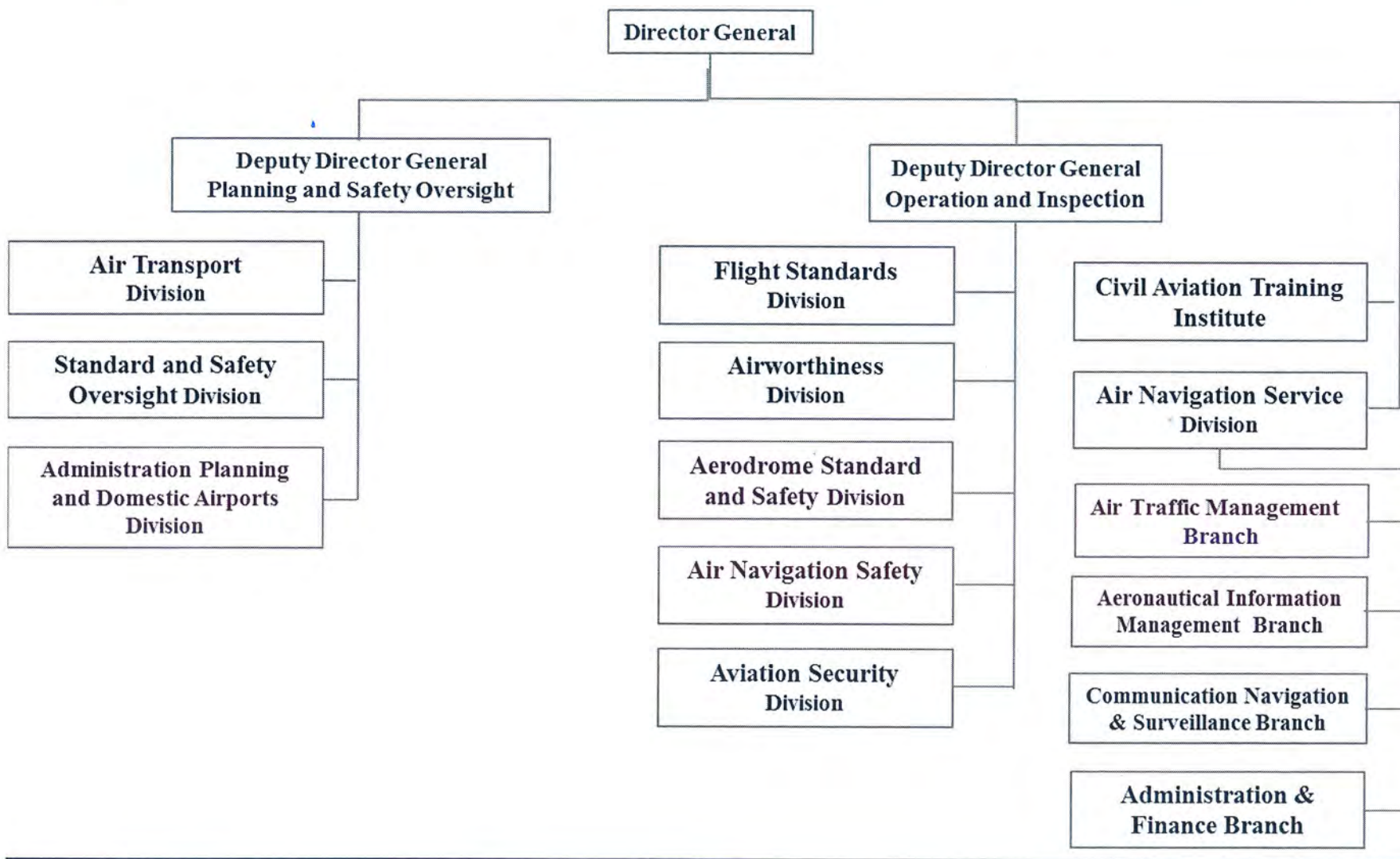


**PROJECT SITE**



**ORGANIZATION CHART OF DEPARTMENT OF CIVIL AVIATION OF MYANMAR**

**DCA Myanmar Organization Chart**





## JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

### **1. Procedures of Project Grants**

Project Grants are conducted through following procedures (See “Attachment-1: Procedures of Japanese Grant” for details):

- (1) Preparation
  - The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA
- (2) Appraisal
  - Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet
- (3) Implementation
  - Exchange of Notes
    - The Notes exchanged between the GOJ and the government of the Recipient
  - Grant Agreement (hereinafter referred to as “the G/A”)
    - Agreement concluded between JICA and the Recipient
  - Banking Arrangement (hereinafter referred to as “the B/A”)
    - Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant
  - Construction works/procurement
    - Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A
- (4) Ex-post Monitoring and Evaluation
  - Monitoring and evaluation at post-implementation stage

### **2. Preparatory Survey**

#### (1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

#### (2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

#### (3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

### 3. Basic Principles of Project Grants

#### (1) Implementation Stage

##### 1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as “the E/N”) will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the “General Terms and Conditions for Japanese Grant (January 2016).”

##### 2) Banking Arrangements (B/A) (See “Attachment 2: Financial Flow of Japanese Grant (A/P Type)” for details)

HA

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.
- b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

### 3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

### 4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

### 5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

### 6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

### 7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

### 8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.





### 9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the “Meeting”) will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client’s obligation, during of construction.

### (2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

### (3) Others

#### 1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

#### 2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

#### 3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff

necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

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**PROCEDURES OF JAPANESE GRANT**

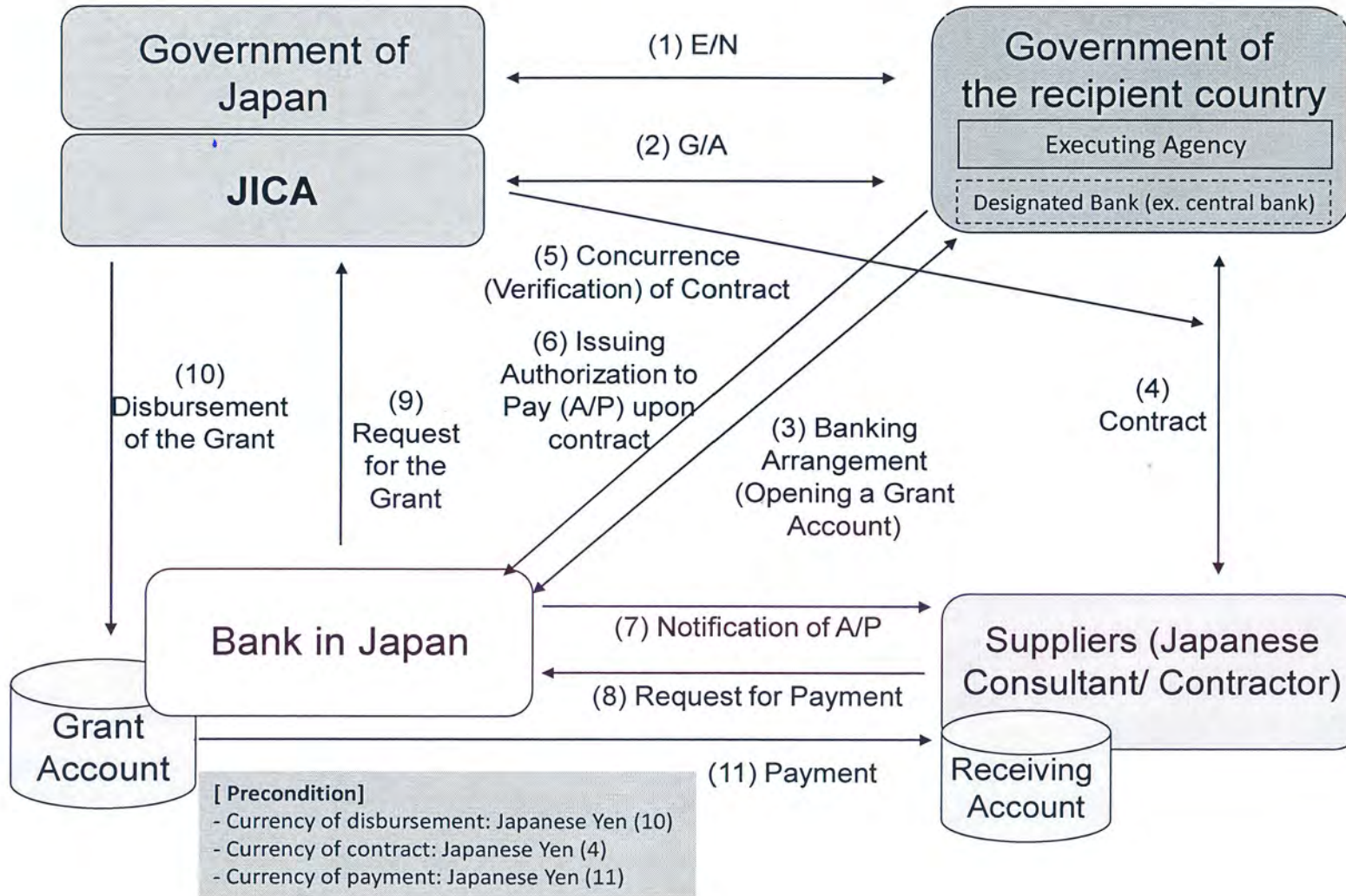
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

Notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.



**FINANCIAL FLOW OF JAPANESE GRANT (A/P TYPE)**



**MAJOR UNDERTAKINGS TO BE TAKEN BY**  
**THE GOVERNMENT OF MYANMAR**

**1. Specific obligations of the Government of Myanmar which will not be funded with the Grant**

(1) Before the Tender

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after the signing of the G/A	MOPF/M OTC		
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	MOPF/M OTC		
3	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding document(s)	DCA		
4	To secure necessary land/site within Yangon, Mandalay and Nay-Pyi-Taw International Airport for installation of Radar with necessary administrative permission(s)	before preparation of bidding document(s)	DCA		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable), (MOPF: Ministry of Planning and Finance, MODS: Ministry of Defense and Security, MOFAC: Ministry of Foreign Affairs and Cooperation)

(2) During the Project Implementation

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	MOPF/M OTC		
2	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s) with Contractor(s) and Supplier(s)	MOPF/M OTC		
	2) Payment commission for A/P	every payment for Consultant, Contractor(s) and Supplier(s)	MOPF/M OTC		
3	To issue the Working Visa for workers	before commencement of the Project	DCA		



4	To enable provision of electric power supply for the equipment	1 month before installation of each equipment	DCA		
5	To enable provision of leased landline circuit between Yangon – Mandalay and Yangon - Nay-Pyi-Taw	1 month before installation of radar equipment	DCA		
6	To enable provision of leased VSAT circuit between Yangon – Mandalay and Yangon - Nay-Pyi-Taw	1 month before installation of radar equipment	DCA		
7	To conduct adjustment of En-route MSDPS at Yangon ATMC for connection of radar data from new SSRs at Yangon, Mandalay and Nay-Pyi-Taw	after installation of radar equipment	DCA		
8	To take necessary measure for safety of construction and installation	during the the Project	DCA		
9	To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Contractor(s) and/or Supplier(s) with internal transportation therein	during the the Project	DCA		
10	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the the Project	DCA		
11	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the the Project	MOTC/ DCA		
12	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the the Project	DCA		
13	1) To submit Project Monitoring Report	every month	DCA		
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	DCA		
	To submit a report concerning completion of the Project	within 6 months after completion of the Project	DCA		

### (3) After the Project

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	DCA		

## 2. Major Undertakings to be covered by the Grant Aid

No	Items	Deadline	Amount (Million Japanese Yen)*
1	<p>To construct and/or install the following facilities and equipment</p> <p>1. Yangon International Airport</p> <p><u>Radar Site</u></p> <p>1-1. Airport Surveillance Radar (ASR)/Secondary Surveillance Radar (SSR)</p> <p>1-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Management Center (ATMC)</u></p> <p>1-3. Multi Sensor Data Processing System (MSDPS)</p> <p>1-4. Approach Control Consoles for Yangon, Mandalay and Nay-Pyi-Taw</p> <p>1-5. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>1-6. Voice Communication Control System (VCCS)</p> <p>1-7. Radar Control Training Simulator</p> <p>1-8. Provision of Nay-Pyi-Taw SSR Data with En-route MSDPS</p> <p>1-9. Provision of Yangon new SSR and Mandalay new SSR Data with En-route MSDPS as backup system</p> <p>1-10. VHF Air to Ground Communication System for Approach Control</p> <p><u>Air Traffic Control Tower</u></p> <p>1-11. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>2. Mandalay International Airport</p> <p><u>Radar Site</u></p> <p>2-1. Airport Surveillance Radar (ASR)/Secondary Surveillance Radar (SSR)</p> <p>2-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Control Tower</u></p> <p>2-3. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>2-4. VHF Air to Ground Communication System for Approach Control</p> <p>3. Nay-Pyi-Taw International Airport</p> <p><u>Radar Site</u></p> <p>3-1. Secondary Surveillance Radar (SSR)</p> <p>3-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Control Tower</u></p> <p>3-3. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>3-4. VHF Air to Ground Communication System for Approach Control</p>	before end of contract	
2	To conduct flight calibration of radar system		
3	To provide training for operation and maintenance of the systems by equipment manufacturer		
4	To implement detailed design, bidding support and construction supervision (Consulting Service)		
	Total		XXX



**Project Monitoring Report**  
**on**  
**Project Name**  
**Grant Agreement No. XXXXXXXX**  
20XX, Month

**Organizational Information**

<b>Signer of the G/A (Recipient)</b>	_____ Person in Charge (Designation) _____  Contacts            _____ Address: _____ Phone/FAX: _____ Email: _____
<b>Executing Agency</b>	_____ Person in Charge (Designation) _____  Contacts            _____ Address: _____ Phone/FAX: _____ Email: _____
<b>Line Ministry</b>	_____ Person in Charge (Designation) _____  Contacts            _____ Address: _____ Phone/FAX: _____ Email: _____

**General Information:**

<b>Project Title</b>	
<b>E/N</b>	Signed date: Duration:
<b>G/A</b>	Signed date: Duration:
<b>Source of Finance</b>	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

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**1: Project Description**

**1-1 Project Objective**

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**1-2 Project Rationale**

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

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**1-3 Indicators for measurement of "Effectiveness"**

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr )	Target (Yr )
Qualitative indicators to measure the attainment of project objectives		

**2: Details of the Project**

**2-1 Location**

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

**2-2 Scope of the work**

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)
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*fw*

*re*



**2-3 Implementation Schedule**

Items	Original		Actual
	<i>(proposed in the outline design)</i>	<i>(at the time of signing the Grant Agreement)</i>	

Reasons for any changes of the schedule, and their effects on the project (if any)

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**2-4 Obligations by the Recipient**

**2-4-1 Progress of Specific Obligations**

See Attachment 2.

**2-4-2 Activities**

See Attachment 3.

**2-4-3 Report on RD**

See Attachment 11.

**2-5 Project Cost**

**2-5-1 Cost borne by the Grant(Confidential until the Bidding)**

Components			Cost (Million Yen)	
	Original <i>(proposed in the outline design)</i>	Actual <i>(in case of any modification)</i>	Original <sup>1),2)</sup> <i>(proposed in the outline design)</i>	Actual
	1.			
Total				

Note: 1) Date of estimation:

2) Exchange rate: 1 US Dollar = Yen

**2-5-2 Cost borne by the Recipient**

Components			Cost (1,000 Taka)	
	Original <i>(proposed in the outline design)</i>	Actual <i>(in case of any modification)</i>	Original <sup>1),2)</sup> <i>(proposed in the outline design)</i>	Actual
	1.			

- Note: 1) Date of estimation:  
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)
-------

**2-6 Executing Agency**

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

<b>Original</b> (at the time of outline design) name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
<b>Actual</b> (PMR)

**2-7 Environmental and Social Impacts**

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

**3: Operation and Maintenance (O&M)**

**3-1 Physical Arrangement**

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

<b>Original</b> (at the time of outline design)
<b>Actual</b> (PMR)

**3-2 Budgetary Arrangement**

- Required O&M cost and actual budget allocation for O&M

<b>Original</b> (at the time of outline design)
---



Actual (PMR)

**4: Potential Risks and Mitigation Measures**

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

**Assessment of Potential Risks (at the time of outline design)**

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

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	Contingency Plan (if applicable):
<b>Actual Situation and Countermeasures</b> (PMR)	

**5: Evaluation and Monitoring Plan (after the work completion)**

**5-1 Overall evaluation**

Please describe your overall evaluation on the project.

**5-2 Lessons Learnt and Recommendations**

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

**5-3 Monitoring Plan of the Indicators for Post-Evaluation**

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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Attachment

1. Project Location Map
  2. Specific obligations of the Recipient which will not be funded with the Grant
  3. Monthly Report submitted by the Consultant
- Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
  - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
  5. Environmental Monitoring Form / Social Monitoring Form
  6. Monitoring sheet on price of specified materials (Quarterly)
  7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
  8. Pictures (by JPEG style by CD-R) (PMR (final) only)
  9. Equipment List (PMR (final) only)
  10. Drawing (PMR (final) only)
  11. Report on RD (After project)



## Monitoring sheet on price of specified materials

## 1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C-D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

## 2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)  
 (Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

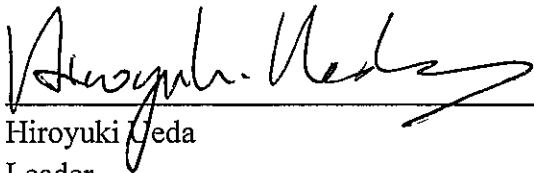


**Minutes of Discussions**  
**on the Preparatory Survey for the Project for**  
**Improvement of Aircraft Surveillance System**  
**(Explanation on Draft Preparatory Survey Report)**

With reference to the minutes of discussions on the Project for Improvement of Aircraft Surveillance System (hereinafter referred to as "the Project") signed between the Department of Civil Aviation (hereinafter referred to as "DCA") of the Ministry of Transport and Communications (hereinafter referred to as "MOTC") of the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 16<sup>th</sup> May 2018, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team" ) headed by Hiroyuki UEDA, Senior Transport Sector Advisor of JICA, to Myanmar for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") of the Project from 3<sup>rd</sup> to 7<sup>th</sup> December 2018.

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Yangon, 6<sup>th</sup> December 2018



Hiroyuki Ueda  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



Min Lwin  
Director General  
Department of Civil Aviation  
Ministry of Transport and Communications  
The Republic of the Union of Myanmar

## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to improve safety of aircraft operations and enhance capacity of air navigation services in the vicinity of three international airports, Yangon, Mandalay and Nay-Pyi-Taw by upgrading aircraft surveillance system at those airports, thereby contributing to enhancement of civil aviation in Myanmar.

### 2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for Improvement of Aircraft Surveillance System”.

### 3. Project Site

Both sides confirmed that the sites of the Project are Yangon, Mandalay and Nay-Pyi-Taw International Airports, which are shown in Annex 1.

### 4. Responsible Authorities for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

- 4-1. The DCA will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time.
- 4-2. The line ministry of the Executing Agency is the MOTC. The MOTC shall be responsible for supervising the Executing Agency on behalf of the Government of Myanmar.

### 5. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Myanmar side agreed to its contents.

### 6. Cost Estimate

The Team explained to the Myanmar side that the rough estimate of the Project Cost is as described in Annex 2. Both sides confirmed that the cost estimate including the contingency shown in Annex 2 explained by the Team is provisional and will be examined further by the Government of Japan for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

7. Confidentiality of the cost estimate and technical specifications

Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. Timeline of the Project Implementation

The Team explained to the Myanmar side that the expected timeline of the Project implementation is as attached in Annex 3.

9. Procedures and Basic Principles of Japanese Grant

The Myanmar side agreed that the procedures and basic principles of Japanese Grant as described in Annex 4 shall be applied to the Project. In addition, the Myanmar side agreed to take necessary measures according to the procedures.

10. Expected Outcomes and Indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Myanmar side will be responsible for the achievement of agreed key indicators targeted in year 2024 and shall monitor the progress based on those indicators.

[Quantitative indicators]

Indicators	Baseline Value (Year 2017)	Target Value (Year 2024) 3 years after the Project Completion
Percentage of aircraft that will take off and land at Yangon and Mandalay Airports with Terminal Radar Control Services (%)	0%	100%
Surveillance capability for airspace below altitude 15,000 feet around Nay-Pyi-Taw Airport	0%	100%

[Qualitative indicators]

- Improvement in safety and efficiency of aircraft operations in the terminal area of Yangon and Mandalay Airports through provision of Terminal Radar Control Services
- Improvement in efficiency of Air Traffic Control Services at Yangon and Mandalay Airports
- Improvement in safety of aircraft operations over air routes around Nay-Pyi-Taw Airport.

#### 11. Technical Assistance (“Soft Component” of the Project)

Considering the sustainable operation and maintenance of the products and services granted through the Project, following technical assistance for ATCs and ATSEPs is planned under the Project. The Myanmar side confirmed to deploy necessary number of counterparts who are appropriate and competent in terms of its purpose of the technical assistance as described in the Draft Report.

- Develop capacity of ATSEP in operation and maintenance of the radar system
- Develop capacity of ATSEP in management of spare parts
- Develop capacity of ATCOs and ATSEP in system transition and troubleshooting
- Develop capacity of ATCOs and ATSEP in safety management of transition to the terminal radar control services, and operation and maintenance of the radar system

ATCO: Air Traffic Control Officer

ATSEP: Air Traffic Safety Electronics Personnel

#### 12. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in (2)-1)-12 of Annex 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by DCA during the implementation stage of the Project.

The Myanmar side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

Both sides also confirmed that the Annex 5 will be used as an attachment of G/A.

#### 13. Monitoring during the implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 6. The timing of submission of the PMR is described in Annex 6.

#### 14. Project Completion

Both sides confirmed that the project completes when all the facilities constructed and equipment procured by the grant are in operation. The completion of the Project will be reported to JICA promptly, but in any event not later than six months after completion of the Project.

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15. Operation and Maintenance of the Project Equipment

DCA agreed to secure staff and labor cost, regular maintenance and overhaul cost for proper and sustainable operation and maintenance of the equipment under the Project.

(1) Minimum Number of ATCOs and ATSEP

- Number of ATCOs for Radar Approach Control Services: 36

Supervisor: 1 x 4 shifts = 4

Mingaladon Approach: 4 (2 Controllers, 2 Coordinators) x 4 shifts = 16

Mandalay Approach: 2 (Controller and Coordinator) x 4 shifts = 8

Nay-Pyi-Taw Approach: 2 (Controller and Coordinator) x 4 shifts = 8

$4+16+8+8=36$

- Number of ATSEP for Maintenance of Radar Systems: 21

Yangon Airport (1 RM1 x 4 shifts, 1 RM1, 1 TS, 1 AE = 7)

Mandalay Airport (1 RM1 x 4 shifts, 1 RM1, 1 TS, 1 AE = 7)

Nay-Pyi-Taw Airport (1 RM1 x 4 shifts, 1 RM1, 1 TS, 1 AE = 7)

$7+7+7=21$

(RM1: Radio Mechanic Grade 1, AE: Assistant Engineer, TS: Technical Supervisor.)

(2) Estimated Regular Maintenance Cost including spare parts

USD 10,000 to 15,000 per year for three airports

(3) Estimated Cost for Overhaul of Radars (Every 5 year)

USD 50,000 per one time for 3 airports

16. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, and Sustainability). The result of the evaluation will be publicized. The Myanmar side is required to provide necessary support for the data collection.

17. Schedule of the Study

JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Myanmar side around April 2019.

18. Environmental and Social Considerations

- The Myanmar side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April 2010).
- Both sides confirmed that the Project is categorized as "C" in the JICA Guidelines because the Project is not located in a sensitive area, nor has it sensitive characteristics,



nor falls into sensitive sectors under the Guidelines, and its potential adverse impacts on the environment are not likely to be significant.

## 19. Other Relevant Issues

### 19-1. Disclosure of Information

Both sides agreed on the disclosure of the Preparatory Survey Report to the public as follows;

- The Preparatory Report without cost estimation of the Project will be disclosed to the public after the completion of the Preparatory Survey.
- The Preparatory Report including cost estimation of the Project will be disclosed to the public after all the contracts under the Project are concluded.

### 19-2. New Yangon Air Traffic Management Center (ATMC)

- The Myanmar side explained to the Team that new En-route radar control system is planned for ATMC to replace existing system at Yangon ACC, and estimated completion of the new system installation would be end of 2020.
- The Myanmar side ensured that the equipment procured by the Grant under the Project shall not overlap with the equipment to be procured by the Myanmar side for the ATMC.

19-3. The Myanmar side understood the principle of the Japan's Development Cooperation Charter, which stresses that ODA must not be utilized for military purpose or promoting international conflicts, and agreed to ensure that neither the equipment and facility to be procured under the Project nor air traffic control data collected by the equipment under the Project will be used for any military purposes.

19-4. To avoid accidents on site during the implementation of the Project, the Myanmar side agreed to cause the consultant and the contractor to enforce safety measures such as setting safety assurance to the site, providing information for security control to public, and deploying adequate security personnel, based on the JICA Guidance for the Management of Safety for Construction Works in Japanese ODA Projects (September 2014), which has been published on JICA's website shown below.

[https://www.jica.go.jp/english/our\\_work/types\\_of\\_assistance/c8h0vm00008zx0m8-att/guidance\\_en.pdf](https://www.jica.go.jp/english/our_work/types_of_assistance/c8h0vm00008zx0m8-att/guidance_en.pdf)

19-5. The Myanmar side shall provide security measures for all concerned Japanese nationals working for the Project, if deemed necessary.

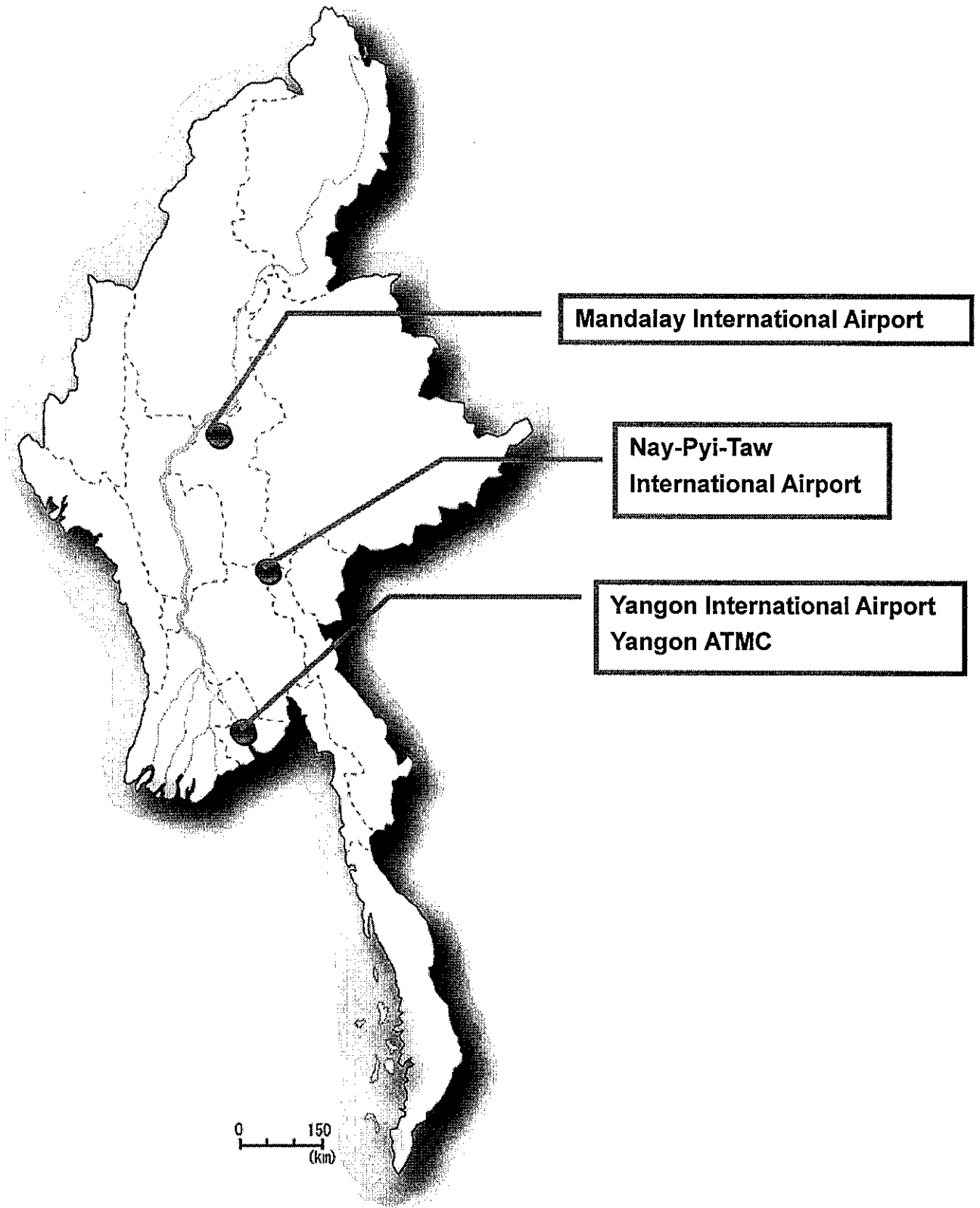
19-6. DCA requested Weather Radars for Yangon, Mandalay and Nay-Pyi-Taw Airports. The Team explained that it is difficult for Japanese side to add the requested Weather Radars to this Project. DCA understood it.

- Annex 1: Project Site
- Annex 2: Cost Estimate of the Project
- Annex 3: Expected Timeline of the Project Implementation
- Annex 4: Japanese Grant
- Annex 5: Major Undertakings to be taken by the Government of Myanmar
- Annex 6: Project Monitoring Report (template)

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**ANNEX1: PROJECT SITE**



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**ANNEX2: COST ESTIMATE OF THE PROJECT**

1. Cost Estimate borne by the Government of Japan

No	Items	Estimate Cost (Million Japanese Yen)
1	<p>To construct and/or install the following facilities and equipment</p> <p>1. Yangon International Airport</p> <p><u>Radar Site</u></p> <p>1-1. Airport Surveillance Rader (ASR)/Secondary Surveillance Radar (SSR)</p> <p>1-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Management Center (ATMC)</u></p> <p>1-3. Multi Sensor Data Processing System (MSDPS)</p> <p>1-4. Approach Control Consoles for Yangon, Mandalay and Nay-Pyi-Taw</p> <p>1-5. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>1-6. Voice Communication Control System (VCCS)</p> <p>1-7. Radar Control Training Simulator</p> <p>1-8. Provision of Nay-Pyi-Taw SSR Data with En-route MSDPS</p> <p>1-9. Provision of Yangon new SSR and Mandalay new SSR Data with En-route MSDPS as backup system</p> <p>1-10. VHF Air to Ground Communication System for Approach Control</p> <p><u>Air Traffic Control Tower</u></p> <p>1-11. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>2. Mandalay International Airport</p> <p><u>Radar Site</u></p> <p>2-1. Airport Surveillance Rader (ASR)/Secondary Surveillance Radar (SSR)</p> <p>2-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Control Tower</u></p> <p>2-3. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>2-4. VHF Air to Ground Communication System for Approach Control</p> <p>3. Nay-Pyi-Taw International Airport</p> <p><u>Radar Site</u></p> <p>3-1. Secondary Surveillance Radar (SSR)</p> <p>3-2. Radar Tower and Radar Building</p> <p><u>Air Traffic Control Tower</u></p> <p>3-3. Radar Data Display (RDD) and Flight Data Display (FDD)</p> <p>3-4. VHF Air to Ground Communication System for Approach Control</p>	
2	Flight inspection of radar system	
3	Training for operation and maintenance of the systems by equipment manufacturer	

4	Soft Component	
5	Implementation of detailed design, bidding support and procurement supervision (Consulting Service)	
6	Contingency	
	TOTAL	

2. Cost Estimate borne by the Government of Myanmar

No	Items	Estimate Cost (Million Myanmar Kyat)
1	Preparation for Radar Site in Three Airports (Land clearing, Provision of power and water supply, security fence and toilet etc.)	
2	Banking Commission	
	TOTAL	

Note:

1) Conditions of Cost Estimate

- Timing of Estimation: June 2018
- Exchange Rate  
USD 1.00 = JPY 108.75  
Myanmar Kyat 1.00 = JPY 0.0805

2) Others

The project is implemented in accordance with the system of Japanese Grant. The above cost estimation does not assure the ceiling cost on the E/N and will be reviewed by the Government of Japan before the conclusion of E/N between the two governments. Cost estimate borne by the Government of Myanmar in the above is provisional, and requires review for implementation.

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**ANNEX3: EXPECTED TIMELINE OF THE PROJECT IMPLEMENTATION**

Estimated timeline of the Project Implementation is as follows;

- Exchange of Note (E/N) and Grant Agreement (G/A): April 2019
- Detailed Design and Procurement of Supplier: April – August 2019
- Manufacturing, Delivery and Installation of the Equipment: August 2019 – March 2021
- Soft Component: January – March 2021
- Warrantee Period: March 2021 – March 2022

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## ANNEX 4: JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

### **1. Procedures of Project Grants**

Project Grants are conducted through following procedures (See “Attachment-1: Procedures of Japanese Grant” for details):

#### (1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

#### (2) Appraisal

- Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

#### (3) Implementation

##### Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

##### Grant Agreement (hereinafter referred to as “the G/A”)

- Agreement concluded between JICA and the Recipient

##### Banking Arrangement (hereinafter referred to as “the B/A”)

- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as “the Bank”) to receive the grant

##### Construction works/procurement

- Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

#### (4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage

### **2. Preparatory Survey**

#### (1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the Project made

by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

## (2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

## (3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

### **3. Basic Principles of Project Grants**

#### (1) Implementation Stage

##### 1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."





2) Banking Arrangements (B/A) (See “Attachment 2: Financial Flow of Japanese Grant (A/P Type)” for details)

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.
- b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA’s procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project’s implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

## 8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

## 9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

## (2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

## (3) Others

### 1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

### 2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be



exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.



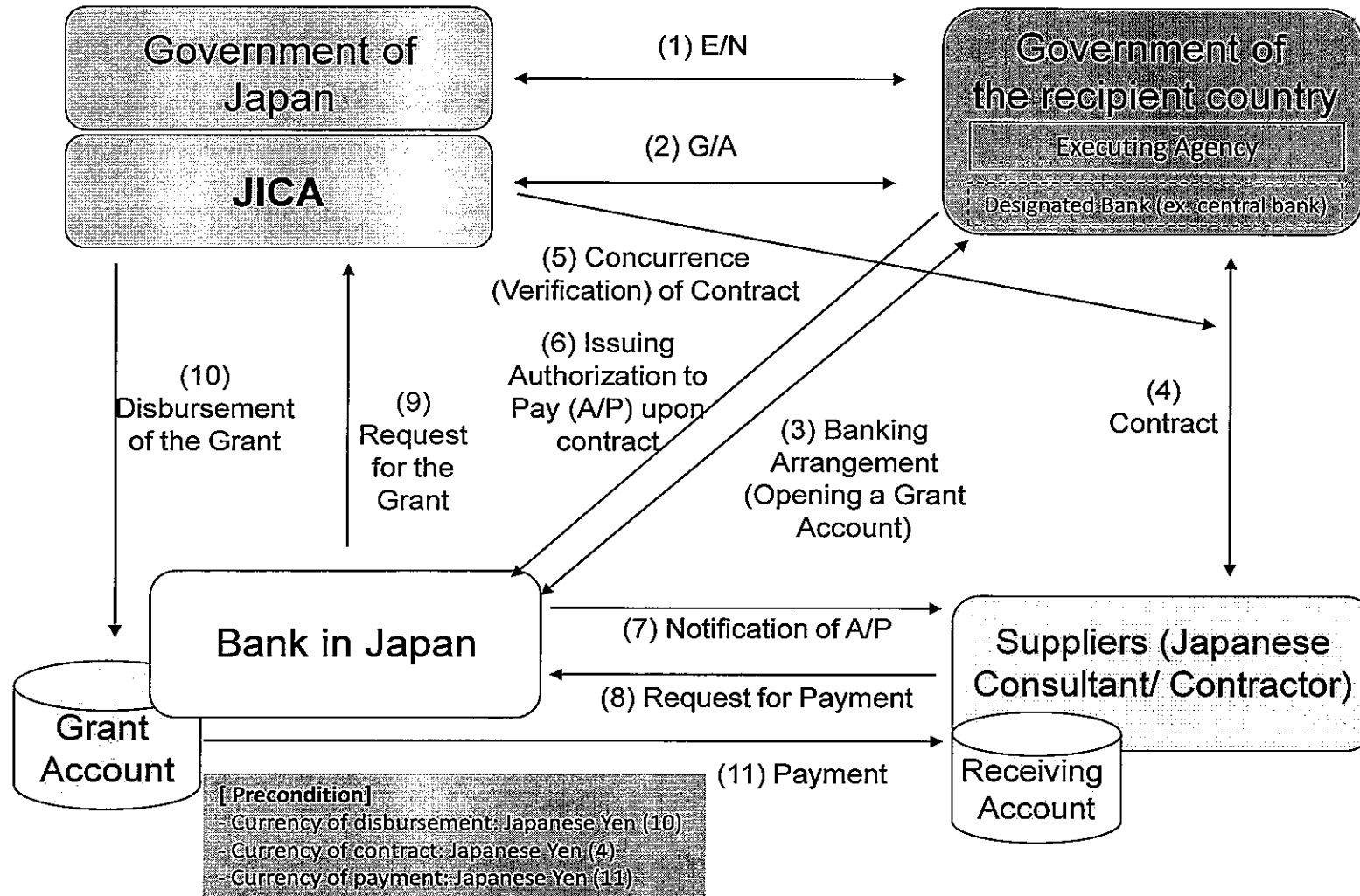
**PROCEDURES OF JAPANESE GRANT**

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

Notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

**FINANCIAL FLOW OF JAPANESE GRANT (A/P TYPE)**



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**MAJOR UNDERTAKINGS TO BE TAKEN BY**  
**THE GOVERNMENT OF MYANMAR**

**1. Obligations of the Government of Myanmar which will not be funded with the Grant**

(1) Before the Tender

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after the signing of the G/A	MOPF/M OTC		
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	MOPF/M OTC		
3	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding document(s)	DCA		
4	Applying and assigning of ASR frequency to/by radio committee.	before Tender Notice	DCA		
5	Applying and assigning Interrogator Identification Code to/by ICAO Asia and Pacific Regional Office.	before Tender Notice	DCA		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable MOPF: Ministry of Planning and Finance),

(2) During the Project Implementation

1) General

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	MOPF/M OTC	37.27 Million MMK	
2	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	MOPF/M OTC		
	2) Payment commission for A/P	every payment for Consultant, Contractor(s) and Supplier(s)	MOPF/M OTC		
3	Preparation for Radar Site in Three Airports with necessary administrative permission(s) (Land clearing, Provision of power and water supply, security fence and toilet etc.)	See 2) Specific at Each Airport	DCA	16.23 Million MMK	
4	To issue the Working Visa for workers	before commencement of the Project	DCA		
5	To enable provision of electric power supply for the equipment		DCA		

		See 2) Specific at Each Airport			
6	To enable provision of leased landline circuit between Yangon – Mandalay and Yangon - Nay-Pyi-Taw	See 2) Specific at Each Airport	DCA		
7	To enable provision of leased VSAT circuit between Yangon – Mandalay and Yangon - Nay-Pyi-Taw	See 2) Specific at Each Airport	DCA		
8	Integration new radar data into En-route MSDPS (Top Sky-ATC) manufactured by Thales (Technical coordination with Thales)	after installation of radar equipment (Target date will be decided between DCA and Thales.)	DCA		
9	To take necessary measure for safety of construction and installation	during the Project	DCA		
10	To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Contractor(s) and/or Supplier(s) with internal transportation therein	during the Project	DCA		
11	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	DCA		
12	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project	MOTC/ DCA		
13	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	DCA		
14	1) To submit Project Monitoring Report	every month	DCA		
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	DCA		
	To submit a report concerning completion of the Project	within 6 months after completion of the Project	DCA		

2) Specific at Each Airport

Site	Equipment	Obligation of Myanmar side	Deadline (Expected Target Date)
<b>Yangon International Airport</b>			
ASR/SSR site	Site Area	<ul style="list-style-type: none"> <li>Land clearing such as cutting trees and removing bushes, construction of access road</li> </ul>	Before Conclusion of Supplier's Contract (Sep. 2019)
		<ul style="list-style-type: none"> <li>Provision of power supply source</li> </ul>	Before Completion of Radar Building Construction (Within 7 Months After Conclusion of Supplier's Contract, Mar. 2020)
		<ul style="list-style-type: none"> <li>Construction of security fence, water supply and toilet</li> </ul>	Before Completion of the Project (Within 19 Months After Conclusion of Supplier's Contract, Mar. 2021)
ATMC equipment room, Approach control room, Radar simulator room and Control Tower	Radar System Equipment	<ul style="list-style-type: none"> <li>Securing of installation space for new equipment and provision of power supply</li> </ul>	Before Arrival of Shipped Equipment (Within 11 Months After Conclusion of Supplier's Contract, Jul. 2020)
ATMC equipment room	MSDPS equipment	<ul style="list-style-type: none"> <li>Provision of leased line &amp; VSAT Satellite channel between Yangon and Mandalay, Yangon and Nay Pyi Taw</li> </ul>	Before Arrival of Shipped Equipment (Within 11 Months After Conclusion of Supplier's Contract, Jul. 2020)
<b>Mandalay International Airport</b>			
ASR/SSR site	Site Area	<ul style="list-style-type: none"> <li>Land clearing such as cutting trees and removing bushes, construction of access road</li> </ul>	Before Conclusion of Supplier's Contract (Sep. 2019)
		<ul style="list-style-type: none"> <li>Provision of power supply source</li> </ul>	Before Completion of Radar Building Construction (Within 7 Months After Conclusion of Supplier's Contract, Mar. 2020)
		<ul style="list-style-type: none"> <li>Construction of security fence, water supply and toilet</li> </ul>	Before Completion of the Project (Within 19 Months After Conclusion of Supplier's Contract, Mar. 2021)
ATC operation building GF and Control Tower	Radar System Equipment	<ul style="list-style-type: none"> <li>Securing of installation space for new equipment and provision of power supply</li> </ul>	Before Arrival of Shipped Equipment (Within 11 Months After Conclusion of Supplier's Contract, Jul. 2020)
<b>Nay Pyi Taw International Airport</b>			
SSR site	Site Area	<ul style="list-style-type: none"> <li>Land clearing such as cutting trees and removing bushes, construction of access road</li> </ul>	Before Conclusion of Supplier's Contract (Sep. 2019)
		<ul style="list-style-type: none"> <li>Provision of power supply source</li> </ul>	Before Completion of Radar Building Construction (Within 7 Months After



Site	Equipment	Obligation of Myanmar side	Deadline (Expected Target Date)
			Conclusion of Supplier's Contract, Mar. 2020)
		• Construction of security fence, water supply and toilet	Before Completion of the Project (Within 19 Months After Conclusion of Supplier's Contract, Mar. 2021)
ATC operation building 9F and Control Tower	Radar System Equipment	• Securing of installation space for new equipment and provision of power supply	Before Arrival of Shipped Equipment (Within 11 Months After Conclusion of Supplier's Contract, Jul. 2020)

(3) After the Project

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the equipment installation works	DCA		

**2. Obligations of the Government of Myanmar funded by the Grant**

No.	Items	Deadline	Amount (Million Japanese Yen)
1	Procurement, Transportation and Installation for the equipment under the Project.		
2	Implementation of detailed design, bidding, and procurement supervision (Consulting Service)		
3	Soft Component		
4	Contingency		
	TOTAL		

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**Project Monitoring Report**  
on  
**Project Name**  
**Grant Agreement No. XXXXXXXX**  
20XX, Month

**Organizational Information**

<b>Signer of the G/A (Recipient)</b>	<p>Person in Charge (Designation) _____</p> <p>Contacts      Address: _____</p> <p>                 Phone/FAX: _____</p> <p>                 Email: _____</p>
<b>Executing Agency</b>	<p>Person in Charge (Designation) _____</p> <p>Contacts      Address: _____</p> <p>                 Phone/FAX: _____</p> <p>                 Email: _____</p>
<b>Line Ministry</b>	<p>Person in Charge (Designation) _____</p> <p>Contacts      Address: _____</p> <p>                 Phone/FAX: _____</p> <p>                 Email: _____</p>

**General Information:**

<b>Project Title</b>	
<b>E/N</b>	Signed date: Duration:
<b>G/A</b>	Signed date: Duration:
<b>Source of Finance</b>	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

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**1: Project Description**

**1-1 Project Objective**

**1-2 Project Rationale**

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

**1-3 Indicators for measurement of "Effectiveness"**

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr )	Target (Yr )
Qualitative indicators to measure the attainment of project objectives		

**2: Details of the Project**

**2-1 Location**

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

**2-2 Scope of the work**

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

**2-3 Implementation Schedule**

Items	Original		Actual
	<i>(proposed in the outline design)</i>	<i>(at the time of signing the Grant Agreement)</i>	

Reasons for any changes of the schedule, and their effects on the project (if any)

**2-4 Obligations by the Recipient**

**2-4-1 Progress of Specific Obligations**  
 See Attachment 2.

**2-4-2 Activities**  
 See Attachment 3.

**2-4-3 Report on RD**  
 See Attachment 11.

**2-5 Project Cost**

**2-5-1 Cost borne by the Grant(Confidential until the Bidding)**

Components	Cost (Million Yen)			
	Original <i>(proposed in the outline design)</i>	Actual <i>(in case of any modification)</i>	Original <sup>1)2)</sup> <i>(proposed in the outline design)</i>	Actual
1.				
Total				

Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar = Yen

**2-5-2 Cost borne by the Recipient**

Components	Cost (1,000 Taka)			
	Original <i>(proposed in the outline design)</i>	Actual <i>(in case of any modification)</i>	Original <sup>1)2)</sup> <i>(proposed in the outline design)</i>	Actual
1.				

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- Note: 1) Date of estimation:  
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

**2-6 Executing Agency**

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

<p>Original (at the time of outline design) name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):</p>
<p>Actual (PMR)</p>

**2-7 Environmental and Social Impacts**

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

**3: Operation and Maintenance (O&M)**

**3-1 Physical Arrangement**

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

<p>Original (at the time of outline design)</p>
<p>Actual (PMR)</p>

**3-2 Budgetary Arrangement**

- Required O&M cost and actual budget allocation for O&M

<p>Original (at the time of outline design)</p>
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Actual (PMR)

**4: Potential Risks and Mitigation Measures**

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

**Assessment of Potential Risks (at the time of outline design)**

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
<b>Actual Situation and Countermeasures</b> (PMR)	

**5: Evaluation and Monitoring Plan (after the work completion)**

**5-1 Overall evaluation**

Please describe your overall evaluation on the project.

**5-2 Lessons Learnt and Recommendations**

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

**5-3 Monitoring Plan of the Indicators for Post-Evaluation**

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
  2. Specific obligations of the Recipient which will not be funded with the Grant
  3. Monthly Report submitted by the Consultant
- Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
  - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
  5. Environmental Monitoring Form / Social Monitoring Form
  6. Monitoring sheet on price of specified materials (Quarterly)
  7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
  8. Pictures (by JPEG style by CD-R) (PMR (final) only)
  9. Equipment List (PMR (final) only)
  10. Drawing (PMR (final) only)
  11. Report on RD (After project)



## Monitoring sheet on price of specified materials

## 1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C-D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

## 2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st	2nd	3rd	4th	5th	6th
		●month, 2015	●month, 2015	●month, 2015			
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)  
 (Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

+A

B