

Chapter 3

Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions

The procedures required for the implementation of this Project are as follows.

Table 79: Required Procedures for Custom Clearance at the Sea Port

Required Procedures	Office Concerned	Submission Time	Required Period	Required Documents to be submitted to the Ministry of Transport by the Department of Meteorology and Hydrology (DMH)	Applicant
Custom Clearance	Ministry of Transport	Immediately after a shipment left from the port	2 months	Application Form Shipping Documents · Shipping Invoice: 1 original · Bill of Lading: 1 original · Packing List: 1 original Photocopy of the Exchange of Notes and Grant Agreement	Department of Meteorology and Hydrology (DMH)

Table 80: Details of Procedures required for the Project Implementation

Required Procedures	Office Concerned	Approximate Period required	Required Documents to be submitted to the Ministry of Transport by the Department of Meteorology and Hydrology (DMH)	Applicant
Building Construction Permit including Fire Fighting Facility Permit and Clearance for Waste Water on Site Treatment (Since the Radar Tower Building is more than 8 floors, a High Rise Building Permit from Myanmar Engineering Society is also required.)	Chief Minister, Rakhine State	1 month	Application Form with the following drawings and documents for each Radar Tower Building <ul style="list-style-type: none"> • Architectural Drawings: 5 sets • Structural Drawings: 5 sets • Electrical Drawings: 5 sets • Air-conditioning & Ventilation Drawings: 5 sets • Plumbing Drawings: 5 sets • Structural Calculation Sheet: 5 sets • Geotechnical Survey Report: 5 sets • Bill of Quantity (BQ) : 5 sets 	Ministry of Transport
	Yangon City Development Council (YCDC)			
	Mandalay City Development Council (MCDC)			
Frequency Permit for Meteorological Radar System	Ministry of Communications, Posts and Telegraphs and Posts & Telecommunications Department	1 month	<ul style="list-style-type: none"> • Request Letter of Ministry of Transport: 1 set • Application Form • Communication Policy • List of Required Frequency(s) • Site Location(s) • Technical Specifications • Equipment Catalogue 	
Frequency Permit for Meteorological Data Communication System	Ministry of Communications, Posts and Telegraphs and Posts & Telecommunications Department	1 month	<ul style="list-style-type: none"> • Request Letter of Ministry of Transport: 1 set • Application Form • Communication Policy • List of Required Frequency(s) • Site Location(s) • Technical Specifications • Equipment Catalogue 	
VSAT User License	Ministry of Communications, Posts and Telegraphs and Posts & Telecommunications Department	1 month	<ul style="list-style-type: none"> • Request Letter of Ministry of Transport: 1 set • Application Form • Communication Policy • Site Location(s) 	

	Telecommunications Department		<ul style="list-style-type: none"> • Technical Specifications • Equipment Catalogue 	
Application for Commercial Power Supply and Step-down Transformer Installation for Radar Tower Buildings to be constructed	Electricity Board under Ministry of Electricity II	1 month	<ul style="list-style-type: none"> • Request Letter of Ministry of Transport: 1 set • Site Location Drawing: 1 set • Electrical Drawing: 1 set (Commercial Power Supply and Step-down Transformer Installation: 2 months)	

3-2 Necessary Inputs from the Recipient Country

In order to further enhance the benefits of this Project, the following recommendations are strongly encouraged and should accordingly be implemented, namely:

1) Manpower Development

- a) Continuous recruitment of human resources for the next generation; and,
- b) Development of more qualified technical personnel through training and other related manpower development programs.

2) Natural Disaster Prevention and Management

- a) Further strengthening of the collaboration among various government agencies, the mass media and other meteorological organizations in the area of the Bay of Bengal for a more effective disaster prevention and management strategy;
- b) Setting up of redundancies in the announcement of warnings and other information dissemination methods through multi-channels to ensure reaching out to the general populace; and,
- c) Continuing educational activities for the general public in coordination with various related disaster management agencies and mass media for a more effective natural disaster prevention and management strategy.

3) Longer Life Span of the Equipment procured and the Radar Tower Buildings constructed under the Project

- a) Regularly secure the necessary budget for the efficient operation and maintenance of the systems and building equipment, and the procurement of requisite spare parts and consumables for all the equipment to be supplied under the Project;
- b) Ensure the protection of the buildings, equipment and facilities against theft and vandalism; and,
- c) Regularly paint and caulk the caulking grooves of the Radar Tower Buildings.

3-3 Important Assumptions

- 1) Utilization of meteorological information/data (including meteorological radar images) and forecasts/warnings by the mass media (TV, radio, newspaper), the Prime Minister's Office, the Ministry of Transport, Relief and Resettlement Department and other government ministries, police departments, fire stations, other government-affiliated organizations, the Department of Civil Aviation, the Port Authority, Red Cross, etc.
- 2) No change in global warming countermeasures, natural disaster countermeasures, and meteorological service policies as determined by the Government of Myanmar.
- 3) Maintenance of a cooperative structure among the mass media (TV, radio, newspaper), the Prime Minister's Office, the Ministry of Transport, Relief and Resettlement Department and other government ministries, police departments, fire stations, other government-affiliated organizations, the Department of Civil Aviation, the Port Authority, Red Cross, etc.
- 4) Continuance of service by a DMH staff who has received the relevant technical trainings related to the Project.

3-4 Project Evaluation

3-4-1 Relevance

- 1) Population to directly benefit from the Implementation of the Project

The overall objective of the Project is to reduce the devastation caused by tropical cyclones and monsoon heavy rain. This could be achieved by improving the DMH's meteorological observation capability and forecasting/warning system through the establishment of the meteorological radar systems. Tropical cyclones and floods caused by monsoon heavy rain are extreme manifestations of nature that may lead to immeasurable loss and distress for quite a number of people, thereby, becoming one of the determining factors for the significant set-back of the national economy. Therefore, the population to be benefited both directly and indirectly by the Project will be the whole nation of Myanmar (approx. 6.3 million based on below figures). It is also expected that the number of population to directly benefit from the Implementation of the Project will proportionally increase due to the fact that the population of Myanmar has been increasing by 2% annually, that is, 20% in 10 years. The following table indicates the population of 14 respective administrative districts (division or state).

Table 81: Administrative District and Population of Myanmar

No.	Administrative District	Division/State	Capital	Area(km ²)	Population (*2012 Estimate)
1	Kachin	State	Myitkyina	89,041	1,652,456
2	Kayah	State	Loi-kaw	11,733	354,963
3	Kayin	State	Pha-an	30,383	1,908,077
4	Chin	State	Hakha	36,019	599,681
5	Sagaing	Division	Sagaing	94,625	6,850,906
6	Tanintharyi	Division	Dawei	43,343	1,762,700
7	Bago	Division	Bago	39,404	6,453,541
8	Magway	Division	Magwe	44,820	5,903,531
9	Mandalay	Division	Mandalay	37,024	8,778,367
10	Mon	State	Mawlamyine	12,297	3,237,068
11	Rakhine	State	Sittwe	36,778	3,531,457
12	Yangon	Division	Yangon	10,171	7,336,709
13	Shan	State	Taunggyi	155,801	6,131,288
14	Ayeyarwady	Division	Patheingyi	35,138	8,703,255
Total				675,577	63,204,000



*2012 Population figures are estimated by the Consultant

Furthermore, since the information of meteorological Doppler radar system is planned to be utilized for navigational safety at the Yangon International Airport, the Project is considered to contribute to the safety of passengers (approx. 2.5 million/year) of the civil aviation aircrafts which take off and land in the Yangon International Airport.

2) Objectives of the Project

In line with increasing global concerns on the outspread of disasters further aggravated by abnormal climate change, the establishment of effective countermeasures against disasters such as severe storms and storm surges by tropical cyclones and floods by heavy rain, etc. has been an urgent task in Myanmar as well as in other countries along the Bay of Bengal. Since Myanmar faces the Bay of Bengal with a long coastline, it is particularly vulnerable to natural disasters with immeasurable negative impacts brought about by climate change mainly due to global warming. Therefore, the key objective of this Project is the effective mitigation of the devastation caused by natural disasters. To achieve this objective, the establishment of the facilities and equipment like the meteorological radar system is crucially important. These will enhance the monitoring capability of hazardous meteorological phenomena such as tropical cyclones and monsoon heavy rain and will improve the forecasting/warning systems in Myanmar and its neighboring countries.

3) Development Plan of Myanmar

After the new administration of Myanmar started in March 2011, the Central Committee for Natural Disaster Prevention, Relief and Resettlement was formed under the guidance of the State Peace and

Development Council's Security and Management Committee as a national development plan for effective disaster preventive measure. Since Myanmar has been severely damaged by tropical cyclones and floods every year, the Government of Myanmar has enhanced its capability of dealing with natural disasters and its disaster prevention system, which is expected to reduce the risk of the poor people particularly vulnerable to natural disasters. To mitigate the damages brought about by tropical cyclones and floods, it is important to transmit prompt and accurate weather information/warnings to each disaster prevention organization, local governments and the mass media. Since the information issued by the DMH is a trigger for the first action of each disaster prevention organization, the improvement of the DMH's monitoring capability of meteorological phenomena is highly required and in accord with the key objective of the Project.

4) Aid Policy of Japan

The Government of Japan had basically stopped providing new economic assistance to Myanmar except for extremely urgent and humanitarian cases since Aung San Suu Kyi had been placed under house arrest by the Myanmar government authority since 2003. However, in 2010, the Government of Myanmar held a general election, released Aung San Suu Kyi, and also shifted to civilian rule in 2011. Along with these positive movements toward the democratization of Myanmar, the Government of Japan has restarted providing economic assistance focusing mainly on cases of basic human needs from which the people of Myanmar can directly receive the benefits.


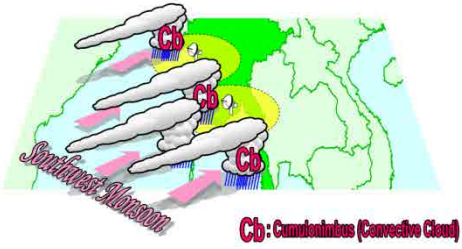
During the Japan-Myanmar Summit Meeting in April 2012, Japan's future cooperation with Myanmar was discussed. The policies of assistance are as follows.


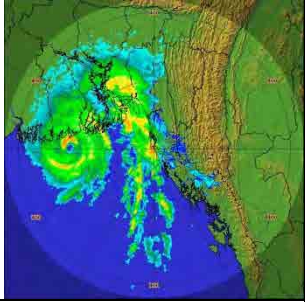
1. Assistance for the improvement of people's livelihoods
2. Assistance for capacity building and institutions development to sustain economy and society
3. Assistance for development of infrastructure and related systems necessary for sustainable economic development

As one of the concrete measures of assistance for the improvement of people's livelihoods among the above three policies, the study for the improvement of meteorological equipment is included for disaster prevention. The two leaders of Myanmar and Japan affirmed a common recognition that the improvement in the meteorological field is pivotal in order to protect the people from natural disasters.

3-4-2 Effectiveness

Table 82: Achievement Indicator

Indicator	Present (Base Line)	Target
Enhancement of Tropical Cyclone and Severe Weather Monitoring Capability	No capability for direct monitoring of tropical cyclonic wind velocity and precipitation intensity.	Tropical cyclonic wind velocity within the radar detection range: maximum 75m/s within a 200km radius Precipitation intensity 1mm/h or more within the radar detection range: within a 450km radius from the meteorological radar systems
	Spatial resolution and observation intervals of the existing 37 synoptic observation stations in Myanmar: <ul style="list-style-type: none"> • 180 minutes observation intervals, • 108,040 observation data/year; and, • approximately 60-70 minutes for completion of all observation data collection 	Spatial resolution and observation intervals of precipitation data within the radar detection range: not more than 2.5 km mesh at 10 minutes observation intervals within a 450km radius from the meteorological radar systems Spatial resolution and observation intervals of the automatic weather observation systems in Myanmar: <ul style="list-style-type: none"> • 60 minutes observation intervals, • 249,660-262,800 observation data/year; and, • approximately 10 minutes for completion of all observation data collection
	Receiving intervals of satellite images showing tropical cyclone location and track: 30-60 minutes intervals by MTSAT	Observation intervals of wind direction, wind velocity, rainfall intensity, location and track of tropical cyclone approaching Myanmar within the radar detection range: 1 minute observation intervals at PPI mode and 10 minutes observation intervals in CAPPI mode (11 angles)
Enhancement of the capability for downburst and wind shear monitoring around the Yangon International Airport	Subjective observation of the area surrounding the Yangon International Airport	Objective observation of downburst and wind shear through radar observation within a 200km radius from the Yangon Meteorological Radar Station
	No provision of downburst and wind shear information to the Yangon International Airport	Provision of downburst and wind shear information (radar images) to the Yangon International Airport
Enhancement of Torrential Rain Prediction Capability	Detection of upper level cloud, especially cirriform clouds at top of the troposphere, more clearly than the lower convective clouds by MTSAT 	Detection of cirriform clouds at top of the troposphere by MTSAT and precipitation clouds which grow from lower level of troposphere within the radar detection range 
	No activity of short range prediction for precipitation cloud movement	Implementation of 0.5-1 hour short range prediction for precipitation cloud movement by radar observation data (images)
Improvement of Weather Program for TV broadcasting	Weather program using MTSAT animation pictures for TV broadcasting	Weather program using MTSAT and radar animation pictures for TV broadcasting

<p>Improvement of Dissemination Capability for Tropical Cyclone Information</p>	<p>Provision of tropical cyclone information indicating tropical depression and cyclone location & moving direction to the government authorities concerned with disaster preparedness & management as well as to the mass media</p> 	<p>Provision of hourly information on tropical depressions or cyclones located within the radar detection range indicating intensity, location and tracks (past and predicted) to the agencies concerned with disaster management, especially to the directly affected local government units, and also to International Organizations, the Red Cross, NGOs, and the mass media</p>  <p>Provision of:</p> <ol style="list-style-type: none"> 1) cyclonic storm surge warnings to the areas which may be violently affected by onshore wind (very high winds pushing on the ocean's surface to the coast); and, 2) cyclonic storm surge advisories to the areas which may be affected by offshore winds (very high winds pushing on the ocean's surface to the open sea), <p>distinguished by tropical cyclone tracks (moving course) as detected by the meteorological radar systems</p>
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Recently, climate change mainly due to global warming has a potential to become the greatest threat to the sustainability of the very foundations of human survival and has been a significant global issue which developed and developing countries alike must deal with through mutually beneficial cooperation. Unless global warming is halted, there are concerns that rainfall and wind velocity of tropical cyclones will be increased and the damage caused by one tropical cyclone will be extensive.

Under these circumstances, the implementation of the Project is, therefore, considered to be an appropriately suitable and worthwhile endeavor. Moreover, in order to reduce the DMH's operational and maintenance costs, the equipment was designed to minimize spare parts and consumables. Also, since the biggest recurrent cost of the Project is expected to be electricity, the equipment and facilities were designed in such a way so as to minimize power consumption. As a result, the DMH's budget is expected to be able to cover the Myanmar portion of the capital and recurrent costs of the Project.

As adequately pointed out in the careful and comprehensive evaluation of the effects of the Project, considerable and enhanced benefits can be achieved vis-à-vis the DMH's capabilities in reducing human loss and the recurrent economic set-back brought about by meteorological disasters including tropical cyclone. The Project would substantially contribute to the mitigation of the adverse effects of meteorological disasters and effectively safeguard the basic human needs of the Myanmar people as well as those of its neighboring countries in the Bengal Bay.

Appendices

Appendix 1. Member List of the Study Team

(1) Preparatory Survey (1) Team

Mr. Shiro NAKASONE	Team Leader	Director, Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Department, Japan International Cooperation Agency (JICA)
Mr. Kunio AKATSU	Meteorological Observation	Global Environment Department, Japan International Cooperation Agency (JICA)
Mr. Shiro OMORI	Meteorological Radar System	Scientific Officer, Observation Division, Observation Department, Japan Meteorological Agency (JMA)
Mr. Hideaki MATSUMOTO	Project Planning	Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Department, Japan International Cooperation Agency (JICA)
Mr. Yoshihisa UCHIDA	Chief Consultant/Meteorological Radar System Planning/Operation & Maintenance	Japan Weather Association (JWA)
Mr. Soshi IWATA	Meteorological Observation and Communication System Planning/Equipment Planning	Japan Weather Association (JWA)
Mr. Nobutaka NOGUCHI	Cyclone & Flood Countermeasure/Forecasting & Warning System Planning	International Meteorological Consultant Inc. (IMC)
Mr. Hiroyuki INOMATA	Facility Planning/Natural Conditions Survey	International Meteorological Consultant Inc. (IMC)
Mr. Kenji MORI	Construction Planning/Procurement Planning/Cost Estimate	Japan Weather Association (JWA)
Mr. Takayuki MOTOYA	Social and Environmental Considerations	International Meteorological Consultant Inc. (IMC)
Mr. Felipe Asane Sarigumba	Data Collection/Analysis	Japan Weather Association (JWA)

(2) Preparatory Survey (2) Team

Mr. Hideo MIYAMOTO	Team Leader	Senior Advisor to the Director General, Water Resources and Disaster Management Group, Global Environment Department, Japan International Cooperation Agency (JICA)
Mr. Kunio AKATSU	Meteorological Observation	Global Environment Department, Japan International Cooperation Agency (JICA)
Mr. Hideaki MATSUMOTO	Project Planning	Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Department, Japan International Cooperation Agency (JICA)
Mr. Yoshihisa UCHIDA	Chief Consultant/Meteorological Radar System Planning/Operation & Maintenance	Japan Weather Association (JWA)
Mr. Soshi IWATA	Meteorological Observation and Communication System Planning/Equipment Planning	Japan Weather Association (JWA)
Mr. Hiroyuki INOMATA	Facility Planning/Natural Conditions Survey	International Meteorological Consultant Inc. (IMC)

Appendix 2. Study Schedule

Preparatory Survey (1) -1

Schedule 2012			Consultant Member	
			Mr. Yoshihisa UCHIDA	Mr. Kenji MORI
			Chief Consultant/Meteorological Radar System Planning/Operation & Maintenance	Construction Planning/Procurement Planning/Cost Estimate
1	17Jun.	Sun	Tokyo (Haneda) → Bangkok, Bangkok → Yangon	
2	18Jun.	Mon	Discussion with JICA Myanmar Office, Preliminary Discussion with Yangon DMH, Data Collection, Visit to local contractors for Topographic and Geotechnical Survey, Study for Unit Price of Construction Materials	
3	19Jun.	Tue	Discussion with Yangon DMH, Site Survey at Yangon DMH and Proposed Yangon Radar Observation Station, Data Collection, Discussion with Myanmar Engineering Society	Visit to local contractors for Topographic and Geotechnical Survey, Site Survey at Yangon DMH and Proposed Yangon Radar Observation Station, Study for Unit Price of Construction Materials, Discussion with Myanmar Engineering Society
4	20Jun.	Wed	Yangon → Nay Pyi Taw, Discussion with Nay Pyi Taw DMH, Data Collection, Site Survey at Nay Pyi Taw DMH	
5	21Jun.	Thu	Discussion with Nay Pyi Taw DMH, Data Collection, Site Survey at Nay Pyi Taw DMH and Proposed Nay Pyi Taw Radar Observation Station and Nay Pyi Taw International Airport	
6	22Jun.	Fri	Discussion with Nay Pyi Taw DMH, Data Collection, Site Survey at Multi-Hazard Early Warning Center	
7	23Jun.	Sat	Nay Pyi Taw → Yangon, Visit to local contractors for Topographic and Geotechnical Survey, Data Collection, Study for Unit Price of Construction Materials	
8	24Jun.	Sun	Internal Meeting, Data Collection	
9	25Jun.	Mon	Discussion with Yangon DMH, Site Survey at Yangon DMH, Visit to local contractors for Topographic and Geotechnical Survey, Data Collection, Study for Unit Price of Construction Materials	
10	26Jun.	Tue	Discussion with Yangon DMH, Site Survey at Yangon DMH and Receiving Station of Yangon International Airport, Data Collection	
11	27Jun.	Wed	Discussion with Yangon DMH, Data Collection, Site Survey at Proposed Yangon Radar Observation Station and Yangon International Airport	
12	28Jun.	Thu	Discussion with Yangon DMH, Site Survey at Yangon DMH and Receiving Station of Yangon International Airport, Data Collection	
13	29Jun.	Fri	Discussion with Yangon DMH, Report to JICA Myanmar Office, Discussion with Department of Civil Aviation (DCA) in Yangon International Airport, Data Collection	Visit to local contractors for Topographic and Geotechnical Survey, Discussion with Department of Civil Aviation (DCA) in Yangon International Airport, Data Collection, Study for Unit Price of Construction Materials
14	30Jun.	Sat	Yangon → Bangkok, Bangkok → Tokyo (Haneda)	

Appendix 2. Study Schedule

Preparatory Survey (1) -2

Schedule 2012		Governmental Member				Consultant Member						
		Mr. Shiro NAKASONE Team Leader	Mr. Kunio AKATSU Meteorological Observation	Mr. Shiro OMORI Meteorological Radar System	Mr. Hideaki MATSUMOTO Project Planning	Mr. Yoshihisa UCHIDA Chief Consultant Meteorological Radar System Planning Operation & Maintenance	Mr. Soshi IWATA Meteorological Observation and Communication System Planning/Equipment Planning	Mr. Nobuhiko NOGUCHI Cytose & Flood Contamination-Forecasting & Warning System Planning	Mr. Hiroyuki INOUMATA Facility Planning/Normal Condition Survey	Mr. Kenji MORI Construction Planning/Procurement Planning/Cost Estimation	Mr. Takayuki MOTOYA Social and Environmental Considerations	Mr. Felpet Assato Saripombha Data Collection/Analysis
1	14 Jul	Sat	Tokyo → Bangkok, Bangkok → Yangon				Tokyo → Bangkok, Bangkok → Yangon					Manila → Bangkok, Bangkok → Yangon
2	15 Jul	Sun	Tokyo → Bangkok, Bangkok → Yangon				Site Survey Preparation, Site Survey at Yangon DMBI, Site Survey for Data Communication in Yangon, Data Collection					
3	16 Jul	Mon	Discussion with JICA Myanmar Office, Courtesy call on Embassy of Japan, Discussion with DMBI, Site Survey at Yangon DMBI and Receiving Station of Yangon International Airport, Discussion with Department of Civil Aviation				Discussion with DMBI, Data Collection		Discussion with Yangon DMBI, Site Survey at Yangon DMBI and Receiving Station of Yangon International Airport, Discussion with the local contractor for Topographic and Geotechnical Survey and Yangon DMBI		Discussion with DMBI Yangon, Site Survey at Yangon DMBI, Site Survey Preparation with DMBI Yangon	
4	17 Jul	Tue	Yangon → Nay Pyi Taw by Road, Discussion with Nay Pyi Taw DMBI				Yangon → Nay Pyi Taw by Road, Discussion with Nay Pyi Taw DMBI, Data Collection		Discussion with Yangon DMBI, Site Survey at Yangon DMBI and Receiving Station of Yangon International Airport, Study for Unit Price of Construction Materials, Discussion with Myanmar Engineering Society, Study for Construction Materials and Methods, Collection of Questionnaires		Discussion with DMBI Yangon, Site Survey at Yangon DMBI, Site Survey Preparation with DMBI Yangon	
5	18 Jul	Wed	Tokyo → Bangkok, Bangkok → Yangon				Discussion with Nay Pyi Taw DMBI about Minutes of Discussion		Discussion with Yangon DMBI, Site Survey at Yangon DMBI and Receiving Station of Yangon International Airport, Study for Unit Price of Construction Materials, Discussion with Myanmar Engineering Society, Study for Construction Materials and Methods, Collection of Questionnaires		Site Survey at the Proposed Hpaun and Mawlamyaik Sites for Automatic Weather Observation System	
6	19 Jul	Thu	National Holiday Yangon → Nay Pyi Taw by Air, Proposed Tampoon AWS site, Internal Meeting				National Holiday Site Survey at the Proposed Tampoon AWS site, Internal Meeting		National Holiday Internal Meeting, Data Collection		National Holiday Site Survey at the Proposed Rango Site for Automatic Weather Observation System	
7	20 Jul	Fri	Discussion with Nay Pyi Taw DMBI about Minutes of Discussion, Nay Pyi Taw → Mandalay by Road, Discussion with Mandalay DMBI				Discussion with Nay Pyi Taw DMBI about Minutes of Discussion, Nay Pyi Taw → Mandalay by Road, Discussion with Mandalay DMBI		Discussion with Nay Pyi Taw DMBI (Nay Pyi Taw Early Warning Center), Data Collection		Yangon → Nay Pyi Taw → Mandalay by Road, Discussion with Mandalay DMBI	
8	21 Jul	Sat	Nay Pyi Taw → Mandalay by Road, Site Survey at the Proposed Mandalay Radar Observation Station and Mandalay AWS site				Discussion with Mandalay DMBI, Site Survey at the Proposed Mandalay Radar Observation Station and Mandalay AWS site		Internal Meeting, Data Collection		Discussion with Mandalay DMBI, Site Survey at the Proposed Mandalay Radar Observation Station	
9	22 Jul	Sun	Mandalay → Site Survey at the Proposed Makhitha AWS Site → Nay Pyi Taw by Road, Internal Meeting				Mandalay → Site Survey at the Proposed Makhitha AWS Site → Nay Pyi Taw by Road, Internal Meeting		Internal Meeting, Data Collection		Site Survey at the Proposed Mandalay Radar Observation Station, Site Survey for Data Communication in Mandalay	
10	23 Jul	Mon	Confirmation of Minutes of Discussion, Signing on Minutes of Discussion				Confirmation of Minutes of Discussion, Signing on Minutes of Discussion		Site Survey at the Proposed Mawlaikya Site for Automatic Weather Observation System		Discussion with Mandalay DMBI, Site Survey at the Proposed Mandalay Radar Observation Station	
11	24 Jul	Tue	Nay Pyi Taw → Yangon by Road, Report to Embassy of Japan and JICA Myanmar Office, Discussion with Myanmar Foreign Trade Bank				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection, Collection of Questionnaires		Site Survey at the Proposed Lashio Site for Automatic Weather Observation System		Discussion with Mandalay DMBI, Data Collection	
12	25 Jul	Wed	Yangon → Bangkok, Bangkok → Tokyo				Discussion with Yangon DMBI, Data Collection, Discussion with Myanmar Foreign Trade Bank, Discussion with Myanmar Post and Telecommunications, Ministry of Communication, Post and Telegraph		Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection, Collection of Questionnaires		Discussion with Mandalay DMBI, Data Collection	
13	26 Jul	Thu	Yangon → Nay Pyi Taw by Road, Discussion with Nay Pyi Taw DMBI				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Mandalay → Nay Pyi Taw by Road, Internal Meeting		Site Survey at the Proposed Lapuata Site for Automatic Weather Observation System	
14	27 Jul	Fri	Discussion with Nay Pyi Taw DMBI, Data Collection, Discussion with Post and Telecommunications Department, Ministry of Communication, Post and Telegraph, Discussion with Budget Department, Ministry of Finance and Revenue				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Site Survey at the Proposed Mawlaikya Site for Automatic Weather Observation System and the Proposed Nay Pyi Taw AWS site		Site Survey at the Mali Hazard Early Warning Center and the Proposed Nay Pyi Taw AWS site	
15	28 Jul	Sat	Internal Meeting, Data Collection				Internal Meeting, Data Collection		Internal Meeting, Data Collection			
16	29 Jul	Sun	Internal Meeting, Data Collection				Internal Meeting, Data Collection		Internal Meeting, Data Collection			
17	30 Jul	Mon	Discussion with Nay Pyi Taw DMBI, Data Collection				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Nay Pyi Taw → Yangon by Road, Internal Meeting, Data Collection			
18	31 Jul	Tue	Discussion with Nay Pyi Taw DMBI, Data Collection				Discussion with Nay Pyi Taw DMBI, Data Collection		Yangon, Internal Meeting, Data Collection			
19	1 Aug	Wed	Nay Pyi Taw → Yangon by Road, Internal Meeting, Data Collection				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Yangon, Internal Meeting, Data Collection			
20	2 Aug	Thu	Yangon → Kyauk Physa by Air, Site Survey at the Proposed Kyauk Physa Radar Observation Station				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Yangon → Kyauk Physa by Air, Site Survey at the Proposed Kyauk Physa Radar Observation Station			
21	3 Aug	Fri	Site Survey at the Proposed Kyauk Physa Radar Observation Station, Discussion with Kyauk Physa DMBI				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Site Survey at the Proposed Kyauk Physa Radar Observation Station, Discussion with Kyauk Physa DMBI			
22	4 Aug	Sat	Site Survey at Kyauk Physa DMBI, Kyauk Physa → Yangon by Air				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Site Survey at Kyauk Physa DMBI, Kyauk Physa → Yangon by Air			
23	5 Aug	Sun	Yangon, Internal Meeting, Data Collection				Internal Meeting, Data Collection		Yangon, Internal Meeting, Data Collection			
24	6 Aug	Mon	Discussion with Yangon DMBI, Discussion with Myanmar Foreign Trade Bank, Meeting with Myanmar Post and Telecommunications, Data Collection				Yangon, Internal Meeting, Data Collection		Discussion with DMBI Yangon, Discussion with the local contractor for Topographic and Geotechnical Survey and Yangon DMBI, Study for Unit Price of Construction Materials		Discussion with Yangon DMBI, Data Collection	
25	7 Aug	Tue	Yangon → Nay Pyi Taw by Road, Discussion with Nay Pyi Taw DMBI, Data Collection				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Discussion with Yangon DMBI, Study for Unit Price of Construction Materials, Study for Construction Materials and Methods		Yangon → Nay Pyi Taw by Road, Discussion with Nay Pyi Taw DMBI, Data Collection	
26	8 Aug	Wed	Nay Pyi Taw → Yangon by Road, Report to JICA Myanmar Office				Nay Pyi Taw → Yangon by Road, Internal Meeting		Discussion with Yangon DMBI, Site Survey at Yangon DMBI, Study for Unit Price of Construction Materials, Study for Construction Materials and Methods		Discussion with Yangon DMBI Report to JICA Myanmar Office	
27	9 Aug	Thu	Discussion with Yangon DMBI, Internal Meeting, Data Collection				Yangon → Bangkok, Bangkok → Tokyo				Discussion with Yangon DMBI, Site Survey at Yangon DMBI	
28	10 Aug	Fri	Yangon → Bangkok, Bangkok → Tokyo				Discussion with Yangon DMBI, Site Survey at Yangon DMBI				Yangon → Bangkok, Bangkok → Tokyo	
29	11 Aug	Sat					Yangon, Internal Meeting, Data Collection		Yangon, Internal Meeting, Data Collection			
30	12 Aug	Sun	Yangon → Nay Pyi Taw → Mandalay by Road, Discussion with Mandalay DMBI				Yangon, Internal Meeting, Data Collection		Yangon, Internal Meeting, Data Collection			
31	13 Aug	Mon	Discussion with Myanmar Ministry of Planning, Myanmar City Development Committee (MDC), Discussion with the local contractor for Topographic and Geotechnical Survey				Discussion with Nay Pyi Taw DMBI (Mali Hazard Early Warning Center), Data Collection		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey, Data Collection		Discussion with Myanmar Ministry of Planning, Myanmar City Development Committee (MDC), Discussion with the local contractor for Topographic and Geotechnical Survey	
32	14 Aug	Tue	Mandalay → Nay Pyi Taw → Yangon by Road, Internal Meeting, Data Collection				Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey, Data Collection		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey, Data Collection		Mandalay → Nay Pyi Taw → Yangon by Road, Internal Meeting, Data Collection	
33	15 Aug	Wed	Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey				Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey	
34	16 Aug	Thu	Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey				Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey	
35	17 Aug	Fri	Data Collection, Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey				Data Collection, Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Data Collection, Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Study for Unit Price of Construction Materials, Data Collection	
36	18 Aug	Sat	Yangon, Internal Meeting, Data Collection				Yangon, Internal Meeting, Data Collection				Yangon → Bangkok, Bangkok → Manila	
37	19 Aug	Sun	Yangon, Internal Meeting, Data Collection				Yangon, Internal Meeting, Data Collection				Yangon, Internal Meeting, Data Collection	
38	20 Aug	Mon	Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey				Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey	
39	21 Aug	Tue	Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey				Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey		Discussion with Yangon DMBI, Discussion with the local contractor for Topographic and Geotechnical Survey	
40	22 Aug	Wed	Discussion with Yangon DMBI, Data Collection				Discussion with Yangon DMBI, Data Collection				Discussion with Yangon DMBI, Data Collection	
41	23 Aug	Thu	Discussion with Yangon DMBI, Data Collection				Discussion with Yangon DMBI, Data Collection				Discussion with Yangon DMBI, Data Collection	
42	24 Aug	Fri	Yangon → Bangkok, Bangkok → Tokyo				Yangon → Bangkok, Bangkok → Tokyo				Yangon → Bangkok, Bangkok → Tokyo	

APX2-2

Preparatory Survey (2)

Schedule			Governmental Member			Consultant Member		
			Mr. Hideo MIYAMOTO	Mr. Kunio AKATSU	Mr. Hideaki MATSUMOTO	Mr. Yoshihisa UCHIDA	Mr. Soshi IWATA	Mr. Hiroyuki INOMATA
2013			Team Leader	Meteorological Observation	Project Planning	Chief Consultant/Meteorological Radar System Planning/ Operation & Maintenance	Meteorological Observation and Communication System Planning/Equipment Planning	Facility Planning/Natural Conditions Survey
1	4 Jan	Fri				Tokyo → Bangkok, Bangkok → Yangon		
2	5 Jan	Sat				Yangon → Nay Pyi Taw by Road, Discussion with Nay Pyi Taw DMH, Data Collection	Discussion with Yangon DMH, Data Collection	
3	6 Jan	Sun	Tokyo → Bangkok, Bangkok → Yangon			Site Survey at Nay Pyi Taw DMH, Internal Meeting, Data Collection	Site Survey at Yangon DMH, Data Collection	
4	7 Jan	Mon	Yangon → Nay Pyi Taw by Air Explanation of Draft Final Report to DMH, Discussion with Nay Pyi Taw DMH			Explanation of Draft Final Report to DMH, Discussion with Nay Pyi Taw DMH	Discussion with Yangon DMH, Meeting with Yangon City Development Committee (YCDC)	
5	8 Jan	Tue	Explanation of Draft Final Report to DMH, Discussion about the Minutes of Discussions with DMH			Explanation of Draft Final Report to DMH, Discussion about the Minutes of Discussions with DMH	Discussion with Yangon DMH, Meeting with Yangon City Development Committee (YCDC)	
6	9 Jan	Wed	Explanation of Draft Final Report to DMH, Discussion about the Minutes of Discussions with DMH			Explanation of Draft Final Report to DMH, Discussion about the Minutes of Discussions with DMH	Yangon → Nay Pyi Taw → Mandalay by Road, Discussion with Mandalay DMH	
7	10 Jan	Thu	Confirmation of Minutes of Discussions, Signing on Minutes of Discussions Nay Pyi Taw → Yangon by Road			Confirmation of Minutes of Discussions, Signing on Minutes of Discussions Nay Pyi Taw → Yangon by Road	Meeting with Mandalay City Development Committee (MCDC)	
8	11 Jan	Fri	Meeting with Yangon City Development Committee (YCSC), Discussion with Department of Civil Aviation, Discussion with Yangon DMH, Report to Embassy of Japan and JICA Myanmar Office Yangon → Bangkok			Meeting with Yangon City Development Committee (YCSC), Discussion with Department of Civil Aviation, Discussion with Yangon DMH, Report to Embassy of Japan and JICA Myanmar Office	Mandalay → Nay Pyi Taw → Yangon by Road	
9	12 Jan	Sat	Bangkok → Tokyo			Yangon → Bangkok, Bangkok → Tokyo		

Appendix 3. List of Parties Concerned in the Recipient Country

- **Department of Meteorology and Hydrology, Ministry of Transport**

Head Office (Nay Pyi Taw)

Dr. Hrim Nei Thiam	Director General
Mr. Kyaw Moe Oo	Deputy Director General
Ms. Khin Cho Cho Shein	Director, Head Office
Mr. Chit Kyaw	Deputy Director, Meteorological Division
Mr. Maung Maung Soe	Deputy Director, Administration, International Affairs Section
Mr. Kyaw Lwin Oo	Assistant Director, Meteorological Division

Yangon Branch

Ms. Ye Ye Nyein	Director, Lower Myanmar Division
Ms. May Khin Chaw	Assistant Director, Agrometeorological Division
Mr. Tint Wai	Assistant Director, Instrument and Communication Division
Ms. Lai Lai Aung	Staff Officer, Lower Myanmar Division
Ms. Khin Myo Yi	Staff Officer, Instrument and Communication Division
Ms. Ohmar Thein	Junior Engineer, Instrument and Communication Division
Ms. May Wut Yi	Junior Engineer, Instrument and Communication Division
Ms. Than Tun Win	Junior Engineer, Instrument and Communication Division

Yangon International Airport

Mr. Tin Htut	Assistant Director, Aviation Met. Office
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Mandalay Branch

Mr. Tint Aung	Director, Upper Myanmar Division
Mr. Hla Saw	Assistant Director, Upper Myanmar Division
Mr. Than Zaw	Staff Officer, Hydrological Section
Mr. Aung Yin	Staff Officer, Meteorological Section
Mr. Kyi Lwin	Staff Officer, Planning & Instrument Section

Meteorological Observatory

Mr. Myo Myint Aung	Chief, Taungoo Meteorological Observatory
Mr. Kyi Lwin,	Staff Officer, Mandalay Meteorological Observatory
Mr. Kyaw Soe	Staff Officer, Meiktila Meteorological Observatory
Mr. Kyaw Soe	Assistant Director, Magway Meteorological Observatory
Mr. Kyi Lwin	Staff Officer, Mandalay Meteorological Observatory
Ms. Moe Moe	Staff Officer, Lashio Meteorological Observatory
Mr. Htay Win	Assistant Director, Monywa Meteorological Observatory
Mr. Kyaw Khin	Deputy Superintendent, Thandwe Meteorological Observatory
Mr. Maung Maung Win	Assistant Director, Patheingyi Meteorological Observatory
Mr. Hla Tun	Assistant Director, Hpa-an Meteorological Observatory
Ms. Hla Hla Kyi	Staff Officer, Mawlamyine Meteorological Observatory
Ms. Tin Yi	Assistant Director, Bago Meteorological Observatory

• **Department of Civil Aviation, Ministry of Transport**

Mr. Win Ko	General Manager
Mr. Win Maw	Executive Engineer, Communication Navigation Surveillance
Mr. Thet Lwin	Director, Communication Navigation Surveillance
Mr. Myint Saung	Executive Engineer, Communication Navigation Surveillance
Mr. Myo Chit	Senior Technical Officer, Communication Navigation Surveillance
Mr. Thein Naing	Assistant Director, Air Traffic Control
Mr. Tike Aung	Director, Air Navigation Safety Division
Mr. Soe Paing	Deputy Director, Air Navigation Safety Division
Mr. Aung Myint Thein	Deputy Director, Air Navigation Service

• **Myanmar Engineering Society**

Mr. Saw Htwe Zaw	Secretary, Central Committee Member
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• **Myanma Foreign Trade Bank**

Mr. Ye Tun Win	Manager
Mr. Hnin Wai Phyo	Manager
Mr. Myint Myint Kyi	Assistant General Manager

- **Posts and Telecommunications Department, Ministry of Communications, Posts and Telegraphs**

Nay Pyi Taw

Mr. Than Zaw Director

Mr. Than Htun Aung Deputy Director

Yangon

Mr. Win Aung Executive Engineer, Overseas Communications

Mr. Sai Saw Lin Tun Deputy Chief Engineer, Overseas Communications

- **Budget Department, Ministry of Finance & Revenue**

Mr. Si Si Pyone Director

Appendix 4. Minutes of Discussions

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR ESTABLISHMENT OF
DISASTROUS WEATHER MONITORING SYSTEM
IN THE REPUBLIC OF THE UNION OF MYANMAR

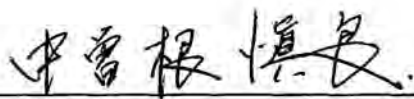
In response to a request from the Government of the Republic of the Union of Myanmar (hereinafter referred to as "GOM"), the Government of Japan decided to conduct the Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Establishment of Disastrous Weather Monitoring System (hereinafter referred to as "the Project") and entrusted the survey to Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Shiro Nakasone, Director of Disaster Management Division 1, Global Environment Department, JICA, and was scheduled to stay in the country from July 15 to August 24.

The Team held discussions with the officials concerned of the GOM and conducted a field survey at the survey area.

In the course of discussions and field survey, both parties confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Nay Pyi Taw, July 23, 2012



Mr. Shiro Nakasone
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Dr. Hrin Nei Thiam
Director General
Department of Meteorology and Hydrology
Ministry of Transport

ATTACHMENT

1. Objective of the Project

Both sides agreed that the objective of the Project is to improve and strengthen the capabilities of forecasting and issuance of warnings for severe meteorological phenomena by establishment of the Meteorological Radar System Network.

2. Contents of the Inception Report

The Team explained the Inception Report to the Department of Meteorology and Hydrology (hereinafter referred to as "DMH"), the Ministry of Transport. DMH agreed and accepted the contents of the Inception Report.

3. Project Title

Both sides agreed to the Project Title as "Establishment of Disastrous Weather Monitoring System".

4. Items requested by the Government of Myanmar

Through discussions between DMH and the Team, the requested components were confirmed as follows.

(1) Procurement and Installation of Equipment

(a) S-Band Doppler Pulse Compression Solid State Radar System including Power Back-up System, Lightening System Measuring Equipment and Spare Parts

- Kyaukphyu (in the existing Kyaukphyu Meteorological Radar Observation Station)
- Yangon (in the DMH Yangon compound)
- Mandalay (in the area of old airport)

(b) Meteorological Radar Data Display System including Software

- Kyaukphyu (in the existing Kyaukphyu Meteorological Radar Observation Station)
- Yangon (in the DMH Yangon compound)
- Mandalay (in the area of old airport)
- Nay Pyi Taw (in DMH Multi-Hazard Early Warning Center)
- Airport Control Tower Building(s) of the Department of Civil Aviation (hereinafter referred to as "DCA")

(c) Meteorological Data Communication System

- Kyaukphyu
- Yangon
- Mandalay
- Nay Pyi Taw (in DMH Multi-Hazard Early Warning Center)

(d) Automatic Weather Observation System (hereinafter referred to as "AWS") with Data Transmitter



- Thirty (30) AWS sites selected through the field survey by the Team and/or DMH
- (e) AWS Data Management Unit
 - Nay Pyi Taw (in DMH Multi-Hazard Early Warning Center)
- (f) Other incidental systems depends upon the result of the survey

(2) Construction of Radar Tower Building

- (a) Radar Tower Building
 - Kyaukphyu
 - Yangon
 - Mandalay

5. Discussions on the project components

(1) Number of Meteorological Radar System

The team explained that;

- (a) number of Meteorological Radar System installed by the Project can not be decided yet;
- (b) there is a possibility to be reduced the number of Meteorological Radar System because of the budget limitation;
- (c) the decision(number of Meteorological Radar System) will be informed through JICA Myanmar Office or by the Team; and
- (d) although the Team will conduct site survey for three sites, Outline Design will be conducted in accordance with the decision.

Myanmar side accepted the explanation made by the Team, and put the priority of the Meteorological Radar site as follows;

First Priority: Kyaukphyu

Second Priority: Yangon

Third Priority: Mandalay

(2) Site Selection for the Meteorological Radar System

For the selection of a site from two candidate sites (either Nay Pyi Taw or Mandalay) as the Meteorological Radar Site by DMH, the Team requested DMH to consider the following points.

- Radar monitoring coverage area which can cover disaster prone areas, major cities, more number of beneficiaries, etc.
- Smooth and appropriate operation and maintenance by DMH including proper allocation of DMH staff to the Rader Site

In response to the above requests from the Team, DMH selected Mandalay and the Team accepted the DMH selection.



(3) AWS Site Survey

The Team explained that since the current security issue and the site survey scheduled in the rainy season, the Team can not visit all the proposed thirty (30) sites.

The Team requested and DMH agreed to conduct the site survey for the proposed sites which the Team can not visit in accordance with the technical instructions made by the Team.

(4) Additional Meteorological Radar Data Display System including Software

Both sides agreed that the Meteorological Radar Data is beneficial for safety operation of air traffic by DCA, and the Team will conduct the survey for Meteorological Radar Data display system to be installed in the airport control tower building(s).

6. Responsible and Implementing Agency

The responsible and implementing entity for the Project is as follows.

Responsible Agency: Department of Meteorology and Hydrology

Implementing Agency: Department of Meteorology and Hydrology

7. Japan's Grant Aid Scheme

7-1 Myanmar side understood the Japan's Grant Aid Scheme explained by the Team, as described in Annex 3. Myanmar side also understood the procedures of the Japan's Grant Aid from the application of a request to follow-up of the Project as illustrated in Annex 4.

7-2 Myanmar side will take the necessary measures, as described in Annex 5, for smooth implementation of the Project, as the condition for the Japan's Grant Aid to be implemented.

8. Schedule of the Survey

8-1 The Team will proceed for further surveys in Myanmar until the end of August, 2012.

8-2 Based on the survey, the Team will conduct analysis in Japan such as designing, cost estimation, etc. until the end of December, 2012.

8-3 According to the result of the surveys, if the Team finds the needs of further field survey, the Team will conduct additional field survey.

8-4 As a result of the survey, the Team will prepare the draft preparatory survey report in English and dispatch a mission in order to explain its contents to Myanmar side in January, 2013.

8-5 In the case that the contents of the draft preparatory survey report are accepted in principle by Myanmar side, the Team will finalize the report and send it to Myanmar side around March, 2013.



9. Other relevant issues

9-1 Environmental and Social Considerations

Both sides agreed that it is not necessary to take procedures for the approval of Environmental Impact Assessment (hereinafter referred to as "EIA") for the Project.

However, the Team explained that the Project is tentatively categorized as "B" based on JICA's Guidelines for Environmental and Social Considerations (April, 2010) due to lack of information on the proposed sites when the Project request accepted in Japan. Therefore, the Team will carry out the scoping of environmental and social impact.

Then if adverse environmental and social impacts are expected by the scoping, Initial Environmental Examination (hereinafter referred to as "IEE") or EIA is required for the Project.

9-2 Undertakings of the Myanmar side for the Survey

As response to the request by the Team, Myanmar side agreed to arrange following items:

- (1) To provide the Team with available relevant data, information and materials necessary for the execution of the Study.
- (2) To prepare the answers for the Questionnaire presented by the Team.
- (3) To assign full-time counterparts to the Team during their stay in Myanmar, to play the following roles as the coordinator to the Team;
 - To make the appointments, set up the meetings with the authorities, departments and all other factories and firms whatever the Team intends to visit.
 - To attend all the site surveys and any other visiting place with the Team and to make any convenience on accommodation, working room, adequate transportation, getting the permissions if required, etc.
 - To assist and to advise the Team for their collection of data and information as much as possible.
- (4) To secure the permission to take photographs and enter into private properties and restricted areas for the Team for proper execution of the Survey, if necessary.
- (5) To take any measures deemed necessary to secure the safety of the members of the Team.
- (6) To make arrangements to allow the Team to bring back to Japan any necessary data, maps and materials related to the Survey, subject to approval by the Government of the Republic of the Union of Myanmar, in order to analyze the Project and prepare the reports.

9-3 Operation and Maintenance cost

Necessary cost for operation and maintenance of the project after the completion of the Project will be surveyed through the Survey.



9-4 Confidentiality of the Project

The Team explained that the preparatory survey report to be prepared at the end of the Survey would be disclosed to the public in principle in Japan. However, the Team also explained that a confidential part which might affect bidding process such as cost estimation should be kept undisclosed until the bidding has been completed.

9-5 Tax Exemption

The tax exemption including Value Added Tax (VAT), custom duty, and any other taxes and fiscal levies in Myanmar which is to be arisen from the Project activities will be ensured by DMH. DMH (the Ministry of Transport) will take any procedures necessary for tax exemption with the Ministry of Finance of Myanmar at their responsibility.

9-6 Height Restriction of any higher building/facility than Radar Tower Building to be constructed in the Project

The Team strongly recommended DMH that the Government of Myanmar shall establish Height Restriction avoiding construction of any higher building/facility than Radar Tower Building(s) to be constructed under the Project for ensuring appropriate Radar observation. DMH understood the recommendation made by the Team and committed to make the necessary action under the supervision of the Ministry of Transport.

9-7 Budget for Meteorological Radar Data Communication

The Team requested to DMH to ensure necessary budget allocation for the smooth Meteorological Radar Data communication.

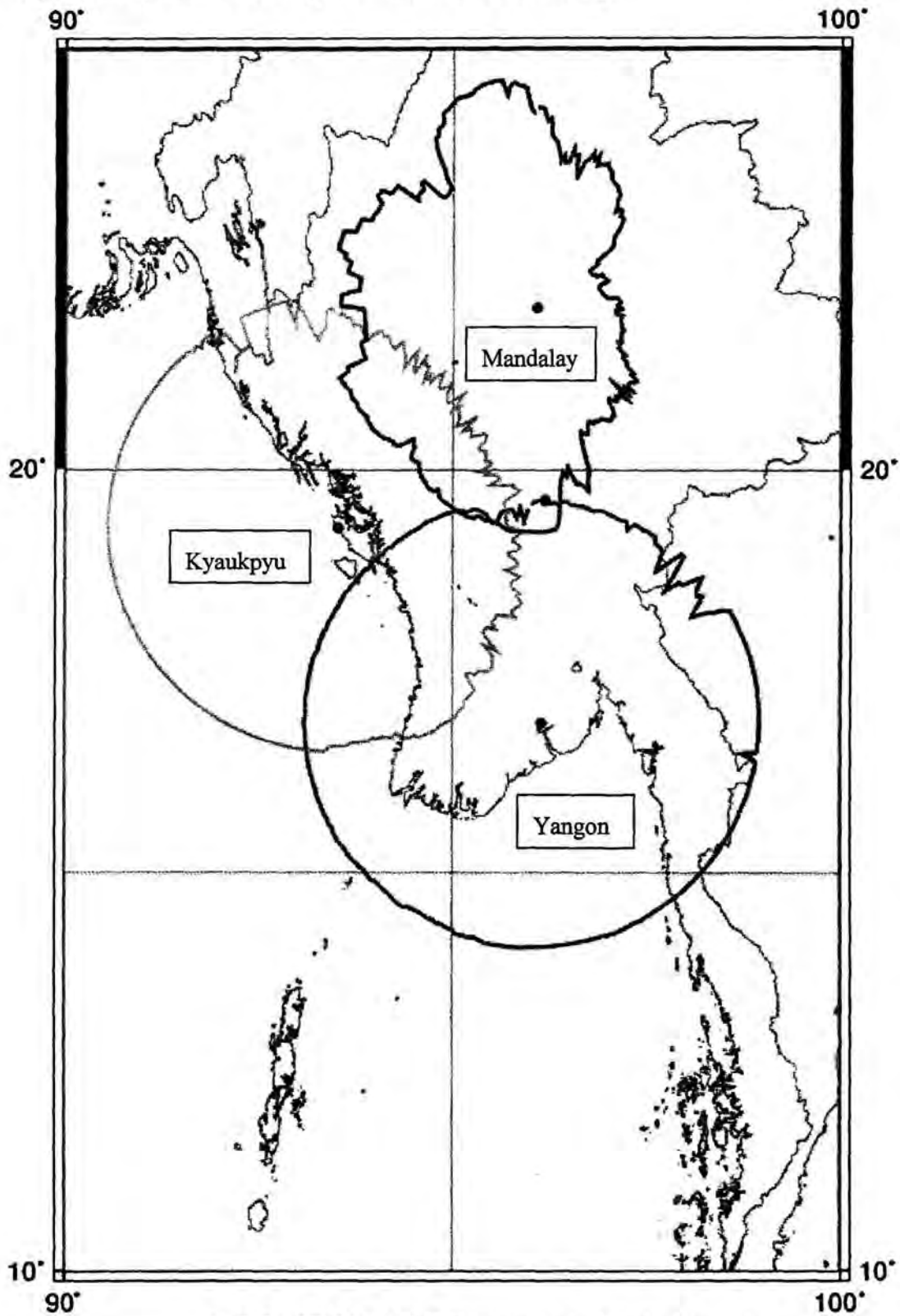
DMH promised to take necessary measures to meet the request from the Team.

- Annex 1: Project Site
- Annex 2: Organization Chart of Department of Meteorology and Hydrology
- Annex 3: Grant Aid Scheme JAPAN'S GRANT AID
- Annex 4: Flow Chart of JAPAN'S GRANT AID Procedure
- Annex 5: Major Undertakings to be taken by Each Government

Related Document to the Minutes of Discussions: Inception Report

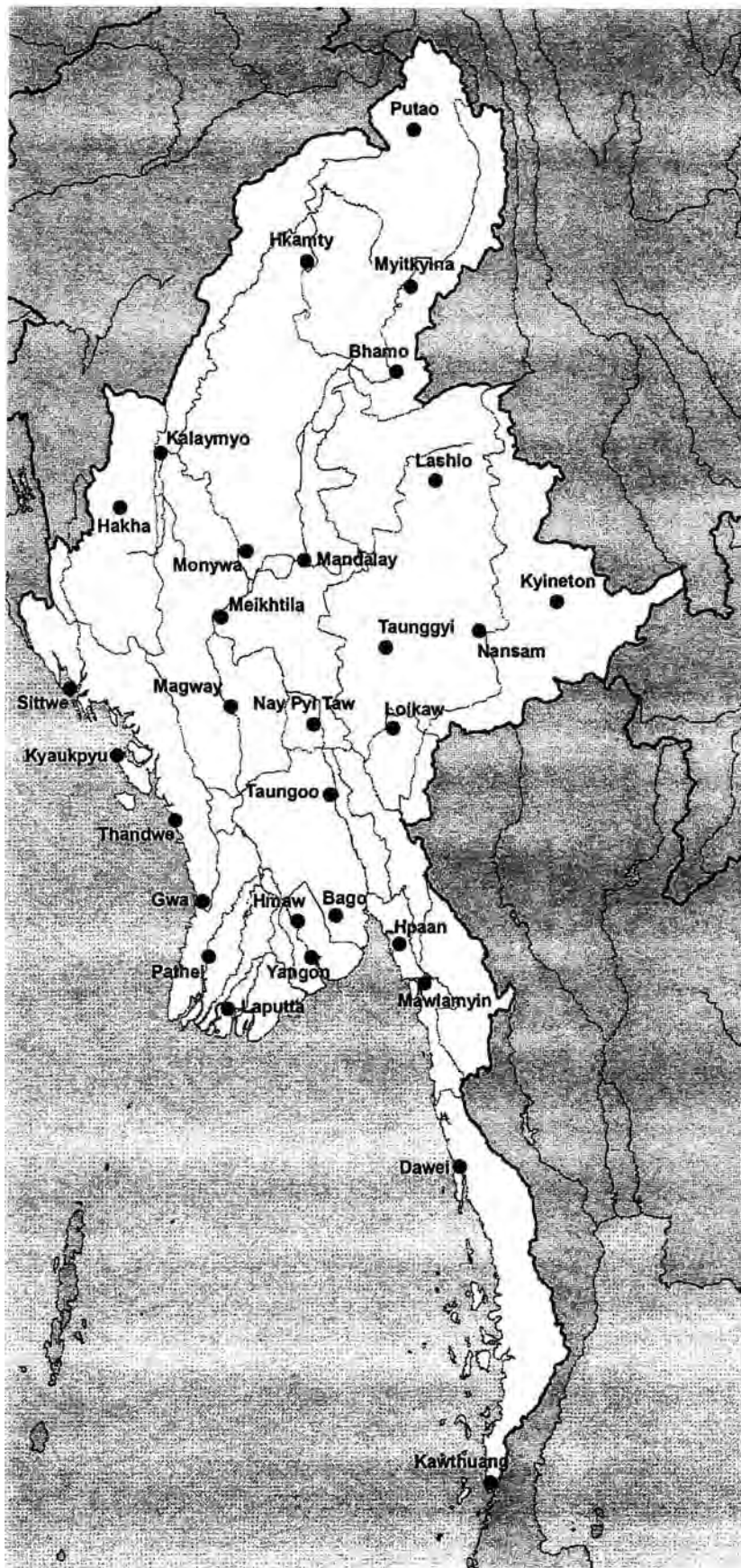


Project Site (Radar Coverage at 4km above sea level)



LOCATION MAP (Meteorological Radar System)

- Annex 1 - 1

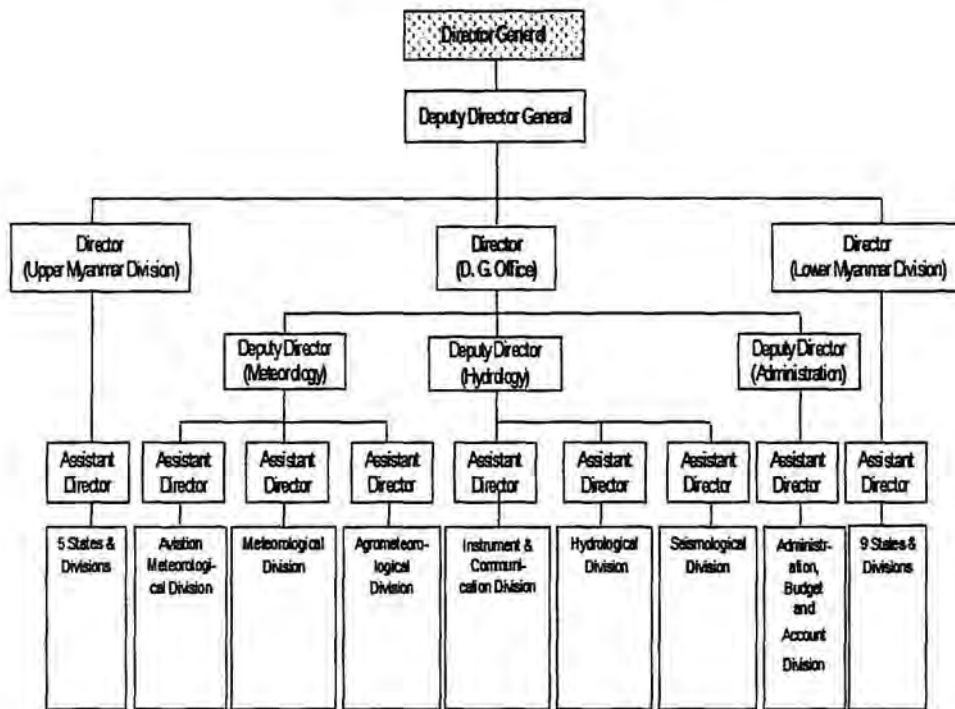


LOCATION MAP (Automatic Weather Observation System)

- Annex 1 - 2

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Organization Chart of DMH



Grant Aid Scheme JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and 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. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and a recipient country
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Preparatory Survey is to provide a basic document 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 country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme 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.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever 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 organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed



by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered 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 appropriateness of the Project.

3. Japan's Grant Aid Scheme

(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 country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) 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 country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex 5.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.



(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

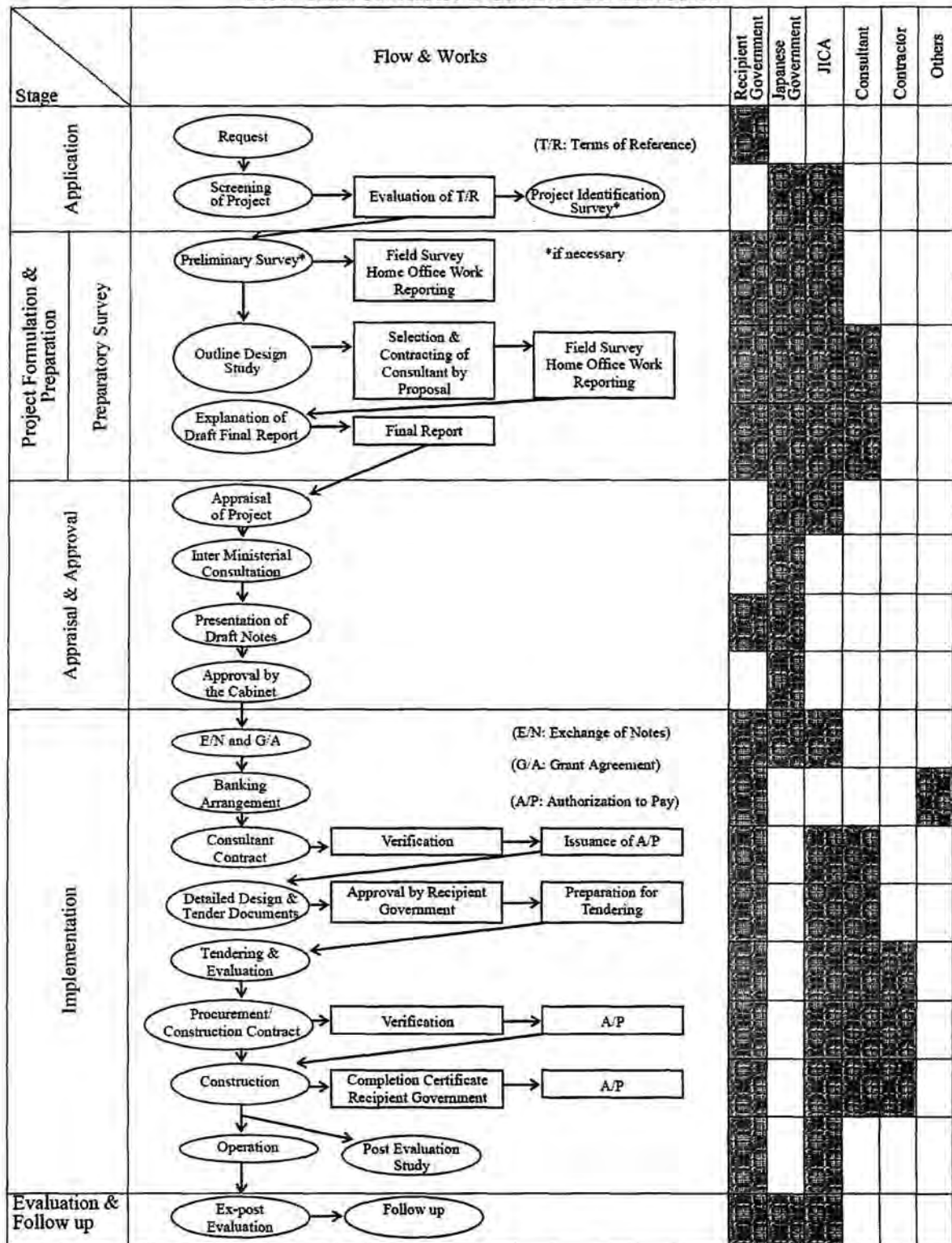
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA's Guidelines for Environmental and Social Considerations (April, 2010).




Flow Chart of JAPAN'S GRANT AID Procedure



Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land necessary for the implementation of the Project and to clear the sites		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
3	5) The road outside the site		●
	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites		
	1) Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
b. The MDF and the extension after the frame/panel	●		
6) Furniture and Equipment			
a. General furniture		●	
b. Project equipment	●		
4	To ensure prompt unloading and customs clearance of the products at the port of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
5	3) Internal transportation from the port of disembarkation to the project site	●	●
	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted	●	●
6	To accord Japanese nationals 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 recipient country and stay therein for the performance of their work		●
7	To ensure that the facilities and the products be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
10	2) Payment commission		●
	To give due environmental and social consideration in the implementation of the Project		●

(B/A: Banking Arrangement, A/P: Authorization to pay)



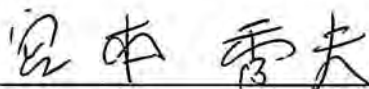
MINUTES OF DISCUSSIONS
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IN THE REPUBLIC OF THE UNION OF MYANMAR
(Explanation of Draft Report)

In response to a request from the Government of the Republic of the Union of Myanmar (hereinafter referred to as "GOM"), the Government of Japan decided to conduct the Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Establishment of Disastrous Weather Monitoring System (hereinafter referred to as "the Project") and entrusted the survey to Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent the Preparatory Survey Team for the Inception Report, which is headed by Mr. Shiro Nakasone, Director of Disaster Management Division 1, Global Environment Department, JICA, from July 15 to August 24. The said Preparatory Survey Team held discussions with the officials concerned of the GOM and conducted a field survey at the survey area. In the course of discussions and field survey, both parties confirmed the main items and signed on the Minutes of Discussions on the Inception Report of the Survey on July 23, 2012.

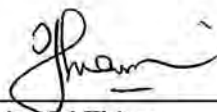
According to the Minutes of Discussions above, JICA conducted series of field survey and discussion among related organization, and finally prepared the draft report of the Survey. In order to explain and consult with Department of Meteorology and Hydrology (hereinafter referred to as "DMH") on the components of the draft report, JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team"), headed by Mr. Hideo Miyamoto, Senior Advisor to Director General, Global Environment Department, JICA from January 6 to 11, 2013.

As a result of the discussions, both parties confirmed the items described on the attached sheets.

Nay Pyi Taw, January 10, 2013



Mr. Hideo Miyamoto
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Dr. Hrin Nei Thiam
Director General
Department of Meteorology and Hydrology
Ministry of Transport

ATTACHMENT

1. Components of the Draft Report

DMH agreed and accepted in principle the components of the Draft Report explained by the Team. The components of the Project are shown in Annex-1. JICA will finalize the Final Report according to the comments from DMH.

2. Tentative Schedule of the Project

The Team explained and DMH agreed the tentative implementation schedule as shown in Annex-2.

3. Confidentiality of the Project

3-1 Detailed Specification

Both sides confirmed all the information related to the Project including technical specifications and drawings and other technical information shall not be released to any other party(ies) before the signing of all the Contract(s) for the Project.

3-2 Project Cost Estimate

The Team explained the estimated project cost to be borne by the Government of Japan as attached in Annex-3

DMH agreed to allocate necessary budget in order to bear requested undertakings as shown in Annex-3 and Annex-4. The Team also explained that these cost estimations are subject to change since they are provisional and need to be examined further.

Both sides agreed that the Project Cost Estimate should never be duplicated in any form nor disclosed to any other part(ies) before the signing of all the Contract(s) for the Project. This confidentiality of the estimated project cost is necessary to ensure fairness of the tender procedure.

4. Undertakings by GOM

Both side confirmed that following necessary measures as well as measures mentioned in Annex-4 shall be undertaken by GOM/DMH for the implementation of the Project.



4-1 Consultation framework for high building construction

The Team strongly recommended DMH that the Government of Myanmar shall establish consultation framework between YCDC (Yangon City Development Committee) / MCDC (Mandalay City Development Committee) and DMH in order that YCDC / MCDC considers issuing permission of high building construction (within 10km radius from the Yangon or Mandalay Meteorological Doppler Radar Systems) on newly planned building/facility in order to ensure appropriate radar observation.

DMH understood the recommendation made by the Team and replied to commence the necessary action under the supervision of the Ministry of Transport after signing on Exchange of Notes.

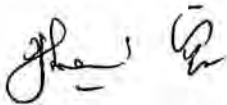
The Team proposed provision of know-how on disturbance impact of planned building to DMH during implementation period.

4-2 Confirmation of No Disturbance Availability to the Existing Communication Links

DMH agreed to obtain confirmation of no disturbance availability to the existing communication links by the Radar Tower Buildings to be constructed under the Project from the Post and Telecommunications Department and the Myanmar Posts and Telecommunications under the Ministry of Communications and Information Technology. In case that disturbance(s) to the existing communication links by the Radar Tower Buildings is confirmed, DMH together with the Post and Telecommunications Department and the Myanmar Posts and Telecommunications under the Ministry of Communications and Information Technology must solve before the completion time of tender documents for the Project which is tentatively scheduled around July 2013.

4-3 Frequency Allocation of a wireless LAN link between Yangon Meteorological Radar Observation Station and the Air Traffic Control Tower in Yangon International Airport

DMH agreed to obtain necessary permission for 4.9GHz band wireless LAN communication system (Meteorological Data Communication System) between Yangon Meteorological Radar Observation Station and the Air Traffic



Control Tower in Yangon International Airport. In order for avoiding unnecessary project delay, the required permission for 4.9GHz band wireless LAN communication system must be available before the completion time of tender documents for the Project which is tentatively scheduled around July 2013, since it is indispensable that 4.9GHz band wireless LAN communication system shall be indicated in the technical specification of the tender documents otherwise no tendering procedures will be made.

4-4 VSAT User License and Permit

DMH agreed to obtain necessary VSAT user license and permit for the Meteorological Data Satellite Communication Systems (VSAT) which are planned to be deployed at DMH Multi Hazard Early Warning Center in Nay Pyi Taw and Kyauk Phyu, Yangon and Mandalay Meteorological Radar Observation Stations. In order for avoiding unnecessary project delay, the required VSAT user license and permit must be available before the completion time of tender documents for the Project which is tentatively scheduled around July 2013, since it is indispensable that the VSAT user license and permit shall be indicated in the technical specification of the tender documents otherwise no tendering procedures will be made.

4-5 Allocation of the Required Frequencies for Kyauk Phyu, Yangon and Mandalay S Band Meteorological Doppler Radar Systems

DMH agreed to obtain the required frequencies (center frequency: 2,796Mhz used for the existing Kyauk Phyu S Band Meteorological Radar System, band width: 10MHz between 2,791MHz and 2,801MHz) indicated below for Kyauk Phyu, Yangon and Mandalay S Band Meteorological Doppler Radar Systems. In order for avoiding unnecessary project delay, the required frequencies must be available before the completion time of tender documents for the Project which is tentatively scheduled around July 2013, since it is indispensable that the frequency for Kyauk Phyu, Yangon and Mandalay S Band Meteorological Doppler Radar Systems shall be indicated in the technical specification of the tender documents otherwise no tendering procedures will be made.

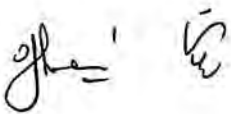


5. Operation and Maintenance System

DMH agreed to allocate the budget and recruit the technical personnel required for appropriate operation and maintenance of Kyauk Phyu, Yangon and Mandalay S Band Meteorological Doppler Radar Systems in accordance with the explanation made by the Team. In addition, DMH agreed to allocate all the required technical personnel at Kyauk Phyu, Yangon and Mandalay Meteorological Radar Observation Stations prior to commencement of the installation works for the meteorological radar system indicated in "Tentative Implementation Schedule" attached herewith as Annex-2.

- Annex-1: Components of the Project
- Annex-2: Tentative Implementation Schedule
- Annex-3: Project Cost Estimation
- Annex-4: Major Undertakings to be taken by Government of Myanmar

Related Document to the Minutes of Discussions: Draft Report of the Preparatory Survey



Components of the Project

DMH Multi-Hazard Early Warning Center, Nay Pyi Taw	Kyauk Phyu Meteorological Radar Observation Station	Yangon Meteorological Radar Observation Station	Mandalay Meteorological Radar Observation Station	Yangon International Airport
I Procurement and Installation of Equipment				
1. S-Band Doppler Pulse Compression Solid State Radar System including Power Backup System, Lightning System, Measuring Equipment and Spare Parts				
-	1	1	1	-
2. Meteorological Rader Data Display System including Software				
1	1	1	1	5
3. Meteorological Data Satellite Communication System (VSAT)				
1	1	1	1	-
4. Meteorological Data Communication System				
-	-	1	-	1
5. Automatic Weather Observation System				
1 (Meteorological Data Management Unit)	-	1 (Meteorological Data Management Unit)	-	-
Total 30 Automatic Weather Observation Stations throughout the country				
II Construction of Radar Tower Building				
6. Construction of New Radar Tower Building				
-	1	1	1	-
III Soft Components				
7. Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery				
8. Prompt and Appropriate Meteorological Doppler Radar Operation and Maintenance utilizing Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book				
9. Meteorological Radar Observation in accordance with Sequence & Schedule for Intensity Mode and Doppler Mode				
10. Reflection of Meteorological Radar Products (Rain Intensity and Doppler) to Weather Forecasting and Aeronautical Weather Operation				
11. Installation Method and Appropriate Maintenance of Automatic Weather Observation Systems (AWS)				

Tentative Implementation Schedule

	1	2	3	4	5	6	7	8																																				
Detailed Design																																												
Internal Work in Japan																																												
Tendering Procedures																																												
	Total: 5.0 months																																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Kyushu Meteorological Observation Station																																												
Construction Work at Kyushu Radar Tower Building	Total: 19.0 months																																											
Preparation Work																																												
Temporary/Earth Works																																												
Structure Work																																												
Finishing Works																																												
Building Equipment																																												
External Work																																												
Equipment Manufacturing for Kyushu																																												
Equipment Transportation for Kyushu																																												
Equipment Installation/Adjustment for Kyushu																																												
Self Component																																												
Meteorological Doppler Radar Operation, Maintenance, Patch Fixing, Upgrade and Recovery																																							11.3 months	11.3 months				
Prevent and Appropriate Meteorological Doppler Radar Operation and Maintenance of Other Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management of Ground Desk																																							1.3 months	1.3 months				
Meteorological Radar Observation in accordance with Expenses & Schedule for Intensity Mode and Doppler Mode																																							0.97 months	0.97 months				
Yamaguchi Meteorological Observation Station																																												
Construction Work at Yamaguchi Radar Tower Building	Total: 23.0 months																																											
Preparation Work																																												
Temporary/Earth Works																																												
Structure Work																																												
Finishing Works																																												
Building Equipment																																												
External Work																																												
Equipment Manufacturing for Yamaguchi																																												
Equipment Transportation for Yamaguchi																																												
Equipment Installation/Adjustment for Yamaguchi																																												
Self Component																																												
Meteorological Doppler Radar Operation, Maintenance, Patch Fixing, Upgrade and Recovery																																							10.07 months	10.07 months				
Prevent and Appropriate Meteorological Doppler Radar Operation and Maintenance of Other Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management of Ground Desk																																							0.57 months	0.57 months				
Meteorological Radar Observation in accordance with Expenses & Schedule for Intensity Mode and Doppler Mode																																							10.97 months	10.97 months				
Manday Meteorological Observation Station																																												
Construction Work at Manday Radar Tower Building	Total: 20.0 months																																											
Preparation Work																																												
Temporary/Earth Works																																												
Structure Work																																												
Finishing Works																																												
Building Equipment																																												
External Work																																												
Equipment Manufacturing for Manday																																												
Equipment Transportation for Manday																																												
Equipment Installation/Adjustment for Manday																																												
Self Component																																												
Meteorological Doppler Radar Operation, Maintenance, Patch Fixing, Upgrade and Recovery																																							1.0 month	1.0 month				
Prevent and Appropriate Meteorological Doppler Radar Operation and Maintenance of Other Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management of Ground Desk																																							1.0 month	1.0 month				
Meteorological Radar Observation in accordance with Expenses & Schedule for Intensity Mode and Doppler Mode																																							1.0 month	1.0 month				
Multi-Hazard Early Warning Center and Yamaguchi International Airport																																												
Equipment Work for Multi-Hazard Early Warning Center	Total: 16.0 months																																											
Equipment Manufacturing for Multi-Hazard Early Warning Center																																												
Equipment Transportation for Multi-Hazard Early Warning Center																																												
Equipment Installation/Adjustment for Multi-Hazard Early Warning Center																																												
Self Component																																												
Equipment Work for Yamaguchi International Airport	Total: 16.0 months																																											
Equipment Manufacturing for Yamaguchi International Airport																																												
Equipment Transportation for Yamaguchi International Airport																																												
Equipment Installation/Adjustment for Yamaguchi International Airport																																												
Self Component																																												
Selection of Airborne (AV) Meteorological Radar Products (Main Intensity and Doppler) to Weather Forecasting and Aeromedical Weather Operation																																							1.0 month	1.0 month				
Automatic Weather Observation System (AWS)																																												
Equipment Work for AWS	Total: 13.5 months																																											
Equipment Manufacturing for AWS																																												
Equipment Transportation for AWS																																												
Equipment Installation/Adjustment for AWS																																												
Self Component																																												
Installation, Operation, Maintenance, Inspection, Patch Fixing, Upgrade and Recovery of Automatic Weather Observation System (AWS)																																							1.07 months	1.07 months				

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3. Recurrent Cos to be borne by DMH

Recurrent Cost of DMH Multi Hazard Early Warning Center in Nay Pyi Taw

Estimated Recurrent Cost

Equipment	Item	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks
1 Product Monitor	Hard disk	9	0	0	0	2,613,803	0	0	0	2,941,858	0	0	Every 4 years
	CD for archiving product data (20 sheets/aset)	2	33,332	34,333	35,363	36,424	37,517	38,643	39,802	40,996	42,226	43,493	
2 Printer	Printer ink cartridge	4	148,148	152,393	157,171	161,886	166,743	171,745	176,897	182,204	187,670	193,300	
	Paper (500 sheets/aset)	2	8,148	8,393	8,645	8,904	9,171	9,446	9,729	10,021	10,322	10,631	
3 Compact UPS	Battery	10	0	0	82,514	0	0	90,165	0	0	98,526	0	Every 3 years
4 SLVA UPS	Battery	1	0	0	214,323	0	0	234,197	0	0	255,913	0	Every 3 years
5 Diesel Engine Generator	Oil seal and filter	2	0	32,807	186,640	34,805	198,006	36,925	210,065	39,174	222,858	41,560	Every 1 and 3 years
	Battery for Engine start	2	0	0	0	0	0	71,274	0	0	0	80,220	Every 5 years
Sub total (Kyat)			189,630	195,319	498,016	2,821,017	213,431	544,196	226,438	3,175,079	594,637	247,425	

Others

Cost Item	Details	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks
1 Electricity Charge		1	2,062,192	2,124,057	2,187,779	2,253,412	2,321,014	2,390,644	2,462,363	2,536,234	2,612,321	2,690,691	*1
2 Fuel cost	Fuel consumption of DEG	1	405,588	417,756	430,289	443,198	456,494	470,189	484,295	498,824	513,789	529,203	*2
3 VSAT Communication Cost	Space Segment for VSAT communication	1	11,921,700	12,279,351	12,647,732	13,027,164	13,417,979	13,820,510	14,235,134	14,662,188	15,102,054	15,553,116	*3
4 GSM Communication Cost	AWS Observation Data Transmission	1	13,140,000	13,534,200	13,940,226	14,358,433	14,789,186	15,232,862	15,689,648	16,160,543	16,645,359	17,144,720	*4
5 Internet Cost	Internet Connection	1	25,000	25,750	26,523	27,319	28,139	28,983	29,852	30,748	31,670	32,620	*4
6 Daily Allowance	For Quick Response Team (travel for 70 day/year)	1	77,000	79,310	81,689	84,140	86,664	89,264	91,942	94,700	97,541	100,467	
7 Transport	Car, Bus, Train, Air, etc. for Quick Response Team	1	729,900	751,797	774,351	797,582	821,507	846,154	871,539	897,685	924,616	952,354	
8 Special Maintenance	System brush-up by manufacturer's engineer	1	0	0	6,523,570	0	0	7,127,388	0	0	7,788,289	0	For 5 days at site
Sub total (Kyat)			38,361,380	39,212,221	36,611,139	30,991,248	31,920,981	40,006,022	33,864,973	34,880,922	43,715,639	37,005,171	
Total (Kyat)			28,551,009	29,407,540	37,109,175	33,812,265	33,134,416	40,556,198	34,091,401	38,056,001	44,310,296	37,152,596	
Total (JPY)			¥2,855,101	¥2,940,754	¥3,710,918	¥3,381,227	¥3,313,442	¥4,055,020	¥3,409,140	¥3,805,600	¥4,431,030	¥3,725,260	

Estimate of annual electricity charge:
 Annual operation hours of Radar System (H) 8,760
 Annual operation hours of Radar System by DEG (H) 438
 Annual operation hours of Radar System by commercial power (H) 8,322
 Annual power consumption of commercial power (kWh) 58,920
 Annual power consumption of DEG (kWh) 3,101
 Annual fuel consumption (L) 775

*1 Annual electricity charge of commercial power (Kyat) 2,062,192
 *2 Annual fuel cost of DEG (Kyat) 405,588
 *3 Annual Space Segment fee (USD) 13,860
 *4 Annual AWS Observation Data Transmission Cost (50 Kyat/Text Message) (Kyat) 13,140,000

Power consumption = 7.08 KW
 Fuel consumption of DEG = 0.25 L/kWh
 Electrical charge = 35.0 Kyat/kWh
 Fuel cost = 926 Kyat/L
 Exchange rate = 10.0 Kyat/JPY
 = 811 Kyat/USD

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Annex-3 - 3

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Recurrent Cost of Kyaok Phyu Meteorological Radar Observation Station

Estimated Recurrent Cost

Equipment	Item	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks		
1	Antenna	Grease (For AZ/EL)	1	0	0	0	0	20,919	0	0	0	0	24,251	1kg/year, Every 5 years	
		Timing belt (For AZ/EL)	2	0	0	0	0	0	0	0	0	0	0	0	
2	Antenna controller	AC fan	3	0	0	0	0	0	0	200,424	0	0	0	Every 8 years	
3	Transmitter/Receiver	AC fan	24	0	0	0	0	0	0	0	0	0	483,249	Every 10 years	
4	Receiver	AC fan	3	0	0	0	0	0	0	0	0	0	3,865,995	Every 10 years	
5	Product Monitor	Hard disk	5	0	0	0	0	0	0	0	0	0	483,249	Every 10 years	
		CD for data storage (20 sheets/1 set)	1	16,667	17,167	17,167	17,167	17,167	17,167	17,167	17,167	17,167	17,167	0	Every 4 years
6	Printer	Printer ink cartridge	2	74,074	76,296	76,296	76,296	76,296	76,296	76,296	76,296	76,296	76,296	0	
		Paper (500 sheets/1 set)	1	4,074	4,196	4,196	4,196	4,196	4,196	4,196	4,196	4,196	4,196	4,196	0
7	Compact UPS	Battery	6	0	0	495,087	0	0	540,995	0	0	0	591,160	0	Every 3 years
8	Emergency Power Back-up Unit	Battery	1	0	0	0	0	0	0	9,729,315	0	0	0	0	Every 7 years
9	Electric Double Layer Capacitor (typed UPS)	AC fan	3	0	0	0	0	0	0	0	0	0	0	0	Every 10 years
		Arrester (6 sets)	1	0	0	0	0	0	0	0	0	0	0	381,481	Every 10 years
10	Diesel Engine Generator	Oil seal and filter	2	0	32,807	186,640	34,805	198,006	36,925	210,065	39,174	223,858	41,560	0	Every 1 and 2 years
		Battery for Engine start	2	0	0	0	0	0	71,274	0	0	0	0	80,220	Every 5 years
Sub total (kyat)				94,815	130,466	779,386	7,393,028	316,584	746,833	10,017,039	8,509,086	911,677	5,625,516		

Others

Cost Item	Details	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks	
1	Fuel cost	Fuel consumption of DEG	1	10,755,203	11,077,859	11,410,195	11,752,501	12,105,076	12,468,228	12,842,275	13,227,543	13,624,369	14,033,100	*2
2	Radome	Caulking repair	1	81,481	83,926	86,444	89,037	91,708	94,459	97,293	100,212	103,218	106,315	
3	Pest-control	Exterminating vermination	1	185,185	190,741	196,463	202,357	208,428	214,681	221,121	227,755	234,588	241,626	
Sub total (Kyats)				11,021,870	11,352,526	11,693,102	12,043,895	12,405,212	12,777,368	13,160,689	13,555,510	13,962,175	14,381,041	
Total (Kyats)				11,116,684	11,492,992	12,472,488	19,436,923	12,721,796	13,534,321	23,197,728	23,064,596	14,873,852	30,006,557	
Total (JPY)				¥1,111,668	¥1,148,299	¥1,247,249	¥1,943,692	¥1,272,180	¥1,352,422	¥2,319,773	¥2,306,460	¥1,487,385	¥2,000,656	

Annual operation hours of Radar System (H) 2,252
 Annual operation hours of Radar System by DEG (H) 2,252
 Annual power consumption of DEG (kWh) 46,439
 Annual fuel consumption (L) 11,615
 *2 Annual fuel cost of DEG (Ky #) 10,755,203

Fuel consumption of DEG = 0.25 LAWh
 Fuel cost = 926 Ky #/L
 Exchange rate = 100 Ky #/JPY

Shin

Recurrent Cost of Yangon Meteorological Radar Observation Station

Estimated Recurrent Cost

Equipment	Item	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks		
1	Antenna	Grease (For AZ/EL)	1	0	0	0	0	20,919	0	0	0	0	24,251	16kg/year, Every 3 years	
		Tuning belt (For AZ/EL)	2	0	0	0	0	0	0	0	0	0	0	0	
2	Antenna controller	AC fan	3	0	0	0	0	0	0	200,424	0	0	0	Every 8 years	
		AC fan	24	0	0	0	0	0	0	0	0	0	0	481,249	Every 10 years
4	Receiver	AC fan	3	0	0	0	0	0	0	0	0	0	0	3,865,995	Every 10 years
		AC fan	3	0	0	0	0	0	0	0	0	0	0	483,249	Every 10 years
5	Product Monitor	Hard disk	6	0	0	0	0	0	0	0	0	0	0	0	
		CD for data storage (20 sheets/1 set)	1	16,667	17,167	17,667	18,112	18,758	19,321	19,901	20,498	21,113	21,746	0	Every 4 years
6	Printer	Printer ink cartridge	2	74,074	76,296	78,585	80,943	83,371	85,872	88,448	91,101	93,834	96,649	0	
		Paper (500 sheets/1 set)	1	4,074	4,196	4,322	4,452	4,586	4,724	4,866	5,012	5,162	5,317	0	
7	Compact UPS	Battery	7	0	0	377,601	0	0	0	631,160	0	0	689,686	0	Every 3 years
		Battery	1	0	0	0	0	0	0	9,729,315	0	0	0	0	Every 7 years
9	Electric Double Layer Capacitor (typed UPS)	AC fan	3	0	0	0	0	0	0	0	0	0	0	483,249	Every 10 years
		Arrester (6sets)	1	0	0	0	0	0	0	0	0	0	0	0	
10	Diesel Engine Generator	Oil seal and filter	2	0	32,807	186,640	34,805	198,006	36,925	210,065	39,174	222,858	41,560	0	Every 10 years
		Battery for Engine start	2	0	0	0	0	0	71,274	0	0	0	0	80,220	Every 5 years
Sub total (Kyen)				94,815	130,466	864,830	8,851,039	325,640	849,276	10,052,395	10,162,404	1,032,651	3,798,115		

Others

Cost Item	Detail	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks	
1	Electricity Charge		1	2,122,273	2,185,941	2,251,519	2,319,065	2,388,637	2,460,296	2,534,103	2,610,128	2,688,437	2,769,085	*1
2	Fuel cost	Fuel consumption of DEO	1	738,806	760,971	783,800	807,314	831,533	856,479	882,173	908,638	935,897	963,974	*2
3	Water supply charge		1	14,600	15,038	15,489	15,954	16,433	16,926	17,434	17,957	18,496	19,051	*3
4	Special maintenance	System brush-up by manufacturer's engineer	1	0	0	6,522,570	0	0	7,127,388	0	0	7,788,289	0	For 5 days at site
5	Daily Allowance	For Quick Response Team (travels for 80 days/year)	1	88,000	90,640	93,359	96,160	99,045	102,016	105,076	108,228	111,475	114,819	0
6	Transport	Car, Bus, Train, Air, etc. for Quick Response Team	1	973,200	1,002,296	1,032,458	1,063,442	1,095,345	1,128,205	1,162,051	1,196,913	1,232,820	1,269,805	0
7	Radome	Caulking repair	1	81,481	83,826	86,444	89,037	91,708	94,459	97,293	100,212	103,218	106,313	0
8	Pest-control	Exterminating vermination	1	185,185	190,741	196,463	202,357	208,428	214,681	221,121	227,755	234,588	241,626	0
9	Internet Cost	Internet Connection	1	25,000	25,750	26,523	27,319	28,139	28,983	29,852	30,748	31,670	32,620	0
Sub total (Kyen)				4,228,546	4,355,401	11,008,635	4,620,648	4,759,268	12,029,433	5,049,103	5,200,579	13,144,885	5,517,295	
Total (Kyen)				4,323,361	4,485,869	11,873,465	13,471,737	5,084,908	12,878,709	15,101,700	15,362,983	14,177,538	11,315,410	
Total (JPY)				¥432,336	¥448,587	¥1,187,347	¥1,347,174	¥508,491	¥1,287,871	¥1,510,170	¥1,536,298	¥1,417,754	¥1,131,541	

Estimate of annual electricity charge

Annual operation hours of Radar System	(H)	2,984
Annual operation hours of Radar System by DEO	(H)	149
Annual operation hours of Radar System by commercial power	(H)	2,835

Annual power consumption of commercial power	(kWh)	60,636
Annual power consumption of DEO	(kWh)	3,191
Annual fuel consumption	(L)	798

*1 Annual electricity charge of commercial power	(Kyen)	2,122,273
*2 Annual fuel cost of DEO	(Kyen)	738,806
*3 Annual water supply charge	(Kyen)	14,600

Power consumption =	21.39	KW
Fuel consumption of DEO =	0.25	L/kWh
Electrical charges =	33.0	Kyen/kWh
Fuel cost =	926	Kyen/L
Exchange rate =	10.0	Kyen/JPY

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Shin-ya

Recurrent Cost of Mandalay Meteorological Radar Observation Station

Estimated Recurrent Cost

Equipment	Item	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks	
1	Antenna	Grease (For AZ/EL)	1	0	0	0	0	20,919	0	0	0	0	34,251	16kg/year, Every 5 years
		Timing belt (For AZ/EL)	2	0	0	0	0	0	0	0	0	0	0	Every 8 years
2	Antenna controller	AC fan	3	0	0	0	0	0	0	200,424	0	0	483,249	Every 10 years
3	Transmitter/Receiver	AC fan	24	0	0	0	0	0	0	0	0	0	3,865,995	Every 10 years
4	Receiver	AC fan	3	0	0	0	0	0	0	0	0	0	483,249	Every 10 years
5	Product Monitor	Hard disk	5	0	0	0	7,260,564	0	0	0	0	0	0	Every 4 years
		CD for data storage (20 sheets/year)	1	15,667	17,187	17,682	18,212	18,758	19,321	19,901	20,498	21,113	21,746	0
6	Printer	Printer ink cartridge	2	74,074	76,296	78,585	80,943	83,371	85,872	88,448	91,101	93,834	96,649	0
		Paper (500 sheets/year)	1	4,074	4,196	4,322	4,452	4,586	4,724	4,866	5,012	5,162	5,317	0
7	Compact UPS	Battery	6	0	0	495,087	0	0	540,995	0	0	591,160	0	Every 3 years
8	Emergency Power Back-up Unit (typed UPS)	Battery	1	0	0	0	0	0	9,729,315	0	0	0	0	Every 7 years
		AC fan	3	0	0	0	0	0	0	0	0	0	483,249	Every 10 years
9	Electric Double Layer Capacitor	Arranger (6 sets)	1	0	0	0	0	0	0	0	0	0	212,630	Every 10 years
		Oil seal and filter	2	0	32,807	166,640	34,803	198,006	36,925	210,065	39,174	222,858	41,560	0
10	Diesel Engine Generator	Battery for engine start	2	0	0	0	0	0	71,274	0	0	0	80,220	Every 5 years
Sub total (Kyat)				94,815	130,466	782,316	7,398,976	325,640	759,111	10,052,595	8,528,038	734,127	5,798,113	

Others

Cost Item	Details	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks	
1	Electricity Charge		1,807,343	1,861,564	1,917,411	1,974,933	2,034,181	2,095,206	2,158,062	2,222,804	2,289,488	2,358,173	*1	
2	Fuel cost	Fuel consumption of DEG	2,109,580	2,172,867	2,238,033	2,305,195	2,374,351	2,445,582	2,518,949	2,594,517	2,672,353	2,752,524	*2	
3	Special maintenance	System break-up by manufacturer's engineer	1	0	0	6,522,570	0	0	7,127,388	0	0	7,788,289	0	
4	Daily Allowance	For Quick Response Team (travels for 20 days/year)	1	22,000	22,660	23,340	24,040	24,761	25,504	26,269	27,057	27,869	28,705	For 5 days at site
5	Transport	Car, Bus, Train, Air, etc. for Quick Response Team	1	194,640	200,479	206,493	212,683	219,069	225,641	232,410	239,382	246,563	253,960	
6	Repairs	Caulking/repair	1	81,481	83,926	86,444	89,037	91,708	94,459	97,293	100,212	103,218	106,315	
7	Pest-control	Exterminating vermination	1	185,185	190,741	196,463	202,357	208,428	214,681	221,121	227,755	234,588	241,626	
8	Internet Cost	Internet Connection	1	25,000	25,750	26,523	27,319	28,139	28,983	29,852	30,748	31,670	32,620	
Sub total (Kyat)				4,425,230	4,557,987	4,697,297	4,843,569	4,980,637	5,125,744	5,283,956	5,442,475	5,602,038	5,771,923	
Total (Kyat)				4,520,045	4,688,453	4,860,613	5,037,545	5,206,277	5,386,855	5,569,551	5,754,513	5,942,166	6,132,036	
Total (JPY)				¥452,004	¥468,845	¥486,061	¥503,755	¥520,628	¥538,686	¥556,956	¥575,451	¥594,217	¥613,204	

Estimate of annual electricity charge:		
Annual operation hours of Radar System	(H)	2,932
Annual operation hours of Radar System by DEG	(H)	440
Annual operation hours of Radar System by commercial power	(H)	3,492
Annual power consumption of commercial power	(kWh)	51,638
Annual power consumption of DEG	(kWh)	9,113
Annual fuel consumption	(L)	2,278
*1 Annual electricity charge of commercial power	(Kyat)	1,807,343
*2 Annual fuel cost of DEG	(Kyat)	2,109,580

Power consumption =	20.72	KW
Fuel consumption of DEG =	0.25	L/kWh
Electrical charge =	35.0	Kyat/kWh
Fuel cost =	926	Kyat/L
Exchange rate =	10.0	Kyat/JPY

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Recurrent Cost of Air Traffic Control Tower in Yangon International Airport

Estimated Recurrent Cost

Equipment	Item	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks
1 Product Monitor	Hard disk	5	0	0	0	1,452,113	0	0	0	0	0	0	
	CD for archiving product data (20 sheets/1set)	2	33,333	34,333	35,363	36,424	37,517	38,643	39,802	40,996	42,226	43,493	Every 4 years
2 Printer	Printer ink cartridge	4	148,148	152,593	157,171	161,886	166,743	171,745	176,897	182,204	187,670	193,300	
	Paper (500 sheets/1set)	2	8,148	8,393	8,645	8,904	9,171	9,446	9,729	10,021	10,322	10,632	
3 Compact UPS	Battery	8	0	0	660,116	0	0	721,327	0	0	788,213	0	Every 3 years
Sub total (Kyat)			189,630	193,319	861,295	1,659,317	213,431	941,161	226,428	1,867,587	1,028,431	247,425	

Others

Cost Item	Details	Qty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	Remarks
1 Electricity Charge		1	442,722	456,004	469,684	483,775	498,288	513,237	528,634	544,493	560,828	577,653	*1
Sub total (Kyat)			442,722	456,004	469,684	483,775	498,288	513,237	528,634	544,493	560,828	577,653	
Total (Kyat)			632,352	651,333	1,330,979	2,143,102	711,719	1,454,398	755,062	2,412,080	1,589,259	825,078	
Total (JPY)			163,235	165,132	313,098	521,210	171,172	345,440	175,506	521,208	418,926	182,508	

Estimate of annual electricity charge
 Annual operation hours of Radar System (H) 4,980
 Annual operation hours of Radar System by commercial power (H) 4,980
 Annual power consumption of commercial power (kW) 12,649
 *1 Annual electricity charge of commercial power (Kyat) 442,722

Power consumption= 2.54 KW
 Electrical charge= 35.0 Kyat/AWh
 Exchange rate= 10.0 Kyat/JPY
 81.1 Kyat/USD

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Major Undertakings to be taken by Government of Myanmar

No.	Items
General Items	
1	To undertake all necessary institutional and juridical procedures in Myanmar.
2	To handle duty (Tax) exemption procedures and to take necessary measures as well as provide requisite legal and/or administrative documentations for customs clearance to customs broker/forwarder to be employed by Contractor at the port of disembarkation for the materials and equipment imported for the Project.
3	To provide necessary working spaces with Internet Connection at the DMH Offices in Nay Pyi Taw and Yangon for the Consultant and the Contractor for the implementation of the Project, if required.
4	To accord Japanese and other foreign nationals including their dependent/s (if any), whose services may be required in connection with the supply of products and services under the signed contracts, such facilities as may be necessary for their entry into Myanmar and stay therein for the smooth and uninterrupted performance of their work i.e. to secure appropriate Visa including its extension/s required by the recipient country in connection thereof.
5	To exempt Japanese and other foreign nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the signed contracts.
6	To pay bank commission to the Myanmar Foreign Trade Bank (MFTB) for issuance of the Authorization to Pay (A/P) and amendments of A/P, if required, for the Consultant and the Contractor.
7	To bear all the expenses, other than those to be borne by the Japan's Grant Aid, necessary for the implementation of the Project
8	To ensure the security of the whole Project site/s and to the Japanese and other foreign nationals engaged in the Project prior to commencement and all throughout the Project implementation.
For the Construction of the Radar Tower Building(s)	
9	To clear, level and reclaim the land prior to commencement of the construction.
10	To secure sufficient spaces at the respective Project sites for temporary facilities such as a contractor's office, workshop, building materials storage, etc. for the construction work.
11	To carry out vital earth moving particularly on the existing hump (small hilly part) in order to secure enough space for the construction of a new radar tower building in the Kyauk Phyu Meteorological Radar Observation Station.
12	To carry out graveling of the existing unpaved access road (from the main road to the Kyauk Phyu Meteorological Radar Observation Station) with enough strength

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	and width suitable for the construction of the new radar tower building.
13	To demolish the existing workshop shed in Yangon DMH Compound in order to secure and allocate ample space for the construction of a new radar tower building.
14	To make available the 30m required extension of the allocated land at Mandalay DMH Observatory to the south side in order to be able to construct and/or put up a new radar tower building.
15	To extend the existing boundary lines of the Mandalay DMH Observatory according to the required land extension.
16	To obtain necessary permissions for the construction of the Radar Tower Building(s).
17	To provide the commercial power (440V, 3-phase, 4-wire, 50Hz) supply (capacity: 100kVA) for Radar Tower Buildings in Yangon and Mandalay.
18	To install the required step-down transformers as well as service entrance connections for the commercial power supply at the site(s) for Radar Tower Buildings in Yangon and Mandalay.
19	To provide the incidental facilities such as water supply and telephone line, internet provision for Radar Tower Building(s) in Yangon and Mandalay.
20	To provide temporary facilities for the availability or accessibility of electricity, water, etc. for the construction work.
21	To construct buildings other than the Radar Tower Building(s), if required by DMH.
22	To undertake incidental outdoor works such as gardening, fencing, gates, boundary walls and exterior lighting in and around the sites, if necessary.
23	To shoulder dispatching cost of the trainees to the training sites; such as daily allowance, transportation fee, accommodation.
For Installation Work of the Equipment	
24	To remove and relocate the existing facilities if available for the installation of the equipment, if necessary.
25	To provide and allocate secure temporary storage area/room for the materials, tools and equipment needed during the installation process.
26	To obtain the required frequency(s) for the meteorological radar system(s).
27	To obtain the required space segment and the VSAT user license from the Ministry of Communication, Posts and Telegraphs for the use of satellite communication for the meteorological data satellite communication system (VSAT) to be installed as well as the provision of redundant communication link such as broadband or dedicated leased line for internet communication.
28	To procure mobile SIM card (GSM/GPRS) for transmitting/receiving data observed by the Automatic Weather Observation Systems (AWS).

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29	To secure ample and strategically located space/s at the existing facilities (Multi Hazard Early Warning Center, Nay Pyi Taw) for installation of the equipment (PC terminals and peripherals) to be supplied.
30	To secure suitable space at the existing observation stations for installation of Automatic Weather Observation Systems (AWS).
31	To extend the existing observation field fence around the installation location of Automatic Weather Observation Systems (AWS) in the existing observation stations which have small size observation field.
32	To shoulder dispatching cost of the trainees to the training sites (including AWS sites which are not accessible to foreigners due to security issue); such as daily allowance, transportation fee, accommodation, if any.
After the completion of the Project	
33	To renovate the existing gates, boundary walls and exterior lighting in and around the sites, if required.
34	To assign staff necessary for smooth operation and maintenance of the Equipment.
35	To remove the existing radar system/structure in order to prevent it from collapsing due to an earthquake and/or strong wind associated with tropical cyclones especially as the existing Kyauk Phyu radar tower building is obsolete.
36	To renovate the existing Kyauk Phyu radar tower building for the establishment of the staff quarter.
37	To renovate the existing Kyauk Phyu Meteorological Radar Observation Office.
38	To procure the required spare parts and consumables for smooth operation and maintenance of the Equipment.
39	To provide adequate maintenance of the Radar Tower Building(s) constructed under the Project, so as they can function effectively.
40	To operate and maintain, and properly and effectively utilize the facilities constructed and the Equipment procured under the Project.
41	To allocate necessary budget and personnel for appropriate meteorological radar observation and forecasting works.

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Appendix 5. Soft Component Plan

Soft Component Plan

<Background of Soft Component Plan>

Myanmar is located in the westernmost part of Indochina along the Bay of Bengal and Andaman Sea. There are high mountains in the northern, eastern, and western area, and numerous small and large rivers flow through the whole land of Myanmar. This geographical condition repeatedly causes floods, flash floods, and landslides everywhere when heavy rain falls. One of the meteorological phenomena causing natural disasters in Myanmar is a tropical cyclone generated in the Bay of Bengal. Heavy rain, strong wind and storm surge brought by a tropical cyclone are destructive and immeasurable. Heavy rain is also created by the southwestern wind from the Bay of Bengal hitting the mountains, so-called the orographic precipitation, during the monsoon period. Due to this heavy rain, flash floods and landslides happen in the mountainous areas and create massive floods in the river basin of the plains and/or coastal areas.

In recent years, there is global concern that the intensity of tropical cyclones and the number of heavy rains will increase and, consequently, meteorological disasters will be magnified as a result of this abnormal climate change caused by global warming. Myanmar is also expected to be greatly affected by a change in meteorological conditions. In order for Myanmar to contribute to the alleviation of the adverse effects of these natural disasters in the Bay of Bengal, 1) the strengthening of the meteorological observation, communication, and forecasting/warning system (through monitoring with meteorological radar system) and 2) the reinforcement of cooperation with other countries in the Bay of Bengal (through the exchange of meteorological observation data and information about cyclones on a timely basis) are the most important and urgent tasks.

Under these circumstances, the existing meteorological radar system of Myanmar, which had played the most important role in monitoring tropical cyclones generated in the Bay of Bengal, completely stopped in 2004 due to aging deterioration. However, more and more tropical cyclones have attacked Myanmar, especially the southern area where most of the population and economic activities are concentrated. Therefore, the key objective of the Project is the effective mitigation of the adverse effects of natural disasters caused by tropical cyclones, heavy rain, etc. To achieve this objective, the implementation of personnel training in addition to the installation of Meteorological Doppler Radar System, Meteorological Radar Data Display System and Meteorological Data Communication System are absolutely essential. These will largely enhance the monitoring capability of hazardous meteorological phenomena such as

tropical cyclones and heavy rain and will improve the forecasting/warning systems in Myanmar as well as create a positive spill-over effect on the neighboring countries in the Bay of Bengal.

Eight (8) years have passed since the existing meteorological radar system of Myanmar operationally stopped. And only 2 technicians having practical experience to operate the existing meteorological radar system currently remains with the DMH. It is good to note that the DMH's technicians are proficient in the use of computers and computerized meteorological observation equipment. However, no technician in the DMH has practical experience to operate a digital meteorological radar system which is planned to be procured under the Project. For the smooth operation and maintenance of the digital meteorological radar system and the assurance of the required sustainability of the Project outcomes, the implementation of the following technology transfers in the soft component (soft component schedule is indicated in the Implementation Schedule attached hereunder) is required.

<Soft Component Target>

The Soft Component Targets are as follows.

- Operation, maintenance, fault finding, remedy and recovery of installed equipment to be appropriately carried out by the DMH
- Prompt and appropriate meteorological radar operation and maintenance utilizing the meteorological radar system manual summary and the meteorological radar system maintenance & management record book
- Meteorological radar observation in accordance with the sequence & schedule for Intensity Mode and Doppler Mode in order to appropriately understand weather phenomena and to utilize the observed radar data for forecasting
- Meteorological radar products to be reflected in weather forecasting and aeronautical weather operation
- Installation work of the Automatic Weather Observation Systems (AWS) to be carried out by the DMH

<Soft Component Outputs>

Soft Component Outputs are as follows.

Table: Soft Component Outputs

No.	Item	Output
1	Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery	Acquisition of technical know-how of appropriate operation, maintenance, fault finding, remedy and recovery 1) Routine maintenance using measuring instruments and tools 2) Practice of replacement of spare parts to actual system and confirmation of system operation 3) Practice of countermeasures, fault finding, remedy and recovery
2	Prompt and Appropriate Meteorological Doppler Radar Operation and Maintenance utilizing Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book	Technical knowledge acquisition of prompt and appropriate meteorological Doppler radar operation and maintenance utilizing meteorological radar system manual summary and meteorological radar system maintenance & management record book
3	Meteorological Radar Observation in accordance with Sequence & Schedule for Intensity Mode and Doppler Mode	Commencement of meteorological radar observation in accordance with the sequence & schedule for Intensity Mode and Doppler Mode in order to appropriately understand weather phenomena and to utilize the observed radar data for forecast operation.
4	Reflection of thirty-nine (39) Meteorological Radar Products (Rain Intensity and Doppler) to Weather Forecasting and Aeronautical Weather Operation	Utilization of meteorological radar products for weather forecasting and aeronautical weather operation
5	Installation, Operation, Maintenance, Inspection, Fault Finding, Remedy and Recovery of Automatic Weather Observation Systems (AWS)	Technical know-how acquisition of AWS installation work, setup of data transmission interval, remedy and recovery (replacement of spare parts, confirmation of system operation, remedy and recovery)

<Means of Verification for Outputs Achievement>

Means of verification for outputs achievement of Soft Component are as follows.

Table: Soft Component Indicators

No.	Item	Objectively Verifiable Indicators	Means of Verification
1	Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery	Operation, maintenance, fault finding, remedy and recovery are carried out appropriately by the DMH	Confirmation of proficiency through 1) routine maintenance using measuring instruments and tools, 2) practice of replacement of spare parts to actual system and confirmation of system operation, and 3) practice of countermeasures, fault finding, remedy and recovery
2	Prompt and Appropriate Meteorological Doppler Radar Operation and Maintenance utilizing Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book	Meteorological Doppler radar operation and maintenance utilizing meteorological radar system manual summary and meteorological radar system maintenance & management record book are implemented promptly and appropriately	<ul style="list-style-type: none"> · Evaluation of frequency of usage of the meteorological radar system manual summary · Confirmation of indications (daily, weekly, monthly) in the meteorological radar system maintenance & management record book
3	Meteorological Radar Observation in accordance with Sequence & Schedule for Intensity Mode and Doppler Mode	Meteorological radar observation is implemented according to radar observation sequence & schedule for Intensity Mode and Doppler Mode	Confirmation of meteorological radar observation in accordance with the sequence & schedule for Intensity Mode and Doppler Mode in order to appropriately understand weather phenomena and to utilize the observed radar data for forecast operation.

4	Reflection of thirty-nine (39) Meteorological Radar Products (Rain Intensity and Doppler) to Weather Forecasting and Aeronautical Weather Operation	Meteorological Radar Products are reflected for weather forecasting and aeronautical weather operation	Confirmation of the extent of utilization of meteorological radar products to be reflected for meteorological forecasting and aeronautical weather operation
5	Installation, Operation, Maintenance, Inspection, Fault Finding, Remedy and Recovery of Automatic Weather Observation Systems (AWS)	Installation work, operation, maintenance, fault finding, remedy and recovery are implemented appropriately by the DMH	<ul style="list-style-type: none"> Confirmation of AWS installation work at several sites where foreigners cannot enter for security reason Confirmation of receiving status of the observed data at DMH Multi-Hazard Early Warning Center, Nay Pyi Taw

<Scheduled Activities of Soft Component>

Expert Consultants to be in charge of the Soft Component are as follows.

- ◆ Meteorological radar adjustment and fault finding: Output 1
- ◆ Meteorological radar operation and maintenance: Output 2
- ◆ Meteorological radar observation: Output 3
- ◆ Meteorological radar products: Output 4
- ◆ AWS operation and maintenance: Output 5

Scheduled Activities of Soft Component are as follows.

Table: Scheduled Activities of Soft Component

Output	Required Technique and Field	Current Technique and Required Technique Level	Target Group	Means of Implementation	Source of Implementation	Products
1. Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery	Engineer who has a meteorological radar adjustment and fault finding technique	Since technicians in the DMH have no practical experience of adjustment and fault finding of a digital meteorological radar system, it is required that the DMH technicians should obtain meteorological radar adjustment and fault finding technique.	Indicated in the table below	Routine maintenance using measuring instruments and tools	Expert Consultant on meteorological radar adjustment and fault finding (Dispatch: 3 times) Kyauk Phy: 1.13 Man-Months Yangon: 0.97 Man-Month Mandalay: 1.0 Man-Month Direct Support	Manual of routine maintenance using measuring instruments and tools
				Practice of replacement of spare parts to actual system and confirmation of system operation		Manual of replacement of spare parts to actual system and confirmation of system operation
				Practice of countermeasures, fault finding, remedy and recovery		Manual of fault finding, remedy and recovery
				Production of operation and maintenance manual		
2. Preparation of Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book	Engineer who has a meteorological radar operation and maintenance technique	Since technicians in the DMH have no practical experience of operation and maintenance of a digital meteorological radar system, it is required that the DMH technicians should obtain meteorological radar operation and	Indicated in the table below	Discussion with the DMH technicians	Expert Consultant on meteorological radar operation and maintenance (Dispatch : 3 times) Kyauk Phy: 1.13 Man-Months Yangon: 0.97 Man-Month Mandalay: 1.0	Meteorological Doppler radar system manual summary
				Selection and explanation of the most important points from meteorological Doppler radar system manual		Meteorological radar system maintenance & management record book
				Production of meteorological Doppler radar system manual summary		↘ Date and time of occurrence of system failure/trouble
				Production of		↘ Cause/s of system failure/trouble

		maintenance technique utilizing meteorological Doppler radar system manual summary and meteorological radar system maintenance & management record book.		meteorological radar system maintenance & management record book Utilization of meteorological Doppler radar system manual and meteorological radar system maintenance & management record book by the DMH technicians	Man-Month Direct Support	(abnormal noise, part degradation, etc.) ↘ Repair procedures implemented ↘ Name and quantity of replaced parts ↘ Name of engineer/s who perform the repair /troubleshooting
3. Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode	Engineer who can identify Clutter and Blind Area by radar observation data and prepare sequence & schedule for meteorological radar observation which is suitable to weather phenomena in Myanmar	Since technicians in the DMH have no practical experience of CAPPI observation using digital meteorological Doppler radar system and has no technique of sequence & schedule for Intensity Mode and Doppler Mode, it is required that the DMH technicians should obtain preparation technique of sequence & schedule for meteorological radar observation with awareness of its importance.	Indicated in the table below	Discussion with the DMH technicians and lecture Identification of Clutter of meteorological radar system and Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees) Preparation of Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees) Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode Implementation of radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode	Expert Consultant on meteorological radar observation (Dispatch: 3 times) Kyauk Phyu: 0.97 Man-Month Yangon: 0.97 Man-Month Mandalay: 1.0 Man-Month Direct Support	Sequence & Schedule for Intensity Mode and Doppler Mode
4. Reflection of thirty-nine (39) Meteorological Radar Products (Rain Intensity and Doppler) to Weather Forecasting and Aeronautical Weather Operation	Engineer who can reflect meteorological radar products for weather forecasting and aeronautical weather operation	Since DMH and Department of Civil Aviation have no technique to utilize digital meteorological radar products for weather forecasting and aeronautical weather operation, it is required that the DMH technicians should understand all the contents of thirty-nine (39) meteorological radar products and obtain the technique to reflect them for	Indicated in the table below	Production of meteorological radar products details Discussion with the staff of DMH (forecasters & technicians) and Air Traffic Control Room, Department of Civil Aviation and lecture (DMH Yangon) Practical training of forecasting operation by use of meteorological radar products details and actual meteorological radar products (DMH Nay Pyi Taw)	Expert Consultant on meteorological radar products (Dispatch: 1 time) 1.0 Man-Month Direct Support	Meteorological radar products details

		operation.		Practical training of aeronautical weather operation by use of meteorological radar products details and actual meteorological radar products (Yangon International Airport)		
5. Installation, Operation, Maintenance, Inspection, Fault Finding, Remedy and Recovery of Automatic Weather Observation Systems (AWS)	Engineer who has an AWS installation, adjustment and fault finding technique	Since technicians in the DMH lack practical experience of AWS installation, adjustment and fault finding, it is required that the DMH technicians should obtain AWS installation, adjustment and fault finding technique.	Indicated in the table below	Explanation of procedures and schedules on AWS installation and adjustment to the DMH technicians	Expert Consultant on AWS operation and maintenance (Dispatch: 1 time) 1.17 Man-Months Direct Support	AWS installation manual
				Production of AWS installation manual		Implementation of AWS installation and adjustment work at several sites where foreigners cannot enter for security reason Receipt of the observed data in good condition at DMH Multi-Hazard Early Warning Center, Nay Pyi Taw AWS operation and maintenance manual
				Production of AWS operation and maintenance manual		
				Training of AWS installation and adjustment work at DMH Nay Pyi Taw and DMH Yangon		
				Training of AWS operation and maintenance at DMH Nay Pyi Taw and DMH Yangon		
				Amendment of AWS installation manual		
				Implementation of AWS installation and adjustment work at several sites where foreigners cannot enter for security reason		
				Confirmation of receipt of the observed data in good condition at DMH Multi-Hazard Early Warning Center, Nay Pyi Taw		
Amendment of AWS operation and maintenance manual						

Timing of each activity commencement in Soft Component is indicated in the following table.

Table: Timing of Activity Commencement in Soft Component

Activity of Expert Consultant	Timing of Activity Commencement
Meteorological radar adjustment and fault finding	This activity must be implemented during the actual operation of the meteorological radar system. The installation work of the meteorological radar system is targeted to be completed during the rainy season and this activity is expected to commence approximately one month before the completion of the installation work (i.e. during the adjustment and initial operation period of the meteorological radar system).

Meteorological radar operation and maintenance	This activity must be implemented during the actual operation of the meteorological radar system. The installation work of the meteorological radar system is targeted to be completed during the rainy season and this activity is expected to commence approximately one month before the completion of installation work (i.e. during the adjustment and initial operation period of the meteorological radar system).
Meteorological radar observation	This activity must be implemented through the utilization of observed rain intensity and Doppler velocity data. The installation work of the meteorological radar system is targeted to be completed during the rainy season and this activity is expected to commence approximately one month before the completion of installation work (i.e. during the adjustment and initial operation period of the meteorological radar system).
Meteorological radar products	This activity must be implemented by using actual meteorological radar products (rain intensity and Doppler velocity). The installation work of the meteorological radar display system at the Yangon International Airport is targeted to be completed during the rainy season and this activity is expected to commence approximately one month before the completion of installation work (i.e. during the adjustment and initial operation period of the meteorological radar display system)
AWS operation and maintenance	This activity is planned to be implemented in Yangon and Nay Pyi Taw during the AWS installation work in the dry season and to be commenced 7 days after the concrete work completion of Yangon AWS foundation. (AWS Installation work must be implemented during the dry season in consideration of the accessibility of all the 30 sites).

The three activities indicated in the following table are planned to be implemented consistently across the three project sites: Kyauk Phyu, Yangon and Mandalay. The necessity of consistently and repetitively implementing the activities is also indicated below.

Table: Necessity of Repetitive Activity Implementation

Three Activities	Necessity of Repetitive Activity Implementation
Meteorological radar adjustment and fault finding, Meteorological radar operation and maintenance, Meteorological radar observation	Installation works of the meteorological radar systems in Kyauk Phyu, Yangon and Mandalay are planned to be individually completed during different rainy seasons by shifting the construction schedules of the meteorological radar tower buildings. As such, the three activities will be implemented three times during three different rainy seasons in the duration of the Project. By consistently and repetitively implementing the activities, 1) the familiarization of DMH engineers with the meteorological radar systems will be increased, 2) the relative insufficient skills of DMH engineers who received technology transfer during the Soft Component that are included in routine radar operation will be supplemented, and 3) through the ample exchange of technical point of views and technology transfer between DMH engineers who are newly allocated and have already started the meteorological radar operation, DMH engineers will additionally acquire the necessary skills to ensure project sustainability.

Target personnel for each technology transfer in the Soft Component is indicated below. For No. 1, 2 and 5, thirty six (36) engineers to be recruited by the DMH for the meteorological radar operation will be included in the target personnel in addition to the existing engineers.

Table: Target Personnel in DMH for Technology Transfer in Soft Component

Technology Transfer of No. 1, 2 and 5		Technology Transfer of No. 3 and 4	
	Number		Number
Engineer (DMH Nay Pyi Taw)	7	Meteorologist	15
Engineer (DMH Yangon)	5	Airport Meteorological Office Staff	4
Engineer (DMH Mandalay)	1	Air Traffic Control Staff (Yangon International Airport)	10
Engineer to be recruited	36		

Details of each activity schedule are as follows.

	Activity No.1 (Kyauk Phyu)	Activity No.2 (Kyauk Phyu)	Activity No.3 (Kyauk Phyu)
Date	Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recover	Preparation of Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book	Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode
1	Japan → Myanmar	Japan → Myanmar	Japan → Myanmar
2	Preparatory Work	Preparatory Work	Preparatory Work
3	Preparatory Work at Meteorological Radar Tower Building		Discussion with the DMH technicians and lecture
4			
5	Practice of routine maintenance using measuring instruments and tools	Discussion with the DMH technicians Selection and explanation of the most important points from meteorological Doppler radar system manual	Identification of Clutter of meteorological radar system and Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees)
6	Production of operation and maintenance manual		
7			
8	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
9	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
10	Production of operation and maintenance manual	Production of meteorological Doppler radar system manual summary (Draft) Production of meteorological radar system maintenance & management record book (Draft)	Preparation of Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees)
11			
12	Practice of replacement of spare parts to actual system and confirmation of system operation		Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode (Draft)
13	Production of operation and maintenance manual		
14			
15	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
16	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
17	Production of operation and maintenance manual	Production of meteorological Doppler radar system manual summary (Draft)	Review of Sequence & Schedule for Intensity Mode and Doppler Mode (Draft)
18			
19	Practice of countermeasures, fault finding, remedy and recovery	Utilization of meteorological Doppler radar system manual (Draft) and meteorological radar system maintenance & management record book (Draft) by the DMH technicians	Implementation of radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode
20	Production of operation and maintenance manual		
21			
22	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
23	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
24	Production of operation and maintenance manual	Review of Meteorological Doppler radar system manual summary (Draft) and Meteorological radar system maintenance & management record book (Draft)	Completion of Radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode
25			Production of Individual Soft Component Completion Report
26	Review of Training by the DMH	Utilization of meteorological Doppler radar system manual and meteorological radar system maintenance & management record book by the DMH technicians	
27	Production of operation and maintenance manual		Technical discussion with the DMH
28	Production of Individual Soft Component Completion Report	Production of Individual Soft Component Completion Report	Preparation for Departure
29	Sat.(Holiday)	Sat.(Holiday)	Myanmar → Japan
30	Sun.(Holiday)	Sun.(Holiday)	
31	Production of Individual Soft Component Completion Report	Production of Individual Soft Component Completion Report	
32	Technical discussion with the DMH	Technical discussion with the DMH	
33	Preparation for Departure	Preparation for Departure	
34	Myanmar → Japan	Myanmar → Japan	

	Activity No.1 (Yangon)	Activity No.2 (Yangon)	Activity No.3 (Yangon)
Date	Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recover	Preparation of Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book	Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode
1	Japan → Myanmar	Japan → Myanmar	Japan → Myanmar
2	Preparatory Work	Preparatory Work	Preparatory Work
3	Preparatory Work at Meteorological Radar Tower Building		Discussion with the DMH technicians and lecture
4	Practice of routine maintenance using measuring instruments and tools	Discussion with the DMH technicians Selection and explanation of the most important points from meteorological Doppler radar system manual	
5			
6			
7			
8	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
9	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
10	Practice of replacement of spare parts to actual system and confirmation of system operation	Production of meteorological Doppler radar system manual summary (Draft)	Preparation of Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees)
11		Production of meteorological radar system maintenance & management record book (Draft)	
12		Utilization of meteorological Doppler radar system manual (Draft) and meteorological radar system maintenance & management record book (Draft) by the DMH technicians	Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode (Draft)
13		Discussion with the DMH technicians	
14	Review of operation and maintenance manual		
15	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
16	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
17	Practice of countermeasures, fault finding, remedy and recovery	Review of Meteorological Doppler radar system manual summary and Meteorological radar system maintenance & management record book	Review of Sequence & Schedule for Intensity Mode and Doppler Mode (Draft)
18		Utilization of meteorological Doppler radar system manual and meteorological radar system maintenance & management record book by the DMH technicians	
19			Implementation of radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode
20	Review of operation and maintenance manual		
21	Review of Training by the DMH		
22	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
23	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
24	Review of Training by the DMH	Utilization of meteorological Doppler radar system manual and meteorological radar system maintenance & management record book by the DMH technicians	Completion of Radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode
25	Production of Individual Soft Component Completion Report	Production of Individual Soft Component Completion Report	Production of Individual Soft Component Completion Report
26	Technical discussion with the DMH	Technical discussion with the DMH	Technical discussion with the DMH
27	Preparation for Departure	Preparation for Departure	Preparation for Departure
28	Myanmar → Japan	Myanmar → Japan	Myanmar → Japan
29			

	Activity No.1 (Mandalay)	Activity No.2 (Mandalay)	Activity No.3 (Mandalay)
Date	Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recover	Preparation of Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book	Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode
1	Japan → Myanmar	Japan → Myanmar	Japan → Myanmar
2	Preparatory Work	Preparatory Work	Preparatory Work

3	Preparatory Work at Meteorological Radar Tower Building		Discussion with the DMH technicians and lecture
4	Practice of routine maintenance using measuring instruments and tools	Discussion with the DMH technicians Selection and explanation of the most important points from meteorological Doppler radar system manual	Identification of Clutter of meteorological radar system and Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees)
5			
6			
7			
8	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
9	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
10	Practice of replacement of spare parts to actual system and confirmation of system operation	Production of meteorological Doppler radar system manual summary (Draft) Production of meteorological radar system maintenance & management record book (Draft) Utilization of meteorological Doppler radar system manual (Draft) and meteorological radar system maintenance & management record book (Draft) by the DMH technicians	Preparation of Blind Area at antenna elevation angle (0.5 interval degree, between 1-3 degrees) Preparation of Sequence & Schedule for Intensity Mode and Doppler Mode (Draft) Discussion with the DMH technicians
11			
12			
13			
14	Review of operation and maintenance manual		
15	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
16	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
17	Practice of countermeasures, fault finding, remedy and recovery	Review of Meteorological Doppler radar system manual summary and Meteorological radar system maintenance & management record book Utilization of meteorological Doppler radar system manual and meteorological radar system maintenance & management record book by the DMH technicians	Review of Sequence & Schedule for Intensity Mode and Doppler Mode (Draft) Implementation of radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode
18			
19			
20	Review of operation and maintenance manual		
21	Review of Training by the DMH		
22	Sat.(Holiday)	Sat.(Holiday)	Sat.(Holiday)
23	Sun.(Holiday)	Sun.(Holiday)	Sun.(Holiday)
24	Review of Training by the DMH	Utilization of meteorological Doppler radar system manual and meteorological radar system maintenance & management record book by the DMH technicians	Completion of Radar observation using Sequence & Schedule for Intensity Mode and Doppler Mode
25	Production of Individual Soft Component Completion Report	Production of Individual Soft Component Completion Report	Production of Individual Soft Component Completion Report
26	Production of Overall Soft Component Completion Report	Production of Overall Soft Component Completion Report	Production of Overall Soft Component Completion Report
27	Technical discussion with the DMH	Technical discussion with the DMH	Technical discussion with the DMH
28	Preparation for Departure	Preparation for Departure	Preparation for Departure
29	Myanmar → Japan	Myanmar → Japan	Myanmar → Japan
30			

	Activity No.4	Activity No.5
Date	Reflection of Meteorological Radar Products (Rain Intensity and Doppler) to Weather Forecasting and Aeronautical Weather Operation	Installation, Operation, Maintenance, Inspection, Fault Finding, Remedy and Recovery of Automatic Weather Observation Systems (AWS)
1	Japan → Myanmar	Japan → Myanmar
2	Preparatory Work	Preparatory Work
3	Discussion with the DMH technicians & forecasters and lecture	Explanation of procedures and schedules on AWS installation and adjustment to the DMH technicians
4	Production of meteorological radar products details	Production of AWS installation manual
5		Production of AWS operation and maintenance manual
6		
7		
8	Sat.(Holiday)	Sat.(Holiday)
9	Sun.(Holiday)	Sun.(Holiday)

10	Discussion with the staff of DMH (forecasters & technicians) and Air Traffic Control Room, Department of Civil Aviation and lecture (DMH Yangon)	Training of AWS installation and adjustment work at DMH Yangon Training of AWS operation and maintenance at DMH Yangon Amendment of AWS installation manual
11		
12	Practical training of aeronautical weather operation by use of meteorological radar products details and actual meteorological radar products (Yangon International Airport)	
13		
14		
15	Sat.(Holiday)	Sat.(Holiday)
16	Sun.(Holiday)	Sun.(Holiday)
17	Practical training of aeronautical weather operation by use of meteorological radar products details and actual meteorological radar products (Yangon International Airport)	Training of AWS installation and adjustment work at DMH Nay Pyi Taw Training of AWS operation and maintenance at DMH Nay Pyi Taw Amendment of AWS installation manual
18		
19		
20	Practical training of forecasting operation by use of meteorological radar products details and actual meteorological radar products (DMH Nay Pyi Taw)	
21		
22	Sat.(Holiday)	Sat.(Holiday)
23	Sun.(Holiday)	Sun.(Holiday)
24	Practical training of forecasting operation by use of meteorological radar products details and actual meteorological radar products (DMH Nay Pyi Taw)	Implementation of AWS installation and adjustment work at several sites where foreigners cannot enter for security reason Confirmation of receipt of the observed data in good condition at DMH Multi-Hazard Early Warning Center, Nay Pyi Taw Amendment of AWS operation and maintenance manual
25		
26	Production of Soft Component Completion Report	
27		
28	Technical discussion with the DMH	
29	Preparation for Departure	Sat.(Holiday)
30	Myanmar → Japan	Sun.(Holiday)
31		Production of Soft Component Completion Report Technical discussion with the DMH Preparation for Departure Myanmar → Japan
32		
33		
34		
35		

<Procurement Method of Soft Component Implementation Resource>

Implementation Resource is procured with the direct support of Japanese consultants who are in charge of procuring the equipment for the Project. The reasons are as follows.

- For technology transfer, personnel with advanced technique and knowledge of weather services, meteorological radar system and automatic weather observation system (AWS) is necessary.
- Personnel as indicated above usually belongs to weather organizations which actually conduct weather services.
- Personnel who has similar experience to the proposed technology transfer is required.

<Implementation Schedule>

The implementation schedule of the whole Project including the soft component is indicated in the following table. The soft component is planned to be implemented during the adjustment stage after the installation of the meteorological radar system and before the completion of the Project.

Soft Component Schedule

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Kyaukpadaung Meteorological Observation Station																																												
Total: 19.0 months																																												
Construction Work at Kyaukpadaung Radar Tower Building																																												
Preparation Work																																												
Temporary/Piling/Earth Works																																												
Structure Work																																												
Finishing Works																																												
Building Equipment																																												
External Work																																												
Equipment Manufacturing for Kyaukpadaung																																												
Equipment Transportation for Kyaukpadaung																																												
Equipment Installation/Adjustment for Kyaukpadaung																																												
Soft Component																																												
Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery																																												
Prompt and Appropriate Meteorological Doppler Radar Operation and Maintenance utilizing Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book																																												
Meteorological Radar Observation in accordance with Sequence & Schedule for Intensity Mode and Doppler Mode																																												
Yangon Meteorological Observation Station																																												
Total: 23.0 months																																												
Construction Work at Yangon Radar Tower Building																																												
Preparation Work																																												
Temporary/Piling/Earth Works																																												
Structure Work																																												
Finishing Works																																												
Building Equipment																																												
External Work																																												
Equipment Manufacturing for Yangon																																												
Equipment Transportation for Yangon																																												
Equipment Installation/Adjustment for Yangon																																												
Soft Component																																												
Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery																																												
Prompt and Appropriate Meteorological Doppler Radar Operation and Maintenance utilizing Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book																																												
Meteorological Radar Observation in accordance with Sequence & Schedule for Intensity Mode and Doppler Mode Sequence & Schedule																																												
Mandalay Meteorological Observation Station																																												
Total: 20.0 months																																												
Construction Work at Mandalay Radar Tower Building																																												
Preparation Work																																												
Temporary/Earth Works																																												
Structure Work																																												
Finishing Works																																												
Building Equipment																																												
External Work																																												
Equipment Manufacturing for Mandalay																																												
Equipment Transportation for Mandalay																																												
Equipment Installation/Adjustment for Mandalay																																												
Soft Component																																												
Meteorological Doppler Radar Operation, Maintenance, Fault Finding, Remedy and Recovery																																												
Prompt and Appropriate Meteorological Doppler Radar Operation and Maintenance utilizing Meteorological Radar System Manual Summary and Meteorological Radar System Maintenance & Management Record Book																																												
Meteorological Radar Observation in accordance with Sequence & Schedule for Intensity Mode and Doppler Mode Sequence & Schedule																																												
Multi-Hazard Early Warning Center and Yangon International Airport																																												
Total: 16.0 months																																												
Equipment Work for Multi-Hazard Early Warning Center																																												
Equipment Manufacturing for Multi-Hazard Early Warning Center																																												
Equipment Transportation for Multi-Hazard Early Warning Center																																												
Equipment Installation/Adjustment for Multi-Hazard Early Warning Center																																												
Total: 16.0 months																																												
Equipment Work for Yangon International Airport																																												
Equipment Manufacturing for Yangon International Airport																																												
Equipment Transportation for Yangon International Airport																																												
Equipment Installation/Adjustment for Yangon International Airport																																												
Soft Component																																												
Reflection of thirty-nine (39) Meteorological Radar Products (Rain Intensity and Doppler) to Weather Forecasting and Aeronautical Weather Operation																																												
Automatic Weather Observation Systems (AWS)																																												
Total: 13.5 months																																												
Equipment Work for AWS																																												
Equipment Manufacturing for AWS																																												
Equipment Transportation for AWS																																												
Equipment Installation/Adjustment for AWS																																												
Soft Component																																												
Installation, Operation, Maintenance, Inspection, Fault Finding, Remedy and Recovery of Automatic Weather Observation Systems (AWS)																																												

<Soft Component Product>

Soft Component Products are as follows.

Table: Soft Component Products in Technology Transfer

Product Name		Submission Time	No. of Pages
Implementation report on 1) routine maintenance using measuring instruments and tools; 2) the practice of replacement of spare parts in the actual system and the confirmation of system operation; and, 3) the practice of countermeasures, fault finding, remedy and recovery.		After Technology Transfer	20
Meteorological radar system manual summary			30
Meteorological radar system maintenance and management record book			10
Radar observation sequence & schedule for Intensity Mode and Doppler Mode			10
Meteorological radar components details			45
AWS installation manual			20
AWS operation and maintenance manual			20
Output Name	Content	Submission Time	No. of Pages
Soft Component Completion Report	<ul style="list-style-type: none"> • Scheduled Activities and Actual Achievement • Scheduled Outputs and Achievement • Factors which influence Achievement of Outputs • Recommendation • Outputs 	Completion of Soft Component	60

<Obligation of the Recipient Country>

Obligations of the DMH for the implementation of the Soft Component are as follows.

- 1) Manpower Development
 - a) Continuous recruitment of human resources for the next generation
 - b) Development of more qualified technical personnel through training and other related manpower development programs
- 2) Longer Life Span of the Equipment procured and the Radar Tower Building constructed under the Project
 - a) Regularly secure the necessary budget for the efficient operation and maintenance of the systems and building equipment, and the procurement of requisite spare parts and consumables for all the equipment to be supplied under the Project
 - b) Ensure protection of the building, equipment and facilities against theft and vandalism

The DMH will be able to implement the above obligations through its organizational and personnel capabilities. Most especially, the “Continuous recruitment of human resources for the next generation” is of vital concern. It is imperative for the DMH to become self-reliant in particular technical areas such as the operation and maintenance of radar systems. Hence, it is essential that it makes continued efforts to recruit and fill vacancies, thereby, promoting and guaranteeing technology transfer for all the technicians and engineer(s). The DMH fully recognizes the need to strengthen the technical section/s. With regards to staff recruitment, the Ministry of Transport is the supervising organization of the DMH and should cooperate and give special attention to this matter.

Appendix 6. References

No	Name of References	Original/Copy/ Digital File	Publisher	Data of Publication
1	Hazard Profile of Myanmar	Digital File	Union of Myanmar	2009
2	Diagnostic Study on the Changing of Ocean Atmospheric Pattern over the South East Asia Region during 1960-2008	Digital File	Department of Meteorology and Hydrology (DMH)	2008
3	Climatological Mean Monsoon Onset & Withdrawal Date	Digital File	Department of Meteorology and Hydrology (DMH)	2012
4	Flood Forecasting System And Flood Warning in Myanmar	Digital File	Department of Meteorology and Hydrology (DMH)	2009
5	DMH-SERVICES	Digital File	Department of Meteorology and Hydrology (DMH)	2012