

# JICA NET DISTANCE EDUCATION ON REMOTE SENSING AND GIS FOR DEVELOPING COUNTRIES

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### ABSTRACT:

Japan International Cooperation Agency (JICA) has initiated a three year-project of JICA NET Distance Education on remote sensing and GIS for developing countries since 2004FY in cooperation with Japan Society of Photogrammetry and Remote Sensing (JSPRS). The teaching contents were prepared by the project team of JSPRS which are consisted of 12 modules each of remote sensing and GIS. JICA NET Distance Education was implemented nine times in the first three year project for 2004-2006FY with the participants of 661 in RS and 665 in GIS from 13 countries including Turkey, Thailand, Philippines, Vietnam, Malaysia, Laos, Kenya, Sri Lanka, Jordan, Cambodia, Bangladesh, Palestine and Mongolia. A module of the distance education is composed of 30 minutes lecture presented with power point images in video and voice, 30 minutes video conference for question and answer (Q&A) session. Three modules will be provided in a session of three hours and half. On the fourth day, an examination is implemented in cooperation with a site facilitator in each country. 573 persons in RS and 582 persons in GIS were presented a certificate of successful completion in the first three year project. So far, the JICA sponsored distance education was successful in terms of systematic education to governmental and university staff in developing countries who are working in the field of remote sensing and GIS with a focus of better management of natural resources and environment. The second three year project has started from August 2007 with updated teaching materials. In the paper, the author as a resource person of JICA NET Distance Education summarizes the advantages and limitations of the distance education through telephone communication system. From January 2008, an advanced course on RS & GIS has started for Kenya.

### INTRODUCTION

JICA initiated RS course once a year since 1978FY with full sponsorship to invite 10-15 trainees per year from developing countries. JICA expanded to mapping & surveying, hydrographic survey, GIS etc. However JICA has changed the policy to introduce partially e-learning system in 2004 to improve the cost-efficiency. The reason is that the cost to invite a person from a developing country used to be very high, say 10,000 US dollars per month in average.

JICA plans to expand JICA NET, a telephone-line based communication system to about 30 developing countries to enable TV conferences between Japan and developing countries. They include Indonesia, Cambodia, Thailand, Philippines, Vietnam, Malaysia, Laos, China, Sri Lanka, Pakistan, Bangladesh, Turkey, Jordan, Palestine, Kenya, Argentine etc.

The objectives of JICA Distance Education are;

- 1) To supplement or replace "Face to Face" training courses which had been adopted by JICA in the past.
- 2) To increase cost performance with respect to number of trainees, high quality lecture materials and lecturers.
- 3) To promote advanced education using IT.
- 4) To support capacity building in developing countries.

JICA contracted with Japan Society of Photogrammetry and Remote Sensing (JSPRS) in 2003 that the fundamental frame work should be proposed by Technical Committee on Strategic Plan for JICA NET Distance Education under the chairmanship of Prof. Shunji Murai on remote sensing and GIS including the

mission and goals, modules and contents, teaching methods etc. In 2003 FY, JSPRS prepared six CDs in total with 3 CDs for RS and another 3 CDs for GIS respectively including power point teaching materials with video and voice and English text for explanation.

JICA started JICA NET Distance Education from 2004 FY in cooperation with JSPRS, JICA Offices in developing countries and a site facilitator representing from each developing country. Until now, nine rounds were implemented in the first three year project (2004-2006FY) and the two rounds have been executed in the second three year project starting from 2007FY.

### PROBLEMS OF CONVENTIONAL JICA TRAINING COURSES

The conventional "face to face" teaching style in a class room would be the best if the teacher and the teaching materials were perfect. But this condition will be difficult to acquire in many cases.

The following problems are recognized by the Technical Committee.

- 1) It is too expensive for JICA to continue to invite trainees from developing countries to Japan. This resulted in limited number of participants, say 10 to 15 trainees per year for a course.
- 2) As there is also a limitation that JICA can find Japanese resource persons who can speak English fluently, some instructors prepared poor teaching materials without the

aid of IT, which resulted in low quality lectures without inspection.

In order to overcome those problems, JSPRS recommended JICA to prepare high quality teaching materials and select eminent lecturers or resource persons, who can speak English well.

### **GOALS OF JICA DISTANCE EDUCATION ON RS AND GIS**

Realizing the requirements of developing countries particularly in Asia and Africa, JICA and JSPRS agreed to set up the following two goals.

- 1). To promote capacity building for human resource development to support sustainable development of natural resources and environment using RS & GIS.
- 2). To provide self learning materials through e-learning to upgrade the capability of applicability.

The main target of trainees will be governmental staff, which are operating RS and/or GIS on daily base or are going to introduce RS and GIS in their technical projects. Teaching faculty and researchers of universities will be also accepted as trainees.

### **BASIC DESIGN OF A COURSE**

- 1) Power Point materials: 25-35 slides per module for 11 modules in total. The 12<sup>th</sup> module is a special module on application of RS or GIS which is composed of 20 applications respectively. Each module except the 12<sup>th</sup> module will take about 30 minutes lecture with voice and video. The lecture will be delivered at each site using CD and LED projector. The text of explanation in English is distributed to each participant.
- 2) After watching the power point materials with voice and video, about 30 minutes will be given to Q&A session through TV conference for three or four developing countries. A resource person should be responsible for answering questions on site. E-mail services will be also provided in case when there are some more questions which are not accepted at TV conference due to time limitation.
- 3) The contents of Q&A session were recorded in writing materials and distributed to the participants. Q&A session will be supported by a facilitator at each site, whose knowledge will be high enough to bridge between the resource person and participants.
- 4) A course on a day will be three hours and half which accommodate three modules including Q&A sessions. In consideration of time difference between Japan and a developing country, the time difference of six hours in maximum will be the limitation to accept the JICA NET Distance Education. Those maximum limited countries include Kenya, Jordan, Turkey etc.
- 5) 12 modules each for RS and GIS can be managed for four half days including examination on the fourth day.
- 6) Those who attended 75 % and more the lectures and passed examination with more than 60% completion will be conferred Certificate of Successful Completion in the name of JICA and JSPRS.
- 7) Three or four developing countries are selected under the condition that JICA local office can support the course and

that a facilitator can be assigned who will call for participants and serve as an assistant through all courses.

- 8) The maximum number of each country will be less than 40. The total will be around 100-120 per time.

### **OUTLINE OF RS AND GIS COURSE**

#### **5.1 RS Course:**

- Module 1: Fundamentals of RS
- Module 2: Remote sensors
- Module 3: Platforms for RS
- Module 4: Microwave RS
- Module 5: Data to be used in RS
- Module 6: Image interpretation
- Module 7: Image processing system
- Module 8: Image processing (1)
- Module 9: Image processing (2)
- Module 10: Image processing (3)
- Module 11: High Resolution Satellite Imagery (HRSI)
- Module 12: Applications of RS (20 applications)

#### **5.2 GIS Course**

- Module 1: Fundamentals of GIS
- Module 2: Data model and structure
- Module 3: Input of geospatial data
- Module 4: Spatial Database
- Module 5: Required hardware & software
- Module 6: Plan for installation
- Module 7: Spatial analysis
- Module 8: Coordinate transformation
- Module 9: Interpolation techniques
- Module 10: DTM
- Module 11: Output of GIS products
- Module 12: Applications of GIS (20 applications)

A full course of RS and GIS, which are given once a week are as follows.

- 1<sup>st</sup> Day: Module No. 1, 2 and 3 of RS
- 2<sup>nd</sup> Day: Module No. 4, 5 and 6 of RS
- 3<sup>rd</sup> Day: Module No. 7, 8 and 9 of RS
- 4<sup>th</sup> Day: Module No. 10 and 11 of RS, and examination for RS
- 5<sup>th</sup> Day: Module No. 1, 2 and 3 of GIS
- 6<sup>th</sup> Day: Module No. 4, 5 and 6 of GIS
- 7<sup>th</sup> Day: Module No. 7, 8 and 9 of GIS
- 8<sup>th</sup> Day: Module No. 10 and 11 of GIS and examination for GIS
- 9<sup>th</sup> Day: Applications of RS and GIS

#### **5.3 COURSE FOR APPLICATIONS OF RS AND GIS**

The application module has been added since 2005 FY. This module was designed without a pressure of examination.

The objectives of application module are as follows.

- 1) To follow up those courses on theories and techniques,
- 2) To introduce a variety of examples of typical and interesting applications in remote sensing and GIS for better management of environment and natural resources,
- 3) To demonstrate how remote sensing and GIS have been successfully used in the actual projects as well as research and development, and
- 4) To make decision makers, managers, scientists and graduate students understand how remote sensing and GIS can be applied with success.

The list of applications for RS and GIS is shown below.

### 5.3.1 RS Applications

1. Land Cover Map based on Satellite Imagery
2. Countrywide Land Cover Mapping
3. Monitoring of Urban Growth in Hanoi
4. Urban Change Study in Mongol
5. Updating Forest Map
6. Height Measurement of Trees by Lidar Data
7. Flood Damage Map in Bangladesh
8. Flood Damage Mapping for Rice Fields
9. Monitoring of Water Quality
10. Monitoring Shrimp Farming
11. Application to Fishery
12. Topographic Mapping from IKONOS Stereo Imagery
13. Automated Extraction of Roads
14. 3D Measurement of Volcanic Crater
15. Monitoring Earthquake Damage
16. Earthquake Damage Detection using HRSI
17. Monitoring Rice Growth by SAR
18. Global Mapping
19. Assessment of Desertification in Arid Area
20. Image Mapping System using Kite Balloon

### 5.3.2 GIS Applications

1. Suitable Land Selection for Agricultural Development
2. Optimum Vehicle Routing
3. Real Time GIS Data Capturing
4. Environmental Study with GPS, Digital Camera and GIS
5. Flood Hazard Map
6. Flood Free Route Location
7. Flood Simulation with Lidar Data
8. Shelter Suitability Analysis
9. GIS Database for Management of Irrigation Facilities
10. Drought Risk Assessment
11. Height Measurement of Buildings with Lidar Data
12. Contour Mapping with Lidar Data
13. 3D City Model with IKONOS and Lidar Data
14. Superposition of Historical Maps onto Present Map
15. Visibility Analysis of Mt. Fuji
16. Crime Mapping and Analysis
17. Disaster Management System for City Gas Network
18. GIS Map for 1995 Kobe Earthquake Damage Assessment
19. Time-space Mapping
20. Scheduling for Day Care Service

## IMPLEMENTATION

### 6.1 First Three Year Project: 2004-2006FY

Nine rounds for 13 countries were implemented in the first three year project in the period of 2004-2006FY. Table 1 and 2 shows the number of participants, number of those who took examination, number of successful completion and the rate.

Remote Sensing (2004-2006FY)				
	No. of Particip.	No. who took exam.	Successful Completion	Rate
Turkey	32	27	18	66.7%
Thailand	75	65	51	78.5%
Philippines	143	134	104	77.6%
Vietnam	75	64	57	89.1%
Malaysia	73	52	36	69.2%
Lao	35	27	7	25.9%
Kenya	111	103	77	74.8%
Sri Lanka	40	39	34	87.2%
Jordan	30	28	23	82.1%
Cambodia	47	34	6	17.6%
Bangladesh	17	16	15	93.8%
Palestine	21	12	10	83.3%
Mongolia	25	14	14	100.0%
Total	661	573	413	72.1%

\*Rate = No. who took exam. / Successful Completion

Table 1 Result of RS Course for 2004-2006FY

GIS (2004-2006FY)				
	No. of Participants	No. who took exam.	Successful Completion	Rate
Turkey	27	24	20	83.3%
Thailand	72	66	60	90.9%
Philippines	145	141	127	90.1%
Vietnam	76	68	67	98.5%
Malaysia	76	48	42	87.5%
Lao	42	26	13	50.0%
Kenya	109	105	102	97.1%
Sri Lanka	46	44	41	93.2%
Jordan	30	28	28	100.0%
Cambodia	42	32	21	65.6%
Bangladesh	17	17	16	94.1%
Palestine	22	18	15	88.2%
Mongolia	28	25	16	64.0%
Total	665	582	521	89.5%

Table 2 Result of GIS Course for 2004-2006FY

### 6.2 Second Three Year Project: 2007-2009FY

The second three year project is now being implemented from August 2007. Two rounds have been complete until now with the updated teaching materials.

The readers can download the teaching materials as follows.

[URLs for Remote Sensing and GIS Course](#)

## ENGLISH VERSION (UPDATED IN 2007)

ID: jica  
 Password: jica001  
 Remote Sensing Disk-1

[http://mmc.jica-net.com/CD/07JTIC003/disk1/Remote Sensing Disk-2](http://mmc.jica-net.com/CD/07JTIC003/disk1/Remote%20Sensing%20Disk-2)  
[http://mmc.jica-net.com/CD/07JTIC003/disk2/Remote Sensing Disk-3](http://mmc.jica-net.com/CD/07JTIC003/disk2/Remote%20Sensing%20Disk-3)  
[http://mmc.jica-net.com/CD/07JTIC003/disk3/Remote Sensing Disk-4 \(Application\)](http://mmc.jica-net.com/CD/07JTIC003/disk3/Remote%20Sensing%20Disk-4%20(Application))  
<http://www.jica-net.com/CD/05TICM001/RS/index.html>  
GIS Disk-1  
[http://mmc.jica-net.com/CD/07JTIC003/disk4/GIS Disk-2](http://mmc.jica-net.com/CD/07JTIC003/disk4/GIS%20Disk-2)  
[http://mmc.jica-net.com/CD/07JTIC003/disk5/GIS Disk-3](http://mmc.jica-net.com/CD/07JTIC003/disk5/GIS%20Disk-3)  
[http://mmc.jica-net.com/CD/07JTIC003/disk6/GIS Disk-4 \(Application\)](http://mmc.jica-net.com/CD/07JTIC003/disk6/GIS%20Disk-4%20(Application))  
<http://www.jica-net.com/CD/05TICM001/GIS/index.html>

The first round was given to Bangladesh, Palestine (Gaza) and Palestine (West Coast) during August and October 2007. The total number of participants was 43 for RS Course and 48 for GIS Course. The successful ratio of the examination was 81.4% for RS and 97.9% for GIS in average.

The second round was given to Mongolia, Philippines, Sri Lanka and Vietnam during January and March 2008. The total number of participants was 86 for RS and 92 for GIS and the average successful completion was 63% for RS and 85% for GIS.

#### **ADVANTAGES OF JICA NET DISTANCE EDUCATION**

According to the questionnaires answered by participants, the following advantages are recognized.

- 1) It will be possible for beginners to study RS and GIS systematically.
- 2) Many participants from different organizations and different countries can share knowledge and experience through the distance education. Particularly TV conference was appreciated by participants for the interactive communication between the lecturer and participants in cooperation of the site facilitators.
- 3) The record of Q&A sessions in written form was very useful to understand many parts and items which are not mentioned in the lectures and the text.
- 4) The examination with the submission of certificate for successful completion had become incentive to concentrate into the lectures and Q&A sessions.
- 5) Those participants can repeat self-learning with given CDs at any time and anywhere.
- 6) E-mail service for extra Q&A session after ordinary session was sometimes useful for those participants to make special questions to the lecturer.

#### **ADVANCED COURSE**

As requested by Kenya where JICA GIS Project is being executed in 2007FY, a distance education of advanced course on remote sensing and GIS has been newly implemented only for Kenya. The total number of participants was 39. This advanced course will be expanded according to request from other countries where JICA project is being implemented.

The objectives of the advanced course are;

- 1) To obtain latest information about advanced technologies in the field of remote sensing and GIS,

- 2) To study more practical method of implementation to adopt remote sensing and GIS, and
- 3) To learn more case studies which were applied successfully in the past.

The course is composed of the following three parts; remote sensing (four topics), GIS (five topics) and project management (three topics) which are presented in five "three hour" sessions.

**Remote Sensing** given by Shunji Murai, Professor Emeritus, University of Tokyo

Module 1) Demand for Satellite Information and Observation Systems

Module 2) Mapping Capability of High Resolution satellite Imagery (HRSI)

Module 3) Aerial Photogrammetry with Digital Cameras

Module 4) Airborne Laser Scanner and its Applications

The teaching materials were made in cooperation of Japan Society of Photogrammetry and Remote Sensing (JSPRS) and ISPRS White Elephant Club.

**GIS** given by Daichi Furuhashi, Center for Spatial Information Sciences, University of Tokyo

Module 1) How to Use the Digital Earth? - ex. Google Earth, NASA World Wind, ArcGIS Explorer-

Module 2) Web mapping service - ex. Google Maps, Map Server, Yahoo Maps-

Module 3) Major software of GIS

Module 4) Open Source, OSGeo, OGC, Low cost GIS

Module 5) GIS forecast, in the future of ten years

**Project Management** by Lal Samarakoon, Geoinformatics Center, Asian Institute of Technology (AIT)

Module 1) Introduction-Theoretical Aspects of project management-

Module 2) Geoinformatics Project Management-Success and Failures-

Module 3) Case Study-Land Use Planning Using Geoinformatics-

#### **CONCLUSIONS**

- 1) JICA NET Distance Education contributed to developing countries in terms of capacity building of remote sensing scientists, technicians, engineers and/or managers who are engaged in governmental projects and university lecture and research.
- 2) JICA NET Distance Education proved successful with respect to the cost effectiveness as compared with the conventional "face to face education". The number of trainees in the distance education will reach about 200 for three courses in a year, while the conventional training just 10 to 15. Until now since 2004FY, more than 700 trainees have completed the Distance Education with less than 20 times expenses as compared with the conventional fellowship style with full sponsorship.
- 3) The interactive TV conference for Q&A session is highly appreciated to overcome the mechanical feeling of "video show" lecture. Figure 1 and Figure 2 show an example of TV screen and Q&A Session answering using a touch panel.

REFERENCES

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Figure 1. TV Screen showing the class room of four countries

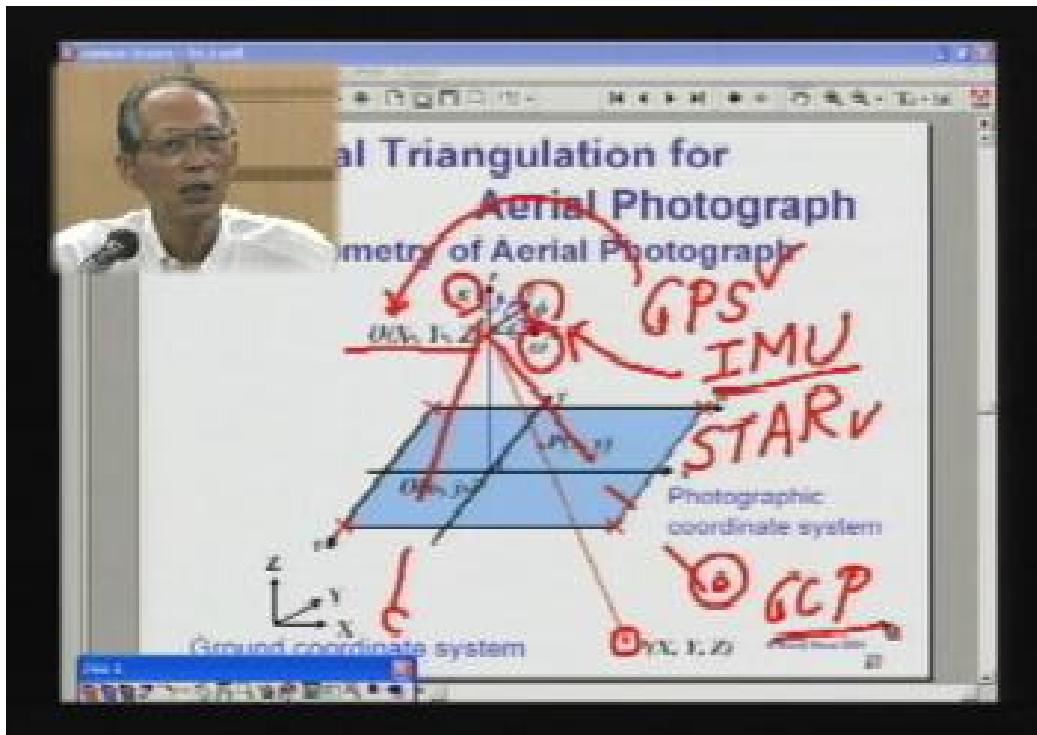


Figure 2. Q&A Session; answering questions using touch panel

