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# Introduction to Remote Sensing and Digital Image Processing Workshop

March 28, 2002

Instruction by Dr. John M. Morgan, III

**Attendance at this workshop was provided on a gratis basis for municipal, county, regional and state government employees by the Maryland State Geographic Information Committee (MSGIC) using NASA grant funds obtained from the National States Geographic Information Council (NSGIC) under NASA Grant NAG 5-8113.**

**Summary Report by: Bill Burgess, Chair  
MSGIC Database and Resource Development Subcommittee**

# Introduction to Remote Sensing and Digital Image Processing Workshop

**Thursday, March 28, 2002**

## 1.0 Introduction

The National States Geographic Information Council (NSGIC) advertised an opportunity for states to receive up to \$5000.00 to host a workshop on remote sensing for local, regional, state and tribal government agencies. These funds were provided through NASA Grant NAG 5-8113. NSGIC required that a listening session be conducted at each workshop to obtain feedback on future user needs, and that a summary workshop report with handout materials be submitted to NSGIC. Each state was given the flexibility to design the workshop to meet their individual needs. Maryland requested funds from NSGIC and was subsequently approved to conduct a workshop.

Towson University hosts an annual GIS conference with a series of GIS-related workshops that are held after the conference. One of the workshops is entitled "**Introduction to Remote Sensing and Digital Image Processing.**" It is offered by Dr. John M. Morgan, III, an Associate Professor at Towson University. Dr. Morgan is also a Principal Investigator in the Raytheon Synergy projects that are also funded by NASA. The Introduction to Remote Sensing and Digital Image Processing workshop was described in the conference program as follows:

"Remote Sensing is being used increasingly to provide data for such diverse applications as land use planning, hydrology, agriculture, geology and forestry. The objectives of this course are: 1) to introduce remote sensing and image processing, 2) to describe the range of applications of satellite remote sensing, 3) to discuss the digital image processing techniques that are commonly used with remotely-sensed data, and 4) to examine how remote sensing can provide timely data for GIS. Examples using Landsat TM data for the selected portions of the Mid-Atlantic area will be utilized throughout the workshop."

Since the workshop covered the desired content, and it was already being offered as part of the TUGIS 2002 conference, it was not necessary to schedule or create a new workshop. This workshop is normally offered for a fee of \$185.00 per person (\$200.00 for late registrations). After securing NSGIC approval, the Maryland State Geographic Information Committee (MSGIC) advertised the opportunity to obtain free admission for municipal, county, regional and state government staff to its entire membership list (~250 persons). This offer was in keeping with the intent of NASA's State, Local and Tribal Applications Program. MSGIC members were asked to extend the invitation to other staff within their organizations and jurisdictions. Considering the number of people notified and the current economic situation in Maryland, it is curious that only twenty-five people pre-registered for the workshop. Most state and local government employees are eager to attend training programs that relate to their job function and they generally take advantage of free training. Including four individuals from the private sector, twenty people actually attended the workshop. MSGIC will attempt to determine why more people did not take advantage of this offer, but that information will not be part of this report.

## 2.0 Workshop Attendees

This workshop was designated as an introductory level course. Advanced level users would not be expected to attend, however, a few of the attendees would be appropriately classified as mid- to high-level users of remote sensing products. They attended the workshop as a refresher and to learn about current projects, including the Towson Synergy project. The list of attendees and their affiliations can be found in Attachment A. Unfortunately, five people registered for the workshop and did not attend. This was an unanticipated hazard of providing free registrations for the workshop. Registration methods for future workshops will attempt to address this issue.

Each of the attendees was asked to list their principal work-related activities and they were allowed to check more than one item. Table One summarizes this information. The diverse nature of most state and local government jobs was evident when reviewing the individual forms.

**Table 1 - Principal Activities of Workshop Attendees**

Land Use Planning/Growth Mgt.	10	Agriculture	3
Land Acquisition/Management	5	Transportation	4
Water Resources Management	9	Simulation Mapping	1
Forestry Management	6	Public Works	1
Wildlife Management	3	Archeology	1
Natural Hazards Management	5	Civil Engineering	1
Health Related Activities	1	Cartography/GIS	4
Emergency Response	6	Defense	1

## 3.0 Current and Future Uses of Remotely Sensed Data in Maryland

The attendees were asked to list the remotely sensed data sources that they currently use, how often they use these data, and if they process the “raw” forms of the data. Respondents were allowed to list as many data types as needed. The results are summarized in Table 2 on the following page. The current usage of remotely sensed data represents a surprising level of activity for persons attending an introductory course. In particular, the use of MODIS and LIDAR were not anticipated. The use of aerial photography and SPOT satellite imagery were expected since since these products are readily available in Maryland. The number of users and frequency of Landsat usage was surprising for this group, but it may reflect the work that Towson University has done with local and state agencies through the Synergy project or other contract work.

**Table 2 - Types of Remotely Sensed Data Used by Workshop Attendees**

Data Source	# of Data Users	Process Data		Daily	Frequency of Use		
		Yes	No		Weekly	Monthly	>Month
MODIS	2	1	1				2
AVHRR	1	1					1
SeaWIFS							
Landsat TM	9	1	8	2	2	1	4
SPOT 10-m Pan	7		7	1	1	2	3
SPOT 20-m MS	2		2		1	1	
IKONOS 1-m Pan	3	1	2	1			2
IKONOS 4-m MS	3	1	2	1			2
IRS-1C 5-m Pan	1		1				1
Aerial Videography	1		1				1
Aerial Digital Scanner	1	1				1	
Aerial Photography	15	4	11	7	3	3	2
LIDAR	3		3		1		2
RADAR							
Thermal Imagery							
Other: Military Data	1		1	1			
Other:							
Other:							

Workshop attendees were asked to predict what types of remotely sensed data products they would use with a greater frequency in the future without regard to any constraints or limitations. The results are summarized in Table 3 on the following page. The responses clearly indicate a preference for higher resolution products. The largest number of respondents indicated they wanted to use higher resolution or more up-to-date aerial photography, however, a significant number of respondents indicated that they would use IKONOS satellite imagery which also shows a preference for better ground resolutions.

**Table 3 - Types of Remotely Sensed Data to be Used by Workshop Attendees with Greater Frequency in the Future**

MODIS	2	Aerial Videography	
AVHRR		Aerial Digital Scanner	
SeaWIFS		Aerial Photography*	12
Landsat TM	2	LIDAR	1
SPOT 10-m Pan		RADAR	
SPOT 20-m MS		Thermal Imagery	
IKONOS 1-m Pan	5	Other: Higher Res. SPOT	2
IKONOS 4-m MS	4	Other: Oblique Aerial Photos	1
IRS-1C 5-m Pan		Other:	

\* Respondents clearly wanted higher resolution and more frequent aerial photography.

#### 4.0 Factors that Affect the Frequency of Use of Remotely Sensed Data

NASA is interested in identifying and solving appropriate issues that prevent wider use of remotely sensed data products. Each of the state workshop coordinators was asked to identify the reasons affecting usage in their states. The workshop respondents were asked to rank the factors found in Table 4 on the following page. The results found in Table 4 were weighted by multiplying answers in the high, moderate and slight agreement categories by factors of 3, 2 and 1, respectively. The total weighted results for each factor appear below.

<b>Factor</b>	<b>Weighted Response</b>
Decreased Data Cost	35
Increased Ground (Pixel) Resolution	34
Increased Budget	31
More Frequent Acquisition	28
Need Additional Training	20
Access to Pre-processed Data	19
Need Hardware or Software Improvements	15
Commercial Sources for Processing	10
No Data License Restrictions	7

**Table 4 - Factors that will Increase the Usage of Remotely Sensed Data by Workshop Attendees**

FACTOR	IMPORTANCE		
	High	Moderate	Slight
Decreased Data Cost	9	3	2
No License Restrictions		2	3
Increased Ground (Pixel) Resolution	6	8	
Access to Pre-processed Data	6	1	
More Frequent Acquisition	6	5	
Need Additional Training	3	5	1
Need Hardware or Software Improvements	3	3	
Commercial Sources for Processing		4	2
Increased Budget	9	2	

### 5.0 What Applications Would Users Like to See Developed

Each of the workshop attendees was asked to list applications that they would like to see further developed. The results are provided below, with no respect to the importance of the application as it relates to other applications. This simply represents a “wish list” from the attendees.

- |  |  |
|--|--|
| 1) Permit Review   | 11) Automate Detailed Classification of Land Cover             |
| 2) Wetland Classification  | 12) Obtain Historical Aerial Photographs in Digital Form       |
| 3) Measuring the Extent of Pollution (Oil Spill / Impervious Surfaces Runoff / Air Pollution Effect on Vegetation) | 13) Identifying Possible Tree Planting Locations               |
| 4) Smart Growth and Planning   | 14) To Ensure that Environmental Easements Are Not Built On    |
| 5) Production of Geology Maps  | 15) Develop a Real Time Parking Locator for Downtown Baltimore |
| 6) Use of LIDAR for Detailed Topography  | 16) Discrimination of Vegetation Types                         |
| 7) Analysis of Impervious Surfaces and Storm Water Management  | 17) Locating Water Bodies                                      |
| 8) To Measure Land Use Changes Over Time   | 18) Measuring Forest Fragmentation                             |
| 9) Identifying Total Maximum Daily Loadings (TMDL) and Water Sampling Points                                       | 19) Mapping Urban Changes                                      |
| 10) Land Cover Change Affects on Wildlife Habitat  | 20) Mapping Agriculture and Forest Land Cover                  |
|  | 21) Bio-Solids Management on Agriculture Fields                |

## 6.0 Instruction Methods and Reaction to the Workshop

Each participant was given a printed and bound handout that mimicked the PowerPoint™ presentation that Dr. Morgan used to instruct the class. He presented “live” instruction on image processing techniques using IDRISI™ software from Clark University. The image processing techniques were applied to Landsat Thematic Mapper Imagery and color infrared Orthophoto Imagery. Although no questionnaire was distributed to obtain feedback on the workshop, most of the attendees openly remarked that it was an excellent course. Each person was exposed to the basic elements of remote sensing and image processing in a manner that took the “mystery” out of the science. This training format and program could easily be applied to other state remote sensing workshops.

At the end of the workshop, we discussed several of the proposed remote sensing applications with the attendees and provided suggestions and contacts for them to pursue as they try to implement their own remote sensing activities.

Attachment A  
List of Workshop Attendees

Last Name	First Name	Affiliation	Municipal	County	Regional	State	Federal	Private	In Attendance
Azevedo	Celina	Montgomery County		X					X
Baker	Tim	EnterInfo, Inc.						X	X
Branigan	John	A.D. Marble & Co. Inc.						X	X
Burgess	Bill	Md. DNR - CCWS				X			X
Busslere	John	Howard County		X					
Chapman	Jon	Md. Environmental Trust				X			
Eanes	Rebecca	Md. DNR - Wildlife				X			
Earle	John	KCI Technologies, Inc.						X	X
Fothergill	Leo	Baltimore Co. Env. Protect.		X					X
Gelner	Robert	Baltimore County		X					X
Heggenstaller	Joe	York Co. PA		X					X
Leandro	Leslie	FEMA					X		X
Luo	Tianjin	Balt. Metropolitan Council			X				
Meacham	Jennifer	Baltimore Co. Planning Off.		X					X
Niesterowicz	Chris	Md. Environmental Service				X			X
Patterson	Pat	Md. DNR - Forestry				X			X
Quinn	Heather	Md. DNR - Geological Surv.				X			X
Savino	Michelle	TU/Md. SHA				X			X
Siano	Frank	Md. Dept. Of Environment				X			X
Teveler	Alice	Washington MTA			X				X
White	Jean	Baltimore County		X					X
Wilding	Duane	Md. Environmental Service				X			
Williams	Timothy	City of Hagerstown	X						X
Wolf	Ray	Lockheed Martin/ US EPA						X	X