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Release of V5.70 TNT products

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Introduction

MicrolImages is pleased to distribute **V5.70** of the **TNT** products and the 42nd quarterly release of **TNTmips**. During the past quarter, there were no special problems in the **TNT** products.

V5.70 introduces several completely new processes in addition to expected improvements in many other processes. The new processes are: 1) mosaic with many new, advanced features, 2) visualization process with advanced layer control and integrated 2D and 3D views, 3) relational database editor with graphical representation, 4) on-line reference manual now all in HTML, and 5) statistical/graphical tools for grouping/naming classes produced in unsupervised image classification.

Nine new Getting Started tutorial booklets are shipping in printed format. All available Getting Started booklets are included on the **V5.70** CD in PDF format for easy viewing in color in Adobe Acrobat Reader (Reader and all sample geodata sets are also on the CD). Using the Reader, you can easily print each Getting Started booklet in color for your personal use. Also enclosed is a new **TNTatlas** sampler CD which was jointly prepared with the Maryland Department of Natural Resources.

Over 150 new feature requests submitted by clients and MicrolImages' staff were implemented in various **V5.70** processes since **V5.60** was shipped. About an equal number of additional requests was logged from the same sources in the same period. This holds the total count of new features not yet implemented to somewhat more than 1700. It is hard to reduce this count rapidly, as all clients and staff continue to have many good new ideas each quarter which are added to this list. However, we are now at least beginning to "hold our ground" in this area, and the count is showing a little reduction. Your new and past requests for features are constantly being prioritized, and those selected as providing the most value to the most clients are given a priority for implementation.

Summary of New Features

As usual, details on all the following and other new features in **V5.70** can be found in their expanded description in later sections of this MicrolImages MEMO.

The 2D display process you have been using in the **TNT** products was created in **V4.0** of the **TNT** products and expanded and extended through **V5.60**. This four year old process has been rewritten incorporating 2D, 3D, and stereo functionality and is being released in a preview form.

Any field in the related attribute tables can now be selected to show as labels for a layer.

A spatial DataTip (like a ToolTip in appearance) will pop in to the view area to identify the nearest vector element, raster cell, ... for the active layer. The property shown in the DataTip box can be the contents of any attribute field you specify for each layer.

The graphical drawing tools now draw directly in the color and line width you select.

The object edit process has many enhancement features which you have requested such as cut, copy, and paste for vectors and their attributes; edit functions via right mouse button; prompts for attribute changes and additions; and so on.

The old mosaic process (six years old) is replaced by a new process for assembling images into a composite raster(s). It has many new features such as warping, transparency to map projection of images, improved contrast matching, define irregular seams, edge feathering, and so on.

A completely new Database Management process is provided to assist you in the creation, management, and editing of your relational databases before or after they are attached to graphical elements. It collects features already available for such operations which were scattered into various hard to find places in other **TNT** processes.

The overall structure of **SML** was revised to make it easier to add vector, CAD, TIN, and database functions. In connection with this, functions are now available for matrix manipulation, vector combinations, raster combinations, raster to vector conversion, and others. MicroImages also announces that it will make **SML** available at no additional cost as part of **TNTview** in **V5.80**.

Unsupervised image classification processes now have new interactive class merging and naming (labeling) procedures using dendrograms, co-occurrence tables, and so on.

The AutoTrace process now has an interactive preview function to assist in selection of the parameters controlling the vector filters it applies.

Queries can be performed on attributes attached to raster cell values to control their use in principal components, multilinear analysis, raster combinations, and decorrelation processes.

The on-line reference manual has now been fully converted to HTML format for use in Internet Explorer or Netscape browsers.

Microsoft Internet Explorer V3.02 (Windows) and V3.01 (Mac) is provided for use on the Windows or Mac platforms (Microsoft has delayed its release for UNIX platforms until Explorer V4.0 is released).

TNTatlas is now FREE for use on all platforms supported by the **TNT** products.

Each layer in an AutoCAD DXF layer can be imported separately or combined as specified into a CAD or vector object in a project file.

At least nine new Getting Started booklets and their geodata sets from Ptolemy are shipping with **V5.70** in black and white printed format.

All available Getting Started booklets are on the **V5.70** CD in Adobe Acrobat Reader PDF files for your review or printing in color (Reader is also being provided).

Priorities of Features for V5.80

First Priority.

Complete the transfer of all features from the old 2D and 3D Display processes to the new Visualization process, and delete the older processes. [This activity is underway as a continuing process.]

Extend the new Visualization process to provide fly-bys (any position above terrain), drive-throughs (a track on the terrain), sail-throughs (restricted to a plane), and other modes. Provide new tools to be used to design the path of motion in 2D and 3D to control the 3D view. Add interactive control of the movement for a 3D view from mouse or joystick.

Allow map layouts to be moved into Adobe Illustrator using its special EPS format (Illustrator Encapsulated PostScript). Output to the generic EPS format will also be provided. Transferring the layout into Illustrator on the Mac or Windows PCs allows the addition of fancier map elements. This capability will be provided under the **P8** printing option similar to the output to TIFF files. [This feature was nearly completed at the time of shipment of **V5.70**.]

Add the ability to create and use any **SML** script as a standard feature in **TNTview** at no additional cost. This adds a similar capability to customize **TNTview** as with Avenue (ArcView) or MapBasic (MapInfo). However, **SML** can expand to provide many more functions than either of these, since the **TNT** products already manage more integrated objects and datatypes (for example, rasters and TIN objects, all platforms, 1 to 128 bit rasters of many types, ...).

Add the ability, at no additional cost, to run compiled executable (*.exe) processes in **TNTview** which were created using the **TNTsdk** (software development kit) available for **TNTmips**. Remember also that an **SML** script can include and run an *.exe process created with **TNTsdk** or other independent C libraries.

Continue to add many new **SML** functions, especially those dealing with vectors.

Allow selection and execution of an **SML** script as a layer in any 2D or 3D view in any process. This will run the **SML** script to determine and recreate this display or view layer at the time of each redraw. Example use would be to plot real time GPS values as symbols on a view.

Provide a mechanism so that your **SML** script can be run from an icon which you add to the main tool bar in a process--such as the visualization or object editor process. In other words, you can customize these processes with your own icons and **SML** scripts.

Directly read live geopoints from GPS units via NMEA (National Marine Electronics Association) and Trimble GPS communication standards and also from saved geodata collected by GPS. Reposition the view based upon coordinates of the live geopoints or other coordinate inputs. Support GPS collection of geopoints to describe elements in the object editor process in a fashion paralleling that for X-Y digitizers. Allow **SML** scripts to read GPS inputs directly.

Add improved, easier, and expanded legend generation in both the screen and print layouts. For example, provide a hierarchical-type legend display window to **TNTmips**, and thus **TNTview**, providing similar functionality to that found in ArcView and MapInfo displays. [This activity is underway.]

During the past three months, a new method for describing complex element styles has been created. It uses a script to describe how each element type (for example, line) will appear when rendered on the screen or printed map. Think of it as something like PostScript. The new process also allows a query of the attached attributes to determine how a symbol style is to be constructed (for example, how a line changes along a path from segment to segment). A new rendering engine to read and display these designs has also been implemented.

During this quarter, this new approach will be integrated into existing processes to allow creation of many new styles which have been requested. For example, geologists need asymmetric line styles (strike and dip lines, characters and symbols in lines, depression contour lines, ...), and other disciplines have their own complex symbol requirements. These changes will be provided with new interactive style design tools, or you can

specify the style by creating a script to describe it. These tools will then be used by MicroImages' graphics specialists to revise and expand the current collection of point, line, and polygon styles. The mechanisms for managing the styles assigned to objects will also be improved and simplified. [Internal development of the prototype of this new style engine is complete, and a new interactive symbol/line style editor is being written now.]

We will continue to add more new features which you have requested into the automatic image classification processes. [This activity is underway.]

Provide a means whereby the Raster Extract and Mosaic processes can automatically cut a larger image into a defined subset of georeferenced quadrangles (for example, individual objects for the grid supplied). This will probably be accomplished using a vector object to determine the areas to be extracted, so irregular areas can also be automatically output (for example, farmer's fields).

The import from the SDTS (Spatial Data Transfer Standard) format will be implemented. [This activity is underway.]

Export to coverage and E00 formats. [Both of these activities are underway.]

The support for use of two-byte character sets for file names and all user interface components will be completed (for Japanese, Chinese, Korean, ...).

Modify the vector extraction process to use regions and the region generation tools.

Add support for the use of stereo SPOT images in the DEM/ortho process, and revise the restitution process (step D).

Provide interactive tools for combining saved regions or between the active and a saved region (for example AND, OR, XOR, ...). [This feature is finished.]

At least nine new Ptolemy Getting Started booklets will be prepared on such topics as:

- filtering images
- editing CAD data
- editing TIN geodata
- using **SML**
- raster analysis operations
- exporting geodata
- vector analysis operations
- sketching and measuring
- digitizing soil maps
- getting good color

The Getting Started booklets entitled Displaying Geospatial Data and Classifying Images will also be reissued to match the revised processes. This will increase the total number of Getting Started booklets and their sample geodata available to about 30. As usual, all these new booklets will be posted on microimages.com during the quarter in Adobe Acrobat PDF files as soon as they are available in draft format. Use your Internet access to download these new booklets and sample geodata, and view them on your system or print them in color.

Second Priority.

Allow cut, copy, and paste between objects of different types (for example vector to raster and raster to vector).

Sort tables on more than one field.

Allow regions to be created from raster objects using expressions.

Extend theme mapping to raster layers.

Allow queries on attributes attached to raster cell values to control how they are viewed (similar to currently using a query to control how a vector object is displayed).

Allow nodes in vector objects to have attribute tables attached.

Populate tables by copying fields from other tables. Example use would be to copy geocoordinate fields from one table and paste into another.

Add capability to save graphic views (histogram, X-Y plot, ...) as CAD objects so that they can be used as a component in a map layout.

Add capability to save tabular views so that they can be used as a component in a map layout.

Modify watershed process to trace ridge lines in vector elements.

Allow theme profiles (queries and display settings) to be saved and reused.

Support the inclusion of "hard edges" in TIN objects (in other words, fixed ridges, drainage, coast lines, ...), and modify the necessary processes to use them.

MIX (Microlimages' X Server)

Modifications.

Only minor transparent changes have been made in the Microlimages **MIX** servers in the past quarter to correct deficiencies detected in their network operations. No significant future changes are anticipated in this area.

Public Release.

Downloads of the **MIX** servers by non-clients from microimages.com have averaged approximately 1000 per week. A total of 20,000 direct downloads have been served. Together with the many mirror sites and inclusion on the CDs of other freeware groups (for example, on the CD of MACLIFE, the top selling Mac specific magazine in Japan), Microlimages estimates that 50,000 now have acquired one of these **MIX** servers.

Unfortunately, it is not apparent that a minimum of a thousand visits a week to microimages.com for access to **MIX** products, or the identification window which pops in when the server starts, significantly increases the interest of these visitors in the other **TNT** products, including access to a free **TNTlite**. It is not even apparent that anyone is using **MIX** to communicate with the workstation versions of ArcInfo or ERDAS.

Microlimages does get short questions daily by email on how to set up and use the **MIX** products. Software support responds to all these requests, often by referring them to the FAQ (Frequently Asked Questions) list being maintained on the site for this purpose. Also, there are frequent requests for new features in the **MIX** servers. These are answered to the effect that the product is free, and new features will be added only if needed by Microlimages' products and client base.

Microlimages also often gets frequent thanks for these free products. Examples of these reactions follow.

email on 1 April 1997 from Slovenia

*"I would just like to thank you for the version of X-windows emulator for Windows 95. This is really a true gift to the computer society who is not well enough to spend money for various software. The **MIX** server is great and very easy to use. Thank you very much once again."*

email on 26 March 1997 from anonymous

"I run NT and have a Linux box to do some assorted things. Being able to run X on my NT box is fantastic. Much appreciated."

email on 7 April 1997 from mbogner@latte.memphis.edu

"It does work! I am able to run the executables which come with the x11r6 binaries. Once I do: set DISPLAY=localhost:0.0, I can run xclock, oclock, etc. which reside on my hard disk. Please keep the server free. It's a great product."

email on 25 March 1997 from mathew@uq.edu.au

"I have used both eXodus and Max X, and I think that this is faster than both."

email on 23 June 1997 from augusto@FCGeorp.com

"I'm writing this letter to thank you for providing such a wonderful Xwindows environment. I was impressed at the fact that you offer it for free. Notwithstanding the fact that I understand it's something you actually use to make your product work within a network I want to express my sincere thanks and appreciation at the fact that you guys allow other people to use your interface for free. This kind of collaboration is the reason why we have such a wonderful worldwide phenomena as the internet. We are a high tech microwave and cellular base station amplifier design and manufacturing company (<http://www.fcgcorp.com>). If you guys ever need anything in the electronics design area don't hesitate to call us because we will help you out and return the favor with pleasure."

New Sample Geodata

NOTE: All the sample geodata sets on the CD are subject to correction, addition, and modification during the quarter as your feedback is received. Most geodata which you might have installed from your **V5.60** CDs have some kind of change. It is therefore important that all sample geodata sets, not just those which are new, be installed and replaced with each new quarterly release.

New sample geodata has been added to the **V5.70** CDs of the **TNT** products. Most of these geodata set directories contain the Project File(s) needed for completing the exercises in the new Getting Started tutorials shipped with **V5.70**. If you install all the sample Project Files from the CD to your hard drive, it will require 115 MB.

IMPORT Directory. This directory contains files in the various external formats imported as examples in the Getting Started tutorial booklet entitled Importing Geodata.

MAPLO Directory. This directory contains the Project Files used for the exercises in the Getting Started booklet entitled Laying Out Maps.

PINMAP Directory. This directory contains the Project Files used for the exercises in the Getting Started booklet entitled Pin Mapping.

Installation

Installed Sizes.

Loading a full installation of **TNTmips 5.7** processes onto your hard drive (exclusive of any other products, data sets, illustrations, Word files, ...) requires the following storage space in megabytes:

PC using W31	74 MB
PC using W95	93 MB
PC using NT (Intel)	93 MB
PC using LINUX (Intel)	71 MB
DEC using NT (Alpha)	99 MB
Mac using MacOS 7.6 (680xx)	74 MB
Power Mac using MacOS 7.6 and 8.0 (PPC)	84 MB
Hewlett Packard workstation using HPUX	101 MB
SGI workstation via IRIX	124 MB
Sun workstation via Solaris 1.x	89 MB
Sun workstation via Solaris 2.x	85 MB
IBM workstation via AIX 4.x (PPC)	112 MB
DEC workstation via UNIX=OSF/1 (Alpha)	141 MB

V5.70 of the HTML based on-line Reference Manual including illustrations requires 31 MB. Installing all sample geodata sets for **TNTlite** and **TNTmips** requires 115 MB.

Upgrading.

If you did not order an upgrade of your **TNT** professional product and wish to do so now, please contact MicrolImages by FAX, phone, or email to arrange to purchase your annual maintenance and obtain the use of **V5.70**. Upon receipt of your order and processing, MicrolImages will supply you with an authorization code by return FAX only. Entering this code when running the installation process allows you to complete the installation and immediately start to use **TNTmips 5.70** and the other **TNT** professional products.

If you do not have annual maintenance for **TNTmips**, you can purchase it to gain access to **V5.70** under the elective upgrade plan at the cost in the tables below. Please remember--new features have been added to **TNTmips** each quarter. Thus, the more quarters you are behind **V5.70**, the higher your upgrade cost will be. As usual, there is no additional charge for the upgrade of your special peripheral support features, **TNTlink**, or **TNTsdk** which you may have added to your basic **TNTmips** system.

Within the NAFTA point-of-use area (Canada, U.S., and Mexico) and with shipping by UPS ground: (+150/each means \$150 for each additional quarterly increment.)

<u>TNTmips Product Code</u>	<u>Price to upgrade from TNTmips:</u>					<u>V5.10</u>
	V5.60	V5.50	V5.40	V5.30	V5.20	and earlier
D30 to D60 (CDs)	\$250	450	600	750	900	+150/each
D80	\$375	675	900	1050	1200	+150/each
M50	\$250	450	600	750	900	+150/each
L50	\$250	450	600	750	900	+150/each
U100	\$450	800	1000	1200	1400	+200/each
U150	\$615	1100	1450	1700	1950	+250/each
U200	\$780	1400	1875	2175	2475	+300/each

For a point-of-use in all other nations with shipping by air express: (+150/each means \$150 for each additional quarterly increment.)

<u>TNTmips Product Code</u>	<u>Price to upgrade from TNTmips:</u>					<u>V5.10</u>
	V5.60	V5.50	V5.40	V5.30	V5.20	and earlier
D30 to D60 (CDs)	\$300	560	750	900	1050	+150/each
D80	\$425	800	1050	1200	1350	+150/each
M50	\$300	560	750	900	1050	+150/each
L50	\$300	560	750	900	1050	+150/each
U100	\$500	850	1050	1250	1450	+200/each
U150	\$665	1150	1500	1750	2000	+250/each
U200	\$830	1450	1925	2225	2525	+300/each

TNTview® 5.7

Features.

The following is a summary of the new features added to **V5.70** of the **TNT** products which are now available in **TNTview 5.7**. Detailed descriptions of these new features can be found in the appropriate section below on New TNT Features.

- The new Visualization process incorporating integrated 2D, 3D, and stereo functionality is being released in a preview form.
- Any field in the related attribute tables can now be selected to show as labels for a layer.
- A spatial DataTip (like a ToolTip in appearance) will pop in to the view area showing the selected attribute field value of the nearest vector element, raster cell, ... for the active layer.
- The graphical drawing tools now draw in the color and line width you select.
- The on-line reference manual is in HTML format for use in browsers.
- Microsoft Internet Explorer V3.02 (Windows) and V3.01 (Mac) is provided and installed as a browser.
- Each data layer in an AutoCAD DXF can be imported separately into CAD and vector objects in a Project File.
- Windows BMP, MRLC, NEXRAD (weather RADAR), ERS-1 SAR, EOSAT-1c, SPOTview, DOQ/COQ (USGS orthophoto quads), and RadarSat raster formats can now be imported.

Changes for V5.80.

TNTview 5.8 will provide the Spatial Manipulation Language (**SML**) process at no additional charge. This expanding geospatial analysis language will permit you to create powerful custom display and analysis functions for your private use, for public distribution, or for commercialization in partnership with the low cost **TNTview** product. **TNTview** is gradually being positioned as a product which is similar in price but superior in capability to MapInfo and ArcView. **TNTview** will also eventually be able to read and use their geodata sets directly.

MicroImages is now focused on adding more between-object functionality to the **SML** function library. It is also necessary to add procedures to create more complex user interface components. However, **SML** is already the only geospatial scripting language which can deal equally well with complex raster objects in close integration with vector, CAD, TIN, and database objects. It already provides the basis to build complex but effi-

cient geospatial applications that are essentially platform and map projection independent.

SML is an interpreted language, as are MapBasic and Avenue, but **SML** is progressively providing access in scripts to use more and more of the large complex functions from which the **TNT** products are built and which do not exist in MapInfo or ArcView. For example, the display function available in **SML** is compiled and efficient and provides many of the complex visualization procedures in **TNTmips**, such as projection independence. The Project File (RVC) read and write functions automatically manage the efficient buffering and storage of your raster, vector, CAD, TIN, and database objects. The viewshed, multilinear raster regression, principal components, linear raster combinations, vector combinations, raster and TIN conversion to vector contours, and other functions released in **V5.70** are further examples of efficient compiled functions which can be used for major tasks. These functions and new functions being extracted from **TNTmips** can be called with a single statement in **SML**, and when you use the powerful RVC access functions, are as efficient in operation as if used directly in **TNTmips**. Can these kinds of things be done with MapBasic or Avenue?

Upgrades.

Within the NAFTA point-of-use area (Canada, U.S., and Mexico) and with shipping by UPS ground: (+50/each means \$50 for each additional quarterly increment.)

<u>TNTview Product</u>	<u>Price to upgrade from TNTview:</u>					<u>V5.10</u>
	V5.60	V5.50	V5.40	V5.30	V5.20	and earlier
W31, W95, and NT	\$95	170	225	275	325	+50/each
Mac and PMac	\$95	170	225	275	325	+50/each
LINUX	\$95	170	225	275	325	+50/each
DEC/Alpha via NT	\$125	225	300	350	400	+50/each
UNIX single user	\$155	280	375	425	475	+50/each

For a point-of-use in all other nations with shipping by air express: (+50/each means \$50 for each additional quarterly increment.)

<u>TNTview Product</u>	<u>Price to upgrade from TNTview:</u>					<u>V5.10</u>
	V5.60	V5.50	V5.40	V5.30	V5.20	and earlier
W31, W95, and NT	\$115	205	270	320	370	+50/each
Mac and PMac	\$115	205	270	320	370	+50/each
LINUX	\$115	205	270	320	370	+50/each
DEC/Alpha via NT	\$150	270	360	410	460	+50/each
UNIX single user	\$185	335	450	500	550	+50/each

TNTatlas™ 5.7

Now Free.

TNTatlas is now FREE for use on each and every platform supported by the **TNT** products. In other words, **V5.70** of **TNTatlas** no longer checks for the hardware key and thus becomes, in effect, a free "runtime" product for your distribution of a Project File(s) containing HyperIndex links. The now free **TNTatlas** software can be used for making one CD at a time (via your CDR drive) or for a mass production run.

Remember that a **TNTatlas** requires only a single, common geodata set in a Project File(s) for direct use on any and all platforms with the appropriate version of the **TNTat-**

las software. Furthermore, **TNTatlas** supports identical viewing, measurement, and printing capabilities from that single set of geodata on every platform.

Sample CD.

A new sample **TNTatlas** CD entitled Maryland's Coastal Bays is enclosed. It has been developed jointly with the Maryland Department of Natural Resources (MDNR) with geodata from this and other Maryland state agencies. It is included with your **V5.70** shipment to illustrate the flexibility of **TNTatlas** to make a single CD which can be used on all Microsoft Windows, Mac and PMac, LINUX, and the other UNIX platforms. It also demonstrates how a single set of color printed instructions can be used with a **TNTatlas** CD regardless of which platform the CD is subsequently viewed on.

The color-infrared orthophoto, SPOT, property boundary, highway, and other geodata making up this sample atlas is a mere fraction of the almost 100 gigabytes of similar geodata in Project Files covering the entire area of Maryland. Good things, especially geodata, do not come cheap! This geodata for the whole state has been built up using **TNTmips** by the persevering GIS staff of the MDNR over the past 10 years. It now makes up the Maryland Environmental Resources and Land Information Network (MERLIN). (The merlin is the official state bird of Maryland and is pictured on the CD and the delivery card.) The preparation of the more than 1200 color-infrared orthoimages in MERLIN was not carried out in **TNTmips**. This major flying, control, and compiling effort was contracted out for several million dollars to a photogrammetric engineering firm who delivered these as Project Files (RVC format) over the past seven years.

All this Project File geodata is now available via MERLIN on-line on five NT-based file servers (each PC has 20 gigabytes of storage on RAID hard drives) on the MDNR's 100 gigabyte Intranet, which reaches almost all of its 3000 personnel. MERLIN is structured into **TNTatlas** form with over 5000 links. It is accessed and used across the department by the general staff using **TNTatlas** software on their personal desktop W95 or NT machines. There is also a large PC-based **TNTatlas** software server available on the network for those general staff who wish to use only the **MIX** server on their desktop PCs. Regular courses of three hours' duration are provided to MDNR's general staff on the operation of **TNTatlas** and MERLIN. As the last of the color-infrared orthophotos is being completed and added to the MERLIN system, it is beginning to be used at all functional levels within the MDNR. The contents of MERLIN are also available to the public for the cost of their reproduction in the various formats exported by **TNTmips**.

The structure and the layout of this sample **TNTatlas** were designed by the staff of the GIS program at MDNR using materials in their on-line MERLIN atlas. Starting with these completed Project Files in **TNTatlas** form, Microlimages' staff added the **TNTatlas** software for each platform, produced the CD reproduction masters, and contracted for the CD production. Microlimages also created the graphics for the CD imprint, transmittal card, and the color printed instructions. This CD and its transmittal and packaging materials are just an example of what you can now do on your own with the free **TNTatlas** publication software and your project materials.

TNTlite™ 5.7

General.

A total of 1500 copies of **TNTlite 5.6** kits were sold directly and via Dealers during the quarter, bringing the total **TNTlite** CD kits shipped to 8500. Currently, completed downloads of **TNTlite** from microimages.com range between 15 and 25 per week.

Getting Started Booklets.

The section below discusses the Getting Started tutorial booklets in detail. It suffices to say that all these booklets can be downloaded free as Acrobat PDF files for use with **TNTlite**. Those buying the physical kit version of **TNTlite** will find it includes printed versions of all the current booklets, and that the PDF files are on the **V5.70** CD.

Summary of New Features.

The following is a summary of the new features added to the **TNT** products to improve their usability in general and for **TNTlite 5.7** in particular. Detailed descriptions of these new features can be found in the appropriate section on **TNTmips**.

- Files in DXF format of AutoCAD can now be imported so that each layer becomes a separate Project File. This allows a **TNTlite** user to select only those kinds of features to import into each object. Using this CAD layer selection, combined with the existing CAD area extraction procedure, a lot more CAD materials fit into the size limits placed on CAD objects in **TNTlite**.
- A least 21 Getting Starting tutorial booklets will be shipping in the **TNTlite 5.70** kits.
- The additional sample data sets for these booklets are included on the **V5.70 TNT** product CDs. Additional **TNTlite** booklets will be added during the quarter as outlined below. Their sample data can be downloaded as it becomes available.

Macintosh

MacOS 8.0 arrived just as **V5.70** was shipping. Preliminary testing indicates that **TNTmips** will operate correctly under this latest version of the Apple operating system. As yet there is no evaluation by MicroImages of the benefits of using the **TNT** products in MacOS 8.0. Under 8.0, the **MI/X** server has a minor distraction in that it does not restore the background color in the large X window after an area is used (for example, a main menu is exposed). This is purely cosmetic and in no way hinders or interferes with the operation of **TNTmips**. A revised **MI/X** will subsequently resolve this.

Getting Started Booklets

Progress.

Introduction.

Nine new Getting Started booklets from Ptolemy are included with **V5.70** in black and white printed format. These tutorials now provide about 450 pages of colorfully illustrated materials to your desktop. This is approximately equal to a big book on Geospatial Analysis. The sample geodata used in each of these, and all other previous tutorials, is included on the **V5.70** CD. The color versions of these, and all previous tutorials, are on the CD in Adobe Acrobat PDF (Portable Document Format) files together with the Adobe Acrobat reader for your easy direct viewing or printing of them in full color.

A historic landmark is achieved with the concurrent release of a detailed Getting Started booklet to introduce you to the features and operation of the brand new Mosaic and the Database Management processes. A booklet is also provided concurrent with the new

features released in the 3D display process. Perhaps this can be counted as one of the many ways in which **TNTlite** has influenced and contributed to the professional users of the **TNT** products? All of you will benefit from this approach and material. Perhaps by now you have experienced the considerable additional value that can be derived from using the color versions of these booklets on screen or printed from your computer?

IMPORTANT: The booklet Getting Started: Displaying Geodata has been revised to match the features provided in the new but incomplete Spatial Data Display process. It has not been distributed in paper form with **V5.70**, as this process will not be complete until **V5.80**. However, the concurrent revised draft version of this booklet is available on the **V5.70** CD as a PDF file for viewing and printing with Acrobat.

Many other topics still remain which do not yet have a Getting Started tutorial booklet. These topics will also require focused efforts for the next six months or more. However, it is the long term goal that every new or significantly changed **TNT** process is released with a concurrent new or revised Getting Started booklet. It is possible that in some cases, revised Getting Started booklets will temporarily be provided only in Acrobat PDF files, as the second Displaying Geodata booklet on the **V5.70** CD only, which has been revised to match the preview of the new visualization process. It is the DISPL58 PDF file located in the GETSTART folder or file on the CD.

On-Line Viewing.

Many of you are already familiar with using the Acrobat Reader to view other electronic materials provided as PDF instruction files with other commercial software. Microlimages processes each Getting Started booklet through the Adobe Acrobat Builder process (for example comes with PageMaker) to produce a PDF file. Using the free Acrobat Reader appropriate to your platform provided by Microlimages, you can view and print each PDF file in full color, preserving its original complex layout.

You will find these Acrobat PDF files on the **V5.70** CD in a folder called GETSTART. You will also find your Reader in the Acrobat Reader folder or directory on the **V5.70** CD. **V5.80** of the **TNT** products will allow you to choose to install the Acrobat Reader and PDF files. But for **V5.70**, you will have to do this manually. Copy the Adobe Reader to any directory. Copy the individual Getting Started booklets (in other words, PDF files) to a suitable directory, or leave them on the CD for direct but slower use. Start your Adobe Reader, and open the appropriate PDF file to view the Getting Started booklet it provides. It is very useful to use the Adobe Reader concurrent with the operation of the corresponding **TNT** process. This will allow you to flip back and forth between stepping your way through the process with the test geodata while referencing the corresponding Getting Started tutorial. Your Reader also provides rudimentary editing capabilities so that you can cut and paste text out of these booklets into other products such as Word, PageMaker, and so on. What could be easier?

Color Prints.

One thing that might be even easier than the on-line viewing of Adobe PDF files is to print them on your color printer for review while learning the process and for quick future reference on your bookshelf. Your version of the Reader comes equipped to automatically detect your printer and use it to produce a good quality color booklet on your small format printer. The individual pages in each Getting Started booklet are designed to fit into a 5.5" by 8.5" printed format. When printed by your Reader, they will usually come

out to scale with the 5.5" by 8.5" area centered in the larger 8.5" by 11" or A4 paper area. Some Windows printer drivers produce the foregoing image size when the Print Quality print dialog option is set to High but automatically enlarge and center this image to fit the entire sheet when the Print Quality is set to Medium or Low. The attached sample color page was printed on the HP Color LaserJet 5M using the Medium print quality setting. It illustrates that this automatic enlargement provides good page sizing, and that a very good quality booklet is printed by the Reader. On a Mac or Pmac, if your printer does not automatically enlarge using the Reader (the text is small at 5.5" by 8.5"), then set the enlargement and repositioning of the margins in the system's Print Control dialog. Unfortunately, this level of control is not available via the Windows printer control and drivers.

Internet.

As soon as a professional writer at MicroImages completes a DRAFT copy of a new Getting Started booklet, they immediately put it into Acrobat PDF format. The Webmaster then immediately places it on microimages.com. This all takes a couple of days and goes on periodically over the quarter with upgraded and final versions substituted as they become available. All current Getting Started booklets are now there in this PDF format, which replaces their previous cumbersome postings in the GIF screenshots. New booklets will appear as they become available. Watch for new Getting Started booklets at this location.

Netscape and Microsoft Explorer both have plug-ins which enable them to access the Acrobat Reader and view these PDF files separately or while you are running **TNTmips**. Use your browser to view or print them over the Internet. You can also use the downloading feature provided at this same location on microimages.com by our Webmaster to transfer any PDF file(s) to your computer for local viewing and subsequent printing.

Status.

Previously Completed Booklets. [12 units already in your possession]

Announcing TNTlite	Surface Modeling
Displaying Geospatial Data	Georeferencing
Feature Mapping	Theme Mapping
Editing Vector Geodata	Image Classification
Editing Raster Geodata	Navigating
Importing Geodata	
Style Manual (the reference guide for creating uniform booklets)	

New V5.70 Booklets. [9 units shipping]

3D Perspective Visualization	Interactive Region Analysis
Pin Mapping	Acquiring Geodata
Managing Databases	Making DEMs and OrthoImages
Mosaicking Raster Geodata	Laying Out Maps
Building and Using Queries	

Partially Completed Booklets. [3 units--mid August availability]

Filtering Images	Editing CAD Geodata
Digitizing Soil Maps	

Scheduled for V5.80. [10 units + 1 updated]

Vector Analysis Operations	Spatial Manipulation	Language
Managing Geoattributes	Constructing HyperIndexes®	
Exporting Geodata	Sketching and Measuring	
Editing TIN Geodata	Changing Languages (localization)	
Getting Good Color	Raster Analysis Operations	
Displaying Geospatial Data (revised for new process)		

Remaining. [15 units]

Creating and Using Styles	Vectorizing Scans
Interpreting Airphotos	TNT Technical Characteristics
Using the Software Development Kit	Understanding Map Projections
Mapping Watersheds and Viewsheds	Warping and Resampling Geodata
Mosaicking	Using the Electronic Reference Manual
Scanning	Combining Rasters
Modeling Watersheds and Viewsheds	Hazard Modeling
COGO	

Future Plans.**Resources Available.**

The three Microlimages professional staff currently writing the Getting Started booklets (Dr. Merri Skrdla, Keith Ghormley, and Dr. Randy Smith) each have seven to eight years of full-time experience working with the **TNT** products. Like all the Microlimages professional staff, they are doing an excellent job at this task, but have other responsibilities at Microlimages. For example, in the process of writing these booklets, they are the first line in checking that the features in the processes are working. As a result, they can only produce between six and nine booklets per quarter.

However, as each quarter passes, they will have to spend more and more time updating the existing booklets for newly released changes in the processes covered. For example, during this quarter, time was spent in updating the already existing Getting Started Display Geospatial Data. As a result, the goal of completing the series becomes progressively harder to reach. Please consider the dates of availability presented in the above schedule as tentative and optimistic, as good things always seem to take longer than anticipated.

Current Priorities.

MicrolImages' management has decided to place the most emphasis each quarter on getting booklets out that correspond to new processes. Second priority will be getting booklets out on scheduled older topics where no booklet has ever been created. For the next couple of quarters, a low priority will be given to upgrading existing booklets until the more important missing booklets are available. Limited resources always mean priorities have to be established, and these will prevail for the next six months.

Professional people with in-depth experience in the **TNT** products coupled with computer, writing, and illustration talent cannot be created overnight. This of course means that some of the existing booklets are going to be out of date. Some of these differences will be minor interface differences with the current software. Others will be more significant. For example, the significant changes in the naming procedures for unsupervised classification are not covered in the Getting Started Image Classification published last quarter.

Keeping Up.

All Getting Started booklets are included in black and white printed format along with the CD in each **TNTlite** kit shipped. The current price of an individual kit is \$30, and at this time it will include 21 booklets. Additional printed Getting Started booklets will be added as they are completed during the quarter. Some time in the middle of the quarter, this will increase to 25 booklets and require that the price of printing and shipping the kit increases to \$35. New **TNTmips** professional products also contain all the published printed booklets and the associated geodata. Existing MicrolImages clients with active maintenance contracts get all new booklets published that quarter in their upgrade shipment. If you want additional printed copies of any one or all of the published booklets, please order a new **TNTlite** kit. You are also free to copy the published booklet, duplicate it via the PDF file, or request it in electronic format for duplication (for example, PageMaker format). MicrolImages has these booklets printed from print files at Kinko's Copy Centers on large Xerox Docutek printers (they automatically produce the whole booklet including printing, cover integration, stapling, folding, and trimming). These print files can also be provided for use on your nearest Xerox Docutek printer to automatically produce the identical black and white assembled booklets.

TNT Reference Manual

Installation.

The **TNT** Reference Manual has now been fully converted to HTML format for use with Internet Explorer or Netscape browsers. The previous View Manual process has now been deleted from **TNTmips**. When you now select Display/Reference Manual from the **TNTmips** menu, it will launch the Internet Explorer browser on the Windows-based platforms. During installation you will be provided with the option to install the Reference Manual and Internet Explorer for the Windows-based platforms. If you prefer Netscape and have it installed already, you can use it and launch it via the same **TNT** menu choice.

Microsoft has delayed delivery of Internet Explorer for UNIX platforms, so it is not on the **V5.70** CD. For the time being, on UNIX platforms this menu choice will default to launching Netscape which you will have to obtain, as Netscape does not allow its browser to be redistributed by others. If you use a different UNIX browser such as Mosaic, you can edit the TNTHOST.INI file to set a different UNIX browser command via

the "HTMLBrowser" field in the "[files]" section. (This field is used by **TNTmips** only on UNIX systems.)

Microsoft Internet Explorer is supplied for the Macintosh platforms on the CD but cannot yet be installed by the **TNT** products installer for the Macintosh. To install Internet Explorer, find the "Mac Internet Explorer 3.01" folder on the **TNT** products CD-ROM. Double click on the "IE 3.01 PPC Minimal Installer" icon if you have a PMac, or click on the "IE 3.01 68K Minimal Installer" icon if you have a 68xxx-based older Mac. Your browser cannot be launched from the **TNTmips** menu on the Mac at this time. You will want to install the HTML Reference Manual using the **TNT** products installer and then manually double click on the "index.htm" file inside the "Reference Manual (HTML)" folder inside your **TNTmips** product folder.

Features.

Providing the **TNTmips** Reference Manual in HTML format gives you a consistent, familiar, uniform user interface across all computing platforms within each browser family. This interface follows industry standards for viewing HTML documents. Browsers are generally freely available from their developers. Using other products for viewing and printing the documentation allows MicroImages to expend its efforts working on geospatial analysis tools for **TNTmips**. The following HTML features have been included in the structure of the **TNTmips** Reference Manual in HTML format.

Hyperlinks. Hyperlinks are special blocks of text that "jump" to another location in the Reference Manual when clicked on. This feature allows you to find out more about a topic. Hyperlinks are like an automatic index that saves you from having to look up terms and topics in a list.

Embedded Images. Text and full-color illustrations are inserted into the Reference Manual with a clean layout. Illustrations are no longer displayed in a separate window. Illustrations can be viewed and printed in full color.

Searching within pages. You can search for key words or phrases in each HTML file.

Page Viewing History. Your browser will retain a list of pages that have been previously viewed and let you navigate back to earlier topics of interest.

Connection to the World Wide Web (the Internet). When combined with your local Internet service provider and a modem, the browser used for the **TNTmips** Reference Manual is also a tool that can provide access to error fixes, beta product updates, and other information at www.microimages.com. The Reference Manual can be directly accessed at <http://www.microimages.com/refman/html>. At the present time, the Reference Manual is only being updated quarterly on [microimages.com](http://www.microimages.com) concurrently with the release of the **TNT** product CDs.

Contents.

The Reference Manual this quarter has 2692 single spaced pages and installs into 31 MB with the illustrations or into 6 MB without them. Last minute supplemental sections which do not occur in the on-line or Microsoft Word versions were created for new processes and features. These sections were completed for **V5.70** after the master CDs were created for the reproduction process. These 42 additional pages are included in supplemental, printed form as follows.

- Polygon Properties (4 pages)
- Voronoi Polygons (6 pages)

SML Language Reference (additions to printed version of Appendix 3 shipped with V5.50--32 pages)

New TNT Features

* Paragraphs or main sections preceded by this symbol "*" introduce significant new processes or features in existing processes released for the first time in **TNTmips 5.7**.

System Level Features.

Graphical Tools.

* **Color Drawing Lines.** The graphical drawing tools now draw directly in the color and line width you select. This improves the visibility of the tool against any background, including color image displays. The graphical tools include the line and polygons tools, the zoom box, slide view, and others. The tools still draw in the harder-to-see complement mode in special situations when whole lines are being moved and speed is important. For example, the complement method is used when you are moving a whole line(s) such as in the calipers, the +-----x line dragging, pulling-out a vertex, and so on. But, in these cases, the line is being moved rapidly over a background and twinkles so that it can be seen. When its rapid movement is stopped, it will be rendered in color.

Solid color drawing lines have been requested for years by many of you. Since the **TNT** products (and their **MIPS** predecessors) never required a special display board with a graphics overlay plane, this feature was difficult to implement. Now your **TNT** systems are fast enough so that this and other similar features can be implemented using a virtual (in other words software) graphics overlay plane.

To set the color and line width for the graphical drawing tools, use the main menu under "Setup/Preferences/Interface". The Object Editor has its own color and width settings located in its "Setup/Preferences/Color" section. If the graphical tool is too slow on your older computer, turn off these color effects, and use only the complement method to improve your performance.

Move Box Tool. The move box tool can now be positioned and sized by manual entry. This box is used in the object editor for CAD objects with respect to block insertions, copy, and move operations. It is also used in the "Paste" tool to accurately position the to-be-pasted object.

Regular Polygon. A new graphical tool has been added to create accurate regular polygons including triangles, hexagons, octagons, and any 'n' sided polygon up to 45 sides. It allows you to set the circumscribed or inscribed radii and a rotation, as well as its exact location. This tool is provided in the object editor for use in editing vector and CAD objects.

Histograms.

There is a new standard Histogram window. It has three data presentation modes: Bar, Outline, and Strip. The Bar mode portrays the histogram as a set of 3D-Bars, the Outline mode as a 2D graph, and the Strip mode as a 3D strip, color coded from green (low) to red (high) depending upon histogram counts. The new display also provides two optional modes: Cumulative and Logarithmic Scale. Grid option is provided to allow you to overlay vertical and horizontal grid reference lines and label them. You can pick the size of the font and add an optional box around the labels to increase their readability. A histogram can also be saved as a snapshot raster for use elsewhere. If you press and hold the left mouse button, a ToolTip will show you the actual count and value of the

histogram at the current cursor position. Pressing the right mouse button shows a ToolTip containing statistical information about the histogram data.

Pin Mapping.

Pin Mapping now allows control of label distance from the "pin". This is useful for symbols which are not centered over the pin.

Element Selection Dialog.

The ability to copy a table from another database object has been implemented via the "Make Table/Form" icon menu in the element row. It allows the selection of a database object even if it is a part of another raster, vector, CAD, or TIN object and brings up a list of tables to select. The table selected will then be copied to the current object's database where it can be used just like any other object.

Display/Spatial Data (new prototype process).

Background.

The Display/Spatial Data process you have used in the TNT products was created in **V4.00** of the TNT products and expanded and extended through **V5.70**. This four year old process is being recreated in a new process for visualizing and viewing 2D and 3D geospatial data. In **V5.70**, both the new integrated and the previous separate display 2D and 3D processes are installed and available. When **V5.80** is released, the older 2D and 3D display processes will be dropped. Please use the new process as much as possible, and provide feedback for its improvement.

General.

The preview of the new **V5.80** process retains many of the view control elements you are familiar with, but has been redesigned to have:

- more functionality using fewer windows,
- layer and other control windows simplified for beginners,
- layer controls, providing much more graphical control over views,
- dialog complexity reduced by extensive use of icons,
- open geo-locked 2D and 3D views in a single group,
- open multiple 3D views in a group with different viewpoints,
- control viewpoints in 3D views in a group via gadgets on 2D views, ...

The redesigned interface eliminates the separate views/groups/layers lists which were confusing to beginners. The new interface combines the layers and groups into a single "list" for each "layout". Each layout has its own layer controls via an Object Display Controls dialog. The interface uses many more icons and allows a group to be expanded and collapsed as needed. Please see the attached color plate entitled New Display Features: Group Controls for an introduction to the new Group Controls window used in this process. This uses (and replaces) many of the features found on the "Element Selection" dialog in the old 2D and 3D display process.

Integrated Views.

Concurrent 2D & 3D. It is now possible to open a separate "group" outside of a layout. This group allows simpler viewing of a set of spatial objects (rasters, vectors, ...). These groups can be either 2D or 3D. A 3D group can have more than one View window open so that perspective and overhead views are displayed at the same time. This allows multiple views of the same layout or group with independent control of the area viewed. You can have a single vertical 2D or overhead view and two different 3D views of the

same area from different directions and viewpoints. Each 3D view will then have its own set of viewpoint and position gadgetry.

Positioning Gadget. A new 3D positioning gadget has been created to allow wider control of the viewpoint position using the 2D or overhead view as a frame of reference. This gadget automatically appears on the 2D view when you create a 3D view. The gadget is illustrated in the attached color plate entitled 3D Perspective Display Groups. Using this gadget, the viewpoint for the 3D view can be set to either keep a specified point centered in the 3D view (for example, look at the same mountain from any direction) or keep the 3D viewer at a specific point (look in all directions from the same mountain top). If multiple 3D views are open, the position of the viewer for all viewpoints can be independently controlled (in other words, a separate positioning gadget will be provided on the 2D view for each 3D view).

Independent Layer Control. Layers and groups may be hidden independently for each view. Thus, your collection of 2D and 3D views in a 3D group can show quite different views of a common ground area. For example, build up a layer list containing two images with a common DEM. One image can be before a disaster (flood, earthquake, ...) and the other after. Add to this layer list the overlaying CAD and vector layers of the infrastructure (roads, power lines, buildings, ...). Open a 2D view to show the before disaster image and the overlays (toggle off the after disaster image's icon in the layer list). In the 3D view, show the after disaster image with the same overlays (toggle off only the before disaster image's icon in the layer list). Now as you move around the view control gadgets on the 2D view (before disaster), you will get the requested 3D view (after disaster). This 3D view will show the areas of possible infrastructure damage relative to the damage shown in the after disaster image. Of course you can toggle the 2D or 3D views between images. Or, if you have a big display screen or more than one screen, you can open a second 3D view to show before and after 3D images for comparison (in other words, one 2D and two 3D views).

Redraw. When you have multiple views open in situations like those outlined above, all views will be redrawn if they are affected by the changes made in any one view. For example, if you simply toggle a layer off for the 2D view, it would not be necessary to redraw the associated 3D view. However, if you delete a layer, all views in the group must and will be redrawn when an automatic or manual redraw is requested.

Color Reconciliation. If you are still using an 8-bit display board or display mode, its limited number of colors (less than 256) are shared among all your View windows. The automatic reconciliation of these limited colors for each view and between views has been improved to support the expanded use of multiple 2D and 3D views.

Fields as Labels.

Any field in the related attribute tables for a layer can now be selected to use as labels for that layer (labels are no longer restricted to the prepared label field). This feature has been requested by many clients and has been added to this new Display process and the older one as well. You may also use a query on multiple fields across related tables as the label field.

IMPORTANT: Choosing to label with a field does not confine the label value to a predetermined field. The field selected can use the results of a query or a computed field to model a value (such as a linear combination of fields). Use your imagination in setting up your labels for a layer.

DataTips.

Concept. Showing many labels in a view for a particular layer can be very cluttered and confusing. The icon ToolTip idea has thus been extended to show individual labels one at a time for the active layer in both Display processes. When this option is selected, a spatial 'DataTip' pops in (looks and behaves like a ToolTip) to show the value from a selected attribute field which can also be a computed field for the nearest element (raster cell, point, line, polygon, ...). It pops in when you pause your cursor long enough near that element in the active layer (you set the time delay). This spatial DataTip can be a totally different field from that used for the labels of the layer. In other words, a layer can be rendered with any field as its labels, and its spatial DataTip can use a totally different field.

The new prototype Display process provides a toggle button on the tab panel for each vector element type in the Object Display Control window to switch the DataTips option on and off. The DataTip... push button on this same panel is used to select the content of the DataTip as the field or computed field from the attribute tables attached to the object. The new Vector Object Display Control window and the use of the DataTips are illustrated for the new Display process in the attached color plate entitled Tabbed Panels and DataTips.

Selecting. An Object Display Control window is shown for each object type. It provides tabbed panels to set up the display characteristics of each graphical element type (points, lines, polygons, ...). See the color plate attached entitled Tabbed Panels and DataTips to illustrate these new features. For example, this plate shows the location of the toggle button which can be used to toggle the DataTip features on and off when the polygons in the particular vector object are part of the active layer. The DataTip... button on this same panel is used to select the content of the DataTip as the field or computed field from the attribute tables attached to the object.

IMPORTANT: DataTips are not confined to a predetermined field. They can show the results of a query or a computed field. For example, use a DataTip to display a modeled value (such as a linear combination of fields). Use your imagination in setting up your DataTips.

Example Use. The fields attached as related attributes to a USDA/NRCS (Natural Resource Conservation Service) soil map (for example in CB_Soils.RVC) can be used to solve the Universal Soil Loss Equation (USLE) to yield potential erosion. The soil loss modeled by the USLE is a linear combination of four soil map attribute values and a precipitation rate factor. Start with the soil polygon vector object in CB_Soils.RVC. Four soil attributes in the related tables for the soil polygons can be used to solve part of the USLE. Simply create a computed field which is a linear combination with scaling coefficients of four soil attributes in the related tables. This potential erosion computed field can be selected as the DataTips field for the polygons in this vector object. The coefficients of the modeled potential erosion shown in the DataTips can then be easily changed by editing the equation for the computed field. This same computed field could be used to provide a potential erosion label for every polygon using the new label field procedures outlined above.

The next step in this kind of dynamic, interactive-based GIS model would be to include the fifth precipitation rate variable to predict soil loss for use as labels or viewing via a DataTip. But, this would require a raster map of the spatial variation in precipitation rate or an actual map of precipitation rate. If the soil polygon vector object was converted to a raster object, exactly the same potential erosion computed field can be evaluated for each soil type cell. A computed field accessing both raster objects could implement the entire USLE. Currently this is not possible, as a computed field cannot yet use fields from more than one object even if they are coincident in cell size, extent, and so on. Thus, the full USLE can only be solved by computing new combined objects, which reduces flexibility in evaluating changes in the USLE (in other words, in evaluating changes in the USLE's coefficients). Please also note that a more complicated Revised Universal Soil Loss Equation (RUSLE) is now used by the NRCS.

[see A Geographic Information System (GIS) Approach for Modeling a Soil Erosion Map from Available Data. Young-Ky Yang and Lee D. Miller. *Journal of the Korean Society of Remote Sensing*. 1986. Vol. 2, No.1, pp 23 to 33. (Dr. Y-K Yang was a Ph.D. student of Lee D. Miller)]

Status Bars.

The status bar now shows the progress of the redraw of each layer in each View window and has been moved into the lower right corner to make more room for other information in this data bar. Several views in a group may need to be updated by your single action such as deleting a layer. Watch this status bar to see which layer in which view is currently being reconstructed.

Missing Features.

The following major features are missing from the preview version of the new Display process: printing, legend creation, HyperIndex Linker and playback, CAD overlay in 3D, **TNTview** setup preferences, the integration of the separate stereoscopic viewing process, and the positioning tools in the Locator window. Printing is being actively worked on now and is nearly done and will be automatically available in any revised versions from software support. The procedures for designing your legends are being improved and expanded and will not be available in this process until **V5.80**. Other missing features noted here and identified by you will be added as this quarter progresses and will be available through the Tuesday and Thursday posting of all of **TNTmips** on microimages.com.

Modifications since **V5.70** CDs.

DataTips are available for use only with vector objects in this new Display process. Since the CDs were prepared, this feature has been extended to show DataTips for all primary objects (in other words, rasters = cell values, CAD, and TIN).

Display/Spatial Data (older familiar process).

Fields as Labels.

Any field in the related attribute tables for a vector object can now be selected to use as labels for that layer (labels are no longer restricted to the prepared label field). This feature has been requested by many clients and has been added to the familiar Display process and the new one as well. You may also use a query on multiple fields across related tables as the label field.

DataTips.

Showing many labels in a view for a particular layer can be very cluttered and confusing. The icon ToolTip idea has thus been extended to show individual labels one at a time as DataTips for the active layer in the Display processes. It can be used for vector, raster, CAD, or TIN objects. Select the database table and field to be viewed as the DataTip and which graphical elements have ToolTips under "Layer/Setup ToolTip...". When this option is selected, a spatial 'DataTip' pops in (looks and behaves like a ToolTip) to show the value from a selected attribute field which can also be a computed field for the nearest element (raster cell, point, line, polygon, ...). It pops in when you pause your cursor long enough near that element in the active layer (you set the time delay). This spatial DataTip can be a totally different field from that used for the labels of the layer. In other words, a layer can be rendered with any field as its labels and its spatial DataTip can use a totally different field.

Nautical Depths.

A new label style has been added to assist in labeling water depth on international nautical charts showing isolated point depths (for example, rocks). It provides several parameters to accurately position each isolated depth value on the chart relative to the actual sea position. The decimal portion of the depth is shown as subscript. The negative depth of a point exposed at low tide is shown with an underline and so on.

Import/Export.

* DXF Extraction During Import.

Each layer in a single AutoCAD DXF file can now be imported into separate vector or CAD objects in a Project File. This has been requested by several clients. It allows you to pick which layers of information to import from all those available in the source DXF file and place these layers into separate CAD objects. This is particularly useful if you plan to edit the CAD object (for example, update it over an image) and then convert it into a vector object for GIS analysis.

Importing from a DXF into separate CAD objects creates a number of small CAD objects instead of one large composite CAD object. This separation "by data theme" is particularly useful to **TNTlite** users, as each separate CAD object can be more easily kept below the size limits of **TNTlite** but contain more of a particular graphical data type (for example, roads, hydrology, building, or ...).

Windows BMP Import.

The standard format used by Microsoft Windows for images (BMP) can now be imported into a raster object in a Project File.

MRLC Import.

Multi-Resolution Land Characteristics (MRLC) LANDSAT format raster files (BSQ) can be imported into raster objects in a Project File. MRLC data contains multi-resolution land cover data of the conterminous United States from local to regional scales with 38m land cover characteristics database using LANDSAT Thematic Mapper (TM) data. The MRLC geodata is produced in a cooperative effort of six programs in four U.S. Government agencies: United States Environmental Protection Agency's Environmental Monitoring and Assessment Program and North American Landscape Characterization Program; United States Geological Survey's National Water Quality Assessment and Earth Resource Observation System Data Center Programs; Department of Interior National Biologic Service's Gap Analysis Program; and the National Oceanic and Atmospheric Administration's Coastal Change Analysis Program. Files selected for import have the file extension BSQ. Header Files with the DDA file extension, image files with the BSQ file extension, and a co-registered 16 bit DEM can also be selected for import in this MRLC import process.

NEXRAD Import.

NEXRAD weather radar scans can be imported into a raster object in a Project File. NEXRAD is the United States' National Weather Service's Next Generation Weather Radar Program. NEXRAD is distributed by the WSI Corporation as commissioned by the NEXRAD Information Dissemination Service Program. These images are also frequently downloaded via Internet.

ERS-1 SAR Import.

European Space Agency's ERS-1 satellite's synthetic aperture radar (ERS-1 SAR) images, including leader and image files, can be imported into a raster object in a Project File. ERS-1 SAR image files have the file extension .bsq. As part of the import, you select the projection used during the import process. The **TNT** Import process lets you select any portion of the ERS-1 SAR raster data for import by defining the range of lines and columns to be imported. The size selection option is especially useful for those creating project materials for use with **TNTlite**.

EOSAT-1c Import.

Earth Observation Satellite Company's EOSAT TM Fast and EOSAT TM TIPS formatted data can be imported into raster objects in Project Files. You can select the range of lines and columns to be imported from either EOSAT TM Fast or EOSAT TM TIPS formatted images.

SPOTview Import.

In addition to the SPOT Image format, you can import SPOTview images into raster objects in Project Files. SPOTview files are cartographic quality SPOT images. You are allowed to select the Header (.hdr), georeference (.rep), info (.rsc), and image (.bil) files for importing.

RadarSat Import.

RadarSat's CEOS radar image and leader file can be imported into raster objects in Project Files. Earth Observation Satellite products developed in Canada to monitor environmental change and support resource sustainability are created by the Canadian Space Agency and use this Commission on Earth Observation Satellites (CEOS) standard for formatting their Synthetic Aperture Radar (SAR) images collected via C-band with a swath from 35 to 500 Km with a resolution from 10 to 100 meters.

DOQ/COQ Import and Export.

Digital Ortho Quad uncompressed (DOQ) or Compressed Ortho Quad (COQ) orthophotos from the United States Geological Survey can be imported into a raster object in a Project File. Correspondingly, raster objects can be exported into the DOQ or COQ format.

Object Editor.

General.

The object edit process has been enhanced to add new features off the list built up from your requests as follows:

- cut, copy, and paste between vector objects via clipboard;
- copy all or part of an attribute table and paste in vector object via clipboard;
- spline, thin, and auto label generation have a preview mode;
- right mouse button pops in customizable list of edit functions;
- prompts for attribute changes for edits of vector and CAD elements;
- default records can now be set for vector and CAD elements;
- “connect the dots” into lines or polygons from imported GPS points;
- elastic, equal-sided polygon tool for up to 45 sides;
- island topology maintained “on the fly” in vector objects;
- nodes in TIN object can be moved;
- improvements in WYSIWYG in raster editing; and more.

All Objects.

Color Drawing Lines. You can now set the graphical tool color and line width for all tools in the editor. This allows better visual perception of the tool, especially against a color reference raster. This feature has been requested for years, but the machine and display speed have been too slow to make this practical until now. This feature has been discussed in more detail above in the section entitled “Graphical Tools”.

More Previews. The Spline, Thin, and Auto Label Generation operations now support a preview mode. This permits you to determine if the final result is what you want before making the additions or changes permanent. The option to change the preview color and width is under “Setup/Preferences/Color”.

Right Button Menu. A new method has been added for quick selection and editing of vector, CAD, and TIN elements independent of the “Element Selection Dialog”. This method is invoked by placing the mouse cursor on the element and then pressing the right mouse button. The element is highlighted, and a menu pops up with a list of operations to perform on that element. If the goal is to select a node, which is hard to select due to the fact that the lines attached to the node will most of the time be closer, press the TAB key while the menu is viewable to cycle through the element types.

The capability to control which operations show up on the popup menu is located under “Setup/Right Mouse Button...”. This dialog will allow control of which operations are enabled and, if the operation requires it, the capability to set the parameters for the operation.

Certain operational parameters are not capable of being set unless an editable object exists and is the current object, for example, “Auto Label Generation”. If this type of operation is selected and invalid parameters are specified for the operation, a dialog is brought up to allow entry of correct parameters. Examples of operations which behave in this manner are the Auto Label and Attribute operations. The list of possible vector

operations includes Attribute, Auto Label, Delete, Edit, Reverse Line, Snap, Spline, Straighten, and Thin. The list of possible CAD operations includes Attribute, Break Line, Copy Element, Delete, Edit, Move Element, Place Back, Place Front, Reverse Line, Spline, Straighten, Style, and Thin. The list of possible TIN operations includes Delete and Edit.

Mac Right Buttons. On the Mac and PMac, the “right” mouse button is simulated by **MI/X** using a Command Key Sequence. The sequence can be just a key or a combination of a special key and a mouse click. This sequence can be set using “File/Preferences ...” from the **MI/X** menu. Here are the defaults:

left (Button 1):	the mouse button
middle (Button 2):	the option key plus the mouse button
right (Button 3):	the “Apple” or command key plus the mouse button

(#1, #2, #3 are the X names for these buttons. The X system is designed to support left handed people. For a left-hander, Button #1 is on the right and Button #3 is on the left. Under Windows products, the **TNT** products support the mechanisms provided for flipping the order.)

The “Apple” or Command Key plus mouse button sequence is very common in Mac and PMac graphics software. If a Mac or PMac has a mouse with two or three buttons, the extra buttons may be used directly.

Attribute Prompting. Prompting for adding attribute records is now operational in the editor for vector and CAD objects. Vector editing actions which will result in prompts for attributes include adding lines, points, and polygons; splitting lines and polygons; and joining polygons. CAD editing actions which will cause prompts include adding, splitting, and joining elements. The controls for setting up which attribute table to use in the prompt are under “Setup/Database Prompt...”. One attribute table can be selected for the prompt for each element type: vector polygon, line, point and CAD elements. In defining the attribute table to set as the prompt table, you are allowed to copy a table from another object into this object.

Record Defaults. The ability to set a default record for use when adding elements has been implemented for CAD and vector objects. In the object toolbar in the “Attributes” group, press the element type for a list of operations on the attributes. Use the “Default Record...” operation to set the default record contents. The default attribute table used is the same as the attribute prompting table discussed above. For example, you can set up an attribute table prompt for the record to enter, and the initial record shown will be the default record.

GPS Editing. A “connect-the-dots” tool is now implemented for adding lines to vector or CAD objects. It is especially useful when GPS observations describing polygons are imported as individual points. The “dots” can be points in any reference or editable CAD or vector layers and reference database record pinmap layers or the current editable layer itself. The tool works by snapping the line vertices to the points in the reference layer. As with other **TNT** product operations, the georeferences of the two objects do not need to be the same.

DataTips. Spatial DataTips are now enabled for the object editor and are outlined in more detail above in the section on DataTips. Set up which database table and field to be viewed as the DataTip and which elements have tool tips under “Setup/Spatial Data Tips...”. When active, you can place the cursor over the element and wait for the speci-

fied delay interval to see the value of the selected attribute field for that element. Spatial DataTips can be enabled for raster, vector, CAD, TIN, and database pinmap layers.

Regions. You will now be asked if you want to save regions created in the object editor when leaving the editor. This save region feature is turned on by default. It can be disabled under "Setup/Preferences/Other".

Polygon Drawing Tool. The vector and CAD editors now provide an elastic drawing tool to create geometric polygons. It allows setting the number of segments to make pentagons, hexagons, octagons, and so on. The range of segments is from three to 45 segments. The manual entry section includes controls for the circumscribed and inscribed radii along with center point and rotation controls. On-screen rotation of the tool is achieved by placing the mouse cursor on the perimeter as you would to resize it. Press and hold the shift key, and press the left mouse button and drag.

Clipboards. The Cut, Copy, and Paste clipboard approach is now supported in the object editor for vector objects. The "Cut" tool allows a piece of the vector object to be placed into the clipboard and that area removed from the editable vector object. There are two methods to define the area to remove from the object. The first is a "User-Defined" method using the "Multiple Line/Polygon Tool" to define multiple areas to cut from. The second method is by using a region tool or region object. Either can be used to specify the bounds of the irregular areas to be cut from the vector object. The standard six spatial methods to further specify the area to cut from a vector are available: "Completely Inside", "Partially Inside", "Clip Inside" (default), "Completely Outside", "Partially Outside", and "Clip Outside".

The "Copy" tool acts much like the "Cut" tool except for three ways. First, the operation doesn't alter the source object. Second, the operation works on reference layers, since they are not altered. Third, you can select the whole object to be in the clipboard.

The "Paste" tool is active if something exists in the clipboard and the editor can paste into the current editable object. A position box is presented when the paste tool is activated. This box defaults to the correct georeference position of the clipboard object in the current object. The box can be moved, rotated, and resized, and a button exists to reset the box to the default position.

More Tips. A "Tip of the Day" dialog is now implemented for the object editor. This dialog informs you of hidden features or helpful suggestions on the editor.

TIN Objects.

Nodes in TIN objects can now be selected and their positions modified. The TIN topology is recalculated after you determine the new position.

Vector Objects.

Island Reconciliation. Editing vector objects now maintains polygon islands "on the fly". This allows correct calculation of polygon areas and boundary lengths, generation of regions based on selected polygons, and polygon display with respect to filling.

Conic Reconciliation. Adding conic elements (circle, arc, arc chord, arc wedge) to a vector object has been modified to generate the conic approximation with the area or the radius being equal to that of the conic. Conics are approximated using a regular polygon with a specified number of sides. The "circle" produced does not necessarily have the same area as a true circle would. Now, if area equalization is selected, it is achieved by adjusting the radius used to approximate the conic so that the area of the polygon generated is the same as the conic. If radius equalization is selected, it will be drawn to a vertex in the polygon, and the circle passes through all these vertices (in other words, the polygon area is smaller than the area of the enclosing circle). The number of vertices to generate the conic in either case can now be adjusted. The controls to adjust these parameters are in the Circle Tool dialog under the "Accuracy" pop-down panel.

Raster Objects.

Drawing tools are now working in WYSIWYG mode.

Modifications since V5.70 CDs.

Since the CDs were prepared, the region manager (and any process using it) has been modified to allow for region objects to be logically combined (AND, OR, XOR, ...). Regions can be interactively selected and combined and the new region immediately applied.

Export to the ArcInfo coverage file format is being actively worked on. Inquire about its status.

Regions.

V5.60 provided a tool for interactively defining a flooded region by selecting a DEM and drawing a dam or dams on it. The region was then defined as the area that would be flooded by that impoundment. In this fashion, dam sites could be quickly tested, the area of a landslide-induced flood located, obstructed channel flooding outlined, and so on. Subsequently, several requests were received for this region finding process to illustrate how the area and the volume of the water would accumulate in this proposed impoundment. This option has been added and shows a "stage curve" graph (a cumulative histogram) for the volume of the impounded water as a function of depth from the bottom to the top of the proposed dam(s). Another graph can be shown for the variation in the area of the impoundment as a function of depth from the bottom to the top of the proposed dam. The use of these options is illustrated in the new Getting Started booklet entitled Interactive Region Analysis.

* Automatic Classification.

Introduction.

Typically, those using unsupervised or cluster image classification procedures set up the process to produce a larger number of clusters (for example, 64, 256, or even more) than the number of classes desired (for example, 10 or 20). This synergistic approach uses the unsupervised process to reduce the millions or billions of possible clusters into a humanly understandable collection, often less than 256. These represent spectrally

and temporally similar features containing some significant portion of the area of the images or those which are very spectrally or temporally dissimilar. You then use your knowledge of the site, knowledge of the objective, and insight to identify the clusters or group of clusters together to assemble and name clusters as surface materials.

V5.70 contains powerful new graphical and statistical tools to assist you in using your knowledge and objectives to group clusters into meaningful surface materials and conditions. These include a new a Co-occurrence Analysis window, a Classification Dendrogram window, an Operations on Classes dialog, a View window to permit immediate evaluation of the groupings in map form, and a suite of interactive tools for iterative merging and unmerging of clusters. Please see the attached color plate entitled Class-Merging Tools Added to Automatic Raster Classification, which illustrates these new interface components and the additional features.

As noted elsewhere, the **V5.60** Getting Started booklet entitled Image Classification has not been reissued this quarter to reflect these changes, as additional features will be added to this process for **V5.80**. However, you will find that the on-line Reference Manual (new HTML format) is current with **V5.70** and contains instructions on how to access and employ these new tools.

Standard 2D View.

A standard 2D View window is presented containing the class raster and can be redrawn to reflect your current grouping of clusters.

You can use any colormap for displaying the class raster in the 2D View window. Choosing a different color map has no impact on how you will be grouping clusters, as the grouping is based upon the saved characteristics of the clustering process and not how you choose to color and view the cluster map. Using the Enhance/AutoColor Map menu selection in the process, you can view a 256 cluster map as a pseudo natural color or color-infrared image. This enables you to use your knowledge of the surface materials to guide you to selecting cells, clusters, and so on to group into clusters and then assign the groups to new colors which represent the surface materials sought. For example, in a wetland or a lake, you may have a floating area of active green biomass (chlorophyll) at the surface. In a 256 cluster map displayed in grayscale or arbitrary clusters, you will have difficulty identifying this from dead vegetation, sun glint, foam, and so on. However, if your 2D View window starts out showing pseudo color-infrared, you can use your knowledge to identify red blobs in lakes and ponds as floating or emergent green biomass and group and name them appropriately.

The color assigned to identify a new cluster can be any arbitrary color. As an option, it can also be a weighted mix of its component cluster's color. Following the procedure in the above paragraph, you will start out with a 256 class pseudo color or color-infrared cluster map in the 2D View Window. With the color weighting option selected, your new clusters (groupings of clusters) will take on the original color of the more populous component clusters. This is intuitive as well, as you proceed to group clusters, the new clusters are colored in an association with reality rather than in an arbitrary or psychedelic fashion. In the example above for green floating or emergent biomass, this cluster grouping will remain some sort of red or pink, water will remain black or blue, and so on.

Co-occurrence Analysis.

The Co-occurrence Analysis window (matrix) displays a spreadsheet-like view with two values for each cell: the frequency or normalized co-occurrence and the spectral sepa-

rability distance (or whatever the input image bands represent) between each pair of clusters. You may choose this separability in the clusters as any one of three different measurements (the Euclidean distance, transformed divergence, or Jeffries-Matusita distance) in both the Co-occurrence view and Dendrogram views.

Depending upon the separability measure you choose, the Co-occurrence window will use color graphics in the matrix to show you those first ten classes with the lowest separability and also the classes with the ten highest co-occurrence values. It will also position the window to display the highest co-occurrence positions in the matrix. Search functions will reposition the contents of the window to each successively higher separability among the first ten. Horizontal and vertical scroll bars are provided so that you can move to any place in this matrix. Each time one or more clusters are combined into a new cluster or group, the co-occurrences are all recomputed and a new table shown with a new group of top ten.

Classification Dendrogram.

The Classification Dendrogram window uses a tree or hierarchical diagram to show how the current group of clusters is related in the selected separability value. Clusters with low separability are grouped together with the tree structure indicating how they might be grouped. Using this diagram, you can select two or more clusters and request that they be grouped together as one new cluster.

Operations on Classes.

The Operations on Classes dialog provides a scrolling list of clusters identified by their number (see Modifications below for cluster naming and color options being added). It can be used to select two or more clusters for grouping into one. It also provides a means of selecting any color to assign to the new cluster; simply click on the color box to see the color selection dialog. As an option, you can select the Mix Color toggle button described above to mix the colors of the clusters being grouped together.

Interactive Tools.

The following tools and others are available to assist you to interactively select, group, and undo operations in all of these new windows and dialog boxes (where appropriate).

In all three windows and the list dialog box, you can use the left mouse button to either select/unselect or highlight/unhighlight one or more clusters for subsequent grouping into a new cluster.

Regardless of which window or list you use to select the cluster(s), all other windows and the list in the dialog box will update to mirror the same selections.

You can merge the clusters selected above (for example, by left mouse button) in the Co-occurrence, Dendrogram, and 2D View window by pressing the right mouse button. In the list dialog, push the Merge button. All windows and the list dialog will upgrade to show these new clusters and associated parameters.

A toggle option is provided in the list dialog to renumber all clusters after a group has been merged.

The last merge operation can be undone, and all three windows and the list dialog will be updated. You can undo one step at a time as far back as the beginning of your session. This is an important feature as you explore forward and backward in how you can best assemble your clusters one step at a time into the best map for your application.

The class characteristics are shown (color, name, cell count, or percentage) in the Co-occurrence window and Classification Dendrogram windows (see Modifications below for color of clusters in the list dialog).

Modifications since V5.70 CDs.

Since the CDs were prepared, the cluster grouping operation has been modified to allow for more interaction in the naming process. The merge list shows the class number, a color sample, and a text string name for each current cluster. You can change the color by clicking on the color sample, and the text can be edited as well.

The separation of the cluster grouping operation into a separate process is also underway. This will enable the unsupervised classification processes to produce the cluster and distance rasters as well as the statistics tables. The separate grouping process will use these. By separating the processes, the highly interactive grouping activity is not "in-line" at the end of the time-consuming cluster run. Thus, the grouping activity can be done at a later time and can be restarted if necessary.

Viewsheds.

Modifications were made to the viewshed process based upon the following technical papers provided by a client.

A Fast Solution to Local Viewshed Computation Using Grid-Based Elevation Models. Jianjun Wang, Gary J. Robinson, and Kevin White. *Photogrammetric Engineering and Remote Sensing*. October 1996. Vol. 61, No. 10, pp 1157-1164.

Extending the Application of Viewsheds in Landscape Planning. Peter F. Fisher. *Photogrammetric Engineering and Remote Sensing*. November 1996. Vol. 62, No. 11, pp 1297-1302.

Following the guidelines provided in these papers, the basic viewshed algorithm was modified to increase its accuracy and speed. You now can limit the horizontal and vertical fields-of-view of the process (for example, to approximate a camera or the view through a window). The maximum distance away from the viewer can also be specified.

Raster Databases.

* The utility of having a relational database attached to the cell values in a raster object is being gradually expanded. **V5.70** provides a means for the standard database queries of these attached tables to determine the actual value used for a cell in these raster processes:

- Linear Combinations
- Multilinear Regression
- Principal Components
- Decorrelation

By use of a query in these processes, the value returned by the query is used instead of the actual raster cell value. This allows many interesting raster-oriented GIS functions to be accomplished in a query.

Multilinear regression can be applied as a powerful GIS to locate important or predictive variables in layers of raster objects containing GIS and image variables in the cells (distance to the nearest road, distance to the nearest school, ..., multispectral images, multitemporal images, soil infiltration, cost surfaces, and so on). **TNTmips** does not even require that these raster objects have a common map projection or identical extent. Now you can evaluate a query on the attribute fields attached to these raster objects to extend the power of this modeling process. For example, a computed field or a query could be used to model the soil erosion using the USLE (Universal Soil Loss Equations) and the attributes attached to a soil polygon map stored in a raster object. A

query or a computed field then returns the erosion value to the multilinear model to determine the importance of that variable among others.

Examples of earlier large multilinear geomodeling studies using stepwise multilinear regression and other techniques can be found in the following references.

Spatial Land-Use Inventory, Modeling, and Projection/Denver Metropolitan Area, with Inputs from Existing Maps, Airphotos, and Landsat Imagery. Craig Tom, Lee D. Miller, and Jerrold W. Christenson. 1978. NASA Technical Memorandum 79710. NASA/Goddard Space Flight Center, Greenbelt, Maryland. 210 pages. [Dr. Craig Tom was a Ph.D. student of Lee D. Miller. Copies of this book are available from MicroImages at no charge.]

Analysis of the Dynamics of Shifting Cultivation in the Tropical Forests of Northern Thailand Using Landscape Modeling and Classification of Landsat Imagery. Lee D. Miller, Kaew Nualcahwee, and Craig Tom. 1978. NASA Technical Memorandum 79545. NASA/Goddard Space Flight Center, Greenbelt, Maryland. 20 pages. [Synopsis extracted from a large Ph.D. thesis on the same topic by Dr. Kaew Nualchawee. This NASA synopsis is available from MicroImages at no charge.]

Raster Properties.

Histograms are optionally computed for each polygon and saved in separate database tables (for rasters 8-bit and less). They are calculated as the number of cells for each raster value in a polygon and created as separate tables for these histogram values.

"Normalized factor" ($\text{MEAN}_{\text{polygon}}/\text{MEAN}_{\text{global}}$) is also computed now. It is calculated by dividing the global mean cell value of all the rasters by the mean cell value inside each polygon.

Surface Properties.

The actual surface area accuracy has been increased by splitting and interpolating for those portions of the raster cells which fall on the boundary of the polygons.

Vector Properties (Interpret/Vector/Polygon Properties...).

Points in Polygon.

Summary information about points in a vector object can now be mapped into the polygons which contain them. This option evaluates the selected points in the same or another vector object for the selected polygons (selections as usual by interaction, query, ...). A statistical summary record of the points in the polygon is inserted into a new related table in the related standard polygon property tables. This record contains a summary of the attribute field or computed field. It records the point count and the sum, minimum value, maximum value, variance, standard deviation, and coefficient of variance of the designated field or computed field in the bounding polygon.

A sample use of this feature can be provided in the first steps taken by many farmers into using precision agriculture. Yield monitors with GPS inputs are now optional on new harvesting equipment (grains, cotton, potatoes, ...). They typically create a map of a large field with 10,000 irregularly placed yield points at accurate field positions. One of the first analysis steps which occurs to the new precision farmer or his agricultural consultant is to examine this yield as a function of the soil, management treatment, or other polygons mapped for the field. This processes this information easily from a vector object of the yield points and a vector object of the polygons.

Polygons in Polygons.

Another means of looking at the spatial relationship of two sets of overlapping polygons is available. This feature compares the selected polygons in the overlaying or source vector object to the selected polygons in the target vector object. For each polygon in

the overlay which overlaps a destination or target polygon, it attaches a record to the target polygon in a properties table which contains the area of its overlap, the percentage of its original area which overlaps, and the value in a selected attribute field.

A sample use of this in precision farming would be to overlay a soil polygon vector object onto a sample grid vector object. The sample grid vector object would have a new properties table containing a record for each soil polygon overlapping the grid cell. This record contains the percentage of the grid cell that is in that soil polygon, the area of the grid cell in that soil polygon, and the soil type. Next, if desired, you could link to all the soil properties for each of these new records in order to evaluate average soil properties within each grid cell.

Mosaicking.

Introduction.

The mosaic process you have used in the **TNT** products was created in **DOS MIPS** and simply translated into **TNTmips** with some enhancements. This six year old process is being replaced by a new process for assembling your multiple images or maps into a raster object. For the **V5.70** quarter, both mosaic processes will be available for your use. When **V5.80** is released, the older mosaic process will be dropped. Any features which you were using in the old process and which are not in its replacement should be communicated immediately to software support.

A detailed Getting Started Mosaicking tutorial booklet is provided in printed form and on microimages.com in Acrobat form for concurrent color viewing or printing. Please print out this booklet in color, and go through its exercises with the sample images provided. A couple of hours spent in this fashion will familiarize you with all the new features in the new Mosaic process and how you can use them in your day-to-day projects. Since this material is available to describe this process to you in detail only, a summary of this major new process is being provided in this section. Please consult the attached color plate entitled Mosaic Process for a visual introduction to this new process.

Summary of New Features.

Some of the advanced features available only in the new mosaic process are:

- a concurrent Getting Started tutorial booklet;
- combine images of different projections, data types, and scales;
- RGB and grayscale images can be mosaicked;
- use vector, CAD, and TIN reference layers (for example, to limit output extents);
- no need to warp first;
- input rasters and output mosaic rasters can be compressed (for example, JPEG);
- improved contrast matching, no overlap required;
- define a polygon area with islands to define area to use from each image;
- draw irregular boundary for each mosaic seam;
- review the area of overlap of two images using pseudo transparency;
- new feathering methods for hiding raster seams;
- save a layout of a mosaic so all its assembly parameters can be altered;
- use a layout to integrate new images into an existing mosaic, and more.

Operational Notes.

Contrast Matching. Your satisfaction in your final mosaic depends to a large extent on how well all the component images disappear as separate entities. The very first thing that identifies an image as a mosaic is mismatch in contrast in its components. The new

mosaic process provides improved histogram matching methods to eliminate the overall contrast differences in the component images. You can let the process determine how to match the component images, select one good image as a model to be matched by the others, or set up an independent reference contrast. Histogram smoothing is available as an option to smooth the reference image's histogram to improve contrast matching results.

When you have finished your mosaic, you may still see some contrast differences along selected edges. This can be due to lens contrast biasing such as vignetting, sun angle effects (for example bright and dark sides), sun glint (especially with water but not uncommon in agricultural fields and bare sandy areas), and others. If your mosaic contains these contrast artifacts, you should consider preprocessing your component images before mosaicking them. For example, the Trend Removal process can be used to adjust the internal contrast bias created by lens effects, sun angle effects, sun glint, and so on.

Georeferencing. The next thing you notice in a mosaic, upon closer inspection of the seams, is the mismatch in the edges. This can result from poor georeferencing of images with good internal geometry. Minimize the overall mispositioning of each component image by using careful georeferencing. Accurate georeferencing, including points in the interior of the component images, provides the control by which Mosaic can optionally improve the internal geometry and positioning of each component image.

Terrain Distortion. If you have good orthophotos with good georeferencing as image components, you will get little or no edge mismatch in this new Mosaic process. Edge distortion commonly occurs due to parallax in areas of topographic relief (for example, hills). If you have any kind of matching georeferenced DEM, then produce orthophotos or "close-to" orthophotos using the Restitution Step D in the DEM/ortho process before using the Mosaic Process.

Edge Distortion. Perhaps you can do nothing more to improve the internal geometry or "ortho" nature of your component images. In these circumstances, become familiar with the methods provided to help you hide or disguise the seams in your mosaic. Often the "cosmetic" results in the final mosaic are the most important component in a successful mosaic project.

Drawing tools are provided to define the location of each seam, so put them where they will not show. Seams can be defined to occur at the edges of fields, tree stands, and so on where a high contrast change across the boundary is not noticed. Where good edge contrast matching is achieved, seams can be placed across the middle of fields where spatial distortions in features will not be noticed, such as duplicate parallel roads or duplicate field edges.

Feathering. Feathering can also be used to hide "in field" seams in uniform areas where there are no spatial details to focus the eye upon edge distortions. Several types of feathering methods are provided to hide your seams. For example, use adaptive feathering (called the Deviation Filter) if some of your seams are drawn along edges of features with high contrast changes while others go across fields with relatively uniform contrast. This feathering option will automatically adjust to give maximum hiding value under either of these conditions. It checks the two corresponding cells in the area of overlap. If they are approximately the same in magnitude (within a tolerance setting), the selected feathering method (for example, averaging the two values) is used in the mosaic for this cell. In areas of uniform low contrast variation such as the middle of a

field or other uniform features, this blends the seam into these tones. However, if the two values vary more than the tolerance, the last of the two values is used, representing the top image of the two. This preserves the lines of abrupt contrast change and will minimize the chance of a second "ghost" contrast boundary showing through in the overlap areas of the mosaic.

Expected Results. All in all, if you work at it, a very satisfactory result can be obtained from simple 35 mm photographs or high resolution digital camera images (for example, Kodak) of sections or square kilometer units if adequate georeferencing is available. For example, accurate georeferencing of 35 mm photographs can be accomplished using existing, older orthophotos or perhaps from approximately georeferenced and rectified satellite images of the general area. Please see the attached color plate entitled Mosaic Process for an example of this application. For testing purposes, MicroImages has also assembled several large natural color mosaics from 25 to 30 slides each using section centered 35 mm slides obtained in Kodak Photo CD format. With care, cheap color or color-infrared pseudo orthophotos can easily be assembled in this fashion for areas of low relief.

User Interface.

Your interaction and the process "philosophy" are simplified, so it's more intuitive and easier to understand. There is no more "anchor" and "target" terminology. The interface of the process has two windows: one is a Mosaic Control dialog, and the second is a standard view window.

The standard view window has two additional tools along with the standard display tools: "Processing Area" and "Output Area". "Processing Area" allows you to select the areas to be used from the currently selected image (active layer). This selected area shows up in transparent yellow color. The "Output Area" tool allows you to select a rectangular output area for mosaicking. Combining these two tools provides a way to use only those areas from the input images that are suitable for inclusion in your mosaic. For example, a cloud or cloud shadow which occurs in the area of overlap on one image, but not on the overlap image from a parallel flight path, can be cut out of the mosaic in advance.

Options.

Four tab-panels are provided to summarize various control options without the use of even larger dialogs. These tabbed panels are used to specify the conditions for your "Input", "Output", "Parameters", and "Enhancement".

Input. This panel contains a list of input objects that are currently selected for displaying and mosaicking. There are two types of input objects: "Mosaic" and "Reference". If objects can be mosaicked (if type of object matches "Application Mode" selection), it will automatically be labeled as "Mosaic" upon initial selections. You can turn on and off any raster that is in "Reference"/"Mosaic" mode.

IMPORTANT: Consider using a georeferenced color scan of a topographic map as a raster for the reference layer. It will provide a check on the distortion and positioning of component images. It can also be used to aid in defining the desired extents of the final mosaic.

All objects that are marked as "Reference" will be displayed in the view window and used for calculation of geographic extents but can't be used in actual mosaicking. If "Application Mode" is "Raster", then objects of other data types can be brought into the process as a "Reference" layer. All objects in the list have their names listed along with their "Mosaic"/"Reference" status and the name of the current map projection used for their display, so you can always see this important information. This panel also has an icon toolbar for accessing common operations performed on individual images or layers: "Add", "Remove", "To Top", "To Bottom", "Raise", "Lower", "Clear All" (clear all selected areas for processing for all rasters), "Reference", "Clear Area" (clear selected processing area for selected raster), and "Layer Controls".

Output. This panel has controls for defining geographical extents of the output mosaic. You can select an output projection and output area from: "Total Extents", "Match First Layer" and "User-defined" (this selection accepts output area defined with the mouse in the view window). The panel also provides the controls for your selection of the output mosaic's cell size, raster data type, and compression options. "Output extents" prompts display geographical extents and the mosaic based on your selections in the current "Output Area" option. To select a reference raster as input to the Mosaic Process, move it to the bottom of the input object list, and choose the "Match First Layer" output area option.

Parameters. This panel provides those options that actually control the mosaicking process: "Warping Model" (Affine, Bilinear, Plane Projective, Polynomial Form Order 2 to 6, and Piecewise Affine), "Resampling Method" (Cubic Convolution, Bilinear Interpolation, and Nearest Neighbor), "Overlapping Method" (Random Feathering, Chessboard Feathering, Last Raster, Average, Maximum, Minimum). The panel also contains "Display Options" that control appearance of the objects in the View window: "Show Object Extents", "Show Object Labels", "Scanline Transparency", "Autonormalize Contrast", and "Wireframe Display Mode".

Each object can be optionally shown with an outline box and its name in order to help you to understand the geometry of complex object layouts. "Scanline Transparency" allows actually seeing one raster object through another in areas of overlap. With this option selected, if you click on the raster in the "Input" list, this object is immediately selected and redrawn on top of all other objects in the View window. They show as just

odd or even lines, so all other objects will show through on the alternate lines. The "Autonormalize Contrast" option automatically sets normalized contrast tables for displaying all input grayscale rasters (to save time). The "Wireframe Display Mode" turns off drawing content of objects so just object outlines (extent boxes) will be displayed.

Enhancement. This panel contains controls for doing "Contrast Matching" and viewing/selecting histograms for the selected rasters. Four matching methods are available: "None", "Equalize", "Normalize", and "Reference Raster". "Equalize" and "Normalize" produce an output mosaic with equalized or normalized histograms. These two methods work well on grayscale images but are generally not useful for RGB images. The "Enhancement" panel also provides a standard histogram display window (see earlier section for details). You can select a source image from the option menu at the bottom of the histogram window and view and analyze its histogram. The "Smooth Histogram" option allows you to smooth the shape of the reference histogram (when doing contrast matching by "Reference") to improve the quality of the histogram matching process.

Surface Modeling.

The Contouring process now has a new "Create Elevation Range Table" option when creating a vector object. It superimposes an object boundary set equal to the maximum extents of the output vector object to the output contours, so all contour lines will form closed polygons in the object. The option also attaches a database record to each contour enclosed polygon that has MinZ, MaxZ, and Weighted Average parameters. The vector object created using this option can be displayed by theme, using Weighted Average field, for example, that gives a nice colorful surface display.

DEM/ortho.

There are no significant externally visible changes in this process in **V5.70**. Internally, the stereoscopic modeling process producing the DEM has been incrementally improved by small changes and altered warning messages.

It is possible that your stereo images are so poor that you cannot get good tie-points. You will no longer be stopped from continuing. Now, you will get warning messages about tie-points with high residuals and can either continue processing or return back and adjust your tie-point positions.

Autotrace.

The Autotrace process now has an interactive preview function to assist in selection of the parameters controlling the vector filters it applies. You simply set the filter parameters (via sliders or values), and the preview window shows what the impact of applying these vector filters will be for a sample area of the input raster. This makes it much easier to find the best settings for each vector filter without having to run the whole process over and over. Your settings for these filters and other parameters can now also be saved for reuse in converting other raster objects in the Autotrace process.

*** Databases.**

Introduction.

A completely new process is available to assist you in the management and editing of your relational databases. It collects features already available for such operations which were scattered in various hard to find places in other **TNT** processes. These editing functions have been redesigned, new ones added, and all combined with graphical

tools to view and manage your chains of related tables making up your database. With these tools, a database can be set up for use as a primary object (pin mapping, contouring, ...) or for subsequent linking up and management as attributes for other primary objects (raster, vector, ...). The process can be used to manage relational databases which are not attributes and to link up tables as attributes. A summary of the many new and revised features follows:

- graphic 'tree-like' display of tables and links in database;
- graphically edit relational links between tables (add or delete);
- automatic comparison of tables to locate potential key fields;
- right mouse button pops in a list of edit functions;
- histogram can be shown for any field in a table (like the X-Y plot);
- more intuitive graphical linking of tables to attributes of elements; and ...

A detailed Getting Started booklet entitled Managing Databases is provided in printed form but did not make it onto the **V5.70** CD. It can be downloaded from microimages.com as a PDF file for use in your Acrobat Reader. Please print out this booklet in color, and go through its exercises with the sample database objects provided. A couple of hours spent in this fashion will familiarize you with all the new features in this new Database Management process and how you can use them in your day-to-day projects. Since this material is available to describe this process to you in detail, only a summary of this major new process is being provided in this section. Please consult the attached color plate entitled Database Editor for a visual introduction to this new process.

This new Database Management process is available from the main menu from "Prepare/Edit Database...". This prompts you to directly select either a main-level database object or an object that has database subobjects (such as a vector). It will open a window that shows as graphical boxes with names how all the tables are related to each other in a relational tree diagram. There are Move, Relate, and Unrelate icon buttons in this window to control what happens when you click the left mouse button.

The actual editing and alteration functions applied to individual tables in the database remain essentially unchanged from **V5.60**. But the management and editing of the overall database structure is significantly changed and simplified in this new Database Management process. It is the easy and logical approach used to get to these tools which has been drastically altered in **V5.70**.

Selecting a Graphical Edit Mode.

Move Icon. This button selects a mode which lets you move the box representing the table around in the window with the mouse.

Relate Icon. Use this button for the mode which lets you establish a relationship between two tables by dragging an arrow from one box (table) to another box (table). Once you have connected the two boxes with the line, you will be prompted to select the fields in each table that are to tie the two tables together. If you drag an arrow from the "Internal" table for elements (points, lines, polygons, ...) to a table that has records related to the elements through some other table, you are given the option of directly attaching those records to the elements.

Unrelate Icon. This mode lets you break relational links between tables by clicking on them. If you try to break the prime link between a table and the graphical elements, you will be warned that this will break all attachments to attributes.

IMPORTANT: Do not break the links between the internal table for your graphical elements and its attribute tables without understanding how you plan to rebuild them. Remember, establishing that link, possibly one-by-one in the object editor, might have been a tedious task. You will be warned if you attempt to do this.

Editing Databases.

Clicking the right mouse button on a table icon (box) in the relational tree pops in a right button menu that lets you choose to:

- open the table for editing,
- change the name and description of that table,
- edit the structure and contents of the table (add fields, delete fields, ...), and
- delete the table.

Clicking the right mouse button on a relational link arrow in the relational tree pops in a right button menu that lets you choose to:

- break the existing relationship between the tables or
- show the fields used for the relationship between the tables.

Clicking the right mouse button anywhere else in the relational tree pops in a right button menu that lets you choose to:

- change the font used to display the table names on the boxes representing the tables or tree or
- change the background color used in the boxes in the relational tree.

New Joins.

Previously, only tables with identical fields with identical datatypes and widths could be joined into a single table. Database tables can now be joined using “compatible” fields. Compatible fields are fields that can be promoted to the larger of the two fields. For example, if one field is a string field and the other is a Unicode field, the string field will be promoted to a Unicode field. The same holds for numeric data such as word, long, float, and doubles. The tables will not be joined if the number of fields is different or if all fields are not identical in datatype and width and/or cannot be promoted (for example a Unicode field cannot be promoted to a double field).

Histogram.

V5.60 allowed the display of two fields in an X-Y plot. Now a histogram plot can be shown for any single field in any table. In the Tabular View window, select the field to plot by clicking on its column heading. The Plot/Histogram option on the Field menu will then create the histogram of the selected field.

Future Plans.

Some possible improvements which might be made in this graphical means of editing database relationships are already known.

- Use an import wizard to provide a more intuitive method for importing one or more tables and specifying how they should relate to existing tables and elements.
- Add zoom in and out controls for the relational tree window. Currently the font chosen to display the table names in the boxes controls the size of the tree window.

- Group move would use a marquee or lasso to select and move a group of tables and their relationships.
- Save the current relational tree layout. It is generated automatically every time you open the relational tree window. If you move tables around for cosmetic purposes, it should remember this.

Plots of Fields.

The Profile window can now show axes with scales. The right vertical axis is labeled based on the data and units in the selected field or computed field. The left vertical axis is labeled between -1.0 and +1.0. This scale is used when working with an autocorrelation function. The X-Y Plot window has been improved to increase its redraw speed. You can also now save the contents of either window as a snapshot raster.

*** SML.**

General Changes.

Expansion of the Spatial Manipulation Language (**SML**) continues. **V5.60** provided changes to the underlying structure of **SML** to allow it to support more of the integrated geospatial functionality of **TNTmips** (for example, conversion between object types). **V5.70** provides some of the new functionality for use in your scripts. These new tool kits or groups of functions are now available:

- vector combinations
- raster analysis
- TIN operations
- matrix algebra
- object conversions
- viewshed

V5.70 will also install 26 new sample scripts on the Custom menu (along with those provided in earlier versions) to illustrate the use of these new functions.

As outlined in more detail above in the section on **TNTview**, MicroImages will make **SML** available at no additional cost as part of **TNTview 5.80**. This will allow **SML** scripts to be created with **TNTview** or **TNTmips** and then used by anyone with either **TNTview** or **TNTmips**. As a result, even more effort is being focused on the development of functions to expand the repertoire of **SML** for **V5.80**, especially in expanding the toolkits for vector, database, and graphical operations.

These **V5.70** and **V5.80** changes, coupled with the ability to choose **SML** scripts as a layer in the new visualization process, allow you to create powerful custom geospatial analysis processes. With **V5.80**, your scripts can be distributed free or for sale for use with powerful built-in features in the low cost **TNTview**. Remember that any **SML** script you create is cross-platform (there is only one set of sample scripts provided by MicroImages for all platforms!). If you need new functions for **SML**, you can create them in "C" or submit a written request containing their description and proposed use to MicroImages. Should you wish to distribute your current scripts for use by others, please post them on microimages.com using the tools provided for this purpose. Watch microimages.com for the new scripts and ideas being posted there by MicroImages and others.

Vector Combination Functions.

VectorAND (OperatorVector, SourceVector [, flags])

Returns output vector object that is the logical AND of the two input vectors.

VectorOR (OperatorVector, SourceVector [, flags])

Returns output vector object that is the logical OR of the two input vectors.

VectorReplace (OperatorVector, SourceVector [, flags])

Returns output vector object that is a replace between the two input vectors.

VectorSubtract (OperatorVector, SourceVector [, flags])

Returns output vector object that is subtract between the two input vectors.

VectorXOR (OperatorVector, SourceVector [, flags])

Returns output vector object that is the logical XOR of the two input vectors.

VectorExtract (OperatorVector, SourceVector, operation [, flags])

Returns output vector object that is extracted by the operator vector object applied to source vector object.

Matrix Functions.

AddMatrix (matrixOut, matrixLeft, matrixRight)

Adds two matrices -> (matrixOut = matrixLeft + matrixRight).

AddMatrixScaler (matrix, value)

Adds scaler to each element of a matrix.

CreateMatrix (numRows, numColumns)

Creates a matrix and returns a valid matrix handle for use by other **SML** functions that take matrices as input.

DestroyMatrix (matrixHandle)

Destroys a previously created matrix.

GetMatrixColSize (matrixHandle)

Returns the number of columns in a matrix.

GetMatrixItem (matrixHandle, row, column)

Returns value of matrix element.

GetMatrixRowSize (matrixHandle)

Returns the number of rows in a matrix.

InvertMatrix (matrixOut, matrixIn)

Inverts a matrix.

MultiplyMatrix (matrixOut, matrixLeft, matrixRight)

Multiplies two matrices -> (matrixOut = matrixLeft * matrixRight).

MultiplyMatrixScaler (matrix, value)

Multiplies each element of a matrix by a scaler.

SetMatrixItem (matrix, row, column, value)

Sets the element of a matrix to a value.

SubMatrix (matrixOut, matrixLeft, matrixRight)

Subtracts two matrices -> (matrixOut = matrixLeft - matrixRight).

TransposeMatrix (matrixOut, matrixIn)

Transposes rows and columns of a matrix.

Raster Analysis Functions.

PrincipalComponents (forwardMat, inverseMat, Ras1, Ras2 [, RasN, ...])

Computes principal components of set of raster objects.

MultiRegression (resultMat, Ras1, Ras2 [, RasN, ...])

Computes coefficients of multilinear regression equations on set of raster objects.

RasterLinearCombinations (transformMatrix, outRVCfileName\$, rasNamePrefix\$, rasDescPrefix\$, flags, InRaster1, InRaster2 [, InRasterN, ...])

Creates raster objects that are linear combinations of any number of input raster objects.

RasterToBinaryViewshed (InRaster, OutRaster, nPoints, xMatrix, yMatrix [, percent, height, zScale])

Creates binary viewshed from an elevation raster object.

Conversion Functions.

RasterToVectorContour (InRaster, zinterval [, zStart, zEnd, zScale, zOffset, sampleRate, resolution, filterSize, flags])

Converts elevation raster object to contour in a vector object.

RasterToTINiterative (InputRaster, zTolerance, maxNodes, zDelta, shortEdge, longEdge, flags)

Converts elevation raster object to contours in a TIN object.

TINToVectorContouring (InTIN, zInterval [, flags [, zStart, zEnd, zScale, zOffset]])

Converts TIN object to contours in a vector object.

TINToRaster (InTIN, OutRaster [, method [, flags]])

Converts TIN object to raster object.

Object Functions.

GetObjectFilename (objectNumber)

Returns the path qualified RVC file name that contains the Raster, Vector, TIN, or CAD object referred to by objectNumber.

GetObjectNumber(SMLObject)

Returns the object number for a Raster, Vector, TIN, or CAD object.

TIN Functions.

GetInputTIN (TINVar)

Allows standard dialog to select a TIN object for input.

GetOutputTIN (TINVar)

Allows standard dialog to select a TIN object for output.

New Sample Scripts.

Twenty-six additional sample scripts can be installed with **V5.70**. This brings the total shown under your custom menu to 32. Most of these new scripts demonstrate the use of the new **SML** functions provided in **V5.70**. However, others such as Viewshed.sml demonstrate how to extend **TNTmips'** GIS functionality.

More sample scripts are planned, so that it will be necessary in **V5.80** to have a hierarchical structure in this menu. Scripts will then be installed into categories such as utilities, image processing, GIS, and so on.

A sample script site has also been established on microimages.com where scripts can be posted for public use. A few interesting client-contributed **SML** scripts have already been posted there. More are needed, so please visit this site and contribute your favor-

ites. You can obtain these sample scripts for your use by using the downloading procedure provided there by the MicrolImages Webmaster. Once you have these scripts on your hard drive, simply place them in the Custom directory with your other **SML** scripts, and they will immediately show up on the **TNT** Custom menu for direct use.

The following new sample **SML** scripts can be installed to provide examples for you to examine to see how they were implemented. All of them will have to be installed. If you want only part of them, install them all, and then go to the Custom directory in your **TNTmips** directory and delete those **SML** scripts which you do not want. When they are deleted, they will automatically disappear from the Custom menu.

Raster GIS Sample Scripts.

viewshed.sml. Objective: *Uses the new RasterToBinaryViewshed () function to calculate a viewshed for all points on all lines of a corresponding vector object.* This script could be used to calculate the viewshed for all points on one or more roads. It demonstrates how the new matrix functions may be used to send any number of data points to an **SML** function. VIEWSHED.RVC contains a vector object, "Vroad", that contains vector lines which may be used in combination with the CB_TMELEVATION raster as input data to the script.

Vector Manipulation Sample Scripts.

vecextr.sml. Objective: *Demonstrate usage of the VectorExtract () functions.*

vecop.sml. Objective: *Demonstrate usage of the vector combination functions.* A sample use of VectorAND (), VectorOR (), VectorReplace (), VectorSubtract (), and VectorXOR ().

Image Classification Sample Scripts.

lincombo.sml. Objective: *Uses the new RasterLinearCombination () function to calculate a brightness raster object from red, green, and blue input raster objects.* The script uses two methods: a simple average of the RGB values and a weighted average based on the CIE luminance response (Y) of a standard observer relative to the luminous efficiency of given phosphor set.

princomp.sml. Objective: *Demonstrates use of the new PrincipalComponents () function to reduce dimensions of a set of raster objects.*

regress.sml. Objective: *Demonstrates use of the new MultiRegression () function to compute multilinear regression equations for a set of raster objects.*

Object Type Conversion Sample Scripts.

rtotin.sml. Objective: *Demonstrates use of RasterToTINIterative () to convert an elevation raster object into a TIN object.*

rtovec.sml. Objective: *Demonstrates use of RasterToVectorContour () to convert an elevation raster object into a vector object.*

tintor.sml. Objective: *Demonstrates use of TINToRaster () to convert a TIN object into a raster object.*

tintov.sml. Objective: *Demonstrates use of TINToVectorContour () to convert a TIN object into a vector contour object.*

TIN Sample Scripts.

gettin.sml. Objective: *Demonstrates usage of GetInputTIN () and GetOutputTIN () functions.*

Matrix Sample Scripts.

addmat.sml. Objective: *Demonstrates addition of matrices using AddMatrix ().*

addmatsc.sml. Objective: *Demonstrates adding a scalar value to a matrix using AddMatrixScaler ().*

creatmat.sml. Objective: *Demonstrates process of creating a matrix using CreateMatrix ().*

getmatit.sml. Objective: *Demonstrates how to retrieve a given row, column value from a matrix using GetMatrixItem ().*

invmat.sml. Objective: *Demonstrates calculating the inverse of a matrix using InvertMatrix ().*

killmat.sml. Objective: *Demonstrates destroying a previously created matrix using DestroyMatrix ().*

matcolsz.sml. Objective: *Demonstrates how to determine the number of columns in an existing matrix. This script uses GetMatrixColSize () in a procedure for printing a formatted listing of the values in a matrix to the console.*

matrowsz.sml. Objective: *Demonstrates how to determine the number of rows in an existing matrix. This script uses GetMatrixRowSize () in a procedure for printing a formatted listing of the values in a matrix to the console.*

multmat.sml. Objective: *Demonstrates multiplication of matrices using MultiplyMatrix ().*

multscal.sml. Objective: *Demonstrates multiplication on a matrix by a scaler using MultiplyMatrixScaler ().*

setmatit.sml. Objective: *Demonstrates how to set a given row, column value of a matrix using SetMatrixItem ().*

submat.sml. Objective: *Demonstrates subtraction of matrices using SubMatrix ().*

transmat.sml. Objective: *Demonstrates computing the transpose of an existing matrix using TransposeMatrix ().*

Exchanging Scripts.

You can access an **SML** “swap shop” repository from the “Free Stuff” selection or directly at <http://www.microimages.com/sml>. On the **SML** home page, you have a choice of submitting an **SML** script or browsing the repository for scripts that are currently available. There is also an “**SML** FAQ” which will be built up as time passes. You may browse through the directories containing scripts contributed by clients and scripts included on the **V5.60** and **V5.70** CDs. You can look at the contents of the scripts in your browser or use the “Save As” feature to download them to your hard drive.

You can submit **SML** scripts to MicroImages via FTP or via an HTML form. Submitting via the HTML form provided is limited because you can only enter 32 Kb of text in the fields where you type (or cut and paste) your script, description files, and so on. The FTP route has no size limits. But, using the HTML form is easier if you don't know how to use FTP.

The HTML submission pages have all the instructions you need to complete the forms and submit your script. The FTP page gives you instructions on how to upload scripts in the proper manner.

Supplement to Appendix.

A supplement to the **SML** function appendix distributed in printed form with **V5.50** is enclosed.

Printing.

The "Page Setup" dialog has gotten a facelift. It's now broken up into five tabbed panels as follows and should be easier to use.

Printer: select a printer driver and output device or file.

Size: select paper size, number of pages, map scale, ...

Color: set color balance (which can now be saved and loaded via "save..." and "load..." buttons), gamma correction, output test strips, ...

Dithering: choose the dither pattern to let Windows drivers do the dithering if a windows supported printer is selected, to create a print raster (in other words, a dithered raster),

...

Plotter: make color settings for pen plotters (disabled unless plotter mode selected).

The output size and page settings were confusing on the old dialog. Each setting was modified through a dialog evoked by a button. Despite the warning it gave, many clients would edit the paper size rather than the output size to get a smaller or larger output on large printers. The option to modify the paper size is provided mainly because for some of the **TNT** printer drivers, the actual printable area of the paper is unknown or gotten from inaccurate printer documentation. On the new dialog, the output size is right there on the Size tabbed panel, while modifying the paper size still requires you to press a button and warns you that you probably don't really want to do that.

If you want to use the old dialog, you can still activate it for **V5.70** only. To switch back to the old panel, edit your `tntproc.ini` file with any text editor, look for the "[PRINTERS]" section and add the line "UseOldSetupDialog = yes".

Microlimages Authorized Dealers

One new Dealer has been added during the past quarter.

Turkey--HAT Inc.

Microlimages is pleased to present HAT Geographical Information, Conversion, Management Systems and Trade Inc. as a new Microlimages Authorized Dealer. HAT is a newly formed company just incorporated in Ankara as the eighth corporation of the Bingol Union. The other companies in this Union deal in businesses related to forest products, tourism, insurance, textiles, and construction. With support from the Union, this new corporation will initially focus upon the introduction of integrated GIS and remote sensing concepts into Turkish municipalities and other local public and private authorities.

HAT has just been founded by several principals with academic backgrounds in urban and regional planning and computers. Before founding HAT, all were employed in Turkish companies which sold, installed, and used other products including ArcInfo, ArcView, Genasys, Microstation, AutoCAD, ErMapper, ERDAS, and Virtuozo. As a result, they begin this new venture with considerable experience in the concepts involved and the needs of the Turkish market. Microlimages is pleased that based upon their previous experience, HAT has selected the **TNT** products to market to its clients. Mr. Alpaslan Savaci, director, can be reached at voice (903)122-133231 and FAX (903)122-138993.

Training of Dealers.

Staff from the following MicroImages Authorized Dealers have had detailed training in the use of **TNTmips** and **TNTview** in the past quarter.

Egypt--FOCUS Integrated Systems s.a.e. (for their staff in Cairo)

Ecuador--aeromapa Cia. Ltda. (for their staff in Quito)

Greece--Dienekis Information Systems S.A. (for their staff in Athens)

Finland--Geological Survey of Finland (for Pentti Ruokokoski in Lincoln)

India--Physical Planning Consultants (India), Ltd. (for Dilip Kumar Paul in Lincoln)

Oregon--Atterbury Consultants, Inc. (for Jim Bender in Lincoln)

Colorado--Furst Light GeoTechnologies (for Tom Furst in Lincoln)

Printers

Epson.

Epson is shipping the Stylus Color 3000--a large format, high resolution, low cost color printer (about 17" by 44"). Initial prices are \$1,995 (see enclosed advertisement). It uses four separate individual color cartridges (CMYK) to print at 1440 by 720 dpi and includes Postscript. **TNTmips** requires optional printer support **P8** to use this printer via Postscript. To print via its Windows drivers up to 11" by 17" requires no optional printer support. To print via its Windows drivers at any size larger than 11" by 17" requires optional printer support **P15**.

Epson is shipping the Stylus Color 1520 which prints up to 11" by 17" at 1440 by 720 dpi. It uses a black cartridge and a 3-color combined cartridge (CMY). It provides a parallel port and Windows drivers and requires no **TNTmips** optional printer support. A Postscript interface is optional on this printer and would require **TNTmips'** optional printer support **P8**.

Encad.

Encad is shipping a new 24" wide roll-fed large format color printer at a low cost in the range of \$2,175 (see enclosed advertisement). It prints at 300 dpi and uses refillable-ink cartridges. It is not clear from the material available if this printer is shipped with Windows drivers. Postscript is available as an option for this printer which would use **TNTmips'** **P8** optional printer support. To print via its Windows drivers at any size greater than 11" by 17" requires optional printer support **P15**.

HP.

HP 1000 is a new 11" by 17" color printer of 600 dots-per-inch selling via discount sources at \$500 (retail \$600). It prints at six pages per minute in black and white and 3.5 pages per minute in color. The standard **TNTmips** (no optional printer support required) can print on this device via the Windows printer driver supplied with it by HP.

HP 2000 and 2500 are new top of the line, large format color printers of 600 dots-per-inch. The 2500 includes a two gigabyte hard drive to buffer images. These printers use large one liter containers for each ink. A second, new ink chemistry is also available which will not fade for a year in outdoor, sunny exposures. **TNTmips** requires optional printer support **P15** to use these printers via the Windows printer driver supplied by HP. The MicroImages printer driver for the HP 750 model will work with these new printers at 300 dpi. MicroImages has just received a model 2500 and is currently working on a 600 dpi version of the driver specifically for these printers. Check with software support on its status.

Computers

This quarter there were significant computer price decreases coupled with big performance gains. The Gateway 'best for your money' computer is now a 266 MHz MMX Pentium II at \$3000 (last quarter it was a 200 MHz). MicrolImages has purchased several of the Gateway G6-266 models recommended below. According to recent articles, there is only a fraction of 1% of all commercial software which directly uses the MMX extensions. However, even without direct support, the MMX features make for faster floating point and other operations. As a result, we find these machines to perform even faster than might be expected by their 266 MHz ratings. For example, the **TNTmips** menu and the 2D display processes load in five seconds, and a monochrome SPOT image displays in less than one second.

Gateway G6-266 (\$2779)

- Intel 266 MHz Pentium II
- 64 MB EDO DRAM
- 512 KB internal cache
- 6.4 GB 10 ms EIDE hard drive
- 17" CrystalScan700 color monitor (.28 dp)*
- 3D 64-bit PCI bus based display board with 4MB memory
- 12X min/24X max CD-ROM drive
- 3.5" diskette drive
- Mid-tower case
- keyboard and MS Intellimouse
- W95, MS Office 97 Small Business Edition(w/o Access)

*change Crystal Scan Monitor to a Vivitron monitor (.26 dp) for \$130

Web Site

The material on the MicrolImages Web site continues to rapidly expand as you and we learn how to use this communication tool. Just a few of the new features added or completed this quarter are as follows.

SML Script Exchange.

You can conveniently download or upload sample **SML** scripts for use by others.

MEMOs.

All the MicrolImages MEMOs back to **V4.00** are now available on the site in HTML form for review. These postings include the illustrations provided with the original MEMOs. New clients may wish to review the earlier MEMOs which highlighted each new feature as it was introduced.

Reference Manual.

The entire **V5.70 TNT** products reference manual has been converted to HTML and has been posted on the site for your use or for consultation of what **TNTmips** is all about. After each new quarterly upgrade of **TNTmips** is released (starting with **V5.70**), the earlier reference manuals will be maintained on line for your convenience and possible reference.

Getting Started.

All the available Getting Started booklets have been provided for your direct viewing via your Adobe Acrobat Reader on the site in PDF files. These booklets will no longer be posted on the site in any other format. The latest, the edited, and all new booklets will be posted at this position as this quarter progresses.

Biweekly Upgrades.

TNT processes for all platforms are modified daily and built (compiled overnight). Twice a week, on Tuesday and Thursday afternoons, the latest versions of all processes on all platforms are posted on the site for your immediate access. Improvements to assist you in finding and downloading these biweekly beta versions for your platform are continually being added based on your feedback.

Several quarters back, it became unnecessary to issue formal beta versions to a few **TNT** clients. Any client can test the beta of the next version of the software on a bi-weekly basis. Some of you do this to gain access to the new features, influence the direction of their modification, cure some problem, and so on. For efficiency, some of you download one or two processes at a time, as you have a good idea of which ones we are actively working on and which ones interest you the most.

It is common and prudent to download these biweekly beta versions of the whole system or particular processes into a separate directory from your latest working version of **TNTmips** (for example, create a **TNTbeta** directory). You can then try the new processes out before transferring them to your working version. Also be careful to make sure you have backup copies of any Project Files you use to test these latest biweekly versions before using them on irreplaceable geodata.

FAQ for **MIX**.

You will find a Frequently Asked Questions (FAQ) section maintained to answer questions from the users of the free **MIX** servers.

Reference Materials

Papers on Applications.

Rewarded.

The following papers were each rewarded \$2000.

Assessing Field Remediation Economics with Integrated Data Analysis. *Two companies team to develop a thematic imaging and spatial analysis technique for exploration and field purposes.* by Jim Walsh. *Earth Observation Magazine*, Volume 6, Number 4, April 1997. pp 16-19.

Fine Tuning Forestry Maps with Satellite Data. *A Portland, Oregon forest management company uses high resolution satellite imagery to manage its properties more effectively.* by Kevin P. Corbley. *Earth Observation Magazine*, Volume 5, Number 7, July 1997. pp 16-18.

Other Papers.

Flood Damage Assessment in the Pacific Northwest. *After recent widespread flooding in the Pacific Northwest, enhanced satellite imagery is offering a unique look at landslide damage.* by Ruth Carapella. *Earth Observation Magazine*, Volume 5, Number 5, May 1996. pp 17-20.

Staff Additions

Dr. Paul A. Carlson has joined MicrolImages as a software support specialist. Paul completed his B.S. degree in Recombinant Gene Technology at the State University of New York College at Fredonia in 1989. Paul next completed his Ph.D. degree in Biochemistry in 1996 at the State University of New York at Buffalo. His thesis topic was "Characterization of the Carboxyl Terminal Domain Fragment of the Repressor Protein of 434 Bacteriophage". Since that time, he has been a Postdoctoral Fellow in the chemistry department at the University of Nebraska at Lincoln investigating the biochemical aspects of the enzyme telomerase.

Clearly this move across town to the MicrolImages team is a career change for Paul, and he is not yet experienced in the application of geospatial analysis. However, he is experienced in the practical use of computers, teaching, writing, logical analysis, and scientific methods and is coming up to speed quickly on the **TNTmips** products and their potential applications. Some of you are already communicating with Paul about your needs for assistance.

Col. John C. Curran has joined MicrolImages as a software support specialist. John completed his B.A. degree at St. Bernard College in Alabama and his M.Ed. degree at Loyola University in Louisiana early in his career. In the early portion of his career, John taught school and eventually became a principal. Most recently, he has been teaching in a Community College in Omaha while preparing to take his comprehensive examinations for a Doctorate in Education from the University of Nebraska at Omaha.

In parallel with his teaching career, John served as a citizen soldier beginning as an E-2 (equivalent to a private) in the Air National Guard of Alabama and Mississippi. He eventually moved from teaching to a full-time position within the California Air National Guard as a Detachment Commander. In 1981, he went on active duty with the U.S. Air Force. After serving on active duty for ten years, John returned to "citizen soldier" status and retired from the Air National Guard in 1992. His last active duty assignment was as Colonel and Director of Reserve Force programs for Air Force Communications Command where he was responsible for the training and readiness of ninety-four Air National Guard and forty-four Air Force Reserve Communication units.

John is not experienced in details of geospatial analysis and **TNTmips** in particular. However, he does bring to MicrolImages a background in management and design of communication systems and computer systems. With his extensive experience in teaching, writing, communications, map and image use, and related topics, he will come up to speed quickly on the **TNTmips** products and their potential applications. Soon you will be communicating with John about your needs for assistance.

Your current support team.

At this point, it may be well to review the makeup of the MicrolImages active software support team. Currently, most of your support will come from Capt. Jeff Chester (team leader), Gregg Hutchison, Dr. Paul Carlson, and Col. John Curran. They are our "communicators and facilitators" and your first line of contact via phone, FAXes, and email. Please keep in mind that they are handling hundreds of inquiries per week.

When active team members are absent, conducting training, overloaded, and so on, they are backed up as needed by former members of this team. Terry Peterson and Kevin Royal, both previous software support team leaders, are now technical sales engineers, but also provide all the technical support for MicrolImages' Authorized Dealers.

Dave Wilson, who was a recent fleeting member of the software support team, is now a member of the software engineering team and is in the back room writing **TNT** code, but Dave helps the active team with **SML** problems. Ron Souliere also still gets the difficult network and hardware support questions.

MicrolImages strives to provide you with the best possible **TNT** software support. All these staff members are available to help you with all aspects of your use of the **TNT** products. If they do not know the answers, they will get them or put you in touch with the party who knows, possibly even the responsible software engineer, as everyone at MicrolImages is oriented toward problem solving. Some of our current software support team are new, but have been employed because they are "quick studies"; others already have considerable experience, and two each have eight to ten years experience in supporting you. Active software support team members may move on to other primary assignments after a year or two. But, they have accumulated experience and often have become your professional friends and are acquainted with your project activities. As a result, they still get pulled back into solving your difficult problems and application designs.

Noteworthy Client Activities

Forestry and Forest Products Research Institute (FFPRI) of Japan

The best paper award at the 1996 fall meeting of the Japanese National Remote Sensing Meeting went to Dr. Sawada and his team of the FFPRI [similar to U.S. Forest Service] for work completed using **TNTmips**. The details on this paper as translated from Japanese are as follows.

Title. Dataset for The Long Term Monitoring of Forest Biosphere Reserves.

Authors. Haruo Sawada, Mariko Hayasi, Kouzo Kawabata, Michic Anazawa, Izuni Nagatani, Naoki Mituzuka, Etsuko Nakazono.

Abstract. Long-term monitoring are required for undertaking the addects [aspects] of global environment changes to forest ecosystem. A GIS system is considered essential for keeping the forest monitoring data based on remote sensing images together with other vector type information. Topographic data, geologic data, forest resource map, vegetation map, climate data, aerial photographs and satellite data were collected, digitized and overlaid on the same GIS system. Satellite data were converted to the relative vegetation index and stored as one of the most important elements in the system. This dataset is found that it may reveal the affects of global environment changes as well as the local ones to natural forest.

Geological Survey of Japan.

A Digital Geological Map of East and Southeast Asia has been published on CD at a scale of 1:2,000,000 by the Coordinating Committee for Coastal and Offshore Geoscience Programmes in East and Southeast Asia (CCOP) and the Geological Survey of Japan. This CD-ROM disk is Digital Geoscience Map G-2 (1997) and contains the map data in two formats--DLG-3 (Digital Line Graph Optional Distribution Format--from the USGS) and RVC (Project Files for use in MicrolImages' **TNT** products). The CD contains maps which cover the areas of Cambodia, China, Indonesia, Japan, Republic of Korea, Malaysia, Papua New Guinea, The Philippines, Thailand, and Vietnam. It can be obtained for about \$25 from the Geological Survey of Japan, 1-3, Higashi 1-Chome, Tsukuba-shi, Ibararaki-ken, 305 Japan.

The color plate attached illustrates the CD-ROM and the cover of the accompanying informational booklet included in the plastic case. The following subsections have been extracted as quotes from the booklet to provide you with additional details on the contents of this CD. It also provides further information on how each member nation assembled the digital map before it was converted by **TNTmips** into the DLG-3 and RVC formats.

“Introduction”

“The Digital Geologic Map of East and Southeast Asia is the culmination of the project, Digital Compilation of Geoscientific Map of East and Southeast Asia, Phase I (DCGM Phase I) of the Coordinating Committee for Coastal and Offshore Geoscience Programmes in East and Southeast Asia (CCOP), Bangkok. The purpose of the DCGM Project is to develop several layers of geoscientific data in the CCOP region, and to establish digital compilation methodology in the region as a common project platform. The DCGM Phase I commenced in 1993 in order to compile a single, geologic digital map of East and Southeast Asia as the most basic layer of information.”

“The project was participated by ten of the eleven CCOP member countries--Cambodia, China, Indonesia, Japan, Republic of Korea, Malaysia, Papua New Guinea, The Philippines, Thailand and Vietnam. The project was coordinated by the CCOP Technical Secretariat and funded with the Japan-ESCAP Cooperation fund. The participating countries provided in-kind contributions of digitization and provision of meeting venues. The expert services are made available by the Geological Survey of Japan (GSJ) through the Japan International Cooperation Agency. The 1:2,000,000 scale base map used for the project was provided to the CCOP by the US Geological Survey. Environmental Systems Research Institute, Inc. (ESRI) donated the GIS software ‘PC-ARC/INFO’ to CCOP member countries for the DCGM Phase I project.”

“The 1:2,000,000 scale geologic map in this CD-ROM was compiled from the most recent small-scale maps of participating and neighboring countries, using a unified geologic legend. The map was digitized of the participating institutions with technical supports from the CCOP and the Geological Survey of Japan (GSJ). Correlation of geologic units across national borders were coordinated by the chief compiler and the national compilers.”

“A Geographic Information System (GIS) or CAD system are required to use the vector format files of this CD-ROM. the software ‘Geomap A’ includes a viewer program to show the geological image database of this CD-ROM under the Windows95.”

“Since the digital data in this CD-ROM is in raw form, users may apply the data in a variety of ways. Hopefully, this CD-ROM will be revised when more precise data and more accurate geologic maps become available.”

“Geological Remarks”

“The Geologic Map of East and Southeast Asia in this CD-ROM was compiled using 1:2,000,000 scale topographic maps (Lambert Azimuthal Equal Area, center point 120°E 15°N), from the World Data Bank 2 (WDB2).”

“The unitary legend for the map has 208 different units divided by geologic ages and lithologies (Fig. 1-3). For example, a polygon for the unit of Permian granite is attributed the code: “P_Pf”. “P” indicates Permian, and “Pf” means felsic plutonic rocks. Although age divisions differ among participating countries, user can consult the time/space plot (Fig. 4).”

"Lithological division of sedimentary rocks is rather simple compared with that for igneous and metamorphic rocks. It is expected for future project to subdivide sedimentary rocks."

"Fault data are separated from geologic data into different files. The density of faults is variable from country to country."

"Digitization Process"

*"The method of digitization differed slightly among participating countries. The geologic maps of Cambodia, China, Indonesia, Vietnam, Malaysia, Brunei and Singapore were digitized by national compilers and contributors on a digitizer and IBM PC compatible machine, using software, PC ARC/INFO software under the instruction of the Technical Adviser and the Technical Assistant. The geologic maps of Thailand, Myanmar, Russia and Japan were digitized by means of ARC/INFO software on a workstation with a digitizer in Japan. The digital data of geologic maps of Korea and Philippines were originally generated by AutoCAD and were transferred into PC ARC/INFO. The geologic map of Papua New Guinea was digitized in MapInfo format and transferred into **TNTmips*** format (.RVC). Digitization of the Laos's geologic maps was conducted by using a **TNTmips** software and a scanner. (*GIS software of the MicroImages, Inc.)"*

*"Once the digitized data in ARC/INFO format were imported into **TNTmips**, all the data for the geologic maps were edited and coordinated to obtain accurate positioning using the 'georeference' command [process] under **TNTmips**. The final data were exported into DLG-3 Optional Distribution Format for the other GIS software."*

"Instruction for the CD-ROM"

"This CD-ROM principally provides the data files to display, print, compile and search the geologic map of East and Southeast Asia. To achieve these purposes, two types of geological map databases, a vector map database (DLG-3 Optional Distribution Format and .RVC format), a geological image database (TIFF format) and a software 'GeomapA' are stored in the CD-ROM, with a document file to help you to use the databases. The document file includes an explanatory note for the CD-ROM."

"Please refer to readme.txt for the structure of the directories and files contained in the CD-ROM."

"The software 'GeomapA' includes a viewer program to show the geological image database in this CD-ROM. Users can install the software by running setup.exe in the root directory of the CD-ROM under the Windows95. Please consult with help menu how to use the software."

Promotional Activities

Promotional Forestry Flier.

A new promotional forestry flier is enclosed. It is just being mailed along with a **TNTlite** and **TNT** Product fliers to 20,000 addresses.

Digitizing Soil Maps.

A new flier to promote the application of AutoTrace to digitizing soil maps has been enclosed. It is also just being mailed to 10,000 individuals with possible interest in digital soil maps.

New **TNTlite** Flier.

A new **TNTlite** flier is being used. While its graphics have been redesigned, its content is quite similar to the previous model.

New TNT products Brochure.

A new short form **TNT** products flier is enclosed. It is similar to the previous one except that it contains a summary NAFTA price for the main products. The idea of a free San Francisco **TNTatlas** has been deleted and replaced by additional information about the free **TNTlite**.

In Preparation.

Additional two-sided color fliers of a design similar to the one above on forestry are being prepared for direct mailings with an orientation on wildlife management, geology, and mineral exploration

Abbreviations

For simplicity, the following abbreviations were used in this MEMO:

W31 = Microsoft Windows 3.1 or 3.11.

NT or NT4 = Microsoft NT 3.1, 3.5, or 4.0 (3.1 is error prone, and thus the **TNT** products require the use of 3.5 and its subsequent patches).

W95 = Microsoft Windows 95.

Mac = Apple Macintosh using the 68xxx Motorola processor and MacOS 6.x or 7.x.

PMac or Power Mac = Apple Macintosh using the 60x Motorola PowerPC processor and MacOS 7.x or 8.0.

MIX = Microlimages' X server for Mac and PC microcomputer platform and operating system.