

Table of Contents

Introduction		5
Summary of New Features		5
Priorities of Features for V5.90		7
First Priority.	7	
Second Priority.	9	
MI/X (Microlmages' X Server)		9
Modifications.	9	
Public Release.	10	
MI/X Feedback.	12	
Floating Licenses		14
Introduction.	14	
Introductory Information.	14	
Single User License. (Single-User/Single Processor)	15	
Multiple User License. (Multi-User/Single Processor)	15	
Floating License. (Single User/Floating Processor)	16	
TNTedit™ 5.8		17
Installed Sizes.	18	
TNTview® 5.8		19
New Features.	19	
SML Added.	19	
SML Modifications since V5.80 CDs.	20	
More SML Changes for V5.90 .	22	
Upgrades.	25	
Installed Sizes.	26	
TNTatlas™ 5.8		26
Installed Sizes.	27	
TNTlite™ 5.8		27
General.	27	
Higher Raster Resolution Limits.	28	
TNTsdk .	28	
Getting Started Booklets.	28	
Macintosh		28
V8.1.	28	
No More Memory Adjustments.	28	
Old Macs to be Discontinued.	29	
Speed Tests		29
MacOS versus Windows.	29	
MacOS versus extensions.	31	
Other Tests.	31	
Maintaining Your System		32
Getting Started Booklets		33
TNT Reference Manual		35
New TNT Features		35
System Level Features.	35	

Project File Maintenance.	36	
* Display/Spatial Data.	36	
Georeferencing.	39	
Import/Export.	40	
Supervised Classification.	42	
Unsupervised Classification.	42	
Profiles.	43	
Databases.	43	
HyperSpectral.	44	
Extract Rasters.	44	
Map Calculator.	45	
Vector to Raster Conversion.	45	
Vector Combinations.	45	
Object Editor.	45	
* GeoFormulas (new prototype process).	48	
Surface Analysis.	49	
Color Models.	50	
Raster Operations.	50	
Regions Operations.	50	
Extract Vectors and CAD.	51	
* Mosaic (a prototype process).	51	
AutoTrace.	53	
Raster Properties.	53	
TNTsdk.	53	
* Symbol Editor.	53	
* CartoScripts (new prototype features).	55	
* Label/Symbol Placement (new prototype feature).	56	
* SML.	56	
Modifications since V5.80 CDs.	75	
Internationalization. (new prototype features).	76	
8mm Tape.	77	
Printing.	78	
Installed Sizes.	78	
Upgrading.	79	
Microlmages Authorized Dealers		80
California--TERA Research, Inc.	80	
Germany--Ingenieurbüro für Geoinformatik	80	
Finland--Soil and Water Ltd.	80	
Discontinued Dealers		80
Computers		81
Web Site		81
Prices		82
Papers on Applications		82
Promotional Activities		84
Noteworthy Client Activities		85
Abbreviations		85

Introduction

MicrolImages is pleased to distribute **V5.80** of the **TNT** products and the 43rd release of **TNTmips**. This release has been delayed by the incorporation of three system-wide modifications which required extensive testing, as they impacted most processes. These overall modifications include the use of the new visualization (display) process throughout; final adjustments to accommodate 2-byte languages such as Japanese, Korean, and Chinese, as well as other non-romance languages; and the addition of a floating license manager for enterprise applications of the **TNT** products.

V5.80 introduces a prototype of a new GeoFormula™ process which you can use to directly view or save rasters from equations that you create to define how your raster, vector, and TIN objects are to be combined.

TNTedit is being released as a product that can be purchased separately at a lower price. **TNTedit** has been added to the **TNT** product suite for those who need its geo-data creation tools but do not need the many other processes built into **TNTmips**. **TNTmips** will continue to provide the full object editor process, which is functionally identical with the separate **TNTedit**.

The following processes have had major features added:

- **Mosaic**: you can now mosaic georeferenced, non-georeferenced, or mixes of both.
- **Styles**: The interactive point style editing tool has many new features including the import and editing of symbols and characters from TrueType fonts.
- **SML**: 158 new functions have been added to provide access to and from vector, CAD, and TIN objects; draw into a view; and to control styles of the elements drawn.

Twelve new Getting Started tutorial booklets are shipping in printed format. All 33 Getting Started booklets which have been produced, including several with revisions, are included on the **V5.80** CD in PDF format.

Over 200 new feature requests submitted by clients and MicrolImages staff were implemented in various **V5.80** processes since **V5.70** was shipped. However, an even larger number of additional requests for new features was logged from the same sources in the same period.

Summary of New Features

As usual, details on all the following and other new features in **V5.80** can be found in their expanded description in detailed sections of this MicrolImages MEMO.

Floating licenses are now available for sharing a **TNT** professional product around a network. This new license allows a single **TNT** product to move or “float” around a network for use on any Windows or UNIX platform.

A new **TNTedit**™ professional product is available. It consists of the following integrated processes assembled from **TNTmips**: visualization (in other words, all of **TNTview**), object editor, import, export, georeference, digitizer support, and some utility features.

TNTview has been expanded so that it can create and use the **TNT** geospatial programming language (called **SML**). With the addition of tools to create interfaces and complete applications, **SML** provides the means to create and distribute advanced geospatial analysis and visualization projects and products. **TNTview** can also execute

new processes created entirely with the thousands of functions in the **TNTsdk** (Software Development Kit).

The size of the raster objects which can be used in **TNTlite** has been increased to 640 by 480 pixels to accommodate the images created by many low-cost digital cameras.

All **TNT** products operate under the latest release of MacOS 8.1 and under the latest beta release of Windows 98. When using the MacOS 7.x or 8.x, the **TNT** products now dynamically manage memory. No more manual memory adjustments.

There are now a total of 33 color illustrated Getting Started tutorial booklets of ~700 pages shipped with each **TNT** product, including **TNTlite**. The on-line Reference Manual provided with each **TNT** product now totals over 3000 pages.

The new visualization process that combines multiple 2D and 3D viewing into a single process has been completed and is integrated into almost all **TNT** processes. As a result, the advanced layer control panel is now also in use in most processes. The first of many GPS support features now plots the position read from an attached GPS unit into the corresponding geographic position in the view.

Scripts prepared with the geospatial programming language (**SML**) available with each **TNT** product, including **TNTlite**, can now be stored as objects in Project Files and selected to automatically compute a display layer in the visualization process.

TNTmips and **TNTedit** can now export to the following formats: ESRI's E00 format; ESRI's coverage files; the Encapsulated PostScript (EPS) file used in Adobe Illustrator and FreeHand; and into the world files used in the Virtual Reality Modeling Language (VRML).

The raster profile viewing capability can now simultaneously display the profiles from many rasters in various colors, symbolism, and scales for easy comparison.

Templates can be created to control how database tables are imported. These same templates can also provide the information on how a series of related tables should be linked up within the associated **TNT** relational database.

Attributes linked to graphical elements in a vector object or to other tables can now use multiple fields as key fields. For example, a FIPS code is made up of a field combining the state and county codes. If the second table has a separate field for the state and for the county codes, the relational linkage can be made by simply using both fields.

Polygons selected by query or other means can be used to automatically extract and create a series of separate raster objects containing the area of each polygon from a large image.

Raster to vector conversion can use queries and many other new, advanced control procedures.

The object editor has new features for improved line snapping, semiautomatic Z value labeling of contours, and creating new elements offset from existing elements.

A new process is available to create and use GeoFormulas™. A GeoFormula is an algorithm which relates raster, vector, and TIN objects in an equation which is evaluated on demand as a visualization layer or to create a new raster object. The objects combined by the GeoFormula need not be in the same map projection, scale, or cover the same common extents.

An interactive procedure to allow region objects to be combined is available wherever regions can be created or used. Using this capability in any **TNT** product permits com-

plex interactive GIS analyses to be performed between objects with the mouse and a few keystrokes.

The mosaic process has more than doubled in capabilities and now provides methods for fully automated mosaicking, semi-automatic bundle adjustment, and manual mosaicking.

Symbols and characters in TrueType fonts can now be imported and edited for use as point symbols. Important new edit tools have also been added to the symbol editor.

Complex cartographic rendering can be accomplished by a query which also selects the elements to be rendered using 44 CartoScript™ functions.

Placement positions for labels and symbols can now be optimized as rendered to avoid overlap or excessive deletions.

The geospatial programming language (**SML**) has been greatly expanded by the addition of 158 new functions in several toolkits. These new toolkits or groups of functions are now available:

- CAD object toolkit
- TIN object toolkit
- drawing functions
- serial port access functions
- vector object toolkit
- CartoScript™ toolkit
- some region analysis tools

The **TNT** products have been completely internationalized for Windows and most aspects of the MacOS. All of the user interface can now be localized into 2-byte languages such as Japanese, Chinese, and Korean, as well as into 1-byte languages such as Greek, Turkish, Russian, and so on. All interface components from strings in database fields to tooltips, dialog text, and error messages can be translated.

Complex map layouts containing transparent layer features such as polygon fills can now be printed.

Priorities of Features for V5.90

First Priority.

System Level. Allow nodes in vector objects to possess attributes and adapt other processes to create and use such nodes. Adding attributes to nodes will allow more complex routing and related features to be incorporated into the **TNT** products. For example, an attribute of a node in a line may specify the overhead clearance of an obstruction in a road, what kinds of turns are allowed at an intersection, and so on.

Create a new kind of vector object which does not require that lines which cross must intersect (as in 3D). This will be a vector object which possesses topology but will not have any polygons. This object type will allow bridges, tunnels, right turns only, structures, and similar features to be recorded and used in route analysis.

There have been requests to allow an attribute table to be linked to what we call element numbers to obtain some parallelism with this older limiting Arc/Info concept. This is not feasible since element numbers are an internal construct in the **TNT** products and change with operations on the object. Therefore, a new element ID will be created which will be available as a hook to which attribute tables can be linked.

Visualization. Extend the new 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 con-

control the 3D view. Add interactive control of the movement for a 3D view from mouse or joystick.

Incorporate the label placement optimization algorithm illustrated via a CartoScript™ with **V5.80** to be directly used in viewing objects.

Add more functionality to directly attached GPS systems and as recorded GPS-derived geodata.

Add capabilities to allow direct control of making raster layers transparent when used as a layer (for example, use a map as a transparent overlay to an image).

Support a view within a view concept within any 2D View window. [available now]

Styles. The improvements in designing and using Internal Styles and CartoScripts will continue. For example, add the capability to import, improve, and use AutoCAD points styles (in other words, blocks) and MicroStation cells as point symbols, including their insertion into line styles.

Several weeks ago, MicroImages developed and tested a very simple and fast method to draw hatch (line-like) pattern fills, and this function can be easily inserted everywhere it is needed. However, before it is useful, a style editor will have to be created or modified to enable design of such hatch fills (color, thickness, continuity, angle, ...).

Restitution. The restitution process, or Step D in the DEM/Ortho process, will be rewritten. The new process will allow the use of SPOT and scanned frame satellite images to be ortho-rectified. The process will also be modified so that it can be applied to vector, CAD, and TIN objects. Investigation will start into the possibility of extending the process to ortho-rectify slant range RADAR images such as RadarSAT.

Classification. A new process will be added for creating training sets for supervised classification procedures. Continue to add new features to the naming procedures used with unsupervised classifications and speed up its performance.

HyperSpectral Analysis. This new image analysis process was nearing completion with the shipment of **V5.80** of the **TNT** products. The prototype process should be available for download from microimages.com by the time you read this MEMO. If you wish to experiment with this capability before **V5.90** is shipped, please check its status with software support.

Import/Export. Add an import for the MapInfo internal format (TAB).

SML. Significantly expand the suite of user interface functions. Some of this will be available by the time you receive this MEMO. Add a suite of functions to create, read, write, and maintain relational database tables when used as attributes or as separate tabular geodata objects. Supply additional missing functions as identified by clients who are experienced and active **SML** script writers. Those particularly interested in experimenting with this expanded functionality can periodically download the **SML** process during the next quarter. [many functions available now]

Printing. 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.

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

TNTedit. The interface will be added into **TNTedit** to allow it to directly load and save E00 and coverage files (and potentially others).

TNTatlas. Produce written instructions and any needed software to assist in the assembly of **TNTatlas** CDs.

Tutorials. At least six new Ptolemy Getting Started booklets will be prepared on such topics as:

- Constructing HyperIndexes®
- **TNT** Technical Characteristics
- Understanding Map Projections
- Managing Geoattributes
- Changing Languages (localization)
- Using the Software Development Kit
- Introduction to Hazard Modeling
- Introduction to DOQs from 35mm Slides

This will increase the total number of Getting Started booklets and their sample geodata available to about 38 to 40. As usual, all these new booklets will be posted on microimages.com during the quarter in Adobe Acrobat PDF and PageMaker files as soon as they are available in draft form. 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).

Extend theme mapping to raster layers.

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.

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

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

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

MI/X (Microlimages' X Server)

Modifications.

Transparent changes have been made in the Microlimages **MI/X** server in the past quarter to correct minor problems. These alterations resulted in somewhat faster response in the PMac version of **MI/X**. **MI/X** was checked out in a beta release of W98 and runs without modification. However, **MI/X** was modified to allow the X window it generates to span several screens to accommodate this important new feature being introduced in W98. The **MI/X** server for dual screen W98 operation is not on the **V5.80** CD and can be requested when needed via software support. No significant future changes are anticipated in the operation of **MI/X**.

Public Release.

Downloads of the **MI/X** server by non-clients from microimages.com now average approximately 1300 per week (100 for 68xxx Macs, 200 for PMacs, and 1000 for Windows products). A total of 50,000 direct downloads have been performed since it was made available without cost for use by others.

There are also 60 different registered international mirror sites from which **MI/X** can be downloaded (see below). MicroImages projects from this information that hundreds of thousands have downloaded and tried these **MI/X** products. The minor flaws these users have found and reported have helped MicroImages further perfect the **MI/X** server. Several of these users communicate with MicroImages each day requesting changes or assistance. Most are referred to the Frequently Asked Questions (FAQ) section which they have obviously not read, but some get direct responses when new questions are raised.

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MI/X Feedback.

The following is typical of the feedback from the FREE **MI/X** products and provides insight into how they are being used around the world.

email from Ola Persson smurfen@ludd.huth.se on 4 September 1997

"Your X Server for Windows 95 is the best thing I have seen for a LONG time. I have been forced to have a UNIX partition at home, in order to do cad/cam in Xwindows at home. I am on a LAN in my dorm, so I usually go home when the computer labs are full...."

email from Paul Whittington paul@sage.inel.gov on 11 September 1997

*"I think **MI/X** is wonderful, and thanks for making it freely available."*

email from Stuart Siegel ssiegel@cmu.edu

"Thanks for making an excellent product available free!"

email from Gurpratap Viridi virdigur@ee.mcgill.ca

"Hi! I am a Computer Engineering student at McGill University, Montreal. I wanted to thank you for making available the MicroImages X server as freeware. This has enabled me to do all my assignments at home without spending a penny, opposed to all those expensive shareware x-servers. Thank you again."

email from Jeff Sheremata <jshereme@maildrop.srv.ualberta.ca

*"Over the past two weeks I have been using **MI/X** for my engineering graphical analysis and I am very impressed with it's performance. Using Matlab on my host's server, my plots essentially appear instantaneously on my home computer screen once the command to plot them is entered. I have not yet used Matlab sitting in front of an UNIX box or through ethernet connection. Once again thanks for your technical support." [This student user of **MI/X** is using a cable modem to connect from his home to the university host. From what we can determine to date, a cable modem is at least as fast as a T1 line when using **MI/X** as an interface.]*

email from Brian Ruppert brianr@nightstar.ml.org

"This is not a request for support. Trust me. :)"

*"Without going into a long story about myself, my life, my computer, and the benefits of managed sheep herding, I would just like to let your corporation know that the **MI/X** server has finally provided me with an easy-to-use, free solution to my previous inability to access X apps from my Linux box on Win95 computers."*

"My sincerest regards go out to the developers of this product. Thank you."

email from Thomas Cameron tcameron@three-sixteen.com.

"Two Words: Holy [expletive] !!!!"

"I am completely stoked that there is a free X server that runs under NT that works at all, much less one that works so well!!!"

"Thanks a million times, you have made my life much, much easier with this product!"

email from John jsillers@austin.ibm.com

"Well, I had my Mac long before I joined IBM. It turns out that having a Mac at IBM is not that unusual. I am very impressed. I spent ~\$200 of my own money for eXodus. After about 9 months Apple changes OpenTransport and eXodus no longer worked. There was no upgrade path and basically I would have to spend another

~\$200. Since I don't use X THAT much from home I went without... So I REALLY appreciate **MI/X** !!!! It works great and I think is quite a bit faster than eXodus."

"It seems like there should be a middle ground. \$200 was far more than X-at-home was worth to me. But I have to say that having **MI/X** free makes me feel guilty (especially when I had to send a note for support). If you are every in Austin I'll buy you dinner!"

Floating Licenses

Introduction.

A new category of license can now be purchased for all the **TNT** products. It is a floating license used in enterprise-oriented network situations. No license previously purchased by any client to use a single-user/single-processor or a multiple-user/single-processor setup with your **V5.70** or earlier **TNT** product will be changed by the addition of this new license category.

A floating license still requires the physical authorization key but allows a single **TNT** product to be "checked out" or shared via the network and executed wherever it is needed. With a floating license, the physical authorization key is not moved between platforms! The check-out, check-in authorization scheme used with this floating license is a commercial license manager called FLEXIm, which is in turn controlled by the **TNT** physical authorization key. FLEXIm is very commonly used to manage the floating licenses of other products such as Arc/Info and ERDAS.

A floating license allows an organization to get more use from a single **TNT** product. For example, installation of three floating licenses might satisfy a network of users with 20 computers who do not use **TNTmips** full-time but only as the need arises. Without employing floating licenses, this organization might require at least five or six conventional single-user licenses to accomplish the same access to **TNTmips**. And even with a larger number of single-user licenses, they would still be constantly manually swapping the physical authorization keys among the 20 computers. As a result of the significantly expanded flexibility of a floating single-user license, its price will be 20% higher than the equivalent single-user fixed license.

The following paragraphs explain the various types of licenses which are now available for the use of the **TNT** products.

Introductory Information.

These general conditions apply regardless of the type of **TNT** product purchased.

TNT software can be installed from the official **TNT** CD anywhere on the network--local machine, remote machine, and on several machines of differing types. Placing, installing, and keeping the **TNT** executables on many different computers of different types is not controlled by your license to the **TNT** product. It is the actual startup and continued operation of the product that will be permitted or prevented by the MicroImages hardware key and/or the FLEXIm license manager, according to the type of license (in other words, type of operation) you have purchased.

The **TNT** product can be operated via X windows from a remote X terminal or a Mac or Windows-based computer using the **MI/X** or some other X server.

Some or all of the **TNT** Project Files can be kept and used on the local computer with the physical authorization key or on a file server without a key anywhere on the network.

In other words, project materials can be stored anywhere that file storage resources are provided by the network.

Single User License. (Single-User/Single Processor)

This license is widely used on stand-alone, local computers which may or may not be part of a network. It permits the **TNT** product it controls to be easily moved around by manually moving the license's physical authorization key from computer to computer.

The physical authorization key must be installed on the computer which will then be permitted to execute one, and only one, copy of the **TNT** product. A second copy of a **TNT** product cannot be started. However, many different **TNT** processes can be started simultaneously within the single **TNT** product as well as simultaneous use of other non-**TNT** products.

The **TNT** software (executables) can be installed on as many computers of varying types as desired, but will execute only if the physical authorization key is attached.

The key can be physically moved from computer to computer by simply unplugging it and replugging it into the same kind of port (parallel or serial) or the Apple Developer Bus (ADB).

For example, this license permits the installation of the **TNT** product software on an office computer and a home computer of a different type. The **TNT** product is then used exclusively at each location by moving the physical authorization key between the two computers.

This license only requires the FLEXIm license manager to be installed on the UNIX or NT computer with the key attached if the single operation of the **TNT** product is going to be from a remote X terminal or remote computer using the **MIX** server.

Multiple User License. (Multi-User/Single Processor)

It is most common for this license to be used by remote access via X terminals or other computers on the network which are using the **MIX** or some other X server. It can also be used on a stand-alone machine to start several copies of the **TNT** product.

The physical authorization key must be installed on the computer which will execute all copies of the **TNT** product. A two-user license allows two separate copies of a **TNT** product to be started, each of which can simultaneously use the multiple **TNT** processes within that product. Similarly, a three-user license allows three copies, and so on.

The **TNT** software executables can be installed on as many computers of varying types as desired, but all of the authorized multiple copies must be executed on the computer which has the physical authorization key attached.

The key can be physically moved from computer to computer by simply unplugging it and replugging it into the same kind of port (parallel or serial) or the ADB. This is not common with this license type, as several other users may be remotely using the license.

This license always requires the FLEXIm license manager to be installed on the computer with the physical authorization key attached. It is the FLEXIm license which, together with the physical authorization key, allows the authorized multiple copies of the **TNT** product to be operated simultaneously.

Before it is shipped, MicroImages encodes the physical authorization key to run the number of simultaneous copies purchased. Thus, it is not necessary to obtain any kind

of authorization code from MicroImages to use this license. It is also not necessary to obtain any authorization code when changing computers, changing operating systems, or even moving between computers. Simply attach the key and reinstall the FLEXIm license manager. This can easily be done as part of the reinstallation of the **TNT** product.

Floating License. (Single User/Floating Processor)

This license is for institutional networked situations where **TNTmips** will be shared on a network among multiple users who will use it only part-time. This kind of license creates a "virtual" authorization key which "floats" from computer to computer under the control of the physical authorization key and the FLEXIm license manager. It allows any computer on the network which has the exclusive use of the virtual key to check out the virtual authorization and use the **TNT** product. The network can be in a single office, between buildings, or any other structure which will support access to the FLEXIm license manager.

Each floating license allows a single use of a **TNT** product at a given time. If a second attempt is made anywhere on the network to start a second copy of the **TNT** product, that location will be notified that the product is being used until its current user exits the entire **TNT** product. However, more than one floating license can be operated on a network so that two or more simultaneous floating operations of **TNT** products can be authorized by purchasing additional single-user floating licenses.

The physical authorization key of the proper type (serial or parallel) must be attached to an operating computer on the network. The FLEXIm license manager must be installed on this computer to create and serve up the virtual authorization key(s) to any other computer on the network. The computer using the license manager can be any UNIX or NT platform supported by the **TNT** products. The floating license can float to and be used on any UNIX, NT, or W95 platform, depending upon the license level purchased. MicroImages and the **TNT** products do not need to know anything about the computer where the license manager is to be installed. Similarly, MicroImages and the **TNT** products do not need to know anything about the remote computers which might use the floating license.

A floating license purchased at a UNIX level must be installed (key and license manager) on a UNIX computer. However, it can float with all authorized features to any UNIX or Windows computer on the network for which **TNT** products are shipped.

A floating license purchased at a Windows level may be installed (key and license manager) on a Windows or UNIX computer but cannot float to a UNIX platform. It can float to a Windows or LINUX computer. The display level (**D40, D50, D60**) will control the size of the display window on that remote computer using the virtual key. Mac and PMac computers can only be used as remote X terminals with a floating license.

More than one license manager with a physical license key can be set up on a single network. One physical key can be used to control one or more floating licenses of a given type (in other words, UNIX level or Windows level).

The **TNT** software can be installed all over the network on as many computers of varying types as desired, ready to run the floating license as soon as a virtual authorization key is available and secured. This results in a lot of software duplication and complicates the management of the **TNT** products. As a result, floating license installations may maintain the actual executables on a single file server. A **TNT** product using a

floating license can be set up to automatically load and execute as needed each processor module from this remote file server for the specific computer type using the virtual authorization key.

Before it is shipped, MicroImages encodes the physical authorization key to run one or more floating licenses purchased, as well as any extended features. It is not necessary to supply any kind of information about your PC or a workstation I.D. code to obtain an authorization code from MicroImages to install the FLEXIm license. The physical authorization key can be manually moved from computer to computer by simply unplugging and replugging it in to the same kind of port (parallel or serial) or the ADB. The FLEXIm license manager can then be reinstalled at the new location. This may be periodically required if the license server fails or computer resources are being reallocated or rearranged.

TNTedit™ 5.8

TNTedit is being released as a new product for the first time as part of **V5.80**. All clients who can install **TNTmips 5.8** can also install **TNTedit 5.8** at no additional cost. However, it is not necessary to do this except as an experiment, since the object editor and other processes provided in **TNTedit** are identical to those provided in **TNTmips**.

What is it? **TNTedit** is a product which fits into an intermediate position between **TNTview** and **TNTmips** at an intermediate price. It consists of the following integrated processes assembled from **TNTmips**: visualization (for example, all of **TNTview**), object editor, import, export, georeference, digitizer support (optional product **X3** is included as standard), and some utility features. Since **SML** is now a part of **TNTview**, it is also a part of **TNTedit**. All the powerful features in **TNTview** are provided, including 2D and 3D visualization, interactive GIS, GeoFormulas, limited size layout and printing, and so on.

Why have it? This new product fits into two niches. First, it allows **TNT** clients who create original vector or CAD geodata to operate more stations at a lower cost. The object editor used in **TNTmips** and **TNTedit** is filled with labor saving concepts; however, creating, editing, or upgrading vector and CAD geodata from scanning and conversion, tracing, digitizing, heads up digitizing, photointerpretation, and so on, is still time consuming. This creative activity requires a lot of dedicated "console" time using the object editor, which can now be purchased via **TNTedit**.

It has also been made very clear from many GIS and remote sensing sites which are locked into other competing products by years of investment and experience, that a good, interactive object editor is needed to create or update their project materials. **TNTedit 5.8** provides MicroImages' powerful object editor for use with Arc/Info and Arc-View; can run concurrent with these products on the same computer; and easily exchanges vector data with them via the import and export of their native coverage, E00, or shapefiles. During the next quarter, **TNTedit** will be modified to directly use these ESRI formats without the need for their import or export into a **TNT** Project File. This will allow these ESRI files to be directly edited and modified in **TNTedit** with both the **TNTedit** and ESRI products running concurrently on the same machine.

Similarly, the powerful image, vector, CAD, and TIN features of **TNTedit** can be applied by those who use MapInfo, ERDAS, ER Mapper, PCI, ENVI, and other commercial products, since their geodata formats are also supported. They can now interactively create or edit any **TNT** objects and convert them into a form suitable for use in the ana-

lytical process in these products (for example, convert a raster to a vector object, a database table(s) into a vector object, ...).

Options? No options are available for purchase with **TNTedit** except annual maintenance. In contrast to **TNTmips**, you can use **TNTedit** at any screen resolution you choose as is also the case with **TNTview**. This makes **TNTedit** particularly powerful if run on a platform with dual monitors (common with MacOS and to become more common with the release of W98). You cannot purchase large format printing, scanning, or **TNTlink** as part of **TNTedit** or **TNTview**.

Prices? **TNTedit** is priced intermediately between **TNTview** and **TNTmips** as follows. Please take special note that no optional or other special features (except product **X3** = digitizer support) are bundled with **TNTedit** for any platform. **TNTview** can be upgraded at any time to **TNTedit** for full credit. Similarly, **TNTedit** can be upgraded to **TNTmips** at any time to obtain access to its processes such as mosaicking, image classification, large format color printing, and so on. Shipping is not included in the prices shown below for **TNTedit**. However, shipping is included in the annual maintenance cost by UPS in the NAFTA nations and air express to all other nations. Those Getting Started booklets applicable will be included with each **TNTedit** product as well as the on-line version of the complete reference manual for all the **TNT** products.

for NAFTA sites.

- \$3000 for Intel and Mac platforms: MacOS, Windows, and LINUX [product **E30**].
(annual maintenance will be \$500 [product **A5/E**])
- \$4000 for the DEC Alpha platform when used with Windows NT [product **E40**].
(annual maintenance will be \$600 [product **A6/E**])
- \$5000 for the various workstations using variants of UNIX [product **E50**].
(annual maintenance will be \$900 [product **A9/E**])

for International sites.

- \$3600 for Intel and Mac platforms: MacOS, Windows, and LINUX [product **E30**].
(annual maintenance will be \$600 [product **A5/E**])
- \$4800 for the DEC Alpha platform when used with Windows NT [product **E40**].
(annual maintenance will be \$700 [product **A6/E**])
- \$6000 for the various workstations using variants of UNIX [product **E50**].
(annual maintenance will be \$1000 [product **A9/E**])

Installed Sizes.

Loading the **TNTedit 5.8** 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	34 MB
PC using W95	42 MB
PC using NT (Intel)	42 MB
PC using LINUX (Intel)	27 MB
DEC using NT (Alpha)	46 MB
Mac using MacOS 7.6 (680xx)	44 MB
Power Mac using MacOS 7.6 and 8.0 (PPC)	48 MB
Hewlett Packard workstation using HPUX	37 MB
SGI workstation via IRIX	44 MB

Sun workstation via Solaris 1.x	33 MB
Sun workstation via Solaris 2.x	33 MB
IBM workstation via AIX 4.x (PPC)	42 MB
DEC workstation via UNIX=OSF/1 (Alpha)	49 MB

TNTview® 5.8

New Features.

The following is a summary of the new features added to **V5.80** of the **TNT** products which are now available in **TNTview 5.8**. Detailed descriptions of these and many other new features can be found in the appropriate section below entitled New TNT Features.

- **TNTview** can run executable programs compiled in C using the **TNTsdk** on a **TNTmips** platform.
- **SML**, the geospatial programming language, is now provided as an integral procedure to create or run **SML** scripts (more details are provided immediately below).
- The new Visualization process incorporating integrated 2D, 3D, and stereo is now fully functional and integrated.
- GeoFormulas can be made and used.
- Regions can be interactively combined to support more complex interactive GIS functionality.

SML Added.

Gradually, **SML** in **V5.70**, **5.80**, and **5.90** is being repositioned as the basis for the creation and distribution of special purpose geospatial products with targeted or private markets. Its incorporation and use in the inexpensive **TNTview** is part of this evolution. As a result, **TNTview** and **TNTlite** are moving into competition with widely distributed commercial products such as ArcView and MapInfo. However, **SML** is expanding 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, ...) and provide a broader range of analysis functions. For example, as many already know, ArcView and MapInfo are not advanced in their use of raster datasets. Similarly, they have no features for the analysis of images, the creation and use of surfaces from TINs, directly using topological objects, and so on. However, as an integrated geospatial programming language, **SML** will differ from these in a number of other unique ways.

The most important distinction is that the development of **SML** features is not focused upon the creation of public and widely distributed products. **SML** is being focused upon the creation of products for direct use by professionals within limited professional interest groups. Thus, MicroImages envisions the end users of your scripts as a group of clients or professionals already working with you, the creator of the script. These might be other members of your organization; your professional peers; your consulting customers; those who subscribe to your image, mapping, GPS, database, or other geodata collection and preparation services; a cooperative; members of a professional association; and so on.

TNTview on any supported platform can create and use scripts prepared with **TNTview** or **TNTmips** on any other platform without modifications. Let's make this clearer as it is unique to the **TNT** products--a single **SML** script will now run without modification or change on any platform with any **TNT** product except the **FREE TNTatlas** product. Yes,

all these same **TNT** products provided within **TNTlite** can also run the **SML** script(s) as long as the sizes of the objects created conform to the limits imposed by **TNTlite**. Project Files are also transparent across all operations, so your project materials can also be immediately used in these scripts wherever they roam. Can any of this be accomplished within ArcView or MapInfo at approximately the same price?

REMEMBER: The scripts and products you prepare with **SML** are automatically cross platform. Any script can be immediately used without alteration by any **TNTmips** or **TNTview** on any computer platform for which they are available.

SML Modifications since V5.80 CDs.

Advances in **SML** are pressing forward at a rapid pace. In preparation for a demonstration to a group of agricultural managers for various corporations, a simple prototype of a sample of a self-contained **SML** agricultural field image application will be available for your testing and modification by 10 February. The creation of this prototype product has required that all the additions and modifications to **SML** and **TNTview** outlined in this section will be completed by the time you read this MEMO. Please contact software support to obtain and experiment with the prototypes of all these new modifications. The sample script(s) involved will, as usual, be posted on the **SML** script exchange at microimages.com, but you will need a new display process to use these post **V5.80** scripts.

Interface Tools.

The **TNT** drawing tools controlled by the mouse (draw lines, circles, ...) can be used in your scripts. A series of other initial modifications have been made to allow you to use the View window and other interface components in a script. For example, you can now add your own 16 by 16 bit icons into the toolbar at the top of the View window to control a jump to, and use of a subsection of your script. To avoid confusion with your icons and processes, most of the icons placed by **TNTview** in the View window toolbar can be suppressed by your script which presents a View window as part of its interface.

The sample agriculturally-oriented **SML** application uses the new interface features. After the **SML** application is started from its icon on a toolbar menu, it presents a simple dialog box asking for the composite colorinfrared image to be displayed and subsequently used to compute relative canopy biomass. Once these inputs are made for the images of a farm, a View window is shown containing the reference image. The cursor in the View window is automatically placed in the polygon drawing mode. After a polygon is drawn around a crop field, the script continues on to compute and display the biomass within this field using the following steps:

- create a temporary region object from this polygon,
- use the region to compute the canopy biomass for the cells it inscribes in the color infrared image in the view,
- scale the biomass range in these cells into 10 intervals to be portrayed in 10 bright colors,
- assign each biomass cell to interval and assign its color,
- replace the cells in the original image inside the polygon with these new color cells representing 10 possible levels of canopy biomass.

Helptips.

In the above sample biomass application, the beginning user may not know what to do if the cursor is in the view waiting for the polygon to be drawn. A new variant on the data-tips interface component is used to provide simple instructions called "helptips" right at the point of the cursor. If the cursor is in the view and stationary long enough (say two seconds), a helptip will be displayed such as "Depress the left mouse button and draw a polygon". After drawing part of a polygon and waiting, the following helptip appears at the point of the cursor: "Depress the right button to close this polygon". The message strings in these helptips and their associated time delays are imbedded directly in the **SML** script. Any drawing tool is available in the script and can have such helptips inserted into it.

Binding Scripts and Data.

Scripts can now be stored as an object in any Project File. Thus, the **SML** script to process and display the geodata in a Project File can be placed into and moved around freely with it. Scripts and Project Files are operating system transparent, so anything you create can be immediately moved between Windows, UNIX, and Mac platforms by network or CD, 'no java'! If you create a standard geodata Project File, add to it your **SML** script(s). You can transfer and use this application on any platform equipped with **TNTview**, **TNTedit**, **TNTmips** and their equivalents in **TNTlite**. This script plus geodata binding, coupled with the unique startup features outlined below, make your **SML** product very easy to use, flexible, available on many platforms, Internet transportable, and unique.

A simple example of this binding would be to put commercial image sets into a **TNTmips** Project File for a fixed area being ordered (for example, a quadrangle or farm). Then copy your **SML** agricultural analysis script, similar to that described above, into the Project File. Your analysis application can then be run automatically accessing the proper images using the new startup features introduced below. When perfected, this approach is similar to clicking on a document on the desktop and starting the application with the document inserted. It improves on this theme by providing various levels of protection to your document = Project File and your application = **SML** script and by automatically operating on any popular platform and operating system.

Starting Script from Icons.

Directly. The script stored in a subobject of a Project File or elsewhere can be automatically started from an icon you create and place on the desktop of your Windows, UNIX, or Mac platform. When you click on your icon, it will then run your own autostart **SML** process as follows:

- **MI/X** will be automatically started in the background,
- **TNTview** will be started in the background,
- your **SML** script will be automatically started using the geodata in the project file,
- the interface created by your script will be exposed in the **MI/X** window, and
- depending on your script design, the geodata in the attached Project File will be automatically analyzed, displayed, or otherwise processed.

Via a Toolbar Menu. An alternate startup procedure is available if several scripts are to be provided so that your user can select from a series of your **SML** procedures or products. When they click on your icon on their desktop, they will run your menued **SML** process as follows:

- **MIX** will be automatically started in the background,
- **TNTview** will be started in the background,
- your toolbar menu will appear containing 32 by 32 bit **TNT** icons/tooltips, and
- selecting an icon will run that **SML** script and so on as outlined above.

For example, one icon on the desktop of any **TNTview**-equipped platform could run a standard script to provide for locating and choosing the geodata object needed, the script could analyze it, and finally one could print it with a prepared layout. Obviously, you can also build a single autostart script to do all of these steps in sequence, but often the beginning user of your products might have less difficulty using a sequence of simpler, semi-isolated steps.

Setting up a Start-up. A toolbar menu of your icons for your **SML** scripts and product can be created by placing all your **SML** scripts into a directory. This is the directory to which you assign the startup icon you create on the desktop. In each of these scripts, you will have imbedded your own 32 by 32 bit **TNT** icon. All icons used within the **TNT** products have been created in a **TNT** icon editor. It will now be provided for your use in creating **TNT** icons.

Accessing **TNTview**. When you create any toolbar menu, it will automatically contain, at the extreme right, a **TNT** icon to exit from **TNTview**. Also, since you do not see **TNTview** when your icons and scripts are being used, an icon to provide access to **TNTview** will automatically appear just to the right of the exit icon in your toolbar menu. The user of your product need not be concerned about the use of the advanced features provided by **TNTview** unless you or they are interested in learning more.

More SML Changes for V5.90.

Introduction.

V5.90 of **SML** will provide even more tools to create complex interfaces for your **SML** scripts such as dialog boxes, legends, and other user interface design and operation tools. You will also be able to encrypt your scripts so that their logic and algorithms cannot be read by others.

A number of you are already at work developing commercial products using **SML**. Some will be privately distributed for sensitive activities confined within a corporation. Some are being created to sell independently with a **TNTview** product. Still others will become available for general use and will be promoted by MicrolImages on behalf of their creators. MicrolImages will also distribute with **V5.90** more sample product **SML** scripts with their own user interfaces to demonstrate simple products and to serve as models to help you create your own products and interfaces.

Gradually, **SML** in **V5.70**, **5.80**, and **5.90** is being repositioned as the basis for the creation and distribution of special purpose geospatial products with targeted or private markets. It is thus moving in the direction of competing with ArcView and MapInfo. However, as an integrated geospatial programming language, it will differ from these other commercial products in a number of ways.

First of all, we envision the end user of these scripts as a group of clients already working with you, the creator of the script. These might be other members of your organization; your consulting customers; those who subscribe to your image, mapping, GPS, database, or other geodata collection and preparation services; a cooperative; members of a professional association; and so on.

Second, it will be possible, by the use of an encryption process introduced below, to protect the intellectual ideas incorporated into your scripts and to control exactly who has access to use them. This will be accomplished by tying all scripts to the hardware authorization keys used with **TNTmips**, **TNTEdit**, and **TNTview**. In other words, the protection of the **TNT** keys will be extended to protect your **SML** products.

More Sales Pitch.

At a minimum, all the powerful features of **TNTview** will be available with the **SML** based products you distribute. Does ArcView or MapInfo have the powerful 2D and 3D visualization tools, interactive regional analysis, import/export, and other advanced tools built into the base **TNTview** product or even available from the myriad of add-ons which must be bought? However, your **SML** applications can still look simple and easy to operate to the new or inexperienced user. For example, the availability of **TNTview** can be hidden as an icon on the toolbar containing icons to start your **SML** products until it is needed by a more experienced user.

V5.80 SML scripts can now contain powerful functions for reading, displaying, analyzing, and writing raster, vector, CAD, TIN, and region objects. Thus, **SML** products can already produce more advanced applications than MapBasic and Avenue. These other programming products hardly know what a raster is let alone what to do with it; they cannot deal with TINs and their application; CAD objects are converted into intermediate forms; and so on. Also, products created with these other products widely circulate at low cost or free without protection from unauthorized use. Do you want to work to create advanced products which circulate in such a fashion?

Let's compare the **SML** cross-platform strategy to other procedures used to customize GIS and desktop mapping products. When using Avenue and MapBasic, you must create separate programs or scripts for each operating system. This increases the difficulty, resulting in limiting the availability of extensions and add-on products to only the most popular platforms. For example, MapInfo has ceased releasing products for the Mac or UNIX platforms, and their partners releasing add-ons or companion products never provided their products for these platforms. This "code for each platform" strategy has also limited these kinds of products to the most popular platforms. It also means that support for your platform will be dropped much sooner when it is no longer marketed. It means that support for new operating systems gaining in popularity will be delayed (for example, the switch from Solaris 1.x to 2.x, support for Rhapsody or LINUX, 64-bit NT--there is already a 64-bit version of the **TNT** products).

All the **V5.70** and **V5.80** changes in **SML**, coupled with the ability to choose **SML** scripts as a layer in the new visualization process, already 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 request as detailed below. Should you wish to distribute your current scripts for public 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.

Submit **SML** Requests.

More and more clients are using **SML** as it expands. To further assist you, effective with the release of **V5.80**, MicroImages will consider promptly adding functions to **SML** which you have found you need. When requesting a new function, please provide a sufficiently detailed explanation of what the function should do. Also, and even more importantly, describe what you want to accomplish with the function in your script, as we may have a different approach to what you need if we know why you need it. If the objective of the function is easily described and understood, submitting a few lines may be sufficient.

In requesting a new function, please understand that MicroImages has set priorities on the creation of new **SML** functions which support the interests of all clients in general. As a result, your function may or may not be assigned an "as-soon-as-possible" priority, but you will be promptly informed of its priority. The following general criteria will be used to assign your function one of two priorities.

- 1) High priority (in other words, "available within the next several weeks") will be assigned to those functions which are relatively easy to implement and of general interest to others.
- 2) Low priority (in other words, "put in with the other 1800 new feature requests") will be assigned to those functions graded as difficult and time-consuming to implement and/or of limited interest to the general user of **SML**.
- 3) As a corollary, if your function is assigned into 2) above (lower priority), you can ask for a cost estimate for moving its priority from 2) to 1) above.

REMEMBER: You can also use the **TNTsdk** to extend the **SML** function library by adding your own, unique functions. However, also remember that they will have to be compiled and provided for each operating system you wish to use, so it might be better to request that MicroImages add them to the standard **SML** function library for all platforms.

Encrypting **SML** Scripts.

Concept.

SML scripts produced in **V5.80** are public and can be used with any **TNTmips**, **TNTedit**, and **TNTview** key and openly read by anyone on any platform. An option to encrypt scripts is currently being implemented and should be available by the time you read this MEMO. Check with software support for its status if you are ready to use this feature. To encrypt a script, you will simply choose a script and the encryption option and designate who will be able to use the script. An encrypted script will then be created and saved for your distribution.

The contents of encrypted scripts cannot be read by anyone but still function just as any public **SML** script. Encrypted scripts will still run in any **TNT** product (including **TNTlite** if the size limitations are observed) designated by you. However, encryption will allow you to control the distribution and use of any of your scripts which contain proprietary ideas. For example, your objective might be to prevent the unauthorized use of a script you sell, hide key concepts in a free script, distribute scripts which can only be used by authorized users, and so on.

Options.

The following options will be available for you to select for creating an encrypted script:

- 1) Encrypted Only. With this choice, the encrypted script can be run with any **TNT** key. For example, this kind of script can still be distributed via the **SML** exchange on microimages.com. In this case, only the content of the script is protected, although it cannot be used by anyone who does not have a **TNT** product key.
- 2) Encrypted with a Password. An encrypted script could be run with any key if the password you set up is provided. But, the script itself cannot be read or modified. Using this option, the script can be placed on a web site or a CD for distribution but only used by someone who later secures a password from the developer of the script by purchase or some other basis. Note, however, that only a single password is used, so it could get into circulation and provide unauthorized use of the script.
- 3) Specific Key Protection. In this case, MicroImages extends the protection of its hardware authorization key to your encrypted script. When you encrypt the script on your **TNTmips**, you enter the key number of the specific key which will be authorized to run the script. The process then produces an encrypted script which is usable only with that specific key. This approach means that you will be distributing each script individually, and it will only run with that specific **TNT** product. Unless the key is stolen, no one else can run your script.
- 4) Password and Key Specific Protection. In this case, you provide both the key number and a password(s) for the script. This kind of script can only be run by those who have the specific key and are authorized to have the password.

SML scripts using options 3) and 4) may sound complicated to manage and distribute one at a time. However, the protection extended to your valuable script would be very hard to beat. It would also be possible to subsequently sell this kind of script automatically over the Internet but still secure one user protection. For example, a buyer of a script could simply submit the script name, electronic return address, payment details, **TNT** key number, and optional password to your server via an electronic form. The encrypted script is then automatically created and sent back for immediate use.

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>V5.20</u> and earlier
	V5.70	V5.60	V5.50	V5.40	V5.30	
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>V5.20</u> and earlier
	V5.70	V5.60	V5.50	V5.40	V5.30	
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

Installed Sizes.

Loading **TNTview 5.8** 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	21 MB
PC using W95	25 MB
PC using NT (Intel)	25 MB
PC using LINUX (Intel)	17 MB
DEC using NT (Alpha)	27 MB
Mac using MacOS 7.6 (680xx)	32 MB
PMac using MacOS 7.6 and 8.0 (PPC)	34 MB
Hewlett Packard workstation using HPUX	21 MB
SGI workstation via IRIX	24 MB
Sun workstation via Solaris 1.x	19 MB
Sun workstation via Solaris 2.x	20 MB
IBM workstation via AIX 4.x (PPC)	24 MB
DEC workstation via UNIX=OSF/1 (Alpha)	27 MB

TNTatlas™ 5.8

There have been no significant changes in **TNTatlas** for this release. Independent operation of **TNTatlas** is now free and does not require a physical authorization key. Those of you who have previously purchased a "stand alone" key-controlled **TNTatlas** no longer need it. Thus, you should consider trading in each **TNTatlas** key for full credit toward a replacement **TNTview** key which would then be 50% paid for.

A number of clients have been struggling with how to publish their own **TNTatlas** CD. A set of revised and expanded instructions is now being prepared to assist you in this area.

Installed Sizes.

Loading **TNTAtlas 5.8** 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	15 MB
PC using W95	18 MB
PC using NT (Intel)	18 MB
PC using LINUX (Intel)	13 MB
DEC using NT (Alpha)	19 MB
Mac using MacOS 7.6 (680xx)	27 MB
PMac using MacOS 7.6 and 8.0 (PPC)	28 MB
Hewlett Packard workstation using HPUX	15 MB
SGI workstation via IRIX	17 MB
Sun workstation via Solaris 1.x	14 MB
Sun workstation via Solaris 2.x	15 MB
IBM workstation via AIX 4.x (PPC)	16 MB
DEC workstation via UNIX=OSF/1 (Alpha)	18 MB

TNTlite™ 5.8**General.**

The special needs of **TNTlite** (for example, windowing during import) have now been well integrated into all the **TNT** products. Special effort to add new features to enhance the use of the **TNT** professional products used via **TNTlite** is no longer required.

TNTlite or the **TNT** professional products are now in use in 133 nations. An increasing number of universities around the world are now using **TNTlite** as the basis for teaching remote sensing, GIS, or their combination as geospatial analysis. An increasing number are contacting Microlimages for assistance in some way. However, it is difficult to tell how many are using **TNTlite**, as a single downloaded copy of **TNTlite** and the PDF files for the tutorial booklets can be distributed locally by network to service a whole course or campus and can be easily copied to individual student computers.

Microlimages is disturbed by how many university and private users of **TNTlite** are not using the latest upgrade even though it is nominally FREE. They will contact Microlimages, asking questions about the operation of a version of 12 to 24 months ago. In general, the users of **TNTlite** are not really aware of the rapidity with which changes are occurring in geospatial analysis and the **TNT** products in particular. For example, **TNTlite** users do not receive the follow-up mailings from Microlimages that are sent to professional clients on such matters. To make those who use **TNTlite** more aware of the dynamic nature of this product, they will now be automatically alerted by **TNTlite** when a new version is likely to be available. This will be accomplished by a pop-in window which will begin to show up only when a **TNT** product is started and four months after it is installed. To avoid irritation, this window will also only pop in with every eighth startup.

Higher Raster Resolution Limits.

Many digital cameras are now available at low cost with a resolution of 640 by 480 pixels. Good digital color projectors are available with a resolution of 640 by 480 pixels (see Sony advertisement enclosed). The latest generation of portables provides a display resolution of 1024 by 768 pixels which accommodates a View window of 640 by 480 pixels with room left for control windows. As a result, MicroImages has raised the maximum raster object size used in **TNTlite** from the product of 512 by 512 pixels = 262,144 pixels to 640 by 480 pixels = 307,200 pixels. Remember that it is the product of rows and columns that is limited to 307,200 pixels. However, neither the row nor column value can exceed 1024 pixels.

TNTsdk.

TNTsdk cannot be provided automatically and free with **TNTlite** since MicroImages must pay a royalty for each copy of Motif that is distributed for the Mac and Windows platforms. However, MicroImages encourages those who use **TNTlite** to consider writing programs via **TNTsdk**, and as a result it can be provided at the normal cost of \$300. Those who wish to use **TNTsdk** on a UNIX platform do not need to pay this royalty, as the Motif libraries are distributed with every UNIX operating system whose vendor pays the royalty and provides them as part of their SDKs.

Getting Started Booklets.

A section below discusses the 33 Getting Started tutorial booklets which are now available. It suffices to say here that all these booklets with associated geodata sets can be downloaded free for use with **TNTlite** as Acrobat PDF files or PageMaker 6.5 files. Those purchasing the physical kit version of **TNTlite 5.8** will find that it includes printed versions of all the 33 current booklets, modest bookshelf storage boxes for the booklets, and that all the PDF files and the sample geodata sets they use are on the **V5.80** CD.

Macintosh

V8.1.

V5.80 of the **TNT** products has been tested with MacOS 8.1. Please move immediately to MacOS 8.1 as it will cure some of the spurious system hangs which you have encountered in all your applications, including the **TNT** products. MicroImages has not tested the impact of the optional new file system provided by MacOS 8.1. As a result, it is not yet known if it provides any benefits, such as faster loading and file access to the operation of the **TNT** products. Tests of the impact of this new file system will begin immediately. Please note that with MacOS 8.1 no extensions are necessary to operate **TNT** products except Speed Doubler. Restarting your PMac with all extensions turned off will provide maximum **TNT** performance.

No More Memory Adjustments.

All **V5.80 TNT** processes now internally, temporarily take memory away from the MacOS system. It will no longer be necessary to occasionally increase the memory (RAM) allocation of a **TNT** process for a large task using the Get Info window. **TNT** processes will now just use whatever amount of memory they need from the system memory and then from virtual memory. Also, the PMac virtual memory access in V8.0 and 8.1 has been improved to the extent that RAM Doubler is now somewhat slower

and is no longer needed for any purpose. However, Connectix's Speed Doubler (V2.0.3) is still absolutely necessary to speed up drive access by using better buffering.

Old Macs to be Discontinued.

V5.90 of the **TNT** products will be provided on the CD for PMacs only using Motorola PPC processor chip 601 or higher. The old standard Macs using Motorola 68xxx processor chips are equivalent to Intel 386 processor chips and are simply too slow to be practical for the use of the **TNT** products. Please notify MicrowImages immediately if you are using an old Mac based on this older 68xxx processor for a professional **TNT** product.

NOTICE: There will be no more releases of **TNT** products for Macintosh computers based on the old 68000 processor architecture.

Speed Tests

MacOS versus Windows.

Test Setup.

During this quarter, there were questions posed about the relative performance of the Intel and Mac based computers. The following tests compare the performance of W95, NT4, MacOS 7.6.1, and MacOS 8.0 on almost identical platforms.

The test machine setups were:

PMac = Power Computing 132MHz 604e processor w/16mb of real RAM and MacOS 7.6.1

RAM Doubler (RD) - ON (set to 48mb)

Speed Doubler (SD) - ON

Virtual Memory - OFF

Only the extensions ON needed to run **TNTmips**

(Having all possible extensions ON will add about 10% to the times reported.)

W95 = Gateway 133Mhz Pentium processor w/16mb of real RAM and Windows 95
Virtual Memory - ON (set to 48mb)

NT4 = same Gateway 133Mhz Pentium processor w/16mb of real RAM and NT4
Virtual Memory - ON (set to 48mb)

The import test used the full SPOT image found in the San Francisco **TNTatlas** in TIFF format (10 meter image at 22mb). The test RVC file was local on the hard drive. The TIFF file imported was located on the same internal hard drive to which the RVC file was written.

Performance.

System RVC Read Test. There is a utility on the **TNTmips** menu designed way back in February 1996 to allow machines and processors plus hard drives to be compared for RVC file reading only. This **TNT** read utility can be used to make sure that several machines have been set up in as optimal a fashion as possible.

Read File Test. The **TNT** read utility was first used with the option to simply read the RVC file containing the SPOT image as a simple 22mb file (not as a raster, just as a

file). Nothing else was done except the read activity. These times are short and similar as they primarily test the ability of **TNTmips** to read with the operating systems' procedures and buffering.

W95	Gateway PC = 8 seconds
NT4	Gateway PC = 12 seconds
for MacOS 7.6.1 and SD 2.0.3	PMac = 9 seconds
for MacOS 8.0 and SD 8.0.1A	PMac = 8 seconds
for MacOS 8.0 and <u>without</u> SD	PMac = 30 seconds

In general, these tests simply check the system setup which, if properly done, produces short and comparable times. However, note the importance of patching the MacOS by using Speed Doubler.

Read RVC Raster Test. Next, the **TNT** utility was used to read the SPOT image as a raster object from the RVC created in the import test outlined below. After reading, nothing is done with the data, and it is simply "thrown away". The utility reports the time needed to read the entire 22mb raster object with the built-in **TNT** buffering.

W95	Gateway PC = 1 min 29 seconds
NT4	Gateway PC = 28 seconds
for MacOS 7.6.1 and SD 2.0.3	PMac = na
for MacOS 8.0 and SD 8.0.1A	PMac = 17 seconds
for MacOS 8.0 and <u>without</u> SD	PMac = 1 min 7 seconds

The MacOS 8.0 patched with Speed Doubler can read the raster object in 60% of the time that it would take under NT4.

Import to RVC Test. The last test was a standard import test (with pyramiding) on both machines from the SPOT TIFF image into a raster object in a project file.

for W95	Gateway PC = 5 min 45 seconds
for NT4	Gateway PC = 2 min 53 seconds
for MacOS 7.6.1 and SD 2.0.3	PMac = 3 min 31 seconds
for MacOS 8.0 and SD 8.0.1A	PMac = 3 min 1 second
for MacOS 8.0 and <u>without</u> SD	PMac = 9 min 33 seconds

Amazing, **it's magic**, a properly tuned PMac **wins** by importing the SPOT TIFF image in 1/2 the time it would take under W95 and in approximately the same time as under NT4!

IMPORTANT: Those using Pentium and Windows based machines should also note from the above that NT4 is twice as fast as W95 in this test and many other serious operations! NT gives maximum performance but with more system maintenance headaches.

MacOS versus extensions.

The following provides additional time tests for various machines and situations, one of which may approximate your system. While there are many factors that influence the performance of your application software, comparing **TNTmips** startup times to those furnished can give a very fast "health" check since the same software is compiled and provided for each computer platform involved.

Many of the unneeded Mac extensions and control panels you load patch MacOS and end up stealing cycles. If you want the maximum performance from your **TNT** product or any Mac application, determine what extensions are needed, use the extension manager to set up this group, and start up the MacOS with only those extensions. For example, using MacOS 8.1 on a stand alone Mac off the network, no extensions are required to run **TNTmips!** However, do use Speed Doubler as documented above.

If you want to use the multitasking feature of the MacOS to switch between **TNTmips** and Microsoft Word, the network, ..., then find out by experimenting to see which extensions are needed for each separate application and then combine them together. How do you do this? You have to play around, starting up the MacOS over and over, adding and deleting extensions until you find out exactly which ones are needed for each application. You will then be surprised to find that your suite of applications does not need most of the garbage that is being loaded and maintained on your Mac. Obviously, you have to work at it to wring maximum performance from your MacOS, and Windows for that matter!

The following comparative tests were performed on a PMac 6100 with 16 mb of real memory, a PPC 601 processor running at 60 MHz, and using MacOS 8.1. This is the original issue, slowest PMac ever produced. "on:" means 60 extensions/control panels were turned on. "off:" means that only the needed Speed Doubler and virtual memory were turned on.

with 60 control panel/extensions	on:	off:
Start TNTmips to the menu level	43 sec	26 sec
Open a new 2D view	67 sec	54 sec
Display an RGB image	37 sec	28 sec

Other Tests.**PMac 200 MHz.**

This test was performed under MacOS 8.1, traditional Apple disk formatting [8.1 supports a new and faster formatting], 24 Mb of real memory, no extensions except Speed Doubler and virtual memory as noted. It is important to emphasize that this PMac uses the PPC 604e processor and not the slower PPC 604, 603e, or 603 processor chips.

with Speed Doubler	on:	off:
Start TNTmips to the menu level	12 sec	20 sec
Open a new 2D view	12 sec	38 sec

Ancient UNIX Workstations.

HP 715 RISC at 33 MHz. This workstation test was performed under UNIX (HPUX 9.x) and 16 Mb of real memory. No other applications or unneeded processes were running concurrently. These times are for the first time that the **TNTmips** process is used.

Start TNTmips to the menu level	36 sec
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Open a new 2D view	53 sec
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It is important to further emphasize that the slow performance of this HP is indicative of the performance you are getting if you are still using an ancient Sun, SGI, and other UNIX workstations using single processors in the 30 to 100 MHz rate. Furthermore, these times are optimal and do not reflect the degradation in performance experienced when other applications and users compete with **TNTmips** for this processor.

W95.

PC 486 at 25 MHz. This test was performed under W95 and 16 Mb of real memory. These times are for the first time that the **TNTmips** process is used.

Start TNTmips to the menu level	67 sec
Open a new 2D view	55 sec

Pentium II 200 MHz. This test was performed under W95 and 32 Mb of real memory. These times are for the first time that the **TNTmips** process is used.

Start TNTmips to the menu level	8 sec
Open a new 2D view	9 sec

Pentium Pro 266 MHz. This test was performed under W95 and 32 Mb of real memory. These times are for the first time that the **TNTmips** process is used.

Start TNTmips to the menu level	3 sec
Open a new 2D view	7 sec

These times are for the second time the **TNTmips** process is used. Under these test circumstances, portions of these processes would have been cached in memory.

Start TNTmips to the menu level	1.5 sec
Open a new 2D view	3 sec

Maintaining Your System

Software support periodically receives communications from users whose computer system performance has gradually degraded. Sometimes this is accompanied by spurious ILL OPS or system hangs. These symptoms often seem to crop up in **TNTmips**, as you do not notice that your other smaller applications, such as word processing, are also slower. Usually these degradations can be traced back to the fact that the hard drive of the system has not been properly maintained. Just as you have to maintain your car and other devices, you also have to put a little time and effort into the maintenance of your computer system. Upgrading your applications or patching your operating system is one obvious maintenance. Taking time to delete all those pesky files which seem to multiply on their own is another. Usually, the one which is not being done is to periodically scan, error check, and defragment the hard drive.

Excessive hard drive fragmentation is usually the cause of most of the system degradation calls received by MicroImages. It is not particularly caused by any application product and could occur from simply moving files around or deleting them. MicroImages will try to help you even though it is really your job and Microsoft or Apple to keep your computer working in an optimal fashion. This whole business of hard drive defragmentation is ridiculous, as a good operating system would not allow it to happen and/or would fix it automatically. What is even more ridiculous is that you have to go out and

buy a separate product to do what you expect the vendor of your operating system to do for you.

for W95. Each drive has a "properties" dialog with a "Tools" tab. This "Tools" tab has an "Error-checking Status" section and a "Defragmentation status" Section. These sections provide buttons to run "ScanDisk" to check the drive for errors and "Disk Defragmenter" to defragment.

for NT. Purchase DiskKeeper from ExecSoft: www.execsoft.com or (800)829-6468. They also have trial versions available. DiskKeeper is available for NT on both Intel and Alpha based platforms.

for Mac and PMacs. Purchase the appropriate Norton Utilities and use "Speed Disk".

When running defragmentation on a PC, it is essential that you choose the Defragmentation Method of Full defragmentation (both files and free space). If you do not defragment the free space, the Windows virtual memory file will be fragmented when created and can cause your computer to run significantly slower (for example, a job that takes one hour could take as little as ten minutes after defragmentation).

The defragmentation process for W31 and W95 also frequently reports that the "fragmentation %" is low and that you do not need to run it. This is incorrect, as it does not include free space in the percentage. Incidentally, the less fragmented the drive, the quicker the defragmentation process. So, if the process is run weekly (for example, Friday when you go to lunch), it will generally complete in under ten minutes, or under two minutes if run daily. It is also advisable to run ScanDisk (or equivalent) with the surface verify option at least once a month.

Getting Started Booklets

The collection of Getting Started tutorial booklets continues to expand. Currently, the series contains 33 booklets, all of which have been provided to you. The available booklets now contain over 700 color pages which provide the equivalent of two good sized textbooks of material on geospatial analysis. Six new booklets have been scheduled for release with **V5.90**. While a total of 54 booklets has been outlined, the priority to create new booklets will begin to decrease, as many existing booklets now need revision and upgrading. The following old booklets were updated during the last quarter: Building and Using Queries and Displaying Geospatial Data (shipping).

Some of you wish to extract material from these booklets for use in your own printed manuals, guides, translations, and other reference materials. The Adobe Acrobat Reader is excellent for viewing and printing the color booklets. However, it is not possible to extract illustrations from the PDF files or translate their text to other languages. MicroImages now creates these booklets in a standard fashion in Adobe PageMaker 6.5 from which the PDF files are created for inclusion on the CD. In response to your requests, the PageMaker files as well as the PDF files for the latest version of each booklet can now be downloaded from microimages.com.

Following the previous model, the sample geodata sets used in each booklet have also been included on the CD and on microimages.com. Almost all of this geodata is sized so that it can be used in the **TNTlite** product.

Previously Completed Booklets. [21 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
Making Map Layouts	Mosaicking Raster Geodata
Importing Geodata	Building and Using Queries
3D Perspective Visualization	Interactive Region Analysis
Pin Mapping	Acquiring Geodata
Managing Databases	Making DEMs and Orthoimages
Style Manual	

New V5.80 Booklets. [12 units shipping]

Vector Analysis Operations	Spatial Manipulation Language
Exporting Geodata	Creating and Using Styles
Editing CAD Geodata	Filtering Images
Editing TIN Geodata	Getting Good Color
Combining Rasters	Using Geospatial Formulas
Sketching and Measuring	Digitizing Soil Maps

Reissued with V5.80. [1 earlier unit upgraded and shipping]

Displaying Geospatial Data

Scheduled for V5.90. [6 units selected from 8 below]

Constructing HyperIndexes®	Changing Languages (localization)
TNT Technical Characteristics	Using the Software Development Kit
Understanding Map Projections	Introduction to Hazard Modeling
Managing Geoattributes	Orthophotos via 35 mm Slides

Possible Futures. [13 units]

Scanning	Vectorizing Scans
Rectifying Images	Mapping Watersheds and Viewsheds
Warping and Resampling Geodata	Using the Electronic Reference Manual
Introduction to GIS	Introduction to Remote Sensing
Introduction to PhotoInterpretation	Introduction to Precision Farming
Introduction to RADAR Interpretation	COGO
Extracting Geodata	

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 \$40, and at this time it will include 33 or more booklets. Additional printed Getting Started booklets are added to the kit as they are completed during the quarter. If you want additional printed copies of any or all the published booklets, please order a new **TNTlite** kit.

All new **TNTmips** professional product shipments contain all the published printed booklets and the associated geodata. Existing MicroImages clients with active maintenance contracts get all new booklets published that quarter in their upgrade shipment. You are also free to duplicate the published booklet, duplicate it via the PDF

file, or cannibalize its contents via the PageMaker file as long as the source of the information continues to be credited to Microlmages.

TNT Reference Manual

The Reference Manual this quarter has 2887 single spaced pages (an increase of 195 pages) and installs into 32 MB with the illustrations or into 7 MB without them. Last minute supplemental sections which do not occur in the on-line HTML version or Microsoft Word version were created for new processes and features. These sections were completed for **V5.80** after the master CDs were created for the reproduction process. These 48 additional pages are included in supplemental, printed form as follows.

- Layer Positioning/Mosaic (8 pages)
- Show GPS Position (2 pages)
- Creating and Using Regions (27 pages)
- Single Record View Style Sample (1 page)
- Adding Layers with **SML** Scripts (10 pages)

There have been requests for "context retrieval" features for use in rapidly finding information on specific topics in the on-line Reference Manual. Microlmages is now testing a JAVA applet search engine which can search the local HTML files and may be provided for this purpose. In the meantime, you can download a free search engine suitable for this purpose called [AltaVista@ Personal Search 97](http://www.altavista.digital.com/av/content/searchpx.htm) from [http://www/altavista.digital.com](http://www.altavista.digital.com). Unfortunately, Microlmages cannot redistribute this AltaVista search engine without paying a royalty. It is also very easy and fast to use Microsoft Word to search the Word version of the Reference Manual directly on the CD.

Microlmages will no longer provide printed copies of the Reference Manual with **TNTmips**. Few people require this huge printed copy, it is not in color, goes out of date with the very next release, and greatly adds to the cost of materials, shipping, and handling.

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 5.8**.

System Level Features.

An "update date" is now displayed in the title bar of processes that have been updated as "patches" (in other words, downloaded) after the official CD version was installed.

When you use a process you have downloaded from microimages.com to correct an error (a patch), this "update date" will appear in the upper left of the main window for that specific process. If you are still using the official release of the process from the CD, no such date will appear. When this date does appear, it is the actual date when this beta or patched process was compiled. To avoid confusion, Microlmages needs you to include this date or lack of it in every error report you subsequently encounter in this process. When a process is being actively expanded or corrected, providing this date in your error report is vital in determining which version of the process you are currently using.

IMPORTANT: When you have installed and tested an interim patched process, please include its “update date” in any additional requests for assistance. This is the date of its compilation which appears in the upper left of its main window.

There is now a Support/Maintenance/Attach Metadata option which will allow quick attachment of metadata to a selected set of objects. An option is available to simply link all these objects to a single metadata file or actually store the metadata as a subobject of each selected object.

Project File Maintenance.

* When copying the files, the option is available to copy or retain links to other files/objects.

RVC Project Files are now automatically packed when copied.

A new description can be entered for the object being copied.

When an object is deleted, the default position in the object list is set to the next object.

Metadata can now be viewed and edited for the selected object.

The “Info” dialog, if open, is automatically updated whenever a new object is selected.

*** Display/Spatial Data.**

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**. There was also a separate process for viewing 3D images. These four year old processes are now replaced by the new process for visualizing and viewing 2D and 3D geospatial data. This new viewing procedure has also been substituted into almost every other **TNT** process which creates and manages a view.

The layer control procedure used in this process has a completely redesigned interface, eliminating the separate view/groups/layers lists. The new subsection of the interface combines the layers and groups in a single “list” for each “layout”. Each layout has its own control dialog. It uses many more icons and allows groups to be expanded and collapsed as needed. It also uses (and replaces) many of the features found on the “Element Selection” dialog in the old (**V5.70** and earlier) display process. The Getting Started booklet entitled Displaying Geospatial Data has been updated and is included in printed form to illustrate these changes.

Simultaneous 2D and 3D Viewing.

It is now possible to open a separate “group” outside of a layout. This group allows simpler viewing of a single set of spatial objects (rasters, vectors, ...). These groups can be viewed in both perspective and “overhead” modes at the same time. This allows multiple views of the same layout or group (even combinations of 2D and 3D views) with independent control of the area viewed. Layers and groups may be hidden independently for each view.

A new 3D positioning tool has been created to allow easy control of the viewpoint position using the overhead view. The viewpoint can be set to either keep a specific point centered in the view (for example, look at the same mountain from any direction) or keep the viewer at a specified point (look in all directions from the same mountaintop).

If multiple 3D views are open, the position of the viewer for all viewpoints can be controlled. A color plate is attached entitled Linked 2D and 3D Views for Complex Visualization to illustrate the use of three different geo-locked views, associated layer controls, and the 3D positioning tool.

Since multiple, locked views are now readily created, an option is available to control whether redraw is to be performed for the active view or for all views.

When multiple views are being used, the limited colors available on some systems (for example, 256 colors) are now shared among views for better overall color quality.

New Layers and Features.

There is now a "GeoFormula" layer type which can be used to preprogram how a layer(s) can be created when viewed from other objects. This new process, which can also be used to create layers in a display, is described below in more detail.

There is now a "Region" layer type. This layer allows previously-saved regions to be added to the group for use as simple borders, backgrounds, and so on.

The progress in creating each layer being drawn is now reported using a status bar at the bottom of the view.

Text layers can now reference project file "text" objects as well as external text files.

An **SML** script can be selected as a layer for use in the display/layout. When the view is drawn or redrawn, the script will be executed, and whatever it does will appear in its layer. A sample use might be to plot real-time GPS units into a view which is automatically redrawn.

* **SML** scripts can be stored as objects in RVC Project Files for easy access and use as layers in a view.

The CartoScript functions described in detail below can be used in an **SML** script and thus control how elements will be drawn in the **SML** layer.

Text objects stored in Project Files can now be selected and used as layers in display and layouts.

Quantitative Readouts.

Datatips can now be selected and displayed for layers that are hidden.

An icon is available on the toolbar to connect to and read live geopoints coming from an attached GPS unit via NMEA (National Marine Electronics Association) and Trimble GPS communication standards via serial ports.

The major and minor axes of ellipses and lengths of the sides of rectangles are now reported in the measurement tools.

The format for the latitude and longitude values shown in the scale/position line for the cursor position can be designed.

Group Settings.

There is now a toggle on the "Group Controls" dialog for groups used in layouts to "lock" the "relative zoom" to the current setting. This prevents the user from accidentally resizing a group, thereby making its scale incorrect when printed.

Routing.

Routes can now be found which begin and end at the same point if way points on the route are entered.

Layouts into Illustrator.

Map layouts can be saved into Adobe Illustrator 7 format (and thereby into FreeHand) using Illustrator's special EPS format (Illustrator Encapsulated PostScript). Output to the generic EPS format will also be provided. [requires printer support option **P8**]

Label Placement Optimization.

Label placement can now be optimized to avoid label "collisions". The significance of a label in this process can be specified by query. (In other words, where label overlap does occur, the more important label will be preserved--for example, the name of the larger city). This new feature can currently be done only with a CartoScript, which is described in more detail in a section below.

Map Grids.

Map grids displayed in 3D views can optionally be used to add Z axis scales (as well as X and Y scales).

Many new formatting options are now available for Latitude-Longitude coordinates.

Tick marks may now be placed inside the border (as well as outside). The length of the ticks inside and outside can be set independently.

Tick marks may now be placed in the interior of the "map" at the location where the map grid lines intersect.

* Axes can be inserted into 3D views.

Pin Mapping.

Pin mapping allows setting of coordinate units (meters, feet, ...) for projected coordinates. It also allows setting of the format (DDDMMSSS, decimal degrees, ...) for Latitude-Longitude coordinates.

Raster Correlation Display.

When a 2D histogram view (scatter diagram) is opened, the position of the cursor in the associated 2D view will be highlighted for the corresponding cell value in the 2D histogram. This produces a "dancing pixels" effect that is useful in identifying spectral characteristics of different areas in a raster.

Getting Started.

Two previously published Getting Started booklets have been edited and updated to cover the changes in the processes: Using Queries and Displaying Geospatial Data. These revised booklets are both included in an Adobe PDF file on microimages.com and on the **V5.80** CD.

Modifications completed since V5.80 CDs.

Zoom to Element Extents. Options are now available on the layer "Tools" icon to zoom to the extents of either the "active" element or the extents of all "currently selected" elements. The affected view(s) will be zoomed and panned so that the entire element(s) are visible in the view.

Multilayer Datatips. A multiple line datatip can be set up to contain separate data lines from separate layers in the view including hidden layers. This multiple line datatip can even contain data from a hidden view. A prefix and suffix string of characters can also

be added to each data element in the datatip. This suffix and prefix information can be different for each line/layer. For example, one line in the datatip can be "infiltration 25 percent". The fixed prefix string is "infiltration", the variable data is "25" read from the appropriate field in the records attached to the Crow Butte soil map, and the fixed suffix string is "percent". The second line in the datatip is "field size is 120 acres". The prefix is "field size is", the variable data is "120" coming from the standard attributes record for a property ownership map, and "acres" is a units suffix.

View-in-View. This viewing feature is now available to allow you to make layer comparisons of any combinations of objects within a 2D view. It may eventually be possible to make similar comparisons with a 3D view. The "View-in-View" icon on the toolbar allows you to pull out and move around a rectangle in a 2D view much like the zoom box. Choosing this tool automatically causes the vertical column of cyan "layer control" icons to be duplicated but with a pink lens instead of cyan. The cyan lens "layer control" icons, as before, still toggle the associated layer in the view on and off. But, the new duplicate pink lens "layer control" icons toggle the associated layer inside the rectangle on and off. At any time, the rectangle can be dragged or resized in the normal fashion, and the interior contents will be almost instantly updated.

A simple use of this powerful feature would be to set up a view with only two layers. One layer is a composite natural color image, and the second layer is an unsupervised image classification of multispectral images of the same area. As usual, these images do not have to be in the same projections, cell sizes, extents, and so on. The View-in-View option can be used to show the natural color image in the outer area and the classification results inside the rectangle. Moving the rectangle around allows a comparison of how the classification layer compares across the rectangle boundaries with the natural color image. This kind of comparison is quite useful when used in connection with grouping and naming the classes in an unsupervised classification raster.

Georeferencing.

Z coordinates can now be transferred (attached) from a "surface" object to the control point being edited.

Multiple objects can now be georeferenced at one time. The same control point set is saved for all selected objects. It is no longer necessary to copy control point sets from one object to the next in a multispectral image set.

The "enhance" view options are now provided for a raster being georeferenced.

The "orientation" of the objects being georeferenced can now be specified.

The line "thickness" for the control points can be specified for improved visibility.

Inactive control points may now be saved. They will become "active" if this option is chosen and they are saved. The "inactive" control points may optionally be sorted to the end of the list.

Import/Export.

* Arc/Info Coverages Import and Export.

Arc/Info coverage format now supports selecting and importing and exporting of single or multiple coverages. The coverage selection procedure now allows selection on any file that is part of that coverage; the import process will determine what coverage files exist. The import process now correctly interprets and imports point coverages and exports them. If projection information exists, the new import process will now correctly interpret the file and store the information as a georeference subobject.

* Arc/Info E00 Export.

* ESRI's E00 formatted files can now be exported as well as imported.

Additional tables included in an E00 may now be imported. Note that according to the information we have available, the "relationships" between tables are not recorded in an E00 file. Therefore, after importing an E00 file, these relationships between tables must be set up within ArcInfo. A dialog advising that this will need to be done will appear if this condition is detected during the import. Anyone who has knowledge to the contrary or sample E00 files which convey table relationships should bring these to MicroImages' attention.

NOTICE: ESRI's E00 files do not seem to preserve any information on the relational links in the tables contained. Thus, it appears that these links must be rebuilt when a new Arc/Info station uses an E00 file. If you can retain your Arc/Info relational links when transferring E00 files between computers or if you have E00 files which automatically build the table links on your Arc/Info computer, please provide examples of these files.

More MapInfo Export Features.

Export to JPEG raster format (*.JPG) is available, including the automatic creation of the associated georeference information in the MapInfo *.TAB file.

TIFF and JPEG files created by MapInfo can be imported, and the import will also recognize and use the georeference from the accompanying *.TAB file if it has the same name as the TIFF or JPEG raster and if both files are in the same directory.

Export DEM.

A raster object containing elevation can now be exported to the USGS DEM format.

Import GTOPO30.

The 30 arcsecond global topographic elevation data provided free on four CDs by the EROS Data Center in the GTOPO30 format can be imported. See the EROS Web site at edcwww.cr.usgs.gov/landdaac/gtopo30/gtopo30.html for more information on how to acquire these CDs.

Improvements to ASCII Text Import.

ASCII text strings of coordinate pairs can now be imported as vertices in a line in a vector object. Successive pairs will be connected together into lines in the order that they are imported. A line-break distance between coordinate pairs can be set. When a gap in the stream of pairs is equal to or larger than this break, it will be interpreted as the end of one line and the start of another. Lines recorded on data loggers from GPS units can be imported into a vector object with this feature.

Coordinate pairs can now be specified for import to be in any one of the Latitude and Longitude formats supported elsewhere in the **TNT** products.

* Adobe Illustrator Export.

Allow map layouts to be moved into Adobe Illustrator using its special EPS format (Illustrator Encapsulated PostScript). Output to the generic EPS format is also provided. Transferring the layout into Illustrator on the Mac or Windows PCs allows the addition of fancier map elements. EPS files can also be used to create PDF files for distribution from **TNT** layout using Adobe Acrobat Distiller. Saving into this format is provided under the **P8** printing option similar to the output to TIFF files.

* SDTS Vector Import.

Topological SDTS vectors can be imported along with their primary attributes.

SPOT Import.

The SPOT CCT, SPOT4, and Australian ACRES variants of the SPOT format can now be imported.

LANDSAT Import.

LANDSAT CCT and its variants called Canadian CCRS and Australian ACRES images can be imported.

GeoTIFF Export.

The GeoTIFF georeference tags which combine with TIFF files to make GeoTIFF data sets can be exported.

ER Mapper Import.

The georeference information can now be imported with ER Mapper files.

VRML Export.

Background. Virtual Reality Modeling Language (VRML) is a scene description language which describes 3D environments over the Internet.

It is a file format (*.wrl) that defines layout and content of a 3D world with links to more information. Unlike HTML, however, VRML worlds are spacious and inherently interactive--filled with objects that react to the user and to each other. VRML is scaleable across platforms: PMacs, PCs, and high-end workstations. The latest VRML specification is version 2.0. You can download the VRML 2 specification at: <http://www.vrml.org/vrml2.0/final/>.

VRML 2.0 Browsers are available FREE from the following sites and others:

Cosmo Player - Silicon Graphics (W95, NT, IRIX 5.3, and IRIX 6.2) [vrml.sgi.com]

WorldView - Intervista Software (W95 and NT) [www.intervista.com]

Liquid Reality - DimensionX (W95, NT, IRIX, Sun, LINUX) [www.dimensionx.com]

Community Place - Sony (W95 and NT) [www.sonypic.com/vs]

See vrml.sgi.com for more information of VRML 2.0 and the links to the sources of these browsers.

Raster Exports. Raster objects can be exported using three different options: Elevation Grid, Profiles, and Solid Profiles. Elevation Grid creates a DEM-like representation of the raster where cell values represent elevation for the raster cells. Profiles and Solid Profiles create a set of profiles created along the scanlines of the raster. You can control the visual appearance of the VRML world by specifying different Z-scale/Z-offset

values as well as sampling rate. Most of the VRML browsers or plug-ins can't handle large data sets, so the sampling helps to speed up display time. The further solution for storing big data sets is dividing your world into a number of small "tiles" and using the LOD (Level of Details) feature from the VRML 2.0 specifications to provide automatic generalization of your data. **TNTmips** will support LOD features in a future version of this export procedure.

TIN Exports. TIN objects can be exported as a set of solid three dimensional facets.

Vector Exports. Vector objects can be exported as a set of 3D lines.

Supervised Classification.

A back propagation method of supervised classification has been added.

The Mahalanobis distance method of supervised classification has been added.

A modal filter for use in postclassification hole or noise filling is now available in the classification process.

Unsupervised Classification.

One or several scatterplots (2D histograms) views can be exposed for pairs of input rasters. Any raster can be assigned to the axes of the scatterplot and exchanged for another. These plots will show elliptical views of the signatures of each cluster in 2D raster space in colors matching the color in the corresponding 2D view. The confidence interval controlling the length of the major and minor axes (therefore the size) of these ellipses can be set (for example, 95% of the cells in the class fall inside the ellipse). Individual grid cells on this plot show circles whose radii are proportional to the frequency of the classified points with the corresponding values in the two rasters.

Clusters can be combined by selecting their corresponding ellipses in the scattergram. The new combined ellipse which results will then be immediately displayed and the other views adjusted (2D, co-occurrence, ...) to represent this amalgamation of clusters.

The highlight color used in the co-occurrence table can be selected.

A color plate is attached entitled New Automatic Classification Features to illustrate some of the new classification features which are available.

Modifications completed since V5.80 CDs.

* Faster Cluster Merging. New interactive procedures have been introduced in **V5.70** and **V5.80** for using the co-occurrence table, elliptical plots, and other procedures to group classes together, and name them. But after making a decision to combine two classes together, it took too long to recompute the new statistics and tables and proceed to the next decision. **V5.80** allows several such groupings to be made in pairs or more before a recompute is initiated, which helps a little. But, the methods used to compute and save the statistics have now been rewritten, and the process is much faster. For example, a recompute of the statistics for a large number of classes might now take 15 seconds instead of ten minutes. This marked improvement makes the whole process interactive, whereby a single pair of classes can be combined, and the recomputation provides new tables for the next grouping or an undo.

Profiles.

The Profile window now allows the selection of multiple raster objects for a superimposed multiple profile display. The profile from each raster can be assigned a color and/or symbolism to distinguish it in this multi-curve plot.

The axes of these profiles are now labeled, and the font sizes and types to be used can be selected.

The range for the vertical axis can be designated.

Positioning a crosshair on or near a position on a specific profile will display its numeric and statistical values.

A datatip will appear when the cursor is near each profile to display its source raster object.

The contents of the profile window can be saved as a snapshot file for subsequent printing.

A color plate is attached entitled Profiles with the Measurement Tools to illustrate the improved appearance and information content of the new profile viewing window.

Databases.

Import Templates.

A text file template can be created, stored, selected, and applied to determine how multiple tables are to be imported. Using this text file, multiple database tables of any format can be imported in one operation.

This template can also be used to control how the imported database files are to automatically link up upon import to create a relational database within **TNTmips**. It can also control how this database is to be attached to an object as attributes.

A template can be used over and over to import and automatically structure and attach a database table to a **TNT** object. This allows repeated examples of the same imports to be programmed and automated. For example, import many soil parameter tables, create relational links to build the appropriate database from them, and attach it to the soil polygon vector object created by the AutoTrace process.

The tree table diagram will be constructed on screen as the template controls the importing and construction of the database.

Multiple Fields as Keys.

Multiple fields in a table can be concatenated into a single field for use as a primary or secondary field for the relational linking of these tables. Think of this as creating a composite field for subsequent use (for example, combine fields such as STATE + COUNTY + SOILTYPE). Using composite fields will allow all the complicated, multiple field relational links that are found in the USDA/NRSC's SUREGO soil database for each county to be duplicated within **TNTmips**.

Graphical Fields.

The single record view now has the option to show a style sample. It defaults to off. To turn it on, go to the menu item Table/Style Sample/Top or Table/Style Sample/Bottom. Single record view does not currently save any previous state information other than the size and location of the window. In **V5.90**, this graphical field will default to showing or not depending on its last use.

Graphical Importing.

Tables can be imported directly from the tree diagram, which will then be automatically redrawn to show their positions.

HyperSpectral.

Modifications completed since V5.80 CDs.

The first prototype of the hyperspectral analysis procedure is nearly complete and may be available for downloading with a NASA AVIRIS sample image by the time you read this MEMO. Please check with software support. An original hyperspectral image has many spectral bands, usually ranging from 128 to 256 raster objects. It would be very inconvenient to end up selecting each band separately for each operation. As a result, a new kind of raster object has been created to accommodate this and other similar needs in the **TNT** Project Files.

This new object is a raster-set object which is something like an RGB color combination raster but with many more bands. This raster-set object will be a single object and might be a LANDSAT image with seven bands, a hyperspectral image with 256 bands, a SPOT image of four bands, and many others. **TNT** processes will be gradually modified to directly recognize each specific raster-set object and then know how to deal with the individual bands it contains. This raster-set object will be used with the first prototype release of the hyperspectral process.

Typically, a single unprocessed hyperspectral NASA AVIRIS aircraft image is 224 spectral bands for an image of 614 by 512 pixels with each pixel stored as a 2-byte integer. This yields an uncompressed file for each image of 140 Mb which covers an area of only 11 by 10 kilometers. Similarly, OrbImage's Orb3 hyperspectral subsystem (supported by the US Air Force as Warstrider) will collect an image of 625 pixels by ? in width (8 meter resolution). Clearly, it will take a lot of space to store any significant areal coverage of such images and a large amount of computer time to analyze them unless a special, well thought-out object structure is devised. The typical tiling and pyramiding used with raster objects do not provide any obvious benefits when the spatial dimension of the object is small, such as with all known proposed hyperspectral imaging devices.

In response to these special characteristics of hyperspectral images, MicroImages has designed a unique object for supporting their use in the **TNT** products. It is a complex loss-less compression format specifically designed for a hyperspectral image of many spectral bands. It will be created during the importing of the hyperspectral image, which will require considerable computation. This new object will be optimized to reduce the storage space for the object while optimizing access to it for both display and complex analysis.

Extract Rasters.

The process can use a vector object to define the extent and extract a series of smaller raster objects. Queries and other selection procedures can be used to determine which vector polygons individually define the area to be extracted into each new raster object. The raster objects are then automatically created and placed into a Project File. Any field in a table attached to the polygons can be used to generate the name for each raster object, or sequential names will automatically be generated. The area outside the boundary specified by the polygon but within its extent will be set to null.

A typical application of this new feature could be to subset an image into smaller images for distribution. The polygons in the vector object might be land parcels such as the fields of farmers subscribing to an image delivery service. The attached data table could contain the name of the farm and crop field which could be concatenated using a computed field into the name assigned to that raster object. Other fields in the attached tables could specify if the specific subscriber ordered this date of image and paid the

previous billing. These fields could then be used in the query to determine if an image product was to be prepared and shipped to that subscriber.

Map Calculator.

The map calculator will now convert strings of coordinate pairs read from a text file and write the converted coordinates out to another text file.

Vector to Raster Conversion.

The vector to raster conversion process has been rewritten to provide all the common features in other vector analysis processes. This provides many new useful procedures. For example, a query can be used to select the elements in the vector object to be converted into the raster object.

Vector Combinations.

Table joining options have been added to this process. The options include joining tables if the table name and structure match, or the table structures match, or do not join any tables. The option to remove duplicate records is also available. Table structures are considered a match if the number of fields for each table is the same, and each field in the first table is compatible with the second. Compatible fields are fields that can be promoted. For example, ASCII string to UNICODE or 4 byte float to 8 byte double.

Lines from two vector objects can now be intersected to produce points in a new vector object at the intersections. Attributes are assigned from the lines to the points created.

Object Editor.

General.

The Object Editor has been modified to use the new spatial display interface components. One of the advantages provided by this interface is the option to open a 3D view of the reference and editable layers. The options to add a surface layer and open a 3D view are under the "Reference/Open 3D View" and "Reference/Add Surface..." menu options. The 3D view is used for viewing only; editing capability is not enabled. The view is closed by pressing the title bar 'X' icon or the "View/Close" menu option on the 3D view window. Any number of 3D views can be opened.

New reference layer types have been made available to the object editor, which include the **SML** and GeoFormula layers.

The editable object operations "Validate", "Remove Excess Nodes", "Remove Unattached Records", and "Update Standard Attributes" have been moved to the "Tools" icon in the layer list from the "File" menu.

Multiple database tables from different layers can be opened and viewed while in the object editor.

Thinning lines in Vector and CAD objects now permits the use of the "Douglas-Peucker" method. A pre-thin spline option has been added to spline the line before thinning. The spline types are "None", "Cubic", and "Quadratic".

Two new Getting Started booklets entitled: Editing CAD Geodata and Editing TIN Geodata have been finished to assist you in editing these types of objects.

Improved Line Snapping.

Multiple additions and modifications have been made to line end snapping in both adding and snapping line operations:

- The end of the line which will snap can be specified. The three choices are “Both Ends”, “Start of the line”, and “End of the line”.
- A line can be forced to a vertex in a line. Select the “Snap To” condition called “Vertex”. The line end will snap only if it is within the snap distance on an existing line vertex and will snap to that vertex point.
- The “Add Line” tool now sets the size of the line end markers, the circle and square, to equal the snap distance specified in “Setup/Preferences/Vector”. This shows graphically whether or not the snap will reach a specific element.
- The “Add Line” tool now sets the end marker to the secondary tool color if that end of the line will snap. The secondary tool color is set in “Setup/Pref-erences/Color”.
- The “Add Line” tool now supports a snap mode called a “Chain Snap”. This mode retains the last point from a previously added line and makes it the start point of the new line. This feature can be used to create a line that is separated into segments by nodes, and each segment has different attributes attached.

The line snapping operation now has a preview option to show where the line will snap to and what the snapped lines will look like. The preview options are “Active” for the active element, “Selected” for all selected elements, and “None” for no preview. The preview color is set in “Setup/Preferences/Color”.

Creating Elements by Offset.

Selected elements can be offset from their original location and inserted at the new location in place of, or in addition to, their beginning position. The offset value and direction can be directly entered or read from fields stored with each element. Use this feature to correct GPS-collected data where the actual point could only be measured by an offset (into a building, projecting over water, and so on).

Both vector and CAD elements can now be created by offset from existing elements. The new offset element is like a buffer zone, except that the zone can be optionally defined for only one side of the selected existing element(s). For a line element, the new offset line element can be created on the left, right, or both sides of the original line. For polygon elements, the offset polygon can be created on the inside, outside, or both sides of the polygon. For point elements, the offset element is a circle.

Selection of offset distance and join methods is available. The join method specifies how the separation between two offset line segments is to be joined if they do not intersect, in other words around a corner in the original line. The three join methods are “bevel”, which is a connection straight from one point to the other, “miter”, which is a connection using the extension of the lines to their intersection point, and “round”, which joins the two ends with an arc. The offset distance, source element deletion, line side, and polygon side can be specified in a dialog box, right mouse button, or via a query of attached attributes. A query can select a collection of elements, create offset elements from them, and delete the original elements. A simple example would be to use a query to select a collection of point elements, create circles of varying diameters around them according to a data field attached to them, and then delete the points.

A color plate is attached entitled New Object Editor Features to illustrate the use of this offset procedure to create new elements.

Assigning Elevation to Contours.

A new tool has been added to rapidly assign Z values to vector lines. This tool is located in the "Tools" section of the vector part of the object editor and is called "Set Contour Z Values". The tool works by using a line drawn across several vector lines that need Z values. Next, a starting Z value and the interval step are assigned. Pressing the right mouse button or the "Assign" button on the dialog will then assign Z values to the vector lines that are crossed by the drawn line. These Z coded vector lines will then change color to denote that they now have a Z value. The "unassigned" field denotes the line Z value for which the lines are not assigned yet and has a default of zero.

There are four assignment modes for Z values including "Uphill", "Downhill", "Flat", and "Unassign". The "Flat" mode assigns the start value to all the crossed lines, and the "Unassign" mode sets the crossed lines to the unassigned value. The operation will beep and present a message on the view window when a conflict in assigning Z values occurs. A conflict can occur when an assigned line is crossed but the value that was to be assigned does not agree with the line's value or if the same line is crossed for a second time, indicating a valley or a ridge. There are two semi-automatic value adjustments included. If the drawn line crosses one assigned line, the "Start (x)" field will be filled in with the appropriate Z value. If the drawn line crosses two or more lines, the direction is adjusted along with the start value.

A color plate is attached entitled New Object Editor Features to illustrate the use of this rapid contour Z value labeling procedure.

Connect the Dots.

It is common for strings of GPS positions to be collected to define polygons and then imported. One way to build these coordinate pairs into polygons or lines is to use a new edit feature to manually connect them. When using this feature, you need not point exactly to the next dot but merely close to it, as the line will snap to the point. It is also possible to snap to and connect points which are not in the editable layer but only in a reference layer. In this circumstance, only the new line or polygon element created by connecting the points will be in the new CAD or vector layer.

A color plate is attached entitled New Object Editor Features to illustrate the use of this procedure for connecting points.

* GeoFormulas (new prototype process).

Concept.

A completely new geospatial formula process has been created for combining raster, vector, and TIN objects. A geospatial formula called a GeoFormula can be written, which when executed, will combine the input objects into a new raster object or a new display layer. GeoFormulas can range in complexity from a simple combination of raster image bands (such as a ratio) to a complicated algorithm involving multiple resolutions of rasters, vector polygons, and TIN surfaces. Think of the formula as creating a virtual raster which only exists when the GeoFormula is executed. Since it is a virtual raster, it can be used wherever other rasters can be used.

A GeoFormula is like an algorithm in ER Mapper or something like the Spatial Modeling Approach in ERDAS Imagine. Like ER Mapper, no intermediate rasters are created. Unlike ER Mapper, it is interpreted rather than compiled. The big advantage over ER Mapper algorithms is that none of the objects used in the GeoFormula need to have concurrent extents, projections, and so on. Furthermore, a GeoFormula can use vector

and TIN objects which are simply sampled (for example, point in polygon for FIELD selected) for each required output raster cell.

Procedure.

The GeoFormula is written using the query scripting language so that all the elements, database fields, and so on from each of the input objects are available for use in a GeoFormula. All the functions in **SML** are also available for use in the GeoFormula except those that read and write objects. These read and write operations must be carried on within the GeoFormula process. The designated input objects can each be any size, projection, scale, and geographic extent. The cell size, projection, orientation, and extent of the designated output raster can be specified when the GeoFormula is run and will be automatically resolved for each input object. A GeoFormula is then evaluated for each individual cell in the output raster. The corresponding raster cell, vector polygon, and TIN triangle for each input object are automatically determined and made available and used in the process.

The display process has also been modified so that it can create or simply choose a GeoFormula as a single layer. For example, a GeoFormula can yield the RGB values to be displayed for each cell. Thus, a very simple GeoFormula could use a FIELD in a database attached to a raster to determine how it was displayed (for example, to act as a color look-up table). Similarly, several rasters could be combined by using a FIELD or computed FIELD in a record attached to each cell in each raster yielding the RGB components of each new cell for display.

Typical Applications.

Here is a simple and easy-to-understand application. Commonly, geologists display RGB raster objects each as the ratio of two TM bands. So, create three subsections in a GeoFormula to compute each ratio. Then, start each subsection (or finish it) with a Brovey transform which uses N low resolution raster object (for example, LANDSAT TM) plus one high resolution raster object (for example, SPOT) to create N high resolution outputs. The virtual rasters to be displayed as RGB in this GeoFormula are the specified combinations of the resolution enhancement and the ratios. Yes, this can be effectively done now in **TNTmips**. But every remote sensing exploration geologist has his own "secret formulae" for combining TM, topography, and other geodata for RGB viewing and direct interpretation.

Another very simple application could use a simple GeoFormula to query the attribute records attached to a single raster to control how it would be displayed. For example, suppose a raster object contains a soil type map with attribute tables attached. A simple GeoFormula could display all the cells in five different colors selected according to each cell's infiltration rate. This is similar to using a query to control how a vector object is displayed.

More Information.

A color plate is attached entitled GeoFormula™ Layers for "Data Fusion" to illustrate the layers which can be created by simple GeoFormula.

A new Getting Started tutorial booklet entitled Using Geospatial Formulas has been provided to illustrate the use of this new process and how to construct GeoFormulas. This booklet includes a sample GeoFormula which uses four attribute fields from the Crow Butte soils vector polygons. It combines them in the Universal Soil Loss Equation (USLE) with a hypothetical raster of rainfall to produce a display of the soil erosion. [For

more information on this topic 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)]

Modifications since V5.80 CDs.

GeoFormulas created, tested, and saved in the new process can immediately be used in **SML** scripts.

Surface Analysis.

Watershed Analysis.

The watershed process can now find and trace ridge lines into a vector object.

Cut and Fill.

A new cut and fill process compares two elevation rasters and creates vector polygons outlining areas of positive, negative, or no elevation change. The volume computed from the elevation changes for each polygon is stored in an attached record in a Volume database table.

Distance Rasters.

The Distance Raster process has been expanded to allow computation of minimum surface distances to features in a vector object. The distance computed for each cell in the output raster is the minimum distance across a three-dimensional surface (provided by an elevation raster or TIN object). Previous versions of the process computed only the minimum horizontal distances to the input features (now available by choosing the Plane surface type).

A cost-weighted distance raster can be computed by using a cost raster as the input surface raster. Each value in the cost raster represents a cost associated with that cell, and the incremental distance of any path crossing the cell is multiplied by the cost factor. Each value in the output cost-distance raster is the minimum cumulative cost-weighted distance to the input features. A cost raster usually results from other previous GIS operations. For example, a series of objects might be combined to provide a composite of land slope, land cover, soil type, and so on. Next, a cost raster is prepared by weighting each of these factors with regard to the cost paid (incorporating travel time, fuel consumption, ...) if a tank were to traverse the cell. For this objective, cells contained within a swamp or lake would have a very high cost compared to those representing flat open ground and would therefore produce higher cost-weighted distance values in the cost-distance raster.

Surface Path Analysis.

A preliminary interactive process is available to find the minimum along-surface distance between two points. The surface raster used can be either an elevation raster or a cost raster (the latter producing the minimum cost-weighted distance). The user draws an initial starting path connecting the points, and the process iteratively alters the line to find a shorter route along the surface. This process is fast, but at present it finds a local minimum-distance path, as the result depends on the initial path drawn. A more powerful approach which would find the global minimum surface path length is being prepared for **V5.90**.

Color Models.

Any color model in **TNTmips** (RGB, HIS, ...) can now also be converted to and from the Munsell or HVS (Hue Value Saturation) color model commonly used for soil color typing by soil scientists.

Raster Operations.

The Brovey Transformation can now be used to fuse images of different resolutions. It is another method for using a high resolution panchromatic image (for example, SPOT) to improve the sharpness or apparent resolution of a lower resolution color image (for example, LANDSAT). This transform is fast as it is a simple linear combination of the bands. While this transform is now directly computed and on the menu, a GeoFormula is also provided to fuse images as displayed with this Brovey transform. Thus, the Getting Started booklet entitled Using Geospatial Formulas provides the equation and additional information on using this transformation.

Regions Operations.

By Raster Expressions.

Regions can now be created by computing the combination of several raster objects (for example, $A > (C - B)$ where A, B, and C are raster objects).

A color plate is attached entitled Regions from Raster Expressions to illustrate how to obtain and use such a region.

Combining Regions.

The ability to perform region combinations has been added to the region manager. This new combinations button brings up a dialog where you can specify the source region and the operator regions to apply it to. There are four operations that can be performed by the source region on the operator regions: AND (Intersect), OR (Union), XOR (Exclusive Or), or Subtract. Since you can select multiple operator regions, the method used to perform the calculation is: "Destination Region = (((Source op A) op B) op C)", where A, B, and C are operator regions. To assist in using this new procedure, the region manager is now able to add regions using the multiple object selection method.

This new interactive means of combining regions, coupled with the ease with which regions can be interactively derived, add significantly to the interactive geospatial capabilities already available in **TNTview** and **TNTmips**. A sample analysis is illustrated in two attached color plates entitled Regions from Raster Expressions and Interactive GIS--Region Combinations. This example clearly illustrates how easy it is with a few mouse clicks to form several regions from different objects and to combine them to perform an even more complex interactive GIS analysis.

Extract Vectors and CAD.

The vector and CAD extraction process now uses region objects to designate the areas to be extracted. As a result, all the tools used to create regions are now automatically directly available in the process.

*** Mosaic (a prototype process).**

The procedures for manual mosaicking have now been provided together with a new semi-automatic mode, so the revised mosaicking process is now completed in prototype form. The older process for mosaicking has been removed from **TNTmips**.

General Modifications.

Trend removal can now be performed as part of the mosaic process. It can be done "on-the-fly" while the mosaic is being assembled.

A region object can now be used to define the area to be processed in each component raster mosaicked. This feature is important to limit the areas of each component raster used in the trend removal for that raster (for example, avoid dark corners, area scanned outside the image, clouds,).

The mosaic raster object created in the process can now be optionally compressed and the null value specified.

Vector and CAD objects can be selected as reference areas for specifying the geoextent of the mosaic. These objects can then be viewed as image overlays providing reference information for placing each component raster and drawing the processing areas on each.

Automatic Mode.

The fully automatic mode of mosaicking was provided in **V5.70** and requires that all component rasters be georeferenced.

Manual Mode.

This mode allows manual positioning and resizing of any raster to fit it into its position in a mosaic. First, select a component raster to be added to the mosaic. Next, select it with the mouse in the list and use the elastic box which appears to move it to the side, creating a mosaic workspace in the view. Select another component raster, and use the elastic box to move it into the correct position relative to the first. Any component raster already in the mosaic being assembled can be reselected, and the elastic box will appear outlining its extents. At any time, the elastic box can be used to translate, rotate, and scale a component raster in the mosaic. As component rasters are added, a periodic redraw will zoom out so that viewing and access is provided for all the component rasters. Zooming in on the area or edge of a particular raster will allow fine tuning of its position.

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.

Bundle Adjustment Mode.

This mode allows the use of a few widely scattered control points occurring in some component rasters. It is designed to start with these control points and use tie points to bridge across the uncontrolled component rasters, thereby creating their spatial relationships. Often, limited control is available in those images at the beginning and ending of the flight lines. However, this procedure will also use control points that can be identified in any interior frames. When this mosaic mode is executed, it simultaneously establishes by a least squares procedure the internal relationships between all component rasters. This fitting procedure gives the most weight to preserving the positions of the control points and less weight to the positions of the tie points.

Control points are attached as usual to the appropriate component rasters in the georeference process. Selecting these rasters first will display them in their relative geographic positions in the mosaic in the view. Then, select and position all the uncon-

trolled component rasters into their approximate positions in the mosaic. When a rough mosaic is completed, zoom in on the boundary of a pair of uncontrolled components or a controlled and uncontrolled pair. Define any number of tie points across this boundary with a minimum of three. This defines the spatial relationship between these two rasters. Continue this procedure for every pair of edges between component rasters except for edges between two georeferenced rasters.

This tie point procedure has a graphic user interface similar to tie point selection in the stereoscopic modeling process but adapted for specific use in the mosaic process. In this process, the current working pair of rasters will be highlighted by filling them with transparent hatch patterns of different colors. The tie point positions previously added are clearly labeled. There are two variable-zoom magnifier windows for accurate image inspection and tie point positioning, so there is no need for constant zoom-in/zoom-out operations on the mosaic view. After three tie points are placed for a raster pair, automatic raster correlation is available to assist in accurate placement of additional tie points.

At any point while adding raster components or tie points, the resulting mosaic can be formed and redisplayed. If desired, this can be done after defining tie points for each pair. Each time, the iterative least square procedure will be recomputed to form the best mosaic possible. Each time, the process will provide an adjustment report as well showing the RMS (Root Mean Square) errors for each image added. This RMS error of an image indicates how accurately it was positioned relative to its neighbor images.

Tie points and manually defined georeference are stored in layout subobject as they are added so that intermediate mosaic results can be stored and the mosaic process restarted and work resumed at a later time.

A color plate is attached entitled New Mosaic Modes (Manual Positioning and Bundle Adjustment) to illustrate some of these new features. The associated Getting Started booklet will be expanded to cover these new modes as soon as possible.

Modifications since V5.80 CDs.

Multi-band images can be mosaicked as a group (TM, MSS ...). Only one image is displayed in the view window, but all bands are used during the processing, utilizing georeference from the first band.

AutoTrace.

An option has been added to include an "implied border" at the edge of the raster and/or null areas. This allows conversion of extracted portions of scanned maps without losing polygons and dangling lines at the edges.

A new booklet entitled Keeping Going: Digitizing Soil Maps is provided to help you use this process in creating soil maps from published USDA/NRSC soil maps.

Raster Properties.

An option is available to force properties of polygons to include the islands within them.

TNTsdk.

All sample applications have been updated to work with recent changes to the libraries.

* It is now possible to build **TNTsdk** applications which will run on **TNTedit** or **TNTview** licenses.

* Symbol Editor.

Point Symbol Editor was significantly redesigned in order to provide more editing capabilities and accommodate new features such as CartoScripts. It now has an improved icon-based interface, so most of the tasks can be easily performed without opening menus.

New Editing Features.

A full-featured UNDO operation has been implemented and can back up 20 steps.

The "Duplicate" operation allows selection of another copy of an existing element. An array operation can create arrays or sets of the existing elements. These both permit assembly of more complex symbols from duplicated components.

A spline operation provides a way to smooth an existing line/polygon.

"Scale" and "Scale All" operations allow elements to be resized using scale factor.

A grid can now be defined and elements snapped to it, such as in drawing rectangles, horizontal lines, and so on.

Working with TrueType symbols.

Complete TrueType font support has been added to the Symbol Editor in order to extract and modify as needed any TrueType symbol or character (for example, its glyphs) in **TNTmips** symbols.

A graphical TrueType selection dialog provides an interactive approach to selecting a TrueType font. After a font is selected, its contents are displayed via a scrolling matrix of the glyphs it contains. Please note that this dialog can be used in a general fashion to inspect all the glyphs in any TrueType font to be used with the **TNT** products. Any symbol or character it displays can then be selected by the mouse. It can then be inserted into the Symbol Editor for editing and saving as a **TNT** style.

A color plate is attached entitled Point Symbols from TrueType Fonts to illustrate how you can import a symbol used by MapInfo and add color and lettering to improve its appearance.

A selection of dozens of free TrueType symbol fonts (and type styles) can be downloaded from www.fontage.com. For example, this site has symbol fonts for USA state outlines, animal shapes, USGS map features, signal flags, food, arrows, and so on. A sample page printed from this site is enclosed entitled Fontage 2 to illustrate snapshots of some of the fonts you can download free from this site.

Creating CartoScripts.

At any time, a symbol being edited can be saved as a CartoScript for use in a query. This is a convenient way to start when developing CartoScripts--it saves a lot of time by providing graphical design tools and requires no need to learn the details of the drawing functions before starting. The CartoScript can then be edited to render more complex styles than could be designed in the Style Editor.

Modifications since V5.80 CDs.

Full Clipboard capability has been implemented: Copy, Copy All, and Paste operations. Simply copy one or all elements in the symbol into the clipboard. Subsequently, they can be pasted back into the symbol edit area using an "elastic box" tool to place them in any location and at any size. This provides a convenient way to exchange graphics between different symbols or duplicate large portions of symbols.

It is also possible to copy any glyph in a TrueType font into the clipboard. This glyph can then be copied from the clipboard and inserted at any scale and position into an existing symbol already loaded into the Symbol Editor. For example, TrueType numbers can be inserted into a highway sign, both of which have been extracted from TrueType fonts. This is illustrated in the attached color plate entitled Point Symbols from TrueType Fonts where numbers extracted from a TrueType font have been inserted into the highway shield created from a MapInfo symbol outline.

Future Plans.

The kinds of future features which are planned for managing **TNT** styles include several procedures. First, the style editor will be modified to import, edit, and use symbols sold for use with AutoCAD (CAD blocks) and MicroStation Cells (also CAD blocks). The interactive style editor will be expanded even further so that more complex line styles can be designed. Lines need to be able to have symbols and characters inserted into them. The symbols and characters inserted into lines or other point symbols need to be "variable", that is, derived at the time of rendering from attached attributes. To use this modification, a procedure is also needed in the object editor to easily and interactively define the positions in the line for the symbols, labels, and contour values.

The symbol editor needs to be expanded to allow hatch or line files to be defined. This will allow the newly implemented fast hatch fill procedure to be used in the display process.

* CartoScripts (new prototype features).

Concept.

A new method for describing complex element styles has been created. It uses a script, which will be called a CartoScript, 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.

Implementation.

CartoScripts use the standard query syntax and add 44 additional drawing functions to create scripts which draw complex lines and symbols which are usually data dependent. Data dependent means that some field(s) in the attributes of the selected lines or points control one or more aspects of the display or drawing of the selected elements. For example, the width of the lines drawn for highways could be controlled by an attribute field containing their traffic counts.

CartoScripts can also be created to draw more complex lines and symbolism than the internal styles. For example, CartoScripts can be used to create complex asymmetric lines used in geologic maps for thrust faults, strike, dip, ...

CartoScripts can be included as subsections in queries, so a single query can be used to select the points or lines as previously, and then the CartoScript portion can specify how they are to be drawn.

The 44 drawing functions used in the CartoScripts are also available to **SML** and are introduced in the section below on **SML**. The documentation of the arguments of each function is provided when it is selected and in the on-line Reference Manual in Appendix 4.

Getting Started.

Creating your own CartoScripts may seem complex at first glance. However, there is a very easy way to get started. At any time, a symbol being edited in the Symbol Editor can be saved as a CartoScript for use in a query. This is a convenient way to start when developing CartoScripts--it saves a lot of time by providing graphical design tools without first learning about how each drawing function works. So, simply find or interactively design a symbol or line. Assign it to the sample elements of interest. For example, use it in a query. Also save it as a CartoScript and imbed this into the same query. Then edit and change the CartoScript portion of the query, and immediately see the new symbolism this creates.

The Symbol Editor generates "user" oriented CartoScript code with a lot of comments that makes for easier script adjustment and understanding. When the Symbol Editor generates the CartoScript code, it extracts all parameters as variables and checks for redundancy. For example, when creating a symbol that consists of three circles with the same radius, one radius variable will be created and placed in the beginning of the code to simplify further adjustments.

Five color plates are attached to provide some sample CartoScripts and their results. Some of these scripts are simple examples and generate styles already easily created

elsewhere in **TNTmips**. Some are a little more complicated and illustrate the idea of data dependence. These scripts can be easily modified to apply to other geodata.

* **Label/Symbol Placement** (new prototype feature).

CartoScripts (Display By Query) provide a new function for optimal label placement. They will display labels and CartoScript symbols without overlap and optimize their locations so the highest density of displaying/printing might be achieved. In the query using this function, a rank can be assigned for each label in such a way that the most important labels will be preserved during optimization and deletion stages. This technique helps to create meaningful labeling for densely populated areas without human interaction. This feature is intended for fine-tuned displays and might be complicated to set up for beginners. Interactive and simpler procedures utilizing the same algorithm for display as and layouts will be introduced in **V5.90**.

A color plate is attached entitled Label Placement Optimization with **TNTmips**[®] to illustrate the use of this concept. The reverse side color plate entitled Automated label placement using cartographic scripts in **TNTmips**[®] contains a sample script to produce the optimal label placement presented.

When studying this important color plate, please remember that it is unlikely that any label placement procedure can solve all placements and find a position to expose every label. To overwhelm any label placement optimization, it is simply a matter of increasing the number of labels. It is thus reasonable to judge the value of label placement optimization based upon how many labels have to be deleted (or overlapped) at a particular label density, text size, and display scale. The plate illustrates a comparison between the built-in automatic label placement of MapInfo and this new CartoScript function available in **TNTview** and the other **TNT** products. It presents a very dense set of labels (539 city names) in a very limited map scale. Certainly add-on MapBasic products must be sold to optimize label placement in MapInfo projects. But, without them, it is obvious from this color plate that MapInfo would be limited to sparse label placement and/or manual repositioning.

* **SML**.

Introduction.

Considerable programming energy has been focused on **SML** in **V5.80** and will continue in **V5.90** to expand it rapidly into a fully featured geospatial programming language. The goal is to allow **TNTview** to be customized to levels which exceed those of MapBasic (for functionality) and Avenue (for interfaces). Since **TNTmips** encompasses more geospatial components and functions, it can potentially exceed the functionality of these other products.

Many clients and prospective clients have requested this approach. MicroImages is responding by adding the major components as rapidly as possible. Several clients have already created complex scripts of 30 pages and more with the earlier versions of **SML** before **V5.70**. Now complex cross-platform scripts can be created for solving individual projects, operational activities, as products for sale to others, and so on. MicroImages expects and needs a lot of feedback from those using **SML** regarding this new major effort to which considerable time will be allocated.

TNTview. The **SML** geospatial programming language is now available at no additional cost as part of **TNTview 5.8** and **TNTedit 5.8**. This change allows **SML** scripts to be

created with all **TNT** products (except **TNTatlas**) and then used by anyone with any **TNTmips**, **TNTedit**, **TNTview**, or **TNTlite** of **V5.80** or later. More details on this can be found above in the earlier section on displays. To assist newcomers to **SML**, a tutorial entitled Getting Started: Spatial Manipulation Language has been completed and is enclosed in printed and PDF file format.

Data Collection Inputs. ASCII and binary strings can now be read and written to serial ports from within an **SML** script. A use of these functions would be to read GPS values within the script from a serial port and insert them as symbols within the view. It is also planned to provide macro functions to read and use NMEA and other GPS data streams directly from the GPS unit via the serial port--in other words, single functions which read a whole coordinate packet from the specific GPS unit.

Saving Scripts. Scripts can be saved as **SML** objects. This procedure will be clear when opening or saving a script. The old "Open..." and "Save..." menu items have been changed to be a pull-right menu with the option "As *.sml" and "As RVC Object..."

As Display Layers. An **SML** script can now be selected just as any other object from the layer select window to create a graphical layer in a 2D or 3D view. The layer containing this script can be hidden, exposed, deleted, automatically rescaled, and so on as desired by the layer controls for each view. More details on this can be found in the earlier section on displays. An example use of an **SML** display layer would be to plot real-time GPS values as symbols on a view. This is a powerful feature with many other potential uses. **SML** scripts can be saved and read as objects from within the RVC Project Files to facilitate their selection as use as layers.

Now Contains CartoScripts. As discussed in an earlier section above, a new set of 44 CartoScript™ functions have been introduced into the **TNT** products to control how graphical elements are rendered by queries. These CartoScript functions are also available for use in **SML** scripts to control how graphical elements are drawn in the new **SML** display layer. In the GPS example above, the symbols plotted can be drawn by these new CartoScript functions (or from the regular existing symbol files).

Documentation. The documentation of each **SML** function is automatically displayed when the function is selected from the scrolling list; no more need to look it up in the HTML reference manual or printed materials. A sample script can also be optionally shown for many functions showing their use in some simple context. These sample scripts, like functions, can be cut and pasted into the script being created. The on-line documentation, reference manual appendix, and sample scripts for all **SML** functions are complete, up-to-date, and current with **V5.80**.

General Functions.

These new toolkits or groups of functions are now available:

- CAD object toolkit
- TIN object toolkit
- drawing functions
- serial port access
- vector object toolkit
- CartoScript™ toolkit
- some region analysis tools

The rapid expansion of this geospatial programming language (**SML**) continues with the addition of 158 new functions in this release (34 for creating and drawing in a layer, 44 for line styles via CartoScripts, and 80 for general purposes). The 80 new general functions in **V5.80** permit vector objects and all their elements to be created, read, and written using a new suite of initial functions. CAD objects and all their geometric shapes,

standard tables, and so on can be created, read, and written using a new suite of initial functions. All the standard geometrical shapes can be created in the new CAD object. RGB to HIS and inverse functions were added to allow scripts to create synthetic resolution by combining raster objects of widely different original resolutions.

Datatypes.

Several new data classes have been added to **SML** in order to make display layers possible. For example, given the variable ThisLayer, which is a layer class variable, you would access the layer's group by saying...

```
group = ThisLayer.group
```

There is currently no way to get a list of these or browse through the members of these structures within the **SML** editor.

A class variable is not just a number and cannot be used as such except that you can compare it to 0.

SML uses strong type checking with class variables. This means you cannot, for example, pass a group variable to a function that wants a layer--if you try, it will give you an error when you check the syntax. However, there are some classes that are "derived" from other classes. An example of this is the "PORT" class, which is derived from FILE. A class that is derived from another class (called its "base" class) is considered to be a member of that class. This means that a PORT variable can be passed to functions that want a FILE. A derived class also "inherits" the members of its base class. There is currently no example of this in **SML**.

Layout. A layout variable corresponds to a layout in the display process. Layouts contain views and groups, as well as a few settings about how the layout is to be displayed. A layout has the following members:

String: name	The name of the layout
Number: MapScale	The map scale at which the layout is designed
Group: FirstGroup	The first group in the layout
Group: LastGroup	The last group in the layout

Group. Group variables represent groups in a layout. Each group has the following members:

String: name	The name of the group
Layout: layout	The layout the group is in
Group: PrevGroup	The group below this in the stack (drawn before)
Group: NextGroup	The next group in the layout
Layer: FirstLayer	The first layer in this group
Layer: LastLayer	The last layer in this group
Region: FullRegion	A region containing the extents of the group
Region: ClipRegion	A region which contains the clipping boundary

Layer. Layer variables represent layers in a group. Each layer has the following members:

String: name	The name of the layer
String: type	Layer type (for example: "raster", "vector", "cad",...)
Group: group	The group this layer is in
Layer: PrevLayer	The layer below this one
Layer: NextLayer	The layer above this one
Region: Extents	The extents region of the layer

Built-in variables. Each **SML** layer gets a built-in variable of class Layer called ThisLayer. From this variable, you can access the other layers and group in the layout. For example, to fill the extents of the group the layer is in, you would call:

FillRegion (ThisLayer.group.FullRegion)

Display Functions.

DispGetGroupByName (layout, GroupName\$)

Returns Group or 0 if no match.

DispGetLayerByName (group, LayerName\$)

Returns Layer or 0 if no match.

DispGetRasterFromLayer (R, layer)

This function works like GetInputRaster, but instead of prompting the user for the raster, gets it out of the specified layer. Leaves the variable alone if the specified layer isn't a Raster layer.

DispGetVectorFromLayer (V, layer)

Like DispGetRasterFromLayer(), but gets a vector instead.

Drawing Functions.

Coordinates in the drawing functions are in the units defined by the **SML** Layer Controls for the layer. They may be in units relative to the ground or relative to the page. Ground relative coordinates are used to draw on top of another layer. Page coordinates are useful if the layer is to draw some part of a map which is not scaled to the ground, such as a north arrow.

MoveTo (x, y)

Moves the current drawing pen to the specified location without drawing anything.

DrawTo (x, y)

Draws a line from the current pen location to the specified location using the current line style. The current pen location is updated to the specified location.

DrawPoint (x, y)

Draws a point at the specified locations in the current point style.

DrawPolyLine (x, y, num)

Draws a polyline connecting all the points specified by arrays. The line is not closed automatically.

DrawRect (x, y, width, height, angle)

Draws a rectangle.

DrawCircle (x, y, radius)

Draws a circle.

DrawEllipse (x, y, xradius, yradius, angle)

Draws an ellipse.

DrawArc (x, y, xradius, StartAngle, SweepAngle, RotAngle)

Draws an arc.

DrawArcChord (x, y, xradius, yradius, StartAngle, SweepAngle, RotAngle)

Draws an arc chord by drawing the arc followed by a line directly from the start of the arc to the end of the arc.

DrawArcWedge (x, y, xradius, yradius, StartAngle, SweepAngle, RotAngle)

Draws an arc wedge by drawing the arc followed by a line from the start of the arc, to the center, then to the end of the arc.

DrawRegion (region)

Draws the outline of the given region in the current style.

DrawUseStyleObject (filename, objectname)

Changes the style object used for subsequent calls to SetStyle functions. Calling this function with no parameters will set the style back to the default object as specified in the **SML** Layer Controls for the layer.

DrawSetPointStyle (name)

Reads the named style out of the current style object. The specified style will be used for subsequent calls to DrawPoint(). If the specified style cannot be found, the style is reset to the default. The style can also be reset to the default by calling the function with no parameters.

DrawSetLineStyle (name)

Reads the named style out of the current style object. The specified style will be used for subsequent line drawing operations. If the specified style cannot be found, the style is reset to the default. The style can also be reset to the default by calling the function with no parameters.

DrawSetFillStyle (name)

Reads the named style out of the current style object. The specified style will be used for subsequent fill operations. If the specified style cannot be found, the style is reset to the default. The style can also be reset to the default by calling the function with no parameters.

FillPolyLine (x, y, num)

Fills a polyline connecting all the points specified by the arrays. The polygon is automatically closed if necessary.

FillRect (x, y, width, height, angle)

Fills a rectangle.

FillEllipse (x, y, xradius, yradius, angle)

Fills an ellipse.

FillArcChord (x, y, xradius, yradius, StartAngle, SweepAngle, RotAngle)

Fills an arc chord by drawing the arc followed by a line directly from the start of the arc to the end of the arc.

FillArcWedge (x, y, xradius, yradius, StartAngle, SweepAngle, RotAngle)

Fills an arc wedge by drawing the arc followed by a line from the start of the arc, to the center, then to the end of the arc.

FillRegion (region)

Fills the given region using the current fill style. Islands of the region are left unfilled.

SetColorName (name)

Sets the color to use.

SetColorRGB (red, green, blue, range)

Sets the current drawing color to the specified RGB triplet. By default, the color components are in the range of 0 to 255. The range parameter is used to override the default range. For example, if range is 100, then the color components should be in the range of 0 to 100.

SetLineWidth (width, units)

Line widths are always in page units, even if the coordinates are in ground units. The default is pixels.

DrawLocalBegin (xcenter, ycenter, xscale, yscale, angle)

This function overrides the current coordinate transformation matrix to provide a local coordinate space. The point at (xcenter, ycenter) of the current coordinate space will become (0,0) in the new coordinate space. Height and width will be scaled according to yscale and xscale, and the whole thing rotated by the specified angle in degrees. The previous coordinate system can be restored by calling DrawLocalEnd ().

SetLineWidth (width, units)

Line widths are always in page units, even if the coordinates are in ground units. The default is pixels.

DrawLocalBegin (xcenter, ycenter, zscale, yscale, angle)

This function overrides the current coordinate transformation matrix to provide a local coordinate space. Height and width will be scaled according to yscale and xscale, and the whole thing rotated by the specified angle in degrees. The previous coordinate system can be restored by calling DrawLocalEnd ().

DrawLocalEnd ()

Restores the coordinate transformation matrix to what it was before the last call to DrawLocalBegin ().

LineStyleSetPoints (x, y, num)

Sets the current line for use with the new cartographic line style functions.

LineStylesSetRegion (Reg)

Sets the current line for use with the cartographic line style functions to the outside border of the given region.

Cartographic Engine Functions.

SML can use all the functions in the CartoScripts™ collection. A script using these functions may or may not be data dependent. A data dependent script makes reference to a specific table and field to arrive at the results. It cannot be used to generate drawing styles for elements in an object that lacks the specified information. Some CartoScript functions may make reference to a standard internal table found with all **TNTmips** vector objects. Equivalent tables are not found with other object types, so scripts that mention these tables will work only with vector objects (unless modified). When an **SML** script using CartoScript functions will not work because some component specified in the script is not present in the selected object, you get a syntax error when you try to use it. The default size specification for style elements uses object coordinates. Thus, although you may not get any syntax errors, the symbols or special graphic components

of a line may be too small to see or larger than intended. Add the statement: `LineStyleSetCoordType (1)` to your script to change the scaling to millimeters (either on the screen or in print). You will also likely have to adjust the numbers used if you make this change.

Line Navigation.

`LineStyleRoll (distance)`

Moves specified distance along a line without drawing the line.

`LineStyleSetPosition (relative_position)`

Moves along a line element a distance specified relative to the line length.

`LineStyleDropAnchor (number)`

Remembers current position (as specified anchor number) for later use.

`LineStyleNextVertex ()`

Moves to the next vertex in a line.

`LineStylePrevVertex ()`

Moves to the previous vertex in a line.

`LineStyleMoveTo (Angle, Distance)`

Moves a specified distance and direction to begin drawing.

`LineStyleMoveToAnchor (number)`

Moves to a previously remembered position to begin drawing.

Line Drawing.

`LineStyleLineTo (Angle, Distance)`

Draws line in a specified distance and direction from current position.

`LineStyleLineToAnchor (number)`

Draws line from current position to previously remembered position.

`LineStyleRollPen (distance)`

Draws the specified length from the current position along a line element.

`LineStyleDrawCircle (radius, dofill)`

Draws a circle of a specified radius, which may be filled and is centered at the position.

`LineStyleDrawThreePointArc (angle1 ,dist1, angle2, dist2, angle3, dist3, closemode, dofill)`

Draws an arc using 3 points referenced from current position, which is the center.

`LineStyleDrawArc (angle, dist, radius_x, radius_y, startangle, sweepangle, rotangle, closemode, dofill)`

Draws an arc.

`LineStyleDrawRectangle (width, height, angle, dofill)`

Draws a rectangle centered on the current position.

`LineStyleDrawArrow (angle, dist, length, sweepangle, dofill)`

Draws an arrow.

`LineStyleSetColor (red, green, blue)`

Sets drawing color by specifying RGB from 0–255.

LineStyleSetTextColor (fgred, fggreen, fgblue, bgred, bggreen, bgblue)
Sets text color and background color (fill color for surrounding box).

LineStyleSetCoordType (type)
Sets coordinates for distance parameters.

LineStyleSetFont (fontname)
Sets font name to use (include file name and extension).

LineStyleDrawText (text, height, angle, isAbs, nextx, nexty, length)
Specifies text to draw.

LineStyleDrawTextBox - (text, height, angle, bordersize, isAbs, nextx, nexty, length)
Draws a text string in a "box".

LineStyleTextNextPosition (text, height, angle, isAbs, nextx, nexty, length)
Computes length and end position of a text string.

LineStyleDrawLine ()
Draws complete line using currently set drawing style. This function doesn't change the current position on the line.

LineStyleSetLineWidth (width, isInMM)
Sets line width for drawing lines.

LineStyleRecordPolygon (start_stop)
Starts or stops polygon recording mode.

LineStyleDrawPolygon (dofill)
Draws previously recorded polygon as a sequence of points.

LineStyleSideShot (dodraw, angle, dist,...)
Draws or records number of points using "sideshot" descriptions (direction + distance) for each point. This function doesn't change current pen position.

LineStyleDrawCylinder (long_axis, short_axis, height, red, green, blue)
Draws a cylinder of specified dimensions and fill color centered on the current position.

LineStyleDrawCube (width, depth, height, red, green, blue)
Draws a cube of specified dimensions and fill color centered on the current position.

LineStyleDrawCone (long_axis, short_axis, height, red, green, blue)
Draws a cone of specified dimensions and fill color centered on the current position.

LineStyleSetCapJoinType (captype, jointype)
Sets the style for line ends and vertices and for joins with other lines when creating offsets.

LineStyleDrawPolyline ()
Draws previously recorded points as a polyline.

LineStyleDrawEllipse (angle, dist, radius_x, radius_y, rotangle, isAngleAbs, dofill)
Draws an ellipse.

Getting Information.

LineStyleGetPosition (get_absolute_flag)
Gets the current position on a line as a distance from the beginning.

LineStyleGetDistanceTo (feature)
Gets the distance from current position to specified feature.

LineStyleIsClosed ()

Tests if the current line is closed (start and end points are the same).

LineStyleGetLineCurvature (distance, maxangle, maxleft, maxright)

Returns information about curvature for a piece of line starting from current position.

LineStyleGetDirection (distance, minangle, maxangle)

Gets direction of the line for the piece of line starting at current position.

LineStyleGetMaxDistance (distance, direction, maxdist)

Gets maximum distance from the line and segment that connects current position and position within "distance" from it.

Line Processing.**LineStyleSpline (num_knots, method)**

Replaces current line with its splined version.

LineStyleThinLine (thindist, method)

Replaces current line with its thinned version.

LineStyleRestoreLine ()

Restores original line coordinates if line was modified using LineStyleSpline/LineStyleThinLine/LineStyleOffset commands.

LineStyleSetScale (scale)

Sets scaling factor for all input parameters like distances and sizes. Using this function, user can adapt a script developed for one object to run for another one without changing all the parameters.

Placement Optimization.**LineStyleAddToOptimizer (xstart, ystart, xlast, ylast, rank, dooptimize, dodelete)**

This function provides access to the built-in generic label placement optimizer. Each label is represented by a rectangle.

Files and Ports.**File Variable Classes.** Variables of class FILE have one member:

Number: pos The current location within the file.

Setting the pos member of a file variable has the effect of seeking to that location in the file.

Port Variable Classes. A PORT is a subclass of FILE and is used to access serial and parallel ports. Although it technically inherits the pos member from the FILE class, it's always 0 and setting it has no effect. Port variables have the following members:

Number: blocking 1 if reads should wait for data, 0 if not (default is 1)

String: setting Port settings (for example: "9600:8:none:1" would set to 9600 Baud, 8 data bits, no parity, 1 stop bit)

Being a subclass of FILE, a PORT variable can be passed to any function that takes a FILE variable, such as fread (), fwrite (), fprintf (), and so on.

File/Port Functions.

PortOpen (name, type)

The type parameter is really unnecessary, since the type can be determined from the name. If omitted, the function will just figure it out.

PortClose (port)

Closes the port.

fread (file, buffer, len)

Reads len bytes from the file and places them in the buffer. The buffer, which should be declared before calling the function, will be reallocated if necessary. Returns the number of bytes actually read. If the file is really a port and file.blocking is zero, the function may return fewer bytes than requested (maybe even 0). If file.blocking is set, it will wait for the requested number of bytes.

fwrite (file, buffer, len)

Writes len bytes to the specified file. Values in the buffer should be in the range of 0 to 255.

freadbyte (file)

Reads a single byte from the given file and returns it. If the file is really a port, and file.blocking is set (which it is by default), then the function will wait for a byte to become available. If file.blocking is zero and there is no byte available on the port, the function returns NULL (not zero). UseIsNull () to see if it's NULL or not.

fwritebyte (file, val, [val...])

Writes the byte(s) to the specified file.

freadstring (file, length)

Reads the specified number of characters from the port and returns a string containing them. See fread () for an explanation on what it will do if file is a port with nothing to read.

fwritestring (file, string)

Writes the string out the specified file.

sleep (seconds)

Pauses script for the specified decimal number of seconds.

Conversion Functions.

ConvertRGBtoHIS (maxrgbvalue, red, green, blue, hue, intensity, saturation)

Converts from red, green, blue to hue, intensity, saturation.

ConvertHISToRGB(maxrgbvalue, hue, intensity, saturation, red, green, blue)

Converts from hue, intensity, saturation to red, green, blue.

Georeference Functions.

CreateControlPointGeoref (Object, numpoints, xsrc, ysrc, zsrc, xdest, ydest, zdest [,xsrcaccuracy, ysrcaccuracy, zsrcaccuracy, xdestaccuracy, ydestaccuracy, zdestaccuracy])

Creates a control point georeference object for a CAD, TIN, vector, or raster object.

Object Functions.

GetObjectExtents (Object, xmin, ymin, xmax, ymax [, georef])

Returns the x and y extents for a CAD, TIN, vector, or raster object.

GetObjectZExtents (Object, zmin, zmax)

Returns the z extents for a CAD, TIN, vector object.

Vector Functions.

NumVectorLabels (Vectvar)

Returns number of labels in a vector object.

CAD Functions.

CADCreateBlock (CADvar, name\$, description\$)

Creates a new CAD block for element insertion.

CADInsertBlock (CADvar, destblock, sourceblock, xinsert, yinsert [, xscale, yscale, rotation] [, numlines, numcols, linespace, colspace])

Inserts a CAD block as a subblock into a CAD object.

CADNumBlocks (CADvar)

Returns number of blocks in a CAD object.

CADNumElements (CADvar, block)

Returns number of elements in a CAD object block.

CADGetElementList (CADvar, block, elemtype\$, elemlist)

Gets list of all elements of a given type in a block.

GetInputCAD (CADVar)

Opens a CAD object for read.

GetOutputCAD (CADVar)

Opens a CAD object for read and write.

CloseCAD (CADvar)

Closes a previously opened CAD object.

CADWriteBox (CADvar, block, lowerleftx, lowerlefty, upperrightx, upperrighty [, rotation])

Creates a polygon from lower left and upper right corner points.

CADWriteCircle (CADvar, block, xcenter, ycenter, radius)

Creates a circle.

CADWriteArc (CADvar, block, xcenter, ycenter, radius, start, end)

Creates an arc.

CADWriteArcChord (CADvar, block, xcenter, ycenter, radius, start, end)

Creates an arc chord.

CADWriteArcWedge (CADvar, block, xcenter, ycenter, radius, start, end)

Creates an arc wedge.

CADWriteEllipse (CADvar, block, xcenter, ycenter, xsize, ysize, rotation)

Creates an ellipse.

CADWriteEllipticalArc (CADvar, block, xcenter, ycenter, xsize, ysize, start, end, rotation)

Creates an elliptical arc.

CADWriteEllipticalArcChord (CADvar, block, xcenter, ycenter, xsize, ysize, start, end, rotation)

Creates an elliptical arc chord.

CADWriteEllipticalArcWedge (CADvar, block, xcenter, ycenter, xsize, ysize, start, end, rotation)

Creates an elliptical arc wedge.

CADWriteLine (CADvar, block, numpoints, xpointlist, ypointlist)

Creates a line.

CADWritePoly (CADvar, block, numpoints, xpointlist, ypointlist)

Creates a polygon.

CADWritePoint (CADvar, block, xcoord, ycoord)

Creates a single point.

CADWriteText (CADvar, block, text\$, basex1, basey1, basex2, basey2, textheight
[, rotation [, xscale [, shear]]])

Creates a single line of text.

CADReadBox (CADvar, block, element, lowerleftx, lowerlefty, upperrightx, upperrighty,
rotation)

Reads a polygon box.

CADReadCircle (CADvar, block, element, xcenter, ycenter, radius)

Reads a circle.

CADReadArc (CADvar, block, element, xcenter, ycenter, radius, start, end)

Reads an arc.

CADReadArcChord (CADvar, block, element, xcenter, ycenter, radius, start, end)

Reads an arc chord.

CADReadArcWedge (CADvar, block, element, xcenter, ycenter, radius, start, end)

Reads an arc wedge.

CADReadEllipse (CADvar, block, element, xcenter, ycenter, xsize, ysize, rotation)

Reads an ellipse.

CADReadEllipticalArc (CADvar, block, element, xcenter, ycenter, xsize, ysize, start, end,
rotation)

Reads an elliptical arc.

CADReadEllipticalArcChord (CADvar, block, element, xcenter, ycenter, xsize, ysize,
start, end, rotation)

Reads an elliptical arc chord.

CADReadEllipticalArcWedge (CADvar, block, element, xcenter, ycenter, xsize, ysize,
start, end, rotation)

Reads an elliptical arc wedge.

CADReadLine (CADvar, block, element, xpointlist, ypointlist)

Reads a line.

CADReadPoly (CADvar, block, element, xpointlist, ypointlist)

Reads a polygon.

CADReadPoint (CADvar, block, element, xcoord, ycoord)

Reads a single point.

CADReadText (CADvar, block, element, basex1, basey1, basex2, basey2, textheight,
rotation, xscale, shear)

Reads a single line text element.

TIN Functions.

GetOutputTIN (TINvar [,flag1\$ [,flag2\$]])

Opens a TIN object for use with TIN toolkit functions.

flag1 optional – "TINToolkit" for use of TIN toolkit functions

flag2 optional – "ComputeStandardAttributes" will cause standard attributes to be built when closed.

TINCreateFromNodes (TINvar, numnodes, xpoints, ypoints, zpoints, zscale, zoffset, xy-tolerance)

Creates a new TIN object from a list of nodes.

TINAddNode (TINvar, x, y, z)

Adds a node to a TIN object.

TINDeleteNode (TINvar, node)

Deletes a node from a TIN object without creating a hole.

TINDeleteNodeAndMakeHole (TINvar, node)

Deletes a node from a TIN object and creates a hole.

TINDeleteEdgeAndMakeHole (TINvar, edge)

Deletes an edge from a TIN object and creates a hole.

TINDeleteTriangleAndMakeHole (TINvar, triangle)

Deletes a triangle from a TIN object and creates a hole.

TINGetNodeExtents (TINvar, node, xcoord, ycoord)

Returns x and y coordinates of a node.

TINGetEdgeExtents (TINvar, edge, x1, y1, x2, y2)

Returns x and y extents of an edge.

TINGetTriangleExtents (TINvar, triangle, x1, y1, x2, y2)

Returns x and y extents of a triangle.

TINGetNodeZValue (TINvar, node)

Returns z value for a node.

TINSetNodeZValue (TINvar, node, zvalue)

Sets z value for a node.

TINGetConnectedEdgeList (TINvar, node, edgelist)

Returns list of all edges connected to a given node.

TINGetConnectedNodeList (TINvar, node, nodelist)

Returns list of all nodes connected to a given node.

TINGetEdgeNodesAndTriangles (TINvar, edge, nodefrom, nodeto, lefttriangle, righttriangle)

Returns nodes and left and right triangles for a given edge.

TINGetTriangleNodesAndEdges (TINvar, triangle, node1, node2, node3, edge12, edge23, edge31)

Returns the nodes and edges that make up a given triangle.

TINNumberNodes (TINvar)

Returns number of nodes in a TIN object.

TINNumberEdges (TINvar)

Returns number of edges in a TIN object.

TINNumberTriangles (TINvar)

Returns number of triangles in a TIN object.

TINNumberHulls (TINvar)

Returns number of hulls in a TIN object.

Vector Toolkit Functions.

GetOutputVector (Vectvar, [,flag1\$ [, flag2\$]])

Opens a vector object for use with vector toolkit functions.

flag1 optional – see below

"VectorToolkit" opens the vector object for use with the vector toolkit

flag2 optional – see below

"NoQtree"	Do not maintain qtrees
"NoDBStatTable"	Do not update Database Statistics tables
"KeepAttachedLabels"	Keep labels that become unattached
"IsContour"	Vector data is a contour set
"NoStyle"	Do not open/create a style table
"NoChangeLists"	Do not maintain an element change list (NO PROMPT)
"NoDatabase"	Do not maintain databases
"NoHyper"	Do not update hyper object
"NoCreateTables"	Do not create databases
"NoCreateStyle"	Do not create a style object
"IgnoreBadMinMax"	Ignore bad min/max values - (only use with validate topo)
"NoValidateNodes"	Do not validate nodes during open
"NoSaveQTree"	Do not save search tree at close
"NoPolyQTree"	Do not generate a polygon qtree
"NoLineQTree"	Do not generate a line qtree
"NoPointQTree"	Do not generate a point qtree
"NoLabelQTree"	Do not generate a label qtree
"NoNodeQTree"	Do not generate a node qtree
"NoElemQTree"	Do not generate an element qtree

VectorValidate (Vectvar)

Validates vector topology.

VectorSetFlags (Vectvar, flag\$)

Sets optional flags for a given vector object.

flag see below

"NoQtree"	Do not maintain qtrees
"NoDBStatTable"	Do not update Database Statistics tables
"KeepAttachedLabels"	Keep labels that become unattached
"IsContour"	Vector data is a contour set
"NoStyle"	Do not open/create a style table
"NoChangeLists"	Do not maintain an element change list (NO PROMPT)
"NoDatabase"	Do not maintain databases
"NoHyper"	Do not update hyper object
"NoCreateTables"	Do not create databases
"NoCreateStyle"	Do not create a style object
"IgnoreBadMinMax"	Ignore bad min/max values - (only use with validate topo)
"NoValidateNodes"	Do not validate nodes during open
"NoSaveQTree"	Do not save search tree at close
"NoPolyQTree"	Do not generate a polygon qtree

"NoLineQTree"	Do not generate a line qtree
"NoPointQTree"	Do not generate a point qtree
"NoLabelQTree"	Do not generate a label qtree
"NoNodeQTree"	Do not generate a node qtree
"NoElemQTree"	Do not generate an element qtree

VectorAddLabel (Vectvar, labeltext\$, height, basex1, basey1, basex2, basey2)
Adds a label to a vector object.

VectorAddTwoPointLine (Vectvar, x1, y1, x2, y2)
Adds a line with only two vertices to a vector object.

VectorAddLine (Vectvar, numPoints, xpoints, ypoints)
Adds a multiple vertex line to a vector object.

VectorChangeLine (Vectvar, linenummer, numpoints, xpoints, ypoints)
Changes the vertices of an existing line in a vector object.

VectorAddNode (Vectvar, x, y, searchdist)
Adds a node to a vector object.

VectorAddPoint (Vectvar, x, y)
Adds a point to a vector object.

VectorChangePoint (Vectvar, point, newx, newy)
Changes the location of an existing point in a vector object.

VectorDeleteLabel (Vectvar, labelnumber)
Deletes a label from a vector object.

VectorDeleteLabels (Vectvar, labellist, numlabels)
Deletes multiple labels from a vector object.

VectorDeleteLine (Vectvar, linenummer)
Deletes a line from a vector object.

VectorDeleteLines (Vectvar, lineslist, numlines)
Deletes multiple lines from a vector object.

VectorDeletePoint (Vectvar, point)
Deletes a point from a vector object.

VectorDeletePoints (Vectvar, pointlist, numpoints)
Deletes multiple points from a vector object.

VectorDeletePoly (Vectvar, polynumber)
Deletes a polygon from a vector object.

VectorDeletePolys (Vectvar, polylist, numpolys)
Deletes multiple polygons from a vector object.

VectorDeleteNode (Vectvar, nodenumber [, flag\$])
Deletes a node from a vector object.

flag see below

"NoCheckHyper"	Do not check differences between hyperlinks
"NoCheckDatabase"	Do not check differences between database attachments

VectorDeleteNodes(Vectvar, nodelist, numnodes [, flag\$])
Deletes multiple nodes from a vector object.

flag see below

"NoCheckHyper"	Do not check differences between hyperlinks
"NoCheckDatabase"	Do not check differences between database attachments

GetVectorPolyAdjacentPolyList (Vectvar, polynum, polylist)
Returns number of adjacent polygons and polygon list.

New Sample Scripts.

The following new sample **SML** Scripts (and all previous) can be installed in functional groups accessed from the Custom Menu to illustrate the use of the new functions. 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**, **TNTedit**, or **TNTview** directory and delete those **SML** scripts which you do not want. When they are deleted, they will automatically disappear from the Custom menu.

CAD Object Sample Scripts.

arc.sml. Objective: *Demonstrates writing and reading a CAD arc using CADWriteArc () and CADReadArc ().*

arcchord.sml. Objective: *Demonstrates writing and reading a CAD arc chord using CADWriteArcChord () and CADReadArcChord ().*

arcwedge.sml. Objective: *Demonstrates writing and reading a CAD arc wedge using CADWriteArcWedge () and CADReadArcWedge ().*

box.sml. Objective: *Demonstrates writing and reading a CAD rectangular box using CADWriteBox () and CADReadBox ().*

circle.sml. Objective: *Demonstrates writing and reading a CAD circle using CADWriteCircle () and CADReadCircle ().*

earc.sml. Objective: *Demonstrates writing and reading a CAD elliptical arc using CADWriteEllipticalArc () and CADReadEllipticalArc ().*

echord.sml. Objective: *Demonstrates writing and reading a CAD elliptical arc chord using CADWriteEllipticalArcChord () and CADReadEllipticalArcChord ().*

elemlist.sml. Objective: *Demonstrates reading a list of all elements of a given type out of a CAD block using CADGetElementList ().*

ellipse.sml. Objective: *Demonstrates writing and reading a CAD ellipse using CADWriteEllipse () and CADReadEllipse ().*

ewedge.sml. Objective: *Demonstrates writing and reading a CAD elliptical arc wedge using CADWriteEllipticalArcWedge () and CADReadEllipticalArcWedge ().*

line.sml. Objective: *Demonstrates writing and reading a CAD line using CADWriteLine () and CADReadLine ().*

point.sml. Objective: *Demonstrates writing and reading a CAD point using CADWritePoint () and CADReadPoint ().*

poly.sml. Objective: *Demonstrates writing and reading a CAD polygon using CADWritePoly () and CADReadPoly ().*

readblk.sml. Objective: *Demonstrates reading a CAD block using CADNumBlocks () and CADNumElements ().*

subblock.sml. Objective: *Demonstrates writing a CAD subblock using CADCreateBlock () and CADInsertBlock ().*

text.sml. Objective: *Demonstrates writing and reading CAD text using CADWriteText () and CADReadText ().*

Conversion Function Sample Script.

rgbhis.sml. Objective: *Demonstrates converting red, green, blue (RGB) values to and from hue, intensity, saturation (HIS), using ConvertHISToRGB () and ConvertRGBtoHIS ().*

TIN Object Sample Scripts.

addnode.sml. Objective: *Demonstrates usage of TINAddNode () to add a node to an existing TIN object.*

delnode.sml. Objective: *Demonstrates usage of TINDeleteNode () to remove a node from an existing TIN object. TINDeleteNode () does not create a hole in the TIN object.*

edgeext.sml. Objective: *Demonstrates usage of TINGetEdgeExtents () to read the x and y extents of an edge in a TIN object.*

edgehole.sml. Objective: *Demonstrates usage of TINDeleteEdgeAndMakeHole () to remove an edge from an existing TIN object. This function creates a hole in the TIN object.*

edgelist.sml. Objective: *Demonstrates usage of TINGetConnectedEdgeList() to get a list of all edges connected to a given node in a TIN object.*

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

getz.sml. Objective: *Demonstrates usage of TINGetNodeZvalue () to read the z value of a node in a TIN object.*

maketin.sml. Objective: *Demonstrates usage of TINCreateFromNode () to create a TIN object from a list of node coordinates.*

nodeedge.sml. Objective: *Demonstrates usage of TINGetTriangleNodesAndEdges () to read the nodes and edges of a triangle in a TIN object.*

nodeext.sml. Objective: *Demonstrates usage of TINGetNodeExtents () to read the x and y coordinates of a node in a TIN object.*

nodehole.sml. Objective: *Demonstrates usage of TINDeleteNodeAndMakeHole () to remove a node from an existing TIN object. Unlike TINDeleteNode (), this function does create a hole in the TIN object.*

nodelist.sml. Objective: *Demonstrates usage of TINGetConnectedNodeList () to get a list of all nodes connected to a given node in a TIN object.*

nodetri.sml. Objective: *Demonstrates usage of TINGetEdgeNodesAndTriangles () to read the nodes and left and right triangles of an edge in a TIN object.*

outtin.sml. Objective: *Demonstrates usage of GetOutputTIN () to open a TIN object for use with TIN toolkit functions.*

setz.sml. Objective: *Demonstrates usage of TINSetNodeZvalue () to change the z value of a node in a TIN object.*

tininfo.sml. Objective: *Demonstrates usage of TINNumberHulls (), TINNumberEdges (), TINNumberNodes (), and TINNumberTriangles () to read the number of hulls, edges, nodes, and triangles in a TIN object.*

triext.sml. Objective: *Demonstrates usage of TINGetTriangleExtents () to read the x and y extents of a triangle in a TIN object.*

trihole.sml. Objective: *Demonstrates usage of TINDeleteTriangleAndMakeHole () to remove a triangle from an existing TIN object. This function creates a hole in the TIN object.*

Sample Georeference Function.

smlgeo.sml. Objective: *Demonstrates creation of georeference object using CreateControlPointGeoref ().*

Vector and Vector Toolkit Sample Functions.

adjpoly.sml. Objective: *Demonstrates usage of GetVectorPolyAdjacentPoly () to find all polygons that share a line with a given polygon.*

numlabel.sml. Objective: *Demonstrates usage of NumVectorLabel () to get the number in a vector object.*

vmake.sml. Objective: *Demonstrates creation of vector using GetOutputVector () with vector toolkit flag.*

vsetflag.sml. Objective: *Demonstrates using VectorSetFlags () to set vector toolkit flags.*

vlabel.sml. Objective: *Demonstrates creating and deleting labels with VectorAddLabel (), VectorDeleteLabel (), and VectorDeleteLabels ().*

vpoint.sml. Objective: *Demonstrates creating and deleting points with VectorAddPoint (), VectorDeletePoint (), and VectorDeletePoints ().*

vline.sml. Objective: *Demonstrates creating and deleting lines with VectorAddLine (), VectorDeleteLine (), and VectorDeleteLines ().*

v2ptline.sml. Objective: *Demonstrates creating a two point line with VectorAddTwoPointLine ().*

vnode.sml. Objective: *Demonstrates creating and deleting nodes with VectorAddNode (), VectorDeleteNode (), and VectorDeleteNodes ().*

vpoly.sml. Objective: *Demonstrates deleting polygons with VectorDeletePoly () and VectorDeletePolys ().*

vchgpt.sml. Objective: *Demonstrates changing the location of an existing point using VectorChangePoint ().*

vchgline.sml. Objective: *Demonstrates changing the vertices of an existing line using VectorChangeLine ().*

Sample Object Manipulation Function.

objext.sml. Objective: *Demonstrates reading an object's extents using GetObjectExtents () and GetObjectZExtents ().*

Submit Your Requests.

More and more clients are using **SML** as it expands. To further assist you, effective with the release of **V5.80**, MicroImages will consider promptly adding functions to **SML** which you have found you need. When requesting a new function, please provide a sufficiently detailed explanation of what the function should do. Also, and even more importantly, describe what you want to accomplish with the function in your script, as we may have a different approach to what you need if we know why you need it. If the objective

of the function is easily described and understood, submitting a few lines may be sufficient.

In requesting a new function, please understand that Microlimages has set priorities on the creation of new **SML** functions which support the interests of all clients in general. As a result, your function may or may not be assigned an "as-soon-as-possible" priority, but you will be promptly informed of its priority. The following general criteria will be used to assign your function one of two priorities.

- 1) High priority (in other words, "available within the next several weeks") will be assigned to those functions which are relatively easy to implement and of general interest to others.
- 2) Low priority (in other words, "put in with the other 1800 new feature requests") will be assigned to those functions graded as difficult and time consuming to implement and/or of limited interest to the general user of **SML**.
- 3) As a corollary, if your function is assigned into 2) above (lower priority) you can ask for a cost estimate for moving its priority from 2) to 1) above.

Scripts for Hire.

In general, Microlimages would prefer that those who wish to hire out their script writing consider using an outside consultant. This would enable Microlimages to concentrate upon creating new and better tools for use by all. However, if Microlimages contracts to create a script(s), it will be placed as another example script in the public domain, not-copyrighted, un-encrypted, and distributed with the **TNT** products without cost.

If you want to contract for private **SML** scripts, there are a number of very experienced consultants who have already developed complex scripts for their own use or for others. These consultants not only know how to design and write a complex **SML** script, but also have the experience in geospatial analysis needed to design a complex application. Please consult one of these experts if you wish to have a private **SML** script developed for your own use or sale.

Ray Harris 11878 Arborlake Way San Diego, CA 92131	phone (619)592-5013 FAX (619)592-5407 email ray.harris@gdesystems.com
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Ray McClain Moss Landing Marine Laboratories P.O. Box 450 Moss Landing, CA 95039	phone (408)755-8682 FAX (408)753-2826 email mcclain@mlml.calstate.edu
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If you would like to add your name to the above list of consultants for hire for creating **SML** scripts, please communicate this to Microlmages. In the future, this list will be maintained for your reference on microimages.com in the same area used for posting sample scripts, some of which have been contributed as sample work by these consultants.

Modifications since V5.80 CDs.

Many interface modifications have already been added to **SML**. Most of these are detailed in a section above associated with **TNTview** entitled **SML Modifications since V5.80 CDs**. As pointed out in the **TNTview** section, an **SML** script can now generate an icon on a menu tool bar. Also, a Windows icon on the desktop can start everything needed to run an **SML** script. This provides direct access to the operation of an application created in **SML**.

The following additional 12 functions have now been added in addition to the 158 provided on the **V5.80 CD**.

Vector Toolkit.

VectorUpdateStdAttributes (Vectvar)
Updates standard attributes.
VectorDeleteStdAttributes (Vectvar)
Deletes standard attributes.

Vector Functions.

CloseVector (Vectvar)
Closes an open vector object.
CreateTempVector (Vectvar)
Creates a temporary vector object.
CreateVector (Vectvar, filename\$, objname\$, desc\$, flag1\$, flag2\$)
Creates vector object without user dialog using same flags as GetOutputVector ().

OpenVector (Vectvarfilename\$, objname\$, flag1\$, flag2\$)

Opens a vector object without user dialog using same flags as GetOutputVector ().

VectorToolkitInit (Vectvar, flag\$)

Initializes a vector object for use with vector toolkit functions. Uses same flag values as second flag to GetOutputVector ().

Console Functions.

CheckCancel ()

Forces the **SML** script to check button.

Conversion Functions.

RasterToVectorBound (Rastvar, flag)

Traces vector polygon boundaries from a raster.

RasterToVectorLine (Rastvar, thinfactor, tracevalue)

Traces vector lines from a raster.

RasterToCADBound (Rastvar)

Traces CAD polygon boundaries from a raster.

RasterToCADLine (Rastvar, thinfactor, tracevalue)

Traces CAD lines from a raster.

Internationalization. ((new prototype features). via 2-byte UNICODE for W95 and NT)

Background.

A couple of years earlier, a considerable software engineering effort was expended on modifications to the **TNT** products to support their localization into other languages, particularly those languages with so many characters that they require 2-bytes per character (for example, Japanese, Chinese, Korean, ...). At the time, this produced the initial results whereby maps and image annotation could be in other languages but would not support a complete conversion of the **TNT** products to the local language.

The difficulties at that time in completing this conversion were associated with problems with the lack of support of long file names, 2-byte fonts, and other needed features in the Windows and Mac operating systems. These operating systems have now been improved to the point that cross-platform localization has been completed for the Windows platforms.

Features.

Directory and file names can now be viewed in 2-byte language fonts such as Japanese, Chinese, ... and improvements have been made in the handling of other 1-byte languages such as Turkish, Greek, Thai...

Message files containing the text for advisories, wizards, information, help, errors, ... can now be translated to display in 2-byte language fonts.

All resource files which contain the text for all interface components (buttons, dialogs, scrolling selection lists, ...) can now be translated to appear in 2-byte languages.

Source code which still directly displayed text messages in English has been searched out and altered to use message files.

Database tables and fields can now have 2-byte names.

Datatypes are now 2-byte. It is unlikely that any other software package supports this kind of native language feature.

Interface font selection is less confusing; it now has only needed and useful fonts.

Contrast table names and colormap names are 2-byte.

Interface elements such as menus and buttons can now mix several 1-byte and 2-byte languages at once, such as Japanese and English.

The **TNT** interface now supports 1/2 width Japanese characters mixed with English characters.

MI/X and **TNTmips** now support switching keyboard layouts via the W95 "Start" bar graphical toggle icon.

A color plate is attached entitled **TNT Products Now Internationalized (Sample Localization in Japanese)** to illustrate some of the interface components of **TNTmips** translated into Japanese.

Encoding.

When importing and exporting a database to dBASE or other external formats, there is now an option to set the character set encoding to be used in the external file. It will default to whatever encoding the table is set to use internally. This feature is provided because most external database file formats don't support UNICODE strings, so fields have to be translated to some other encoding (for example, Shift-JIS for Japanese).

Future Plans.

The text in the window bars is still English, and a means to translate it is being investigated. The current limitation is a feature of the TWM window manager, which is outside of MicroImages' control.

8mm Tape.

NovaXchange, a Windows product, can now be purchased to download image files from 8mm Exabyte tapes to files onto a hard drive. [Note that these are not UNIX tar files or the files of some specific backup/restore software, but original images and header information. Methods to read UNIX and PC tar files from tape onto the hard drive are already readily available]. After NovaXchange has been used to download the image files to a hard drive, the **TNT** import processes can be used to create the appropriate raster objects. This gets the job done and does not require the recreation of the **TNT** 8mm tape import option. Some written instructions on how to use NovaXChange to download images from 8mm tape are available via software support. The following 8mm tape formats have already been supported by this import procedure: RadarSAT, SPOT, and LANDSAT TM.

NovaXchange is about \$700 retail and is available from NovaStor Corporation located at www.novastor.com or as follows:

NovaXchange
NovaStor Corporation
80-B West Cochran
Simi Valley, CA 93065 USA
Phone (805)579-6700
FAX (805)579-6710
email sales@novastor.com

There is also a shareware utility for transferring 8mm tape files to your hard drive. It is called "TAPE.EXE" and is part of GNU tar for DOS package. The file "GTAK212B.ZIP"

can be downloaded from: www.a2znet.com/shareware/CDR31. This file contains TAR.EXE and TAPE.EXE as well as some documentation and source code. These programs only support tapes connected via SCSI. The TAR.EXE may also be called GTAR.EXE on some sites.

Printing.

General.

More options are now provided for rotating portrait to landscape and landscape to portrait layouts and printing operations.

Landscape printing is provided for all printers which do not have a built-in landscape orientation option in their hardware or drivers.

Map layouts can be saved into Adobe Illustrator 7 format (and thereby into FreeHand) using Illustrator's special EPS format (Illustrator Encapsulated PostScript). Output to the generic EPS format is also provided. [This requires printer support option **P8**.]

The name of the raster being printed is now displayed.

Transparency.

3D groups and groups with transparency can now be printed. It is not necessary to do anything special to make it happen. If it's on the screen, it will print. One word of warning: It will take a LOT of disk space! To figure out how much, take the printer resolution and square it to get bytes per square inch. Multiply this by the size of the group in inches ON THE PRINTED PAGE. (In other words, it's not related to the size of the input objects, just the size of the group being printed). Then, for a group containing just transparency, multiply it by three. This will tell you how many bytes of disk space will be needed for the temporary raster used to render the transparency in the group before printing. If the group is 3D, multiply it by seven instead of three. It's important to realize that this can get huge, so compute it out and make sure you have the drive space free. However, this large disk space is only needed for groups containing transparency and/or 3D and only needs to be big enough to hold the area covered in the largest single group.

Installed Sizes.

Loading a full installation of **TNTmips 5.8** 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	66 MB
PC using W95	83 MB
PC using NT (Intel)	83 MB
PC using LINUX (Intel)	56 MB
DEC using NT (Alpha)	89 MB
Mac using MacOS 7.6 (680xx)	70 MB
Power Mac using MacOS 7.6 and 8.0 (PPC)	80 MB
Hewlett Packard workstation using HPUX	84 MB
SGI workstation via IRIX	102 MB
Sun workstation via Solaris 1.x	73 MB
Sun workstation via Solaris 2.x	71 MB
IBM workstation via AIX 4.x (PPC)	92 MB
DEC workstation via UNIX=OSF/1 (Alpha)	116 MB

V5.80 of the HTML based on-line Reference Manual including illustrations requires 32 MB. Installing all the sample geodata sets for **TNTlite** and **TNTmips** requires 136 MB. The 33 Getting Started Booklets require a total of 37 MB.

Upgrading.

If you did not order **V5.80** of your **TNTmips** and wish to do so now, please contact MicroImages by FAX, phone, or email to arrange to purchase this upgrade or annual maintenance. Upon receipt of your order and processing, MicroImages 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 5.80** and the other **TNT** professional products.

If you do not have annual maintenance for **TNTmips**, you can upgrade to **V5.80** via the elective upgrade plan at the cost in the tables below. Please remember that new features have been added to **TNTmips** each quarter. Thus, the earlier your current version of **TNTmips** relative to **V5.80**, 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>V5.20</u>
	V5.70	V5.60	V5.50	V5.40	V5.30	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>V5.20</u>
	V5.70	V5.60	V5.50	V5.40	V5.30	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

Microlimages Authorized Dealers

Three new dealers were added during the past quarter.

California--TERA Research, Inc.

Microlimages is pleased to present TERA Research, Inc., a long term client, as a new Microlimages Dealer located in Sunnyvale. TERA engages in research, systems integration, and contract work for private, military, and security agencies in the U.S. and abroad. For further information please contact Dr. Jack Liu (formerly serving you from GeoDigiGraphics) by voice at (408)734-3069 x125 or FAX at (408)734-8689 or by mail at 1344 Bordeaux Drive, Sunnyvale, CA 94089-1005.

Germany--Ingenieurbüro für Geoinformatik

Microlimages is pleased to present the Ingenieurbüro für Geoinformatik as a new Micro-Images dealer, located in Kleve near Cologne in northeastern Germany. Geoinformatik is a new company founded by Frank Kohlleppel in 1996, at which time they started using the TNT products as clients. Geoinformatik began by supplying geospatial consulting and service to farmers, archaeologists, planning bureaus, and other local professionals and authorities. As part of their expansion plans, Geoinformatik will now offer TNT products and systems to these clients. For further information please contact Frank Kohlleppel at voice at (4928)2139-0031 or FAX at (4928)2139-0032 or by mail at Drususdeich 19, Kleve 47533, Germany.

Finland--Soil and Water Ltd.

Microlimages is pleased to present Soil and Water Ltd., a long term client, as a new Microlimages Dealer located in Helsinki. Soil and Water Ltd. is one of several large subsidiary companies of Finvest Oy. These subsidiaries are engaged in large forest management and construction operations in Europe. Soil and Water employs hundreds of engineers and professionals engaged in all aspects of environmental management projects. For further information, please contact Pentti Ruokokoski (formerly serving you from the Geological Survey of Finland) at voice (358)968-2661 or FAX at (358)968-26600 or by mail at Itälahdenkatu 2, Helsinki 00210, Finland.

Discontinued Dealers

The following dealers are no longer authorized to sell Microlimages' products for various reasons. Please do not contact them regarding support, service, or information about the TNT products. Please do contact Microlimages directly or one of the many other Microlimages Authorized Dealers.

Spectrascan Pty. Ltd. (Bill Holman) of West Perth, Australia is discontinued.

GEOMAX (Tom Murauskas) of Omaha, Nebraska is discontinued.

Integrated Geoscience, Inc. (Stuart Blundell) of Helena, Montana is discontinued.

Geological Survey of Finland (Pentti Ruokokoski) of Espoo, Finland is discontinued. Pentti is now employed by our new dealer and long time client, Soil and Water Ltd. (see above).

GeoDigiGraphics (Dr. Jack Liu) of Sunnyvale, California is discontinued. Jack is now employed by our new dealer and long time client, TERA Research, Inc. (see above).

Computers

Each quarter, there is a better computer to recommend at approximately the same price. The Gateway 'best for your money' computer is now a 300 MHz Pentium II with a 8.4GB drive and 19" monitor (last quarter, it was a 266 MHz Pentium II with 6.4GB and 17" monitor).

Best Power for the Price.

Gateway GP6-3000 (\$2900)

- Intel 300 MHz Pentium II
- 64 MB SRAM
- 512 KB internal cache
- 8.4GB 8.5ms ultra ATA hard drive
- 19" EV900 color monitor (.26 dp)
- 3D 64-bit nVidia AGP 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 (w/o Access)

Best \$1000 Platform.

This computer is faster and more powerful than many computers used today for **TNT** products by professionals. A surprisingly large number of those ordering **TNTlite** indicate it will be used on a PC 486 machine. These PC 486 based machines maxed out at 66 MHz.

Compaq Presario 4514 (\$999 direct, \$950 from Best Buy or similar)

- Intel 233 MHz Pentium no monitor included!
- 32 MB SyncDRAM
- 512 KB internal cache
- 3 GB IDE hard drive
- motherboard based display 1 MB video memory
- 20X CD-ROM drive
- 3.5" diskette drive
- 33.6Kbaud modem
- 14.5" high tower case, 1 unused drive bay, 2 unused expansion slots
- keyboard and mouse
- W95

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.

Use this site area to share your sample scripts with others. While there, you can see if there are any new scripts of interest to you and easily download them. All the sample application scripts discussed in other sections of this MEMO will be posted there for

your testing and as use as models for advanced scripts. Remember, scripts posted there which are identified as developed for **V5.90** will probably require that you also download a new display process from the Tuesday/Thursday interim releases.

GeoFormula Exchange.

An exchange site for GeoFormulas has also been set up with the same features as for the **SML** site. Please use this site to post your interesting GeoFormulas and to download those provided by Microlimages or others.

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. Duplicates of these booklets are also posted for your use and modification in PageMaker 6.5 format. The latest, the edited, and all new booklets will be posted at this position as this quarter progresses.

TNT Problems and Plans.

Problems. Microlimages has been establishing a Web procedure whereby you will be able to check on known problems in the **TNT** products via microimages.com. This procedure should be placed on-line shortly after **V5.80** ships. It will provide a means by which you can look through the list of known problems in the official CD release (for example, **V5.80**) and try to see if the problem you think you have has actually been identified. You can then determine if it has been fixed since the last official CD release and obtain the correction via the Tuesday/Thursday interim releases. Those who have reported problems and received an error code will be able to directly check on the status of that problem using the code.

Plans. These new procedures will also allow you to review the long list of new features which have been posted for the possible future addition to the **TNT** products. Each feature will have a priority attached to it which has been assigned by Microlimages. If it has been added to the appropriate process, then it is available via the Tuesday/Thursday interim release and will be officially released on the next CD. Features are arranged by process and function so you can easily locate and check your area of interest. If you have made a specific request and been notified of its code, you can directly enter this code to learn about its status and the priority assigned to it.

Prices

You can now use any pen plotting feature supported by **TNTmips** free, without purchasing the **L3** feature. Pen plotting can be via any pen plotter which is supported or via HPGL protocol to most large format color ink jet printers. You might choose to use pen plotting during the creation and editing of vector or CAD objects, as it is a faster means of generating simple interim line drawings.

Papers on Applications

Rewarded.

The following papers were rewarded \$2000.

Maryland Creates ELECTRONIC ATLAS to Make GIS Data Available. by Kevin Corbley. EOM, Volume 6, Number 12, December 1997/January 1998. pp 14 -17. [also on color cover]

Other Papers.

Geographische Informationssysteme (GIS) in der Praxis von Naturschutz und Landschaftsplanung. 1. Folge: Praxisrelevante Funktionen von Geoinformationssystemen. by Frank Kohlleppel. MagNatur, Volume 1, Number 1, 1996. pp 50-53.

Geographische Informationssysteme (GIS) in der Praxis von Naturschutz und Landschaftsplanung. 1. Folge: Das richtige GIS - die Stecknadel im Heuhaufen?. by Frank Kohlleppel. MagNatur, Volume 1, Number 2, 1996. pp 64-67.

Wenn Die Stadtvater in den digitalen Landschaftsplan schauen. Kommunale Geo-Datenbanken können der Verwaltung helfen und Kosten sparen. by Anneli Wallentowitz. Frantfurter Allgemeine Zeitung. [leading German daily newsletter] 2 December 1997. 1 page.

Plane schmieden mit Geo-Informatik. by Matthias Alisch. GeoBIT, Das Magazin für raumbezogene Informationstechnologie, Volume 2, Number 6, September 1997. pp 6-10.

TNTmips - GIS, Desktop Mapping - und Bildverarbeitungssystem. no author. GeoBIT, Das Magazin für raumbezogene Informationstechnologie, Volume 2, Number 6, September 1997. p 37.

Landsat images assist in mapping Caspian bathymetry. Shallow depths, wind-driven tides create problems for seismic vessels. by Kevin Corbley. Offshore, Volume 57, Number 7, July 1997. p 54.

Approach of a GIS-based system to model ecological developments in floodplane-ecosystems by changing the hydrological factors. Dissertation submitted in part fulfillment of requirements for the degree of Master of Science in Geographic Information Systems. by Detlef Gunther-Diringer. World Wildlife Foundation--Auen Institute. Rastatt, Germany. June 1997. pages unknown.

Topside Planning--Field Remediation Economics. Two companies develop a thematic imaging and spatial analysis technique for exploration and field purchase. by Kevin Corbley. Hart's Oil and Gas World, September 1997, pp. 58-59.

Zbytočne malo známy TNTmips. by Slavomir Daniel. CAD and Graphics. Computer Press, Praha, Slovakia. Number 4, 1996, pp. 164-166. [CAD and Graphics is a high quality Slovakian quarterly publication. This article reviews TNTmips in Slovakian and contains several color images of TNTmips screens. Its author received MicrolImages' monetary reward, as the article met the published criteria.]

Mapping Shipwreck Sites by Digital Stereovideogrammetry. by John A. Gifford. Underwater Archaeology, 1997, pp. 9-16. [from page 10: "The SIS package used for this project--TNTmips versions 4.5-5.5, written and distributed by MicrolImages, Inc. (Lincoln, Nebraska)--has the capability of grabbing video signal frames (primary and secondary fields) and creating rasters from them; registering the rasters to an arbitrary, user defined coordinate system; rectifying the registered rasters by applying various models of distortion; sampling raster image pairs with a prospective projection subroutine; and from these left-right pairs, generating elevation models. These models may be either traditional Digital Elevation Models (DEMs) or the more efficient data structures called Triangulated Irregular Networks (TINs). No other software is required, and in fact the routines used in this project only comprise about 5 percent of all the routines available in the package. "]

A LANDSAT MSS-derived fire history of Kakadu National Park, monsoonal northern Australia, 1980-94: seasonal extent, frequency and patchiness. by Jeremy Russell-

Smith, Paul G. Ryan, and Richard DuRieu. *Journal of Applied Ecology*, 1997, 34, pp. 748-766.

Small is beautiful--evaluation of two low-cost GISs. by Kristof Ostic and Zoran Stancic. *Archaeological Computing Newsletter #48*, 1997, pp. 14-19.

[a review of **TNTlite** and GRASSLAND and comparison with IDRISI]

Letter to the Editor. A response to 'Small is beautiful--evaluation of two low-cost GISs', in ACN48. *Archaeological Computing Newsletter #49*, 1997, pp. 1-3.

Geospatial analysis aids exploration. *Southern Remote Sensing has solved the problem of how to manage the large variety of geodata types needing to be analyzed in day-to-day operations.* by Richard DuRieu. *Australia's Paydirt*, November 1997, Vol. 1, Issue 34. page 29.

GIS to Support 'Precision farming'--Optimizing Costs and Protection Drinking Water Resources. H.N. Resch et al. Published in German, 1997, reference incomplete.

GPS-Logged Aerial Video as a Georeferenced Tool for Digital Imagery in Remote Regions, a Case Study in Madagascar. 1997. Dana M. Slaymaker, Dept. of Forestry and Wildlife Conservation, University of Massachusetts and Lee Hannah, Conservation International, 62 Grove Street, Turners Falls, MA 01376. 7 pages.

Aerial Photography of the Ankarafantsika Reserve (Madagascar). *Using digitized 35mm imagery and GPS-logged survey with low-level aerial videography to create a semi-controlled raster base of the park.* 1997. Dana M. Slaymaker, Dept. of Forestry and Wildlife Conservation, University of Massachusetts and Lee Hannah, Conservation International, 62 Grove Street, Turners Falls, MA 01376. 7 pages. [many color screen captures]

Promotional Activities

Postcard announcing V5.80.

TNTlite users just cannot grasp the frequent upgrade concept since they are not paying for it in advance. To get these users to understand that they are not using the latest product, a postcard mailing to about 10,000 such users is just being shipped. A copy of this dual postcard is enclosed.

New TNTlite Flier.

A new **TNTlite** flier is almost in final form for promotional use. While the graphics have been redesigned, its content is quite similar to the previous model.

Web Site.

Product promotional materials recently prepared by MicroImages are being posted in electronic form for downloading on microimages.com. For example, the **TNTlite's** Out flier, the Archaeological flier, and others are already available. These materials are in PageMaker 6.5 format so that they can be abstracted for other uses or printed up in poster size by MicroImages' dealers going to shows. The ability to print them poster size and obtain good results is tested by MicroImages before they are posted.

Noteworthy Client Activities

[From Japan] *"8th October we had a third users meeting at some user site in Tsukuba Science City. About 40 persons gathered. Dr. Sawada, keynote speaker, presented by the title of 'Forestry Data Set of GIS and Remote Sensing'. He is combining S-Plus statistical software with **MIPS**. Dr. Wakita introduced the CCOP digital geological data of East and Southeast area. I explained how to do Mosaic (following Get Started and data sets), how to access FTP server of MicroImages to get patches and enhancements, and how to use X-server on Windows95 and Mac."*

*"**MIPS** is dominant GIS system in [three government agencies] in Japan. [A client] bought 8 ArcInfo several years but they seemed died (one of reason is expensive annual maintenance fee, 1 million yen per year, and difficult to pay, difficult to use as well.) [Another client] also has two Arc, but almost dead. Only one or two special persons, 'programmers', can use."*

*"Almost no competition with MapInfo, as they are focusing on business GIS. To enter that market localization of software (menus, etc.) are needed. We want to focus this market this year, though." [Suitable localization is being released in **V5.80**, and **TNTmips**' interface has already been translated into Japanese.]*

"Workstation ERDAS is dying, very decreasing its sales."

"[A competitor] is still selling Arc/Info by 6,300,000 yen [about US\$50,500]. The seems sell NT version by the same price. Who buys such expensive software?"

Abbreviations.

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

W31 = Microsoft Windows 3.1 or 3.11.

W95 = Microsoft Windows 95.

W98 = Microsoft Windows 98.

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).

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.

MI/X = MicroImages' X server for Mac and PC microcomputer platform and operating system.