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Introduction

MicroImages is pleased to distribute **V6.40** of the **TNT** products, which is the 49th release of **TNTmips**. A count of 139 new feature requests submitted by clients and MicroImages' staff were implemented in **V6.40** processes. The following major features have been added.

- **Undo Edits:** Multiple Undo (reverse) operations are now provided in the Spatial Data Editor on raster, vector, CAD, and TIN objects.

- **Interactive Legends:** New layout tools are available to design more attractive and complete legends. You can reorder elements, move elements and design appearance, edit heading text and appearance, edit each legend description and control its appearance, create multicolumn legends, and more.

- **Legend Management:** Legends can now be kept with each layout and composite legends can be assembled from the styles of multiple layers. Create legends from all element types in a layer and use their descriptions by default.

- **Visual Selection**: All objects in a Project File can be previewed and selected from thumbnail views in the new Overview window. Thumbnail views are automatically created and stored in the Project File for raster, vector, CAD, and TIN objects.

- **GeoCatalogs:** Automatically catalog all the objects in all Project Files together with their properties. Use GeoCatalogs to locate and select objects for visual or automatic selection.

- **Macro Scripts:** Add custom features to display toolbar with new **SML** macro scripts.

- **Tool Scripts:** Add custom tools to the display toolbar using new **SML** tool scripts.

- **3D Queries:** Elements can be selected for use in a 3D view by a query. These elements can then be filled as in a 2D view (transparency, patterns, ...). Elements selected in a 3D query will show in a concurrent 2D view and vice versa.

- **3D Watershed Vector:** The watershed process now creates a 3D vector object for streams, basins, and watersheds with attached attribute tables including properties such as stream order, length, and many others.

- **Faster Watershed Modeling:** Large elevation rasters can now be processed 10 to 20 times faster providing for improved depression filling and limiting the area of the processing to an irregular region. All watershed modeling functions are now available for use in **SML**.

- **Faster Vectors:** Vector objects can be optimized to zoom in views 2 to 5 times faster. This optimization is automatically performed by all vector imports.

- **Faster Wireframes:** Viewing and moving 3D wireframes is now up to 10 times faster.

- **NIMA Formats:** NITF 2.1 images can be imported and exported, CADRG map files and CIB images can be imported.

- **Imports:** Access is added for PNG, ArcGrid binary, transparent GIF, TAB databases, TAB to CAD objects, CGM, RLE, and miscellaneous formats.

- **Preview Export:** Examine thumbnail view of all objects to confirm their contents as they are selected for export.

- **TNTlite:** Project Files created in **TNTlite** can now be used in all the **TNT** professional products.

- **TNTserver/TNTclient:** **TNT** queries can be evaluated by the **TNTserver**. URLs to other sites can be created from atlas attributes. ViewMarks to mark and retrieve views can be used in clients.

- **QuickGuides:** 6 new QuickGuides are available.

- **Getting Started Booklets:** 4 new Getting Started Booklets are available.

Hardware Keys

Changes in Keys.

New Combo USB Key for Windows and Mac.

A new combo USB key for Windows and Mac platforms is now used for **TNTmips**, **TNTedit**, and **TNTview**. Since the release of **V6.30** the Mac and Windows versions of new **TNT** products are priced identically. Thus, you can now request that your new combo USB key be programmed so that it can be moved between these platforms. A combo USB key programmed in this fashion permits **TNTmips**, **TNTedit**, and **TNTview** to be freely moved, tested, and used among Mac and Windows (except Windows NT) platforms.

Important Note: Unfortunately, Windows NT 3.x or 4.x does not support USB ports and connections so that only a parallel port key can be used.

MicroImages recommends that a USB key, not a parallel key, be used with **TNT** products on a Windows 95, 98, ME, or 2000 platform. Parallel keys are quickly damaged if anything other than a printer is attached to them to use the same parallel port. USB keys simply act as another device on the USB "bus," are not required to transmit data to/from another attached device, and respond only when correctly addressed.

LINUX Parallel Key.

The standard, small parallel key is now provided with the **TNT** products for use on a LINUX platform. USB support has only recently become available for LINUX. As a result, most peripheral devices with USB connections do not have drivers for LINUX. Their manufacturers are also moving slowly to provide LINUX support due to the many "flavors" and versions of LINUX currently available. Unfortunately, the manufacturer of the keys used by MicroImages for the **TNT** products has indicated that the LINUX drivers for its USB keys will not be available until late in 2001.

Correction: Contrary to the statement in this MEMO for **V6.30**, USB keys for LINUX are not available for the **TNT** products.

Separating Mac and Windows/LINUX USB Keys.

Somebody at Rainbow Technologies is color blind and can not see the rainbow.

The purple USB key for use with a Mac only can be identified by the words "RAINBOW Eve3" embossed upon it.

The purple USB key for use with Windows and LINUX can be identified by the words "RAINBOW SuperPro" embossed upon it.

The purple USB key for use on both a Mac or Windows USB port can be identified by the words "RAINBOW Combo" embossed on it.

UNIX Licenses.

The serial I/O key is the only key available for use with the various types of **TNT** licenses for UNIX platforms, but is not available for LINUX platforms.

Floating Licenses.

The various types of keys outlined above are for use with **TNTmips**, **TNTedit**, and **TNTview**. They can be programmed to support the use of these products for each license type: single-user/single-platform; multi-user/single-platform; and floating licenses. Floating licenses are not available for use with the Mac platform.

TNTserver.

A USB or parallel I/O key can be supplied for a W2000 platform hosting a **TNTserver**.

Only a parallell I/O key can be supplied for the NT4.0 platform hosting a **TNTserver** as NT does not support USB.

Key Summary.

The following types of keys are available for the **TNTmips**, **TNTedit**, and **TNTview** product licenses. These same types of keys are available for use with single-user/single-platform, multi-user/single-platform, and floating platform licenses.
- USB key interchangeable between Mac and Windows platforms except for NT, which does not support USB.
- Parallel I/O port key only for Windows- and LINUX-based platforms.
- Serial I/O port key only for UNIX-based platforms, but not for LINUX.
  (*Floating platform licenses are not available for any Mac platform, as FLEX/lm does not support Macs.)

The following types of keys are available for **TNTserver** product licenses.
- Parallel I/O key for use with **TNTserver** on Windows NT.
- USB key or parallel I/O key for use with **TNTserver** on Windows 2000.

Key Exchanges.

When you purchase a new computer with USB support you may find it more convenient to use a USB combo key than your existing parallel or serial key. Also you may wish to use the new USB combo key to install your **TNT** product on both Mac and Windows platforms and switch the key between them. To make this exchange, simply let MicroImages know of your need and return the key you wish to exchange by air express with insurance. A replacement key will be shipped immediately by air express. The charge to exchange your parallel or serial key for a new USB key or to obtain a replacement for a damaged key that is out of warranty will be $100 including immediate return shipment by air express.

If for some reason you need to replace a damaged serial key or to move your key from USB or parallel to serial, the more expensive new serial key is $150 including air express. For example, the parallel key for **V6.40** of the **TNT** products can be switched between Windows and LINUX. However, if you are using an earlier version of a **TNT** product, only the more expensive serial key will work for those switching a **TNT** product from Windows to LINUX. Under these circumstances the

parallel or USB key originally provided for Windows will need to be exchanged for a serial key for use on both LINUX and Windows.

Platform Specific News

LINUX.

The **TNT** products have been tested for correct operation on common LINUX releases (for example, RedHat V6.4 and V7.0) on platforms using dual Intel processors.

W2000 and NT.

The **TNT** products have been tested for correct operation on NT4.0 and W2000 on platforms using dual Intel processors.

Macintosh.

Compared with Windows platforms, those using Macs to surf the web have had a major headache using any site (such as a **TNTserver**) that downloads a Java client for local execution. Unlike Windows, previous versions of the Mac Java engine would not locally cache any Java, such as **TNTclient**, for reuse later. In other words, if you use the **TNTclient** on a Windows platform in Internet Explorer or Netscape Navigator, it is locally cached on your hard drive as long as your browser is operating. To revisit the **TNTserver**, you would simply go back to it and your browser will detect that it has the client cached and reload it locally in a couple of seconds. Unfortunately, until this month, Internet Explorer 5 used on the Mac platform would not cache the client. As a result, when you left the site from which you just downloaded a Java client, that client was purged. When you came back to that site, Internet Explorer 5 would again need to spend minutes downloading the same client. This is particularly annoying for those Mac users who connect by a phone modem to access any site that downloads a Java client.

This month Apple finally released a version of their Java engine used for Internet Explorer 5 (called MRJ version 2.2.3) that will cache Java clients. The latest MRJ is always available at www.apple.com/java. If you use MacOS 8.x or later, please obtain and replace any earlier MRJ component. Now that caching is working on the Mac, you will find that your visits to the many sites that download some kind of Java client will be much faster if you use the Internet for extended periods, move back and forth between sites, or have on-all-the-time service.

The most recent version of Netscape Navigator for the Mac platform is way behind the capabilities of Internet Explorer and should not be used on the Mac. Most Java clients will produce errors in this browser!

USB Key.

Using the new USB Combo key you can easily move the operation of your **TNT** products between Windows and Mac platforms.

Editorial and Associated News [by Dr. Lee D. Miller, President]

This release of the **TNT** products introduces new kinds of geospatial procedures, at least they are new to the **TNT** products. Since the concepts are probably new to you as well, I have tried to describe why they are, or will soon become, important to you as you expand your use of our products. My opinions, which might have been more clearly identified if they occurred here, were incorporated into these introductions in the New

Features section. They need not be repeated here where only their significance is summarized.

Working Together.

At one point after its release, Microsoft had documented 63,000 bugs in Windows 2000. All software has errors. The sign on my desk used to say *"all software has errors, it is how we solve them that really counts."* After almost 15 years in this business I have found it is difficult to help some people. In these very few cases I have had to drag out another aphorism that *"you will usually catch more flies with honey than vinegar, especially if you are persistent."* This has recently led me to amend the sign on my desk to a more realistic form of:

"All software has errors, it's how **_we work together_** to solve them that really counts!"

With this operational concept on our front door, MicroImages will continue to work with you to solve a problem if you will just stick with us on it. Sometimes an error can be solved in a day and sometimes it takes 6 months. The hardest problems are those that we do not have here. This happens when we can not reproduce the error with the geodata and versions of the product we have and/or the information you have provided. You just have to keep at us if we can not reproduce the problem and do not fix it. At least 90% of the errors we can reproduce are fixed in a few days except in special periods around release times when some problems are fixed immediately. At this same time others must be delayed for weeks until after the release (in other words, they require generic changes that can not be introduced without a high risk of adding many other errors in other features).

New Features.

While I do not know all the detailed features of competing products, here is how I think these new initiatives in **V6.40** fare. Where I am ignorant of some other parallel capabilities in competing commercial, university, or public products, I would be grateful if you would point them out so MicroImages can expand these new starts.

GeoCatalogs.

I believe that the ArcCatalog procedures available for use with ESRI products, which predate our efforts, have a similar function to our GeoCatalog application. I also assume that they are primarily concerned with the narrower management of their coverage files. Other competing GIS or IPS products do not tightly integrate and use as equals all geodata types. Individual users of these products do not tend to quickly accumulate large collections of mixed geodata types. As a result, they do not yet have a need for this kind of inventory and visual search capabilities for all the principle types of geodata.

Macro and Tool Scripts.

These new features can benefit users of all **TNT** products at all levels. Now Spatial Manipulation Language can be used to construct new custom oriented procedures. This is not unique in the industry. However, let me take the use of these customization features to the extreme and use them in the free **TNTatlas** and see how they fare against the competition. Use as an example an atlas assembled from public geodata. Everyone would like to figure out a way to take the wide variety of public geodata in the United States, add value, and resell it. If you have private geodata sources or buy and

add value to commercial data, then this model works even better, especially outside the United States where public geodata is sparse.

Assume that a HyperIndex is assembled for a special purpose, such as to provide a hierarchical base for a pending land use study, to compare sites, for educational purposes, and many other regional purposes. This application might use and combine only public geodata such as TIGER vectors, Landsat TM images, DRG topographic maps, some public database, and so on. The act of assembling this kind of material into a HyperIndex and publishing it on a CD <u>adds value to it</u>. Some of you are already making these kinds of atlases based upon widely available public geodata and perhaps just a little dash of important private database materials used as a pinmap layer.

Macro and tool scripts allow you to add much more value to your **TNTatlas**, regardless of the geodata source, by providing specialized tools that can be tailored to a specific use. A simple example of an extension of your current uses of **TNTatlas** might make these opportunities clearer. Assume that some site(s) will become the subject of extensive efforts in the office and the field by one professional exploration geologist. An atlas could be assembled at the beginning of the project of a regional area. It is made up of a low cost set of Landsat TM7 images, scans of public domain topographic maps, available airphotos, regional geologic maps, and proprietary detailed geologic maps and geochemical databases. This geodata could be assembled into a **TNTatlas** just for this one application. Now a privately developed suite of special interactive geologically oriented interpretation tools can be added to this **TNTatlas**. Special display functions such as multispectral color combinations and connections to other programs can also be added using macro scripts. Your value added product might be even simpler. The **TNTatlas** is made up of only a collection of maps, airphotos, and Landsat images. The accompanying custom tools each perform a special interpretive action, such as determining and saving the strike and dip of an area observed in the field and outlined in the tool.

There are now many free viewers that can be provided and used with a CD full of geodata in several formats. Few of them will support multi-layer, multi-type geodata overlay with map projection reconciliation. At this point I do not know of any other viewer that will also support a hierarchical geodata structure and let you add your own interactive tools. All this for free in as many copies as you like?

Queries in TNTserver.

TNTserver, **TNTclient**, and **TNTbrowser** were first introduced as a means of using hierarchical HyperIndex structures on the Internet or private intranets. Many nations do not have a rigid street naming and numbering schemes in place. Many private applications of the HyperIndex concept via an intranet do not use any "go-to" concept as reflected in current on-line products that "go-to" based on an address. The focus of these products has been upon applications where the user does not have any particular geographic area of interest.

Concurrent with the release of the **V6.40 TNT** products, our web-centric products now also support **TNT** queries. These queries can be entered directly or hidden in the client. They allow each user to jump to a predefined view in the atlas based upon known information such as a street address; a county; a zip code; a city name; a geographic point; a school district; a township, range, and section; and others dependent upon available layers and attributes.

We are now demonstrating a **TNTclient** that lets you choose which kind of a "go-to" input directly zooms you to the site and atlas layer(s) of interest. Contrast this to the many web sites that let you only enter an address and retrieve a single kind of view. But, this **TNTclient** will let you select and use any of these geographic location methods. It also still provides the navigation, layer controls, measurement tools, and other features used in the previous versions.

New clients are also being released for you to use to create your own end user interface and product. They will also allow you to incorporate all or any combination of the **TNTserver** features. One is a client created entirely in HTML. As in all HTML code, this client will be available for modification by anyone. Any of you maintaining a web site already knows how to create an interface with HTML. A Windows client is also being prepared and will be compiled in C++ and downloaded as a stand alone program (**TNTclient** and **TNTbrowser** are written and provided in Java). From these various options you will be able to choose, use, and modify that client that most suits the particular needs of your application.

News Items.

Those of you in other nations and professions do not necessarily track or observe the "behind the scenes developments" that point out how things are being determined. The following extractions from news articles indicate the actions we can expect that will provide advances in 2 to 3 years in the resolution (to 0.5-meter) and proliferation of 1 meter sources of satellite imagery.

Bandwidth Surplus.

The following are small excerpts from an article entitled Operators of Fiber-Optic Networks Face Capacity Glut, Falling Prices that appeared in the Wall Street Journal of 19 October 2000 on pages B1 and B4.

"Competition is growing fierce, take Cogent Communications Inc., a Washington D.C. start-up that plans to offer 100 megabits per second [a T3d line or equal to an OC-2 line, which is a Switched Optical Network] *of Internet access to more than 500 corporate customers in several cities for $1,000 a month starting in November. That's more than 60 times the capacity of a standard high-speed office hookup* [a T1 line]—*at a lower price."* [Last year MicroImages was paying over $1000 per month for a T1 line; currently we use 2 medium capacity DSL lines.]

"Big 'backbone' carriers, such as 360networks, which usually provide wholesale service for carriers that actually service businesses and consumers, face other obstacles. One is the 'last mile' problem, the fact that phone lines that connect consumers and small businesses to the Internet usually are too slow to take advantage of the high speeds. Moreover, there aren't enough applications, such as video-on-demand services, to soak up all the bandwidth." [Why provide applications if you can not deliver, therefore sell them!]

...

"The price of bandwidth in a competitive area of the U.S. is about a tenth [10%] *of the price four years ago, and less than 1% of the price in the mid-1980s, though prices for bandwidth connecting various regions of the world aren't falling as fast. To avoid pure price competition, 360networks often sells its capacity in conjunction with data-center services and other add-ons."*

...

In a few years, "we'll all be buying our music and our videos online, and those are unbelievable file sizes," says Mr. Olsen, the vice chairman. Moreover, 360networks is in talks with a company seeking to broadcast sports over the Internet, says marketing chief Mr. Brennan. The service will allow viewers to customize their viewing and watch, say, just one star's play at a golf tournament, he says. "That application hogs bandwidth." he adds. [Much better explanation would be to track your national team or star at the 2004 Olympics.]

[As briefly alluded to, the current glut in capacity would <u>disappear overnight</u> if they would just get busy getting it to us at a reasonable cost. Success and leadership in this area in the United States would immediately prompt similar undertakings in many other nations and more bandwidth between them. The last mile will be improved in Lincoln by the end of the year when competitive DSL (phone lines) and cable modem (TV cable) service are available to most homes. These 5 to 10 times increases in data rates relative to the normal 56Kb phone modems will temporarily satisfy the web surfer, but will not provide good video on demand service. Many other nations are also rapidly building trunk line bandwidth capacity and so similar higher speed service with local links can not be that far off between major cities.]

Politics, Not Technology, Determines Resolution.

Extracted from an untitled press release in Aviation Week & Space Technology, July 31, 2000, page 5.

"A long-awaited decision to allow the sale of high-resolution commercial space imagery is expected soon. Officials from the Defense, Commerce and State departments are in the midst of a series of meetings to determine whether to grant Space Imaging's request to sell 0.5-meter resolution imagery. The company already sells 1-meter-resolution pictures taken by its Ikonos remote-sensing spacecraft, and this year will have $200 million in revenue from the system, compared with $40 million last year. A senior Pentagon official says the application will be approved."

[It is really unfortunate that politics control the distribution of technology that has such direct benefits to humankind.]

Space Cameras for Sale.

The following statements are abstracted almost verbatim from the article: <u>Kodak Aggressively Chasing New Markets in Remote Sensing</u>. SPACE NEWS, August 28, 2000, page 26.

"Kodak is aggressively marketing a new satellite camera called the Model 1000. It is a standardized, commercial derivative of cameras Kodak designed and built specially for two U.S. satellite imaging firms: Space Imaging, Thornton, CO and EarthWatch, Longmont, CO." [It is important to note that neither of these companies to whom we attribute this technology actually built the camera. They were responsible for the space system integration and launch. Since anyone or any nation can buy the technology and launch it, these and similar companies will evolve into marketing organizations in the long run.]

"Kodak hopes to increase its share of the camera side of the remote-sensing market with this lower-cost camera. The model 1000 is intended for foreign governments and companies, scientific organizations and commercial imagery providers. It can take black-and-white pictures with 1-meter resolution, which can distinguish objects 1 meter across and larger, and color pictures with 4-meter resolution.

"The Model 1000 will not offer the same accuracy as the custom-built models. The camera on Space Imaging's Ikonos satellite offers resolutions of .82 meters when pointed straight down and 1-meter resolution aimed right and left.

"The benefits of the Model 1000 are in its cost and availability. The camera is priced at about $22 million to $23 million—about 30% less than a custom-engineered system— and can be delivered within 24 months of when it is ordered. The custom built models took 30 months to deliver.

"Kodak identified at least four or five sales opportunities before introducing the Model 1000 in July 1999. But Kodak has yet to make a sale, despite a market that has been very active in the last two years."

Several U.S. companies have complained that strict U.S. export laws have hampered their efforts to sell remote-sensing satellite hardware abroad. Kodak notes that export licensing has not been a problem. The problem is a lack of budget stability among interested parties.

"Non-U.S. companies have been scoring successes in this market. For example, El-Op Electo-Optics Industries, a division of Elbit Systems Ltd. of Haifa, Israel, recently sold a high-resolution satellite imaging camera to South Korea. And the France based division of Europe's Astrium satellite consortium won a contract in 1999 to build a high-resolution imaging satellite for Taiwan.

"Based upon the difficulty that the existing operators are and will have providing appropriate cloudless images with small footprints it is very likely that we will see many more such systems in the next 5 years easily afforded by a government backed undertaking."

[It will not be that long before your nation considers it feasible to launch its own 1 meter satellite in a preferential orbit. It may become a matter of national pride and one peaceful means of engaging in a space program of direct benefit to your populace.]

TNTsdk® 6.4

All of the functions in **TNTsdk** should now have revised documentation in the new commercial system. This new documentation of all these functions can be viewed on-line at microimages.com.

TNTlite® 6.4

Important Notice: **TNTlite 6.4** creates RVC files that can be immediately used by **V6.40** of the **TNT** professional products.

Mass Distribution by Dealers.

More **TNTlite 6.4** CDs have already been ordered for distribution by MicroImages' dealers and clients than any previous version. MicroImages thanks you for helping others to obtain and use this product. MicroImages is answering an increased number of requests for support from students around the world using **TNTlite**. It is safe to quote that "**TNTlite** is now in use in almost all the world except some island nations and several central African countries."

Image Analysis in Geology.

The 3rd edition of Dr. Steve Drury's popular hardcover book entitled Image Interpretation in Geology being published by Blackwell Science has been delayed until January 2001. As a result the **TNTlite** version accompanying it will be **V6.40** if the exercises and

sample data can be revised accordingly. Look for the advertisement and preorder information attached.

The Chapters in this 3rd edition are:
Chapter 1: Electromagnetic Radiation and Materials
Chapter 2: Human Vision
Chapter 3: How Data are Collected
Chapter 4: Photogeology
Chapter 5: Digital Image Processing
Chapter 6: Thermal Images
Chapter 7: Radar Remote Sensing
Chapter 8: Non-image Data and Geographic Information Systems
Chapter 9: Geologic Applications of Image Data
Appendix A: Stereometry
Appendix B: Image Correction
Appendix C: Sources of Remotely Sensed Images

The **TNTlite**-sized geologically-oriented tutorial exercises he has prepared for replication onto the **TNTlite 6.4** CD included with this book are as follows:
Exercise 1: Displaying Image Data
Exercise 2: Working with Additive Primary Colours - Three Channel RGB Images
Exercise 3: Enhancement of RGB Images by Decorrelation
Exercise 4: Band Ratios
Exercise 5: Principal Component Analysis (PCA) Methods
Exercise 6: Spatial Frequency Filtering
Exercise 7: Georeferencing Images
Exercise 8: Digital Elevation Models
Exercise 9: Creating Reconnaissance Geological Maps from Landsat TM Data
Exercise 10: Multispectral Classification
Exercise 11: Hyperspectral Processes
Exercise 12: Surface Fitting of Geophysical Data

TNTatlas® 6.4

Inherited New Features.

The following general improvements in all the **TNT** product operations automatically were added to the free **TNTatlas 6.4**, which can be installed from the **V6.40** CDs without charge or placed free on a CD with your HyperIndex and distributed as a **TNTatlas**. These improvements are detailed below in the major section on New Features for **TNTmips** and include:

- visual selection of all objects in a Project File,
- use **SML** macro scripts,
- use custom tools using **SML** tool scripts,
- select element in 3D view by query, and
- faster zooming into vectors.

Special New Features.

Designing a HyperIndex.

The HyperIndex concept provided in the **TNT** products is still unique. It is the only approach that permits the preparation of a single geodata structure that can be used without alteration:

  • directly on a web site with a low cost **TNTserver**,
  • used on all popular platforms from a CD with a free viewer, and
  • created and used in all **TNT** geospatial analysis products on all platforms.

MicroImages has experience assembling atlas and web site materials. We have also discussed similar efforts with clients involved in these activities. It has become clear that those designing their first HyperIndex for use in **TNTatlas** usually have no previous experience in assembling a hierarchical geodata structure. True, we all use the library and the Internet, but few professionals have experience or training in the design of hierarchical data structures. Specialists experienced in the use of other GIS and image processing products also have little understanding or previous knowledge of how a hierarchical geodata structure could be used in your free, end-user oriented materials such as **TNTatlas**, **TNTclient**, or **TNTbrowser**.

A hierarchical structure in a database is usually relational, but many relational database structures are not hierarchical. Some professionals are trained to think hierarchically such as librarians and taxonomists (..., family, genus, species, variety). Some industry's data structures have been hierarchical from the onset, such as in the banking industry. However, it was only recently that the usefulness of creating and maintaining large geodata structures became apparent for public and private access. It was only in the past couple of years that mining industries, state agencies, land stewards, web oriented industries, and many others began to consider hierarchical storage of their geospatial materials and how it can be mined by staff and/or the public.

Since the concept of creating, maintaining, and making effective use of hierarchical geodata structures is so new, you can not expect to use the concept without help. When your inexperience is combined with the various flexible ways in which a HyperIndex can be assembled, often the first atlas ends up being a learning process where the procedures are first understood and reconciled. The next thing that happens is that you redesign and remake the atlas based upon the knowledge gained in the first effort.

Your assembly of your first HyperIndex and **TNTatlas** or **TNTserver** (both are a HyperIndex and the software) will produce the most satisfying results if a careful design is made in advance. Your "on-paper" design must be based upon a clearly defined goal conditioned by the geodata and related materials available and the many features provided for use in a HyperIndex. Nothing substitutes for experience, however, it is MicroImages' responsibility to make that experience more profitable and easier to acquire.

MicroImages continues to tune the process of assembling a HyperIndex and to add features to expand the tools and operations available. But as outlined above, the current problem is how to help you design a HyperIndex with your unique geodata to achieve an easy to use atlas with meaningful content. Some of this can be accomplished by even more software like the wizard procedure released in **V6.30** to check for structural flaws in your HyperIndex assemblage of files. You are now responding with requests for additional wizard checks and pointing out some of its shortcomings.

Efforts toward helping new users of HyperIndex in **V6.40** have concentrated upon providing written information. This is provided as 2 new Getting Started Booklets. The first booklet is entitled <u>A Case Study, MERLIN: Enterprise-wide Geospatial Analysis</u>, which outlines the larger context of using these well organized, hierarchical geodata through-

out a public enterprise. It illustrates how the **TNT** products can be used to satisfy all the differing requirements in such a setting. The second booklet is entitled Introduction to Designing Electronic Atlases and draws upon MicroImages' experience and that of other clients in using **TNTatlas** and **TNTserver**. It reviews key things that you should consider in the design of your HyperIndex and its associated **TNTatlas** and/or **TNTserver** project. Both of these booklets are in your **TNT** product folder for reading on-line in Adobe Acrobat Reader or printed in color.

Protecting Atlas Contents (after V6.40).

Experienced creators of **TNTatlas**es now use it to distribute proprietary or restricted-use geodata. Up to this point, the Project Files used in the HyperIndex provided for the **TNTatlas** could be read and, thus, exported by **TNTmips**. This can provide access to the proprietary geodata they contain for other uses, which is not desired. As a result, MicroImages is currently adding a new feature to provide Project File based restrictions to control the use of Project Files. Coding Project Files in this fashion will confine their use to a **TNTatlas**, which can be used with the unique **SML** tools it contains and, as normal, to view and use the hierarchical atlas that accompanies it on the CD. When the RVC files making up your HyperIndex are coded in this fashion, they can not be accessed by any other **TNT** product. They can not be read by **TNTmips** and exported for a use separate from the original features provided by the **TNTatlas**.

French Language TNTatlas.

Prepared By Intern!

The sample French atlas uses a very detailed digital geographic data base being assembled for all of France by *l'Institut Géographique National*. With their permission, this sample French atlas was created by Prisque Lemblé, a 2nd year GIS student at *l'Ecole Nationale des Sciences Géographiques* in France while visiting MicroImages as a 3 month summer intern. All the internal features in the atlas, in other words all the objects and Project Files in the HyperIndex, are in French such as the names, descriptions, and strings in the attribute tables.

Starting from no previous experience with the **TNT** products, Prisque completed the Getting Started tutorial booklets on his own (about 6 weeks). During and following this period, he imported the available sample geodata from several sources and their distribution formats. After becoming familiar with the **TNT** products, he designed and structured the HyperIndex with special attention to the new Getting Started booklets discussed in the section above. He also revised the atlas several times based upon his increasing experience and running it through the **TNTatlas** assembly wizard procedure.

To publish his atlas, Prisque combined his HyperIndex with the **TNTatlas** software for the Mac and Windows platforms (using the wizard procedure for Windows; setup for the Mac is still a bit more complicated). This assembly was then copied to a Mac/Windows hybrid CD master so that the resulting **TNTatlas** CD can be installed and used interchangeably on a Windows or Mac platform. Multiple copies were then prepared using MicroImages' CD duplicator with automatic feeding. The colorful label was designed, printed, and attached by MicroImages using special circular CD labels and the same printers used to produce the attached color plates.

This CD based French **TNTatlas** project is described in more detail on the attached color plate entitled TNTatlas: If It's France, Make It French. He also installed the same

HyperIndex on the MicroImages **TNTserver**, and you can view it at microimages.com. You can review this activity in more detail below in the **TNTserver** section, or on the attached color plate entitled <u>TNTclient: If It's France, Make It French</u>.

The standard **TNT** language resource files for both French and English were included with this **TNTatlas** software assemblage. A minor modification to the **TNTatlas** operation was required to insure that this French **TNTatlas** actually starts up using French for all its components: ToolTips, DataTips, messages, menus, ... its interface can be switched to English from the menu, but of course, the actual atlas contents imbedded in the Project Files are in French and no translations exist for them. Thus, this is a French atlas but its operation in the **TNTatlas** software can be in French (the default), English, or all other languages supported by the **TNT** products. You can include any, and all, language resource files on the CD and select them during the operation of the **TNTatlas**.

<u>Navigates With a Tool Script.</u>

The potential uses of macro and tool scripts in a CD-based **TNTatlas** are illustrated in the attached color plate entitled <u>Find Streets</u> and discussed in detail in the section below on the Spatial Manipulation Language (**SML**). You can now use these new features to add all manner of custom features, tools, and procedures to your **TNTatlas**, including those delivered free on CD. This sample tool script was thought up and implemented by Prisque Lemblé to navigate directly to streets. Just as he was in the last 2 weeks of his internship, he gained access to the newly added tool script procedure, helped debug the process, and added this script to his atlas.

This tool script can be used at all levels in the atlas to search by name for all the streets in the local area covered in detail in this atlas. The tool script requests the street name and searches the attributes of the specific layer in the atlas, locates them, zooms the view to the area of the street(s) in the layer, and shows and highlights them. If more than one street of the particular name is located, they are all highlighted. The atlas provides French DataTips at this level for streets. While still in this custom tool, the cursor can be moved to a highlighted street and its specific name can be read as its DataTip. If the correct highlighted street is selected in this fashion in the tool, the view will zoom in more tightly to that street at which point an image and other layers can be turned on. This is the very first tool script created for a **TNTatlas**, but it provides an example of the many powerful extensions that could be added to and distributed without cost with any **TNTatlas**.

Before arriving at MicroImages, Prisque was already familiar with the operation of other GIS and image processing products (from academic courses only). However, his experience illustrates that someone who approaches the **TNT** products with an open mind and devotes the time can become professional in their use, create an atlas, and add unique features to it in a reasonable period. Certainly you can think of many tools, software procedures, and connection to other software for use with an installed or CD-based **TNTatlas** that are unique to your profession. The geodata in a **TNTatlas** can be public (use of linked formats), restricted to use only in the atlas and other **TNT** products (used in RVC), or restricted only to use in that **TNTatlas** (see section above). Where else can you obtain these kinds of options to couple with the unique needs of the user of the geodata in a specific profession and distribute it all for free?

<u>Starts In the Preferred Language.</u>

The sample French CD atlas noted above is totally in the French language. The entire interface, attributes, DataTips, HelpTips, messages, everything is in French. It was therefore important that this CD, and any CD designed for direct use in any other language, use the French language resource files when started from the CD or after installation on a system set up in French. A procedure is now available to create an atlas that starts up and operates in another language. During the creation of the atlas you can specify the start up language if you include the **TNT** language resource files. The English language file will also always be present so the user who wishes can change the interface of the **TNTatlas** into English. However, the language used internally in the atlas components, in this example French, are only in one language, French. Thus your attributes such as street names, DataTips, object names and descriptions, and all other internal components must be created and used in the language used in the design of the HyperIndex.

Runs Directly From CD.

> You can now optionally set up a **TNTatlas** CD so that the software is started up directly from the CD using the atlas on the CD.

When the self contained CD version of **TNTatlas** was first introduced 6 years ago, you could not only install the **TNTatlas** software from the CD, but also run the software directly from the CD. This feature was removed after a few trials as the CD drives commonly available at that time were 40 to 50 times slower than those commonly used today. The result was that when software was used directly from the CD it loaded up slowly, not due to the **TNTatlas**, but due to the hardware. This reflected poorly on the **TNTatlas** performance so this "run direct" option was disabled. Now that CDs are fast, this feature has been restored and you can set up a **TNTatlas** to be run directly from a CD. The French **TNTatlas** described elsewhere in this MicroImages MEMO can be installed or will run from the CD. The option to run directly from a CD still installs a small collection of files such as the X server and the language resources files. These items will be automatically installed in a few seconds the first time you start the **TNTatlas** directly from the CD (in other words, when you double click the atlases icon). It would even be possible to reactivate the feature where the **TNTatlas** automatically starts up to its first level when the CD is inserted.

Installed Sizes.

Loading **TNTatlas** 6.4 processes onto your hard drive (exclusive of any other products, data sets, illustrations, documentation files, and so on) requires the following storage space in megabytes.

	for **V6.30**	for **V6.40**
PC using W95, W98, WME, NT, or W2000	24 MB	26 MB
PC using LINUX (with Intel) kernel 2.0.36	23 MB	24 MB
Mac using MacOS 8.x or 9.x	43 MB**	49 MB**
SGI workstation via IRIX	25 MB	27 MB
Sun workstation via Solaris 2.x	25 MB	26 MB
IBM workstation via AIX 4.x (with PPC)	28 MB	29 MB
COMPAQ/DEC workstation via Tru64 UNIX (with Alpha)	28 MB	30 MB

** The Mac installed size includes the JAPAN1.OF font of 10.4 MB that is automatically installed. Delete this font if you do not require the use of Japanese.

TNTserver 2.1

Free Trial!

Try **TNTserver** free for 3 to 6 months.

MicroImages will loan you a **TNTserve**r for trial without charge for a period of 3 months. This loan may be extended, if necessary, for 3 additional months based upon your progress. At the end of the loan period the **TNTserver** will time out and cease to operate unless purchased.

There are 4 steps involved in getting a **TNTserver** up and running on the Internet or your private intranet.
1) Collect and assemble your geodata into a HyperIndex to provide the basis for your on-line atlas.
2) Install the **TNTserver** on a Windows NT or W2000 platform.
3) If you do not have one already, set up a web server on the same or separate computer using NT or W2000.
4) Obtain access to a continuous web link and an IP address. **TNTserver** can be published initially over a reliable 56 Kb modem site that can be left on 24/7/365 (every hour/day/all year).

If you want to conduct your tests privately or before you get an Internet IP address, the machine with the **TNTserver** can simply be added to your internal network via Ethernet. It can then be used immediately by anyone with access to it using the **TNTclient** or **TNTbrowser**. Those already using the **TNTatlas** software on an intranet to remotely access and use atlases can also immediately access them with a browser over their network or via the Internet when the **TNTserver** is operational.

To qualify for this trial period you must own a current version of an M50 level **TNTmips** (needed to create a HyperIndex) and complete step 1 above to create some material as an atlas for use in the **TNTserver**. You can apply for your loaner by simply supplying a portion of this atlas (for example, fill up a CD) for our examination. The only use of this material, unless you authorize other uses, will be to make sure you have already committed time and resources to planning this project and will move on with the additional steps. Contact MicroImages if you wish to request a **TNTserver** loan and additional information will be supplied.

Totally French Atlas Published.

At microimages.com you can now review a sample atlas of a small area in France. Details about the preparation of this atlas and its contents can be found in the section above entitled French Language TNTatlas. Its content and distribution as a **TNTatlas** on CD are also summarized in the attached color plate entitled TNTatlas: If It's France, Make it French. The simultaneous publication of this HyperIndex as a sample atlas via the Internet is summarized in the attached companion color plate entitled TNTclient: If It's France, Make It French. As soon as this atlas was completed for publication via **TNTatlas** on the CD, it was immediately posted without alteration for access via the **TNTserver** at microimages.com.

All aspects of this atlas and its publication on CD (as a **TNTatlas**) and the Internet (via the **TNTserver**) are in French. This atlas clearly shows the use of a HyperIndex and

both of these products to provide materials to your nation in your language. They demonstrate the state of MicroImages' final efforts to stamp out all vestiges of English in your publication of geodata in your nation in your language.

Data Distribution Opportunities.

The joint simultaneous publication of the French atlas outlined above via CD and the Internet illustrates the important opportunities in the simultaneous publication of an atlas assembled in a HyperIndex. An atlas can be reviewed on the Internet and simultaneously distributed (for example sold) on a CD. No other geospatial product offers this opportunity! For example, consider a coproject between a private company and a government entity (in the United States, these are called CREDAs). The government entity underwrites, supplies the materials, and shares the cost with a private company for the preparation of existing government map and image materials. For this use of public funds, it obtains these materials for internal use in digital form and provides public access to them for viewing and simple geospatial uses via the network (for example, their advanced viewing as overlays, for measurements, printing small samples, ...). The private company shares the cost, provides the technology, and operates the web site. The private company also receives the right to distribute the geodata used in the atlas in a value added form by CD, or even via the Internet. Please note that at this time it is hard to control rights to geodata actually distributed via the network. However, publication for viewing and use via a **TNTserver** does not provide access to the original geodata except in very small pieces, and even this could be controlled.

The publicly viewed/used atlas provided via a **TNTserver** provides the basis for sales of all, or subsections of it, via **TNTatlas** on a CD. A **TNTatlas** can now provide value added applications via **SML** using tool and macro scripts. When eventually required, an encryption scheme can be added to protect the geodata and scripts on this atlas against any other use. A **TNTatlas** could be provided for use in more complex, flexible applications such as in **TNTview**, **TNTedit**, or **TNTmips** and where export to other formats could be disabled. Or, a **TNTatlas** is simply provided on the CD as a free viewer using a geographically organized structure. In this example, all the geodata could be linked into the HyperIndex in other commonly used formats such as GeoTIFF (images), Shapefiles (line work), DXF (CAD files), Access (tables)... This type of **TNTatlas** may be required by a public institution, which must place all or part of the geodata it maintains in the public domain for immediate use by anyone in a variety of other products.

Sample Web Atlases.

Two color plates introducing some of the other new on-line atlases are attached entitled New Sample Web Atlases and More Sample Web Atlases. These are examples of the efforts of others using both a CD and/or the **TNTserver** to publish their organized geographic materials. To review these samples and the other sites noted elsewhere in this MicroImages MEMO, simply access them on microimages.com. You will be linked out from microimages.com when appropriate to other remote client sites around the world using a **TNTserver**.

Germany: Lower Saxony.

This attractive atlas of geochemical data of northwest Germany was first distributed on a CD by a state geological organization (BGR) as a **TNTatlas**. The CD of this **TNTatlas** is in German but its **TNTclient** resource files are in English, so its on-line user interface is also in English. The remote client interface could also be in German if its resource

files were translated. Please see the **TNTatlas** subsection above entitled Starts In the Preferred Language for additional discussion on using a **TNTserver** in your language.

Cameroon: Forest Protection.

PSC, GmbH, a MicroImages dealer in Germany, under the sponsorship of the German Agency for Technical Cooperation (GTZ) completed a geospatial project related to the protection of the forests of Cameroon in central Africa. This **TNTatlas** was originally published on CD in French as a forest protection plan based upon the maps, images, and proposals it presents.

Australia: SRS Atlas.

SRS, a MicroImages dealer in Australia, prepared this atlas for distribution on CD as a sample of their activity and the capabilities of **TNTatlas**.

Monterey Bay, California.

Paris and Associates, a MicroImages dealer in California, created this atlas to illustrate some of the processed image results they have prepared for their local area.

Tornado Study.

Paris and Associates also prepared this atlas on CD to illustrate the probability of tornado damage to 2 sites being considered for a critical government installation.

California Quadrangle Maps.

WorldGIS, a MicroImages dealer in California, has published several sample atlases on their web site using **TNTserver**. This particular atlas provides access to every 1:24,000 United States Geological Survey topographic map in California. These maps were imported from color scans in the Digital Raster Graphics format.

New Features.

The best way to review the new features being added to the **TNTserver** is to periodically try them. They are introduced and tested first at http://www.microimages. com/testserver/. The following key features have just been added to create **TNTserver 2.1** and are subsequent to those reported in the **V6.30** MicroImages MEMO and the accompanying special MicroImages MEMO entitled Announcing TNTserver™ 2.0: How TNTserver Works with MERLIN and dated 1 May 2000.

Using Fuzzy Queries.

TNTserver will now respond to a **TNT** query. These queries are directed to a specific layer/attribute set in the HyperIndex. Accompanying the query can be the number of steps to navigate down in the stack to find the layer/attributes and the action to be taken, such as a zoom factor. For example, the user of the **TNTclient** fills in the blanks in the interface (name, address, zip, …). The query is sent with these values to **TNTserver** for evaluation. Accompanying the query is the preprogrammed request to navigate to the level of interest and the zoom level required. **TNTserver** moves into the atlas the 2 levels specified to locate the layer/attributes of interest. It then evaluates the query on these attributes to locate and select the element(s). The requested composite view is zoomed to include the extent of these elements and sent back to the client.

After **V6.40** was manufactured, the query procedure used in the **TNT** products was modified to return a fuzzy result of 0 to 1. Before this modification, your queries were al-

ready being evaluated to determine how well they matched in each test and yielding a fractional value between 0 and 1. But, only exact matches of 1 were allowed and all non-1 results were set to 0. Features using this fuzzy or probabilistic query result will gradually appear in future **TNT** products. They are already being tested in the **TNTserver**. Each test of the query in the server can be used or rejected in the **TNTserver** or in the **TNTclient** based on this probability of a match.

An example might serve to illustrate how this probability of match will work. Many web sites that allow you to search and view maps will evaluate a search for 901 Main and return multiple results in some fashion. Even the simplest of these results might include 901 Main, 901 N. Main, and 901 E. Main. At a good site you will be given a message to narrow your search or a choice of these results before the action of retrieving a map. Each site handles this ambiguity in a different manner. The most probable result is that the entry of 901 Main is not requesting the other 2 locations. A query to the **TNTserver** will find the most probable result for this address and the other 2 locations with lower probabilities. The appropriate action can then be taken. In this example, the client will get all three choices and the highest probability choice will be highlighted and its view shown. The other 2 choices can also be presented in the list to be selected and their views directly retrieved.

At present, queries can be imbedded in the **TNTclient/TNTbrowser** or in various paths in the HTML of the site for use with the new HTML client. Since queries are layer/attribute specific if required they could be kept on the **TNTserver** with the layout that contains the layer to be searched. This approach would remove from the client the necessity to send the query to the **TNTserver**. Many queries could, thus, be kept with any layout and called into use by a client.

HTML Printing.

Browsers are responsible for confining downloaded Java based clients to something called the "sandbox." The term comes from some early programmers ideas that using downloaded Java programs is like letting a child play in a sandbox in your yard but nowhere else. It is the area of your computer into which Java is confined in an effort to protect your computer from all the many bad things that might be done by automatically downloading a malicious Java program. Without special (unsafe) permissions or your trust of a "signed" Java client (in other words warranted Java client) you do not want to keep a Java client in this sandbox and do not want it to get out by reading or writing to the outside area. Printing is a means of getting out of the sandbox and does require releasing some safeguards or boundaries of this sandbox. This is probably an acceptable risk but some more cautious administrators will not allow it. However, even more restrictions are placed on how the printing can be accomplished. By now most have learned that there is a simple expedient to capture the screen containing a **TNTclient**. Simply copy it and paste it outside your browser into another application, such as Word, and print it there. This works but severely restricts the kind of print layouts that can be provided by a **TNTclient**. As a result, a new printing feature is supported by **TNTserver**. When you request a print, a trip to the server is made, and it returns a layout of the print page as an HTML description with the component image(s) embedded. This HTML can be interpreted by your browser and printed according to the layout designed by the site manager. An HTML frame is available whose contents can be altered by the site manager to determine what will appear on the end users printed page. The

initial layout options provide for a title, positioning and scale of the composite view, a logo, text description, and a scale bar.

Java Servlet for HTML.

A prototype of an HTML version of the **TNTclient** is now available to communicate with the **TNTserver**. It will be described below in the major section on **TNTclient/TNTbrowser**. A Java servlet has been added to **TNTserver** in order to translate HTML requests. When the HTML version of **TNTserver** is interpreted by your browser you can interact with it. The new Java servlet is cached at the server and is used to translate your inputs, sent via this **TNTclient**, into requests in the standard **TNT** protocols accepted by **TNTserver**. **TNTserver** sends the standard results back to the servlet, which translates these responses into the HTML and JPEG images interpreted by your browser to construct your results page. Browsers can accept JPEG, GIF, PNG, and other formats as inserts for use in this page. The servlet and **TNTserver** can be expanded to return these other kinds of components as needed. For example, JPEG is effective for images whereas PNG is commonly used for graphical components.

Remote Polygon Creation.

V2.1 introduced the first query capabilities into the **TNTserver**. **V2.2** will introduce the next important geospatial component. It permits a user of a custom **TNTclient** to draw regions on a local composite view (images, maps, overlays, ...) and send these polygons back to the **TNTserver** for addition to an object in the atlas. For this kind of application, an empty polygon object is added to the atlas at the desired level covering all the possible area of input. This kind of capability will permit remote creation of simple geographic allotments, such as remote recording of land easement, hunting area allotments, crop spraying areas, areas defined by field GPS, crop insurance recording, and many other applications. This approach is particularly important where several parties are in field offices and must insure that no area is allocated twice.

Any subsequent user who wants to add to a layer, or simply has permission to view it, must see all previously created polygons. Each subsequent user of this client who wishes to add additional polygons must do so with complete knowledge of what has been added by others. Please take note that this new layer is a polygon object and has no topology. As a result, new polygons can be drawn that overlap others already in the object. However, all the existing polygons will be visible to the current client.

This kind of client has to request that the **TNTserver** lock the local area of its view until the added polygon is complete and submitted, or this user is "timed out" for lack of action. In this fashion, an area is "checked out" by someone who is in the process of adding a polygon to it. Collisions of two or more users of this feature at the same time will result in temporary access refusals. These will be very minimal if only the geographic area of the current view of a client is locked. In other words, if a client is viewing an area to create polygons, other clients will be denied access to the limited area of views requesting that particular layer. This "geographical locking" prevents anyone else from adding polygons to the same local area without complete knowledge of all the existing, previously entered polygons.

Safari 2000.

During August and September MicroImages supported Dr. Robin Harris of Geodatec, a MicroImages Dealer in South Africa, in his use of a **TNTserver** as part of a large scale

climatological study called Safari 2000. The objective of Safari 2000 and its specific use of the **TNTserver** are summarized in an attached color plate entitled <u>TNTserver: Safari 2000</u>. Safari 2000 is the largest, single scientific endeavor ever conducted in Africa. This lab, field, aircraft, and satellite study initially involved 180 scientists from 13 nations, which are listed on the reverse of the color plate. The intensive field portion of Safari 2000 is complete and data analysis will continue for 3 to 5 years. NASA and several South African institutions coordinated the multi-nation effort (see reverse of plate). Extensive material on this project is available on many participant and news web sites and can be located by searching for "safari AND 2000" via any search engine. NASA's web sites have a large amount of background material. The National Geographic web site has a good summary. The Safari 2000 web site and the associated **TNTserver** can be reached at www.safari2000.org or from a link from NASA, the National Geographic Society, or microimages.com. During the period of the active field work, this site, the **TNTserver**, and those involved operated out of a hanger in northern South Africa, which served as a base for the aircraft, some satellite image downlinks, and the project's field coordination office.

The **TNTserver** was/is used as part of the Safari 2000 site to publish the geospatial data collected by the aircraft and satellite systems as it was acquired (within hours when possible). It provided a means of immediately sharing these images with all other experimenters as they planned their field trips and other missions. For example, the ER-2 (NASA's U-2 science platform) pilots and pilots of the other aircraft, the local program manager, and the experimenters (located around the world) all wanted to examine the quality and contents of the various kinds of satellite images to plan their lower altitude missions of that or the next day. This meant that Dr. Robin Harris, the site manager for the **TNTserver** portion of the site, had to spend a lot of long hours with **TNTmips** immediately importing and adding geodata, primarily images, from up to 20 different formats. After a month of setup and the first couple of weeks of the active program when some formats for purely experimental satellite images were perfected, Dr. Harris was able to use the **TNTserver** to provide access to viewing all these materials. A list of the many kinds of geodata ingested immediately by **TNTmips** for use in this **TNTserver** is on the back of the color plate. No other Internet server product could have met the requirements of this project at any price, and certainly not when supported by one person at a low total cost. The project required the efforts of a dedicated, experienced geospatial analyst. He in turn needed to be equipped with the technology needed for importing the many unusual formats, georeferencing, geographical/hierarchical assembly, and immediate publishing of diverse material in near real time from a remote experimental field site.

Control Panel.

It is no longer necessary to take an entire atlas (HyperIndex stack) off-line to alter it. The administrator, using the control panel, can now take a section of the atlas off-line using check boxes to lock or unlock each associated directory. Previous to this change, the listing in the control panel for the directory had to be removed and then added to the list for the lock to activate.

Caching.

TNTserver 2.0 provided automatic caching of commonly used layouts in the memory available to the **TNTserver**. Sometimes, depending upon user activity and available

memory, the starting layout would get purged from the cache. With **V2.1** you can insure this does not happen by locking any layout into the cache. This prevents a layout from being unloaded by **TNTserver 2.1**. It makes sure that the starting atlas pages (startup layout) remain loaded and quickly generated. You set this option in the appropriate layout in **TNTmips** under Layout / Options. When a layout is locked in this fashion, even when the **TNTserver** is restarted and the caches are rebuilt, this layout will again be locked into the cache once it is viewed. To change a locked layout to unlocked, you must use **TNTmips** to alter it.

Bigger Cheaper RAID Drives.

It continues to become cheaper to assemble and add storage to a network for direct use by a **TNTserver**. Maxtor drives of 60 GB can currently be assembled in a set of 8 into a RAID drive. Each drive for the last 2 of these RAID assemblies added to the MicroImages Internet server farm were $230 each or a total of $1840 for 8. A retired computer with an slower processor was used as the basis for each of these assemblies by adding to each 2 controllers, each managing 4 drives, and using Microsoft's RAID support built into Windows NT. These older tower machines have adequate power supplies to support the low power requirements of new drives. One drive of the 8 is lost to the RAID 5 protocol, so these units each yield 7 X 60 = 420 GB of storage and together provide nearly a terabyte of storage for a cost of $4000 ($.005 per megabyte, or about half a cent, in a RAID file server). Maxtor is replacing this 60 GB drive with a faster 80 GB drive that will initially retail for $300. The next 8 drive RAID will yield 7 X 80 = .56 TB for a drive cost of $300 X 8 or $2400, or less as the drives decrease in price. Microcomputer companies such as Gateway are currently testing 100 GB drives.

TNTclient™ and TNTbrowser™ 2.1

Why Provide non-Java Clients?

Unfortunately, competition among the 2 major players has handicapped the utopia promised by the developers and proponents of Java. Java1.1 is provided as part of your browser and is widely installed on most computers. However, Java1.1 is not a rich language in which to develop attractive, interactive interfaces. Sun, who developed and promotes Java, is battling the rest of the computer community over releasing Java to an international standards committee. Sun wants it to be a universally used product on every computer, but wants to retain control of it. Microsoft has added non-standard extensions to Java1.1 that, if used in your program, will result in their restriction to the Microsoft controlled platforms.

Java2 is a rich language, but is not commonly used on Microsoft controlled platforms. Microsoft refuses to support Java2 for competitive reasons and is releasing its own equivalent cross-platform .NET product. While Java2 is available for Windows browsers from Sun, the general public user of Internet browsers will not have Java2 installed. It is an 11 megabyte download, which they generally will not do just to visit a site. All this means that using Java1.1 restricts the capabilities of a **TNTclient** and **TNTbrowser** while using Java2 restricts its public use. **TNTclient**s and **TNTbrowser**s created in other languages will provide the basis for you to more easily develop your own **TNTclient**s using HTML and for **TNTbrowser**s with more advanced capabilities using Java2 or C++.

> Important Note: **TNTserver** protocol can be generated by any **TNTclient/TNTbrowser** you develop in Java2. Java2 would be appropriate for building a **TNTclient** or **TNTbrowser** used on an intranet where users can be instructed to install Java2 if it is not.

New HTML TNTclient.

The Java version of the **TNTclient** has evolved into a thick client by being extended to do more and more things, thus taking longer and longer to download. It is now being determined if it can be restructured into pieces that can be downloaded as needed (for example, only download the measurement panel when it is selected for use). This may speed up the use of the Java-based **TNTclient**. However, there is still the problem that few of you outside the United States have the experience to undertake the creation or extension of this Java-based **TNTclient** for your special purposes. On the other hand, anyone who maintains a web site, a requirement for the use of a **TNTserver**, is forced to become familiar with HTML to create and maintain that web site.

MicroImages has developed an alternate HTML-based **TNTclient** to help you redesign and extend it for your special needs. This client is now available in prototype form. You can pull it apart and organize its pieces and set it up as a series of thin clients obtained in HTML only when each feature is selected by the end user. It is likely that no 2 sites using this version of the **TNTclient** will look alike. Almost immediately you will adjust the appearance of this **TNTclient** and add and subtract features from it to suit your needs and to match the design of the rest of your web site. For example, it may be easier for your users to first select from a page presenting a suite of operations (for example, from a variety of queries) such as search by address, by city, by county, by zip code, ... Their selection on this 1st page would then present a 2nd page with the input cells for that specific query and the choices of what they wish to view such as a topographic map, a digital orthophoto map, or a SPOT image. When the **TNTserver** receives this input, it evaluates the query it contains and responds with the components of the 3rd page for the specified zoom, location, and layers. This 3rd page also introduces options to the user for using measurement tools, requesting new overlays, other zooms, printing, and so on. Using this prototype HTML code, you can customize and extend your HTML-based **TNTclient** as you wish using its sample requests to the protocol supported by the **TNTserver**.

New Windows TNTbrowser.

The HTML-based client described above is designed to provide you with a client you can more easily modify. Just as with other HTML approaches, it will not require long downloads. It can provide the fancier, yet simpler serial interface sequence familiar from other web sites. However, to provide more complex capabilities, a C++-based **TNTbrowser** is being developed for use on Windows platforms only with a native Windows interface. The **TNT** products are built from a rich C++ **TNTsdk** functions and class library representing 15 years of development, 100s of employee years, considerable cross platform experience, and use of a reliable and stable compiler. Requests are now being received to support remote geospatial data editing, buffer zone creation, route finding, and other more advanced features. This will require that the **TNTserver** be provided with more of the advanced functionality of the other **TNT** products. It also requires that the **TNTbrowser** provide advanced interaction with the end user. A native

Windows **TNTbrowser**, written in C++ and the **TNTsdk** can better support these kinds of complex interactions between the end user and the **TNTserver**.

Typically a C++ browser will be used to support special advanced geospatial operations. The 1st C++ browser is being written to support the user interaction and communications required to remotely add polygons to a layer in an atlas via the Internet. This particular operation requires careful coordination between this **TNTbrowser** and **TNTserver** as well as additional protocol in the **TNTserver**. These interactions and the objective of this approach are discussed above in the **TNTatlas** subsection entitled Remote Polygon Creation. Since this **TNTbrowser** is a program written in C++, it will be compiled and, like the Java-based **TNTbrowser**, this program will have to be downloaded from the remote site. However, since it is a file.exe it should be substantially smaller than the current, equivalent Java version of the **TNTbrowser**. This means it will download faster. Since this will be a native Windows program, its operation on a Windows platform will be familiar to its user. It will be able to use Windows features and interact with other Windows programs. It has not been decided as yet if the original C++ code created for this Windows **TNTbrowser** will be provided for your modification and extension.

New Features.

Queries.

The **TNTatlas** subsection above entitled Using Fuzzy Queries describes how the **TNTserver** has been modified to evaluate the same queries used in other **TNT** products. The first **TNTserver** to support these queries required that you know how to write them in the panel provided and direct them to the appropriate layer and attributes in a **TNTserver** based atlas. Several simple demonstrations of this approach were illustrated at microimages.com for your testing and modification. The addition of this panel to the **TNTclient** allowed the brute force entry of queries to evaluate this new feature in the **TNTserver**. This approach is most likely to be used by an experienced user of the **TNT** product exploring geodata available from a **TNTserver**. It may also be used to directly prepare and test a query that will be subsequently controlled by a user interface and used publicly.

Most end users do not want to concern themselves with the creation of a query. They simply want to provide the input to the query by "filling in the boxes." At the present time, an interface for a query or series of queries can be built into the panels used in the **TNTclient**. The **TNTclient** now used with the Nebraska Statewide atlas has a panel to permit the end user to select how they wish to search for their area of interest in this atlas. This panel permits the user to select from a variety of search methods and several kinds of views that can be retrieved by the query from the atlas. Eventually, a similar query panel will appear in the **TNTclient** used with the MERLIN atlas. It will allow Maryland property owners to enter a parcel's location and using the property centroid layer (a statewide vector point file), zoom directly to the property to obtain a view of it in the color-infrared DOQQs, a 1 meter natural color DOQQ where available, a 1:24,000 topographic map, or a SPOT image.

Selecting a Query.

The kind of search to be performed is selected from those provided at the top of the new query panel. This causes the remainder of this panel to reconfigure itself to pro-

vide the interfaces described below used to obtain your input for the selected type of search.

Selecting Layers.

This same panel provides a drop down box from which you can choose the kind of layer combinations you wish to view when your search is successful and the **TNTserver** returns a view. The choices in Nebraska currently are the 1 meter DOQQ, the 1:24,000 topographic map, or a 1999 Census Bureau Map. However, these choices can be modified in the **TNTclient** to use any kind of complex multi-layered view that could be constructed in the atlas.

Street Address.

The most popular search method that might be selected for use in this panel for the urban dwellers in Lincoln and Omaha would be street address. The boxes for input for this selection are street number and name, county, city, and zip code. Any combination of your inputs can be evaluated by the query sent to the **TNTserver** and, depending upon its success, your desired view returned. The fuzzy logic used to evaluate your inputs to this query are described above in the **TNTatlas** subsection entitled Using Fuzzy Queries. The search is performed on the fields specified in the query on the attributes of a hidden vector object containing the 1999 TIGER Census Bureau county-wide 1:100,000 maps. There are 93 of these detailed county maps just imported and added to the Nebraska Statewide atlas, which adds considerably to its size.

Township/Range/Section.

If you live in the vast rural areas of Nebraska you are involved with the land and know where the area of your interest is in the Unites States Public Land System and how it is designated by its township, range, and section coordinates. The Nebraska Statewide atlas has a hidden vector layer of all the 1 square mile section polygons making up this grid system to which their coordinates in this system are attached as attributes. If you enter your township and range into these boxes in the panel, the view you retrieve will be of the 6 by 6 mile sections making up that township. If you also add a section number from 1 to 36 in the 3rd box, you will retrieve a view of that specific section or square mile. This search is not fuzzy and will always return the requested 1- or 36-square mile view if it is in Nebraska. This kind of rural land retrieval of information has not been found in any other web atlas.

City Name.

If you dwell in a rural community or small city in Nebraska, you will choose the city method of searching. This requires only one entry to be made which is the city name in Nebraska. This search will use the 1999 Census data to locate the polygon representing that city and zoom the requested view to encompass it, regardless of its size.

Zip Code.

The 1999 TIGER Census map layer also contains polygons for every zip code boundary. If you decide to make a zip code search and enter any valid Nebraska zip code, your selected view will encompass the area of that zip code.

County Name.

For those who think bigger, choose any Nebraska county from the list provided and your view will zoom to encompass that county. While not apparent to the user of the Ne-

braska Statewide atlas, many of its components are organized into county units for convenient management. Lincoln is in Lancaster county.

Latitude/Longitude.

If you are truly geospatially aware, or happen to have a GPS unit in your hand, choose to enter your coordinates (or any other point). The kind of view you select to retrieve will be centered at that point.

ViewMarks.

An icon is provided by the Java version of the **TNTclient** and **TNTserver** to be used to mark any of your views in any atlas. These ViewMarks are somewhat similar to the use of bookmarks in your browser. They permit your direct return to any previous composite view you mark, just as it was when you marked it. ViewMarks can be saved in a new file on your drive by the **TNTbrowser**. When you start up the **TNTbrowser**, you can use the same icon to select this file and to add a new ViewMark or to select and use one. When an existing ViewMark is selected, it will automatically take you, via the Internet or intranet, to the appropriate atlas and retrieve the exact composite view you marked.

The **TNTclient** also provides ViewMarks in the same fashion as the **TNTbrowser**. However, the **TNTclient** operates only inside the Java sandbox in your browser. This means that the **TNTclient** can not save a file of these ViewMarks for future use. As a result your ViewMarks only last for the duration of that session with the **TNTclient**.

Access From a Mac.

The **TNTclient** is now automatically cached on the Mac by the latest October release of the MacOS Java engine called MRJ V2.2.3. If you upgrade Microsoft Explorer to this latest version of MRJ it will no longer download the **TNTclient** every time it is used. The previous absence of caching required frequent downloads of any Java client by a Mac making all such sites appear very cumbersome to use. This was a shortcoming of the MacOS and not of those sites. This latest version of MRJ also finally solves the problem of pop-up menus in the **TNTclient** (for example, those provided by the menus on the zoom icons). They will now stay open properly so that selections can be made from them. As a result, the current **TNTclient** and **TNTbrowser** now function the same on a Windows or a Mac platform if the latest MJR Java plugin is obtained from Apple's web site and used.

Translating the Interface.

The on-line version of the French atlas illustrates that the resource files of the **TNTclient** can be translated and automatically obtained by a browser. If you are operating your Windows or Mac in French, your browser will come up in French and when you access the **TNTserver** site, the French interface files will accompany it. As a result, the **TNTclient** will open up with all interface components in French, except the timing bar and messages generated directly by the **TNTserver**.

TNTview® 6.4

Inherited New Features.

The following general improvements in all the **TNT** product operations automatically were added to **TNTview 6.4**. These improvements are detailed below in the major section on New Features for **TNTmips** and include:

- visual selection of all objects in a Project File,
- geographical searches for objects,
- create/use **SML** macro scripts,
- create/use custom tools using **SML** tool scripts,
- import of several new formats such as NITF2.1,
- free training as part of the **TNTmips** introductory training,
- select element in 3D view by query, and
- faster zooming into vectors.

Upgrading.

If you did not order **V6.40** of **TNTview** and wish to do so now, please contact MicroImages by FAX, phone, or email to arrange to purchase this upgrade or annual maintenance. Entering an authorization code when running the installation process allows you to complete the installation and immediately start to use **TNTview 6.4**.

If you do not have annual maintenance for **TNTview**, you can upgrade to **V6.40** via the elective upgrade plan at the cost in the tables below. Please remember that new features have been added to **TNTview** with each new release. Thus, the older your current version of **TNTview** relative to **V6.40**, the higher your upgrade cost will be.

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 upgrade increment.

TNTview Product	Price to upgrade from **TNTview**:					**V5.80**
	V6.30	**V6.20**	**V6.10**	**V6.00**	**V5.90**	and earlier
Windows/Mac/LINUX	$175	275	400	500	555	+50/each
DEC/Alpha via NT	$250	350	500	600	700	+50/each
UNIX single user	$300	475	600	675	725	+50/each

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

TNTview Product	Price to upgrade from **TNTview**:					**V5.80**
	V6.30	**V6.20**	**V6.10**	**V6.00**	**V5.90**	and earlier
Windows/Mac/LINUX	$240	365	465	545	605	+50/each
DEC/Alpha via NT	$300	450	550	650	750	+50/each
UNIX single user	$350	550	700	800	850	+50/each

Installed Sizes.

Loading **TNTview 6.4** processes onto your hard drive (exclusive of any other products, data sets, illustrations, documentation files, and so on) requires the following storage space in megabytes.

	for **V6.30**	for **V6.40**
PC using W95, W98, WME, NT, or W2000	31 MB*	29 MB*
PC using LINUX (with Intel) kernel 2.0.36	25 MB	27 MB
Mac using MacOS 8.x or 9.x	46 MB**	51 MB**
SGI workstation via IRIX	29 MB	32 MB
Sun workstation via Solaris 2.x	27 MB	29 MB
IBM workstation via AIX 4.x (with PPC)	30 MB	34 MB
COMPAQ/DEC workstation via Tru64 UNIX (with Alpha)	32 MB	35 MB

* W95, W98, WME, NT, or W2000 installed size also includes the native **SML** 6.4 inter-preter for Windows.

** The Mac installed size includes the JAPAN1.OF font of 10.4 MB, which is automati-cally installed. Delete this font if you do not require the use of Japanese.

TNTedit™ 6.4

Undo.

TNTedit 6.4 contains a single, new, powerful feature added specifically to improve its use. You can now undo edits to raster, vector, CAD, and TIN objects up to 50 steps. You can switch among these layer types in a single view to edit any of them. The new undo icon will let you backup the steps you have taken if you switch to any previously edited layer as long as you stay in the Editor process. Undo is introduced in detail in the section below on **TNTmips**.

Inherited New Features.

The following general improvements in all the **TNT** product operations automatically were added to **TNTedit**. These improvements are detailed below in the major section on New Features for **TNTmips** and include:
- undo edits to raster, vector, CAD, and TIN objects,
- visual selection of all objects in a Project File,
- geographical searches for objects,
- create/use **SML** macro scripts,
- create/use custom tools using **SML** tool scripts,
- import and export of several new formats such as NITF2.1, and
- free training as part of the **TNTmips** introductory training.

Upgrading.

If you did not order **V6.40** of **TNTedit** and wish to do so now, please contact MicroI-mages by FAX, phone, or email to arrange to purchase this upgrade or annual mainte-nance. Entering an authorization code when running the installation process allows you to complete the installation and immediately start to use **TNTedit 6.4** and the other **TNT** professional products it provides to you.

If you do not have annual maintenance for **TNTedit**, you can upgrade to **V6.40** via the elective upgrade plan at the cost in the tables below. Please remember that new fea-tures have been added to **TNTedit** with each new release. Thus, the older your current version of **TNTedit** relative to **V6.40**, the higher your upgrade cost will be.

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 upgrade increment.)

TNTedit Product	Price to upgrade from TNTedit:				V5.80	
	V6.30	**V6.20**	**V6.10**	**V6.00**	**V5.90**	and earlier
Windows/Mac/LINUX	$350	550	700	800	875	+50/each
DEC/Alpha using NT	$500	750	950	1100	1200	+50/each
UNIX single user	$650	1000	1350	1600	1750	+50/each

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

TNTedit Product	Price to upgrade from TNTedit:	V5.80

	V6.30	V6.20	V6.10	V6.00	V5.90 and earlier
Windows/Mac/LINUX	$500	750	950	1100	1200 +50/each
DEC/Alpha using NT	$600	900	1150	1400	1500 +50/each
UNIX single user	$750	1200	1550	1850	2000 +50/each

Installed Sizes.

Loading **TNTedit 6.4** processes onto your hard drive (exclusive of any other products, data sets, illustrations, Word files, and so on) requires the following storage space in megabytes.   for **V6.30** for **V6.40**

	for V6.30	for V6.40
PC using W95, W98, WME, NT, or W2000	48 MB*	58 MB*
PC using LINUX (with Intel) kernel 2.0.36	45 MB	58 MB*
Mac using MacOS 8.x or 9.x	57 MB**	63 MB
SGI workstation via IRIX	54 MB	75 MB
Sun workstation via Solaris 2.x	48 MB	63 MB
IBM workstation via AIX 4.x (with PPC)	60 MB	80 MB
COMPAQDEC workstation via Tru64 UNIX (with Alpha)	65 MB	87 MB

* W95, W98, WME, NT, W2000 installation size also includes the native **SML 6.4** interpreter for Windows.

** The Mac installed size includes the JAPAN1.OF font of 10.4 MB, which is automatically installed. Delete this font if you do not require the use of Japanese.

Free Training

In addition to the last free, week of training for 2000, 13-17 November, MicroImages will offer 2 additional free week long training sessions in the first portion of 2001: 22-26 January and 19-23 March. Please note you should register early as current demand for places in these training sessions is rising, and there is an upper limit on the number of people in the facilities and the computer equipment available. A color flier is enclosed to describe this free training and includes a registration form. You can find the contents of this flier and the registration form at http://www.microimages.com/announce/freetrain.htm.

Note: MicroImages has scheduled no further free training sessions beyond those in November, January, and March. It is possible that training will no longer be free after the March session.

QuickGuides

Six new 1-page QuickGuides are enclosed with **V6.40** bringing to 16 the number provided in printed form with each new **TNTmips** product. If you have suggestions for QuickGuides that might help others with special features or help you remember some important feature, please let us know.

- Scale Controls on Layers
- Scale Controls on Elements
- Layout Templates
- Layout Transparency
- Floating 3D Layers
- AutoColor

All 16 Guides can be downloaded in Adobe Acrobat Reader PDF form from http://www.microimages.com/didyouknow/.

Getting Started Booklets

There are now 54 Getting Started Booklets. These tutorial and reference booklets provide over 1300 pages and over 3000 color illustrations.   They are up-to-date with the features in **V6.40** of the **TNT** products. Remember that each new **TNTmips** now comes with 2 thick notebooks containing color printed copies of every booklet. Those of you receiving your **V6.40** upgrade on CD can view and refer to any booklet using Adobe Acrobat Reader. If you install all these booklets as part of any **TNTmips** product, you can directly access these booklets via Help / Getting Started.

New Booklets Available.

Four new GSBs are being released for the first time with **TNT V6.40** and are introduced in the attached color plate entitled New Getting Started Tutorials. They are:
- Introduction to Remote Sensing of the Environment (RSE)
- Introduction to Designing Electronic Atlases
- Getting Started Operating with a GPS Unit
- A Case Study, MERLIN: Enterprise-wide Geospatial Analysis

The existing GSB entitled Modeling Watersheds and Land Surfaces required significant modification due to the many last minute improvements in **V6.40** of the Watershed Analysis process. This revised GSB was not available for release on the **V6.40** CD. If you are planning to use this process, please download the revised booklet, which has been posted with all the other booklets at microImage.com.

On-Line Reference Manual

V6.40 of the Reference Manual for the **TNT** products has single-spaced pages distributed as follows.
- Basic System Operations 185 pages
- Display 687 pages
- Edit 270 pages
- Process 1057 pages
- Support 94 pages
- Appendices 21 pages
- Glossary 87 pages

2401 total

The following supplemental documentation was prepared after the masters were duplicated for **V6.40** and is enclosed in printed form:
- Adding Legends   10 pages
- Geospatial Catalog Manager   4 pages
- Add Layer from GeoCatalog   6 pages
- Edit / Spatial Data (Prototype Undo)   2 pages

New TNT Features

Paragraphs or main sections preceded by the asterisk "" symbol introduce significant new processes or features in existing processes released for the first time in **TNTmips 6.4**.

System Level Changes.

* Visual Object Selection.

Do You Need It?

Under some circumstances you need to see the objects in a Project File before you determine their usefulness in a **TNT** process. This is often the case for a Project File that:
- is a year or 2 old,
- contains many objects with poor organization,

- lacks adequate object descriptions,
- started as a temporary object and was later simply renamed,
- has many objects imported from other formats, and so on.

General Operation.

A new Project File Overview window now automatically opens by default when the Select Object dialog is opened by any process that uses a View window. When you select a Project File, the thumbnail view of all the primary geo-objects of the appropriate type will be automatically displayed in this Project File Overview window (your groups and layouts will not show). The thumbnail views shown match 1 to 1 the list of objects in the Select Object dialog. For example, if the procedure requires a raster object, then only the raster objects will show in the list and as thumbnail views. If the procedure can use any type of geospatial object or you toggle selection into the show all mode, then the list and the thumbnail views will be shown for every geospatial object in the Project File. The procedure and its basic operations are illustrated in an attached color plate entitled Project File Overview.

Selecting Objects.

Each thumbnail view is labeled with the object name. When your mouse is placed over a thumbnail view, a HelpTip pops up containing the Project File name and location and the object name and description. Use all this information to locate each object of interest and select its thumbnail view with the mouse. An outline box around 1 or more thumbnail views shows they have been selected for use in the current procedure. The object(s) selected with the mouse via their thumbnail views will be automatically placed in the selection list in the Select Objects dialog. Thus, objects selected visually are treated just as if selected from the list of the Project File's contents. In other words, you can select from the list of contents of the Project File or visually from the thumbnails to build your list of selected objects and then view them as before using the "OK" button. The Project File Overview window will open by default when selecting an object. Thus, you can easily use either selection method to add objects to a complex view.

Controls.

The Project File Overview window can be resized just like any other window to show more thumbnail views. The size of a thumbnail view can be selected to control the trade off between the usefulness of the thumbnail views and the number of thumbnail views that this window shows. The choices of the sizes of the thumbnail views are 32 by 32 pixels, 64 by 64, 96 by 96 (the initial default), 128 by 128, and 192 by 192. If all the thumbnail views do not fit in the current window at the selected size, it can be scrolled to review them all.

Created as Needed.

The thumbnail raster of the size you have selected is created from the object the first time it is viewed in an Add From GeoCatalog (see below) or Project File Overview window. The tiny raster is resampled from the smallest pyramid layer for a raster object or plotted into this thumbnail raster for a vector, CAD, region, or TIN object. It is then automatically stored with the object for any future use. The thumbnail raster is time stamped, so that if the object it represents is altered, it is remade and replaced the next time it is needed. If the object is read-only, its thumbnail view can not be saved and will always be remade every time a thumbnail is needed for that object. Gradually, all your read/write objects are going to accumulate thumbnail views of your preferred viewing

size. This reduces the time needed to display thumbnail views in all the processes that use them.

Best Utilization.

The ability to browse the Project File contents is another example of something whose need is caused by technological advances (more geodata more rapidly accumulated) and whose solution is supported by related advances (more drive and screen space). For example, drive space advances of several years ago supported the use of large rasters and pyramiding took some unnoticed storage to speed up viewing of images. Now a tiny bit more of that drive space can be used to store small snapshots of each object. Certainly compression schemes can accomplish similar results for rasters, but the **TNT** products must support features applicable to large vector, CAD, and TIN objects as well.

Dual monitor systems have become economical and popular. The **TNT** products now support them as standard. Thus the **TNT** products can be used with inexpensive dual monitors on any platform. These provide the screen real-estate to open a large View window, a large Project File Overview (many thumbnails at once) window, and a Select Objects dialog. Directly viewing all three of these interfaces makes it easier to search your Project Files for objects and add them to full view for a final decision. Dual screens and this approach is even more powerful when you use GeoCatalog(s) to browse or mine large collections of unfamiliar objects scattered among many Project Files.

Banishing 8-bit Color.

Today display cards with memory for only 8-bit color are antiques. However, sometimes a **TNT** product will accidentally be installed on an old computer or your display parameters automatically reset by some other program to use 8-bit color. Processes in **TNT** were originally designed to operate in 8-bit while reserving some of the 256 colors for interface components. These reserved colors were not specific colors and were allocated as needed. Modern, inexpensive display cards have plenty of memory and operate in 16-bit and 24-bit color at high resolution. As a result, new and revised **TNT** processes are being written to take advantage of the fact that a wide spectrum of colors is available and that none needs to be reserved. If a **TNT** product detects it is operating in an 8-bit color mode, you will be reminded to switch to 16- or 24-bit color but can continue in 8-bit if you like. Modern operating systems, such as Windows, permit you to easily switch color depth without shutting down your computer.

* GeoCatalogs.

What Are They?

A GeoCatalog is a relational database indexing all your available geospatial data. It provides the basis for finding the geodata you need by geographically defined searches. Think of it in the current vernacular as a means of "mining geodata." GeoCatalogs are created using Support / GeoSpatial Catalog Manager. Each GeoCatalog inventories every major object encountered: all raster, vector, CAD, TIN, region, and hyperspectral objects. It inventories all georeferenced objects in every Project File within its search path (the designated directory and its subdirectories).   Referring to the attached color plates entitled: Introducing GeoCatalogs and Coverage and Containment will assist you in understanding the following text descriptions of the creation and use of GeoCatalogs.

Why Are They Needed?

Over a very short period of time you have experienced a rapid increase in the amount of geodata available for use in your **TNT** products. You have probably noticed that you recently began to create Project Files that have many objects and subobjects. This results from many convergent factors.

Local Resources. You now can quickly create more objects in your own work with the **TNT** products using your faster processor and much larger, cheaper hard drive(s) on your system or network. With larger capacity drives, it is no longer necessary to impose upon oneself a rigorous management of geodata.

Easy Local Acquisition. There are many more convenient low-cost sources of geodata. You can now easily scan and use airphotos or acquire images from inexpensive, higher resolution digital cameras and digital video.

Free Materials. More, free geodata is available such as second hand access to Landsat TM7 scenes, digital orthophoto quads (DOQs), digital topographic maps (DRGs), county-wide maps (TIGER), world elevations (GTOPO30), world maps (DCW), and others.

Commercial Changes. You can purchase new, high resolution images from commercial sources that are assembling large collections of images from which you can purchase. Older sets of images from commercial systems such as SPOT and previously classified sources are being released for use at low, or no cost. As a result, lots of free geodata or low cost subsets can now be easily obtained via the Internet.

Larger Goals. Couple the proliferation of geodata sources with your larger ambitions (for example the use of a **TNTatlas** or **TNTserver**), and the many intermediate objects created, and you are becoming lost in a sea of geodata.

Geodata Management Strategies.

TNT products were designed from the start,15 years ago in the DOS era, to keep all geospatially related project materials together in Project Files. MicroImages' products have always focused upon helping you manage your geodata in an organized fashion. That is why the Project File was invented many years ago along with the **TNTatlas**, to keep your materials together in an organized container with all the modifiers and changes associated with a current project. The **TNT** Project Files also provide long file names, long object descriptions, metadata, data type icons, pop-up HelpTips, and other similar features all designed to help you identify each object. However the problem now is to locate them among 1000s before any identification can be attempted.

Competitive, commercial products, which were not originally built on an effective geodata management concept, have gradually had to move toward the project file idea (for example, ERDAS and ArcView now use the concept of a project file). Several project-oriented public geodata structures have also been released such as SDTS, HDF, DIGEST, and OpenGIS to name a few. Unfortunately, public formats can become a nightmare as they are complicated and subject to change and misuse by anyone. Furthermore, there is often no one to turn to who will take responsibility for hacked up data published in these open systems. Just because everyone can obtain the documentation of the format does not mean they will correctly use it to create their materials.

As noted above, rapidly increasing drive space has resulted in a more cavalier attitude toward careful management of our geodata in the tightly controlled **TNT** Project File structure. The Project File provides an identification oriented container. But, it requires a rigorous approach to use these features to keep oneself from getting lost in a mire of

Project Files and objects. You now have, or will quickly accumulate, many Project Files and objects whose status, content, current and future utility, and/or purpose is unclear. Experienced users of a **TNT** product are dealing with many 1000s of objects in 100s, if not 1000s of Project Files. It is clear that this situation will only get worse for all if something is not done about it in the **TNT** products, as well as in other competing geospatial products.

Getting Organized.

The GeoCatalog process, released for the first time in **V6.40**, finds every Project File in the specified directory tree and builds a relational database out of their geographic and other standard descriptive characteristics. Every object in every Project File must contain a standard set of information describing it to permit its use in applicable **TNT** processes. This descriptive information is automatically created. You also routinely create needed descriptive information (for example, by georeferencing) to make effective use of all your geodata in the **TNT** products, especially for its use in advanced viewing procedures.   While the specific details vary between primary object types, it is standard for each object type (for example, for all rasters, all vectors, or ...). These parameters, or adjectives, are variously referred to as modifiers, or subobjects. Since all Project Files have a standard extension (.rvc) they can be located readily and automatically anywhere on any set or subset of drives accessible (local or networked) to a **TNT** product.

Is The Concept Extensible?

A GeoCatalog is a relational database and its contents can be expanded in the future to collect and store new kinds of metadata about all the objects it encounters. Since the structure is relational, adding new tables to it, as the need arises, can be transparent to any processes created earlier that did not need that information. Furthermore, Geo-Catalogs are transitory and will be remade frequently. Adding more fields and tables to its structure for new purposes is quickly reflected in all GeoCatalog files. As a result, any new parameters added rapidly become available in all GeoCatalogs for any new process that can use them.

The initial GeoCatalog files store descriptive data such as the current geo-location and identification of each object, its type and extents, and similar information. Many features describing the object are not brought into the GeoCatalog contrary to what you might expect. This kind of information can be searched in situ in the objects that are identified via the geographical descriptive material in the GeoCatalog. In this fashion, these modifiers, or subobjects, describing the object in more detail can be changed by procedures, such as editing, that act on the contents of the object. Thus, routine processing of an object will not require the GeoCatalog to be rebuilt and yet these changes can still be evaluated in its use.

Your Project Files can now become extensions of your GeoCatalogs, which provide a means of very quickly locating objects whose type, contents, and spatial extent are of possible use. When required, the object itself can deliver up more detailed information regarding its technical characteristics such its rows, columns, element count, a thumbnail view, a search or query on its attributes, and many others. Advanced future uses of this object mining concept is one of the reasons that **V6.50** will provide all **TNT** processes with even faster access to objects in Project Files, especially those that contain many objects. This improved access is being introduced with the new **V6.40** spatial object editor providing an undo feature.

Creating a GeoCatalog.

Use Support / Geospatial Catalog Manager to create each new GeoCatalog. You name each GeoCatalog so that you can make as many as you like. You can select a specific directory to be cataloged and all its subdirectories will automatically be cataloged as well. Each user can create their own **TNT** GeoCatalogs on a shared computer. Geo-Catalogs can also inventory the objects in shared Project Files created by multiple net-worked users.   Building a catalog is fast, so they can be rebuilt frequently. As the con-cept advances in future **TNT** releases, GeoCatalogs may even be rebuilt on startup, in the background, overnight, or when any Project File is changed.

How Are They Used?

The initial use of the GeoCataog is to automate your search for any geodata to which you have access and that is suitable for selection and use in your current **TNT** process. **V6.40** of the **TNT** products introduces the Project File Overview window (see section above) as a visual means to locate and identify the object(s) you need in a **TNT** proc-ess. Its use assumes you can remember which Project File contains the objects of in-terest. The use of GeoCatalogs with search controls automatically expands this visual selection approach to help you locate any available object from among 1000s.

Each GeoCatalog you build automatically and quickly inventories all the **TNT** objects of any type in all the Project Files in the directory you select. Hundreds of objects can be cataloged in just a few seconds and thousands in a minute.   Search logic can then be applied to any GeoCatalog to locate and show each object selected in the search as a thumbnail view in a new window called "Add Layer From Geospatial Catalog." This panel is similar in general appearance and function to the visual selection window de-scribed above for the new Project File Overview window. Any object shown as a thumbnail view in this panel can be selected with a mouse click and used in the opera-tion, such as adding a layer(s) to a view or choosing it for editing or analysis. The search logic, the thumbnail view, and its label and HelpTip will often be all you need to determine the identity and suitability of the object for the current operation from among 1000s of objects in many Project Files.

General Operations.

Searching By Geographic Extents. A new menu choice to search your GeoCatalogs is now an option for any process that has a View window. It is accessed by selecting "Add From GeoCatalog" from the Add Layer icon in the View window. It occurs in the same menu list as the options of "Quick Add," "Raster," "Surface," "Vector," ... Choosing "Add From GeoCatalog" opens a new "Add Layer From Geospatial Catalog" window with panels to select and define how you wish to use a GeoCatalog.

Catalogs Panel. Use this panel to navigate to and select the GeoCatalog(s) you wish to search.

Search Panel. This panel controls how the GeoCatalog will be searched. It is used to define the search criteria by which objects will be selected from the GeoCatalog(s).

Results Panel. A GeoCatalog search is initiated automatically when you switch to the Results panel. All objects located by your search will be displayed as thumbnail views in this panel that looks and functions similarly to the Project File Overview window. Pick and use any of the objects shown in this panel by clicking the mouse on them to select their thumbnail view(s). The Apply button will add them to the View window and the list

of selected layers, just as if they had been selected for the view by any other means. The thumbnail view panel and the View window both remain accessible at the same time so you can interactively select and view objects. If you click on the OK button, selected objects are added to the View window and the Add Layer from Geospatial Catalog window is closed.

Search by Object Type.

Each GeoCatalog has entries for every object in its search path. When you use the Add Layer From Geospatial Catalog window you can define which GeoCatalog you want to search and the search criteria for the object types you wish to view in thumbnail form. The simplest search control is to use the toggles across the top of the Search panel in this dialog to specify the type(s) of objects you wish to locate. Whatever other search criteria you establish, these toggles determine whether or not that kind of object will be included. For example, you may want to review all raster objects in a directory regardless of their geographic location. Select only the GeoCatalog for that directory in the Catalogs panel, in the Search Panel toggle on only the Raster option, toggle off the Search Extents option (no geographical search), and go to the Results panel to see/select all the raster object thumbnails located by that GeoCatalog search.

Simple Searches.

If you have the Search Extents toggle off and one or more object types selected in the Search panel, you are not performing a geographically controlled search. All the geographical control options in the Search panel will be grayed out. If you select the Results Panel, you will get a panel with the thumbnail views of all the objects of that type(s) in the selected catalogs regardless of their geo-location. Depending upon the complexity of the directories inventoried in the GeoCatalogs, this may produce a few meaningful thumbnails or 100s or 1000s.

Geographical Searches.

Toggle on the Search Extents in the Search panel to perform a geographically controlled search of the objects in a GeoCatalog. You can search by a geographic extents box (the "Specify by Range" option), by a single geographic point (the "Specify by Point" option), or a region bounding the area of your interest (the "Specify by Region" option). If your View window is not empty when you open the "Add Layer From Geospatial Catalog" window, the layers in the view will determine the defaults for the geographic area of your search. If you have not selected any object and your View window is empty, or if you wish to replace the default values, you can manually enter values to specify a geographic box or point, or you can select a region.

Note: To perform a search for objects related to your current view, it must contain at least one object.

Search Criteria.

Toggled Off. If the Search Extents option is toggled off in the Search panel, you are requesting a search that is unrelated to your current view. You can have a blank View window or a complex composite view and the search results will be the same. Your search will show the thumbnail view of all the various object types specified by their individual toggle buttons in the Search panel. This search will find a large or small number of objects depending on the scope of the GeoCatalog(s) you select and which ob-

ject types are sought as defined by your settings of object type toggles in the Search Panel

<u>Toggled On.</u> If the Search Extents toggle button is on in the Search panel, then at least one georeferenced object should be displayed in the View window for geographic coordinates to be automatically entered. In this mode, you are searching for other objects that have a geographic relationship to those you are currently viewing, so you can immediately visually identify, select, and add them to the layers in your current view. If you have a blank View window this kind of search is undefined unless you manually enter the coordinates for the extents defining the area of interest.

<u>Search by Range.</u>

If you have one or more objects in your View window when you open the "Add Layer From Geospatial Catalog" window, its Search panel will automatically default to a search for objects that could be logically added to that view. When you select the "Specify by Range" option the bounding geographic extent of all the objects in the active group in your current View window will be used by default. The current values of this geographic extent will show in the Search panel in the map projection and units you choose in the panel. These can be edited in the panel, but are usually used "as is" in this approach. You can also use sliders to set the minimum coverage of this geographic extent in percent and the minimum containment of this extent, both of which will be tested against the geo-area of each object in the GeoCatalog.

<u>Search by Point.</u>

If you select the "Specify by Point" option, the center of the view when you open the "Add Layer From Geospatial Catalog" window is used by default. The values of this geo-point will show in the Search panel in the map projection and units of your choice in the panel. These coordinates can be edited in the panel.

<u>Search by Region.</u>

If you select the "Specify by Region" option, you may then select a region object or a vector object to specify the area to search. This search uses the selected, irregularly bounded region or the outer boundary of the polygons in a vector object to define the geographic area of its search. It will only produce results for use with the objects in your current View window if the region or vector selected is somehow geographically related to the area of those objects. Often, when a vector object is selected to geographically bound a search, it will be one of those used as a layer in the current view. However, the search you are setting up can be much more geographically constrained. Simply make the View window active and create any region by any method and save it. Then make the search panel active and immediately select that region via the Search panel. For example, select 3 polygons in the view with the mouse, draw a polygon, do a query, ...; save these as a region; select it in the Search panel, and search all your geodata for any additional coverage of these specific areas.

This region boundary will be used for your search according to the minimum coverage percentage and containment percentage settings. A good example of how to use a region object is illustrated in the color plate entitled: <u>Introducing GeoCatalogs</u>. The Maryland counties outline has been selected to provide a region and used to search for other objects of Maryland with a 0% coverage requirement and 100% containment. Thumbnail views of objects contained entirely within the Maryland boundary were returned and

some of these objects, including a county outline map, were then selected and displayed.

Limiting a Search.

You could search your GeoCatalog for all the objects with geographic extents with some overlap of the designated geographic extents box. As a result, you might get 100s to 1000s of objects that satisfy this search ranging in size from small digital camera images and local maps to satellite images and regional and national maps. Because of the large number of objects found, this search is of limited value. The Minimum Coverage and Containment setting of the sliders in the Search Panel help you focus your search. Use them to narrow the scope of a search that returns too many objects. If you set the minimum coverage value high and the minimum containment high you will only retrieve objects that nearly match the designated extent box in size and overlap most of it. The color plate entitled Coverage and Containment illustrates the use and some of the limitations of these search constraints.

Minimum Coverage.

This value indicates in percent the area of the designated geo-extent box used in the search that must be contained in each of the objects selected from the GeoCatalog. This value is computed for each object by dividing the area of the object overlapping the designated geo-extent box by the area of the search's geo-extent box. Higher settings eliminate objects with only a minimum overlap with the desired area or objects entirely contained within the area that are small relative to the search extents. When the minimum coverage is set to 90% only objects whose coverage overlaps the area of the searched for geo-extent box by at least 90% will be retained.

Minimum Containment.

This value indicates in percent the area of the object in the GeoCatalog that must be contained within the geo-extent box. This value for each object tested is computed by dividing the area of geo-extent box covered by the object by the total area of the object. If the minimum containment value for the object tested is high, then most of the object contains geodata related to the searched for geo-extent box. When the minimum containment is set to 100%, only objects in the GeoCatalog the cover areas totally inside the extents box will be found.

Geospatial Display.

Faster Vectors.

It is illogical to view all of the vector elements in a large vector object at once, for example, all of the lines in a TIGER vector object of a populated county. All you will achieve is a color blob in the view with few of the features resolved. Often your use of a large vector object will be when zoomed into a large scale to achieve a detailed view of a local area. Under these conditions, which are the most common way of viewing large objects, the maximum benefits will be provided from the new optimized vector structure.

When a vector object is optimized the internal arrangement of the components making it up are reordered to support faster display of subportions of the object. Zooming in to large scale views (high zoom levels) of a vector object that has been optimized can be 2 to 5 times faster. Rendering the entire contents of a large vector object (for example, 50,000 or more lines) is typically 20% faster.

An existing vector object can be reordered into a new optimized vector object by using Process / Vector / Optimize. All the import processes that create a new vector object now automatically optimize it. Since optimized vector objects merely have a new order for their components, their subsequent use is transparent to all vector processes. However, other processes that create or modify a vector object, such as the Spatial Data Editor, do not yet create or maintain the optimized order in the vector objects they change or save. These vector processes are gradually being modified to take advantage of the faster reading when they process subsections of an optimized vector object and to maintain the optimized order if they alter the object.

Optimizing a vector object will not noticeably change its view performance if the object is small or if a large portion of a large object is displayed. However, you may notice that the size of some vector objects is reduced by this optimizing operation. This results because the object is cleaned up during optimization, such as by deleting unattached records. This is much the same effect that can be achieved by extracting a whole vector object to form a new vector object.

Add Macro Scripts.

The Spatial Manipulation Language (**SML**) can now be used to prepare macro scripts, which can be added as an icon to the View window toolbar in any process. When a macro script is selected, it can perform a wide variety of actions. These could include providing a new layer for the display, starting some other program, exporting data from a Project File, using any information about the layers in the current view, and so on. These actions can be chained together to automatically combine the contents of the current view and its objects with the capability of other non-**TNT** programs. **SML** functions are already available to access information about the current display, such as its geo-location, the paths to objects displayed, scale, extents of each object, lists of selected elements, and so on.

A powerful use of a macro script would be to use the geospatial capabilities of a **TNT** view to assemble and select elements of interest in an object (by mouse, query, ...). At any time, by selecting its icon, a macro script could be used to automatically export the currently selected elements and start a model or some other kind of non-**TNT** product to use them.

The details of the concept of macro scripts, how to set them up, and sample scripts are explained in detail below in the **SML** section.

Add Custom Tools.

The Spatial Manipulation Language (**SML**) can now be used to prepare your own unique custom tools that can be added as icons to the View window toolbar. The use of tool scripts, how to set them up, and sample tool scripts are discussed below in detail in the **SML** section. When you select the icon for new tools you create, they can act directly on the view just as the other **TNT** tools do. Just a few examples of what your custom tool could do are to:
- draw, measure, select, ... in the view in unique ways (see Area or Region Statistics example);
- perform actions on the objects used in the view or any object, such as searching for elements in an object viewed, and rezoom the view to contain them (see Find Streets example);

- run some other program, such as starting the **TNTbrowser**, as a separate process and window and then automatically zoom it to a view of the geo-position of each mouse click in the View window (see Run TNTbrowser example posted on microimages.com).

3D Views.

Vector objects can now be draped over other layers in a 3D view using solid or transparent polygon fills. The polygon filling option in the Vector Object Display Controls dialog applies to all open View windows containing the same vector. Thus, when you have both a 2D and 3D view of a vector object, the polygons will be filled the same. Filling with patterns will work in 3D but often does not provide the desired results as they are rendered in the plane of the surface and appear distorted.

A query can now be applied to select elements simultaneously in 2D and 3D views of the same vector object. For example, if you highlight elements in the 2D view, they will immediately be highlighted in the 3D view. The color plate entitled Polygon Fill and Query in 3D Visualization illustrates these new 3D vector display options.

The wireframe rendering in 3D views for large rasters is now up to 10 times faster for large elevation rasters.

View-in-View.

The use of this tool is now even more intuitive. Its most common application is to compare 2 layers. When the tool is selected, the top layer in the view window will, as usual, show outside the box. But now the second layer in the view will automatically show inside the box. If your view has many layers, the tool will automatically show the top (outside) and second down layer (inside) the box. As before, you can use the legend view check boxes or the layer visibility icons in the control window to select other layers to show in the inner and outer areas.

New Defaults.

New defaults have been provided to preserve your preferred actions from session to session. When you save group or layout views that are geolocked, they will be recorded as such. Groups and layouts will also save the LegendView on/off status of each view.

Import/Export.

Optimizing Vectors as Imported.

All vector objects of all topological types are now automatically optimized in order to support faster zoomed-in viewing. To read more about the purpose of this optimization see the section above entitled Faster Vectors.

Preview Objects for Export.

The Preview tab panel has been added to the Select Object window. This will enable you to visually confirm the contents of each object you are about to select for export.

Import Rasters.

Ikonos Images (Space Imaging).

Ikonos images can be imported from the 48-bit RGB TIFF and GeoTIFF formats as 3 of 16-bit rasters or 3 of 8-bit raster objects.

ArcGrid.
ESRI's various ArcGrid format types can be imported into rasters.

PNG.
The Portable Network Graphics raster format popular in Internet applications can be imported and exported.

RLE (Intergraph).
The Run Length Encoded (RLE) raster formats used by older Intergraph products can be imported.

GIF.
Rasters to be used as transparent overlays are used on the Internet. These transparent GIFs can now be imported.

LANDSAT-HDF (NASA).
Landsat images can be imported from the Hierarchical Data Format.

MODIS-HDF (NASA).
Multispectral images collected by NASA's Moderate Resolution Imaging Spectrometer (MODIS) sensor can be imported from the Hierarchical Data Format.

CADRG (NIMA).
The U.S. National Imaging and Mapping Agency publishes topographic, aeronautic and other maps in the Compressed ARC Digitized Raster Graphics (CADRG) format. CADRG is the standard version of the RPF used for maps, which can now be imported. Maps in the ARC Digitized Raster Graphics (ADRG) format can also be imported by previous versions of the **TNT** products.

CIB (NIMA).
The U.S. National Imaging and Mapping Agency publishes some images in the Controlled Image Base (CIB) format. Images in the Controlled Image Base format have had various kinds of processing applied subsequent to acquisition (for example, they have been georeferenced). CIB is the standard version of the RPF used for these images, which can now be imported.

RPF (NIMA).
The U.S. National Imaging and Mapping Agency has many standard data formats. The Raster Product Format is a generic raster format in which NIMA distributes and uses public and classified raster material such as maps and images. NIMA usually renames the rasters it provides in this format to identify the kind of materials being provided, for example CIB or CADRG. If any materials are encounted in the generic RPF format, they can be imported.

* NITF 2.1 (NIMA).
The U.S. National Imaging and Mapping Agency transfers images around in the National Imagery Transfer Format (NITF 2.1). NITF is not an RPF format but a much more complicated hierarchical data structure like the **TNT** Project File, HDF, and SDTS. Images and auxiliary data in the NITF 1.0, 1.1, 2.0, and 2.1 data structure can now be imported into a Project File and exported.

Export Rasters.

PNG.

The Portable Network Graphics raster format popular in Internet applications can be exported and imported.

NITF 2.1 (NIMA)

The U.S. National Imaging and Mapping Agency transfers images around in the National Imagery Transfer Format (NITF 2.1). NITF is a complicated hierarchical data structure like the **TNT** Project File, HDF, and SDTS. Images and auxiliary data in the NITF 1.0, 1.1, 2.0, and 2.1 data structure can now be exported and imported.

Import CAD.

TAB (MapInfo).

Import of the MapInfo internal TAB files has been improved and is faster. The accompanying tables as well as more of the modifying auxiliary data are now imported.

CGM.

Computer Graphics Metafiles (CGM) can now be imported into CAD objects.

Point Symbols.

CGM.

The U.S. and other military organizations use approximately 6000 map symbols to represent map items and their characteristics ranging from platoons to whole armies. The Computer Graphics Metafile (CGM) is the format in which these symbols are distributed, and they can now be imported into point symbols.

Database Import.

When importing database or vector data from text format, it is now possible to specify that a TAB character separates the database columns. To do this you enter "\t" (that's a backslash followed by a "t" without the quotes) for the delimiter character.

Modifications since V6.40 CDs.

Import TIGER.

Each year the U.S. Census Bureau revises and adds to the TIGER data of every one of the over 3000 counties. TIGER files for each county for each year representing all the detailed map content at a 1:100,000 scale can be downloaded from http://www.census. gov/geo/tiger99/. The revised formats for TIGER files for 1998, 1999, and 2000 can be imported.

Map Layout.

Combining a progressively wider variety of geodata into new and readable maps requires more advanced legends. Complete interactive design of pleasing to view yet complex legends has been out of reach for a single geospatial product. Often one software product is used to prepare the image components, another for the line work, and a third product to design the legends and do the other "finish work" (for example, Adobe's Illustrator or MacroMedia's Freehand).

Recent releases of the **TNT** products have provided for the preparation of better maps by incorporating cartoscripts, templates for maps in a series, advances in map layout procedures, and related improvements. In the interim, you have requested a variety of improvements in the tools to design legends. Some of your important suggestions are

implemented in **V6.40** and it is planned to concentrate improvements in map layouts in this area in the next few releases.

While not a recently developed map design, geologic maps represent complex properties in 2 and 3 dimensions in maps.   Until recently these maps were developed manually by the geologist and hand drafted by experienced cartographers.   Rendering all the elements in a geologic map has been one of the objectives of the **TNT** products.   Attached is a color plate illustrating a small section of a larger 1:24,000 geologic map entitled <u>BEDROCK GEOLOGIC MAP OF THE NORTHERN MIDWAY VALLEY AREA, NYE COUNTY, NEVADA</u>. The attached subsection was 100% designed and rendered by **TNTmips**. It contains no elements or features cosmetically inserted from some other product. It was prepared using vector objects, map layout, cartoscripts, and other **TNT** features but none of the components of this map were "drawn in."

This sample map covers about 1/3 of the area of the original geologic map prepared and printed by the U.S. Geological Survey. Its components (contours, geologic polygons, faults, etc.) were available as digital files in Digital Line Graph format. They were imported and used as the basis to prepare and render the attached sample map on a low-cost color printer. The resulting product is very similar to the corresponding subsection of the USGS printed map but at a scale of 1:48,000. It is attached to this MEMO to represent the current capabilities of the map layout process in **TNTmips** and the results of using some of the new **V6.40** interactive legend design features.

NOTE: All the features in map layout and used in the sample geologic map, including all the new legend features, can be used to prepare and print maps in your language.

* **Legend Design.**

Composite Legends.

You can now combine samples of elements from any or all of the layers used in a layout into one or more composite legends. You can then edit and lay out these legend samples to make a cosmetically pleasing legend. This new multi-object legend(s) is associated with multiple layers and thus is not stored with any one object in a Project File. It is stored as part of the layout as are other map specific components, such as a scale bars. When you access or reuse the layout, the associated legend(s) is also available for reuse and alteration.

A new "Legend Display Controls" dialog box with panels is provided in **V6.40**. It can be accessed from the Layout Controls window by Add Legend / Add Multi-Object Legend. The attached color plates entitled <u>Interactive Legend Design</u> and <u>More New Legend Features</u> illustrate the following new legend design features.

Selecting Layers.

The Layout panel in the Legend Display Controls dialog lets you add entries for the elements in any layer in the current layout. Simply use the Add Layer icon and select the element type for the layer of interest. The legend samples for the selected elements in the layer will be added to the current panel followed by their text descriptions, which can be any field from the layer's attribute tables including a computed field. You can accumulate legend samples in this dialog panel from as many layers as you like.

Reordering Samples.

You can reorder the position in the Layout panel of any legend sample and its associated text. Simply left-click the mouse on the legend sample/text and drag it up and/or down and drop it into the new position. The order of sample/text items will automatically adjust to accommodate the inserted sample/text and delete the space they previously occupied. You can select a range of legend samples to move by holding down the shift key while using the mouse to select the first and last sample/text item. You can assemble a discontinuous group of legend samples by using the control key while selecting each. When discontinuous sample/text items are selected and moved in this fashion, they will be grouped in the previous order at the new position.

Editing Sample Appearance.

The legend sample(s) appearance can be edited as a single unit or as a group. Use the right mouse button to get a pop-up menu and select Properties. A Properties window will open to provide controls to choose the sample(s) height, width, rounded or square corners, and the color of its border. Legend samples for line elements can be toggled to be represented in a straight or zigzag segment. Top and left offset settings allow you to control the vertical spacing and horizontal positioning of the samples.

Editing Sample Text.

If you select only a single legend sample/text, the Properties window will provide even more controls. For the single sample you are provided a scrolling window containing the current text label (if any), which can be edited, added, replaced, or a paragraph entered. Icon buttons are also provided so you can cut, copy, paste, and find pieces of text.

Multiple Columns.

Legends can be designed with multiple columns. This is a common means of organizing similar kinds of legend samples for similar types of graphical elements. One column might contain samples for polygons, a second for line elements, and so on. After you have added both of these groups of legend samples into the single column panel, choose Add Vertical Guide from the right mouse button menu to add a new vertical guide to the right of your samples for the new column. You can select a group of legend samples and drag them over the right vertical guide; these samples will automatically snap left to the closest guide. The process can be repeated to add additional columns and vertical groups using the Add Horizontal Guide.

Add Headings.

Headings and stand alone text can be inserted into your columns of legend samples. Use the Add Text icon in the Legend Display Controls dialog to open a Properties Window. Enter the text for your heading into this window. You can style this text and use cut, copy, paste, and find icons. You can choose from 2 available text styles, Normal and Heading. To modify either style, use the Edit Text Style icon in the Legend Display Controls window.

Add Framing.

Legends assembled in the Layout panel can be framed by selecting the Frame panel. It will construct a frame around the whole legend of the specified width and color and add a drop shadow to the frame of controlled width and angle if desired. You can offset the frame from all the legend samples. The background of the legend inside the frame can also be filled with a selected color.

Database Operations.

Standard Attributes for TIN.

A standard attributes table can now be created for TIN objects using Process / TIN / Standard Attributes...   The kinds of attributes computed and stored are slope, aspect, and flatness for triangles, slope and azimuth for edges, and so on. Multiple TIN objects can be selected in this procedure.

* TNTedit with UNDO (new prototype process).

Only a New Undo Icon?

Extensive reworking has provided a new prototype version of the **TNT** Spatial Data Editor with an undo feature for all edit operations it can perform on raster, vector, CAD, and TIN objects.   While this was a significant modification, its purpose is obvious and it requires only a few paragraphs to introduce. Only a single Undo icon has been added to the user interface, but this represents an important new feature requested by many clients. Color plates are attached to illustrate the various kinds of undo operations on various object types.

Seems Simple But!

Editing a topological vector object by simply adding a straight line can split many polygons creating new polygons, altering many attribute tables, and creating new topology. The attached color plate entitled UNDO Vector Edits illustrates and discusses such an action and its reversing via the Undo icon. Even what appears to be a simple edit operation can alter attributes in an attached relational database causing many changes to its tables, records, and linkages.   The **TNT** Spatial Data Editor supports many such complex operations that alter multiple objects. The new undo procedure reverses all such operations by simply restoring the entire object to its previous state. However, this is not done by simply duplicating the entire object between each edit operation.

How Does It Work?

Your edit operations were already being performed on a duplicate temporary object automatically created by the Editor. Your edit operations cause new disk blocks or segments to be added or changed in that temporary object. The new **V6.40** of the Editor marks each edit altered block or segment in this temporary object with a new indexing scheme. Now the altered blocks are marked as belonging to each of up to 50 previous states of each temporary object.   All of these kinds of blocks are ignored when the temporary object is used in a redisplay, edited again, or saved.

When the Undo icon is selected, the Editor marks the blocks from the most recent edit operation. It then restores the blocks from the previous-to-edit state by revising their marking. This restores the temporary object to the state and appearance it was in before the last edit operation. You can repeat this undo operation up to the maximum of 50 previous edit operations performed on that object in the current edit session. If you save the object during the editing session, its temporary object still exists. This temporary object remains just as it was when it was saved until you exit the Editor. Thus, as long as you are still in the same edit session, you can select that layer (object) again in the Editor for new editing or to undo any previous edit operation. The attached color plate entitled UNDO Multi-step Edits illustrates this procedure.

Toggle Between Objects.

Your edit operations are being performed on duplicate objects in temporary files automatically created by the Editor. Each time you choose to edit a different layer in your current composite view, its corresponding temporary object is created. As you proceed, you can toggle the Editor between editing a vector layer (object), then a raster layer (object), return to edit the original vector layer (object), and so on. You might also toggle between editing several concurrently displayed vector layers. The marking scheme for undo blocks accumulates up to 50 operations in each of these separate temporary objects. Thus, when you toggle back to any spatial object you have previously edited in the current session, it is in the state in which you last left it, and its previous edit operations can be undone. This is a powerful feature allowing you to move between layers and adjust features in them to match. The attached color plate entitled UNDO Edits in Multiple Layers illustrates this procedure.

When you elect in the same session to return to a previously edited layer to undo an operation, by error the edit icon will be dim and will not function. An easy work around is available. When you return to a layer to use undo if you first save the layer, the Undo icon will be activated and can be used and reused for that layer. Frequent saves are always prudent but, if this is a nuisance, it can be corrected (in other words, no save required to make the icon active) by downloading a revised version of the Editor from microimages.com. However, it is also prudent to do frequent saves in any complex editor.

What Took So Long?

Undo of edits has been requested by various clients. The rigorous maintenance of topology in the **TNT** products has been one of the impediments. Clearly it has not really been practical to introduce this feature until your processor and drive access performance would support it and adequate drive space was commonly available. Remember, **TNT** products are designed to handle massive geodata objects. A simple action on one of these objects can create many changes that must be retained temporarily if the operation is to be reversed and subsequently erased.

Limiting Drive Space.

As noted, the changes for up to 50 edit operations are recorded for each layer in the edit session and can be reversed using the Undo icon up to 50 times in sequence. When the 51st operation is performed, without an interim undo, the records for the 1st of the 51 operations are released and erased (a technology called circular buffering). As you can imagine, saving all the changes for 50 complex edit operations for each layer selected in a session could require significant disk space. By default, the number of undos for each layer is set to 10. If you have a larger hard drive, you can increase this number up to 50. The Setup / Preferences dialog in the Editor lets you set the number of Undo Levels to a lower or higher number up to 50.

Save Frequently and Still Undo.

Just as before, your edit operations and the data for undoing them are part of the temporary objects created in the current edit session. When you quit the Editor, all your current edit operations become permanent, the temporary files are erased, and the capability of undoing or reversing them is lost. However, remember, saving frequently while in the current edit session does not prevent you from selecting any layer and using the Undo feature on it.

Any Redo?

Commonly when using the undo operation you will undo back 1 too many steps and need a Redo icon. A request for this new feature has been logged to provide a forward restore operation. While it does not appear difficult to add, it is clear at this point that the contemplated Redo operation will support restoring only 1 deleted edit operation.

Edit in Place.

The Undo icon will not be available if you choose the edit-in-place option. This capability of the Spatial Data Editor should be used only when absolutely necessary. When it is used, no temporary object is created, direct changes are made to the selected object, and the undo scheme will not be available. The only reason you will want to use edit-in-place is when you have a small drive and want to do a very large edit operation, which is any in a large raster object.

Miscellaneous.

Custom brushes used to edit raster objects now show up in the correct size and color that they will draw in.

Creating Objects Faster.

The prototype version of the Spatial Data Editor uses new, low level libraries to create and manage the objects in Project Files. These libraries will be introduced into all processes in **V6.50** to support the use of multithreaded processes in all the **TNT** products, the implementation of a Project File server (in other words, simultaneous multiple users of a single object over a network), and other advanced features. For example, several different users or processes could use a single object if only the blocks in the object, not the entire object, were locked or marked and unlocked as required.

These new libraries provide the basis for the new undo feature. They have other immediate results in the edit process as well. They can create or locate a large number of objects or subobjects in a Project File much faster. This can be 1000s of times faster when 100s and 1000s of objects are involved. Another example of these improvements in the Editor is in the management of styles. Style objects are rapidly growing in number and size as legend, pinmapping, and cartographic capabilities improve. For example, the U.S. military symbol library, which can now be imported from the Computer Graphics Metafile (CGM) format, yields more than 6000 style objects. Each style object describes a shape and its characteristics. The creation and location of these kinds of styles and patterns in style objects is much faster, in some cases a 1000 times as fast.

* Modeling Watershed Physiography.

Faster and Better.

Elevation models are appearing with finer and finer resolution. As their resolution improves they describe the true surface and drainage more accurately while the raster correspondingly increases in size. Computing drainage, watershed boundaries, and related physiographic properties is a time consuming process. Recently the watershed process in **TNTmips** was applied to projects that were simply too large for it and would take too much time to complete to be practical. **V6.40** releases a completely revised watershed process whose aim is to provide more information more accurately from larger elevation rasters. To accomplish this, the process has been improved to provide 10

to 20 times faster processing on large rasters. This is accomplished in part by using a much more efficient depression-filling algorithm.

Technical improvements have also been added as part of the rewriting of this process to provide more accurate results. These include using a new method for resolving flow directions over flat areas that uses the DEM elevations to impose a slope away from higher elevations and toward lower elevations. This method is described by Garbrecht and Martz, 1997, <u>Journal of Hydrology</u>, v. 193, pp. 204-213. In the sequential depression-filling mode, the ability has been added to select specific watersheds and fill depressions in the downstream and/or upstream direction.

In addition to the above objectives, all the functional steps used to model a watershed and compute its properties in this process are now also included in the **SML** function libraries. These functions are also arranged into a DLL that can be used with the **TNTsdk**.

<u>Graphical User Interface.</u>

The user interface has been redesigned to use logically organized tabbed panels. This has simplified the interface and reduced its size for easier use.

<u>Adding A Mask.</u>

The process will now allow you to define an area of interest that is bounded by a coastline or contains lakes or other bounding physiographic features. To do this you can select a mask raster to overlay the DEM and exclude any area from analysis. An existing mask raster can be loaded. Region objects can be created within the watershed process using standard region-generation tools and used to create the mask. The attached color plate entitled <u>Watershed Modeling</u> illustrates the excellent results obtained for a coastal area.

<u>Saving More Geospatial Properties.</u>

The flow paths (stream lines), basins (polygons), and watersheds (polygons) are now saved with 3D coordinates in vector objects for use in other processes such as in 3D displays. Standard attributes are also created and attached to these new vector types. Attached to the stream lines as attributes are the length and other related linear properties. A table is also saved that contains the stream order of the segments of the drainage as defined by 4 different schemes: by Horton, by Strahler, by Shreve, and by Scheidegger. Attached to the watershed polygons are area, perimeter, centroids, and so on.

<u>Spatial Manipulation Language (SML).</u>

V6.40 adds powerful new ways to use Spatial Manipulation Language (**SML**) in your **TNT** products. Now you can use **SML** to implement new interactive tools using the new tool scripting approach or with macro scripts to add custom features accessed from any View window. Referencing the attached color plates entitled <u>Macro Script Setup</u> and <u>Tool Script Templates</u>, will help you understand the following text descriptions of these new applications of **SML** scripts. There are also several example scripts discussed, illustrated in additional color plates, and included on the **V6.40** CD. Even more, new sample scripts are being provided in the **SML** script exchange available at microimages.com.

<u>* Macro Scripts.</u>

Macro scripts are executed from icons you add to the menu bar of the View window. Macro scripts can be run from these icons in Display, Edit, and any other **TNT** process that provides a view. Using **SML** functions, a macro script can access the features of the current view in the process such as the layers used, zoom factor, scale, styles, extents, projections, regions, geo-location, selected elements, and so on. A macro script could access and operate on some of these features such as selected elements, regions, or objects in the current view or any objects containing the same area. It can then redisplay the view using the modified layer it creates or start some other external process and provide it with data related to the current view.

A typical use of a macro script might be to select polygons in a composite view one-by-one, using a query, by drawing a polygon, or simply select them all. When this macro script is started from an icon on the menu bar, these selected vector elements are automatically saved to a temporary vector object and exported to a Shapefile. The macro script continues on to start ArcView and display the **TNT** selected polygons with other available Shapefiles.

Another sample use of a macro script would be to start a web browser and automatically use it to send a URL containing the center geo-coordinate of your view. Assuming the remote site (for example, a **TNTserver**) is programmed to respond to this URL, it can send back to the browser some kind of view of the center of the view in your **TNT** product.

The **TNT** products are very good at creating, storing, selecting, and compositing your massive collections of geodata. Now macro scripts can be used to interactively export selected geodata and start an external, 3rd party product to use it. Using macro scripts, you can mate these powerful **TNT** capabilities to other related geo-products, especially those that ingest geodata for use in the specialized models popular in your profession or that you create in Visual Basic, Java, C, Avenue ...

Sample Macro Script.

> Note: The color plates illustrating sample **SML** scripts have portions of that script on the reverse with annotated comments. Each script file also contains extensive comments (omitted from printed versions) to assist you in understanding and modifying them.

Zoom to Scale.
An elegant, 16-line **SML** macro script [*zoomto.sml*] illustrates how easily **SML** can create a script to add useful new features for visualization. This script and its use are illustrated in an attached color plate entitled Zoom to Specified Map Scale. When this script is added to your menu bar in the display process, its icon will pop-up a menu from which you select various custom zooms for the center of your current view. This menu can provide your selections for zooming to map scales (for example, 1:2400, 1:10:000, 1:250:000, ...) as well as zooming the total size of the view to any ground dimension (for example, 1 mile, 1 kilometer, 10 kilometers, 1 meter, ...). You customize this menu to suit your specialized needs by adding or deleting view scales and sizes without altering this 16-line **SML** script! Your ground dimension choices will use the current view's width or height, whichever is minimum, and add 10%. Changing the script to automatically interpret your ground dimensions in metric units instead of English units requires the simple substitution of the word "kilometers" for "miles" in the script.

You must calibrate your CRT or flat panel to provide accurately scaled views via the Zoom to Scale script. This might occur when you wish to compare a paper map to an accurately scaled view. For most applications, where you are simply trying to view at an approximate scale or ground area, the **TNT** default calibration for a 17 inch monitor at 1024 by 768 pixels may be suitable. For more precise work you can calibrate your screen size and pixel choice using a preference setting at Support/Setup/Preferences.

As noted, you can easily and immediately change the choices presented on this script's pop-up zoom menu. Simply open the Macro Script Properties window from Options / Customize / Macro Scripts, which you will need to use to add any macro script to your display menu bar. Navigate to, and select this **SML** script (for example, c:\DATA\ zoomto.sml) to add an icon for access. This window will show you the current scales and dimensions in the scrollable list of Menu Choices. If you select any existing Menu Choice, the selected menu entry can be deleted or edited. You can add any number to your Menu Choices by creating a new line in this panel with the <enter> key and typing in the number you want. If the number is not followed by any trailing alpha characters, it will be interpreted by this macro script as a scale choice. If you enter a number followed by any alpha character(s), it will be added to the Menu Choices as a ground dimension and the numeric portion will be interpreted as miles. When you close the Customize Macro Scripts window the icon for this macro script will automatically appear. When you select this icon, the pop-in menu provides the choices, which the script will automatically recognize and use.

If you wish to have your numeric entries for ground dimensions interpreted as any other linear unit supported by the **TNT** products (for example, as kilometers), simply change "miles" to "kilometers" in the position noted in this script on the color plate. For example, you can change "miles" in the macro script to "kt" for nautical miles, feet, yards, meters, or any other linear unit supported by the **TNT** products (see View window for Options / Position Report / Units menu for choices). This script will directly interpret any number followed by any alpha characters as the number in the numeric system (nautical miles, feet, ...) specified in the script. You can make the trailing alpha characters anything you choose in order to identify the ground dimension units that you see in your pop-up menu. However, it is important to note that the alpha characters, which you enter after the ground dimension number, act only to identify it as a linear measurement to this script and do not change its units. Thus, if you do not edit this script and you merely edit the menu choice to show "1 km" instead of "1 mi" the 1 will still be interpreted as 1 mile.

Macro Script Properties Window.

Adding a Script.
The attached color plate entitled: Macro Script Setup illustrates how you setup and add a macro script(s) to all your view windows. The Macro Script Properties window (Options / Customize / Macro Scripts) is used to add any script on your local drive or some other drive on your network. A library of macro and tool scripts could be maintained on a network machine, installed by you as icons on your view menu, and then used from the remote drive. Using remote scripts could get convoluted as the remote scripts could be altered by other programs to change their operations on an hour-to-hour basis by using database files or images that are frequently changed in name, location, content, and so on. For example, you have a remotely accessed macro script that pinmaps vehicle locations stored elsewhere in someone else's database structure. The administrator of

the remote data could alter your password at any time to control your access to this script or alter the name of the database the script would use.

Icon or Pop-up Menu.

When you have located the script, you can select an icon to represent it on your view. If you click on the current icon in the Macro Script Properties window, it will open the Icon Selection window showing all the small icons used in the **TNT** products. Pick any icon in this window and it will be substituted for the icon in the Macro Script Properties window and used to start this script on the view toolbar.

Menu Choices.

You use the Type toggle option ("Simple Button" or "Menu Choice") to designate whether the macro script is going to automatically run when its icon is selected from the view menu bar or will pop-up your menu choices. If you select to use menu choices, then your script will have to be designed to start by interpreting what action or path each of your menu choices will take in the script. The Menu Choices in your script are interpreted in any way you wish. In other words, your script can be designed to do whatever you tell it to do when the menu choice is selected in the pop-up window and starts the script at that entry point. For example, the tiny Zoom to Scale script examines the menu choice to determine how to use it (zoom to scale or dimension) and then appropriately uses the numeric value it provides.

Your script can use a menu choice as a fork in its preprogrammed actions, a name, a location, a value to be interpreted, and so on. For example, your menu choices might be the common names of other computers on your network where your script is to send data and then execute some process on that computer using programs that are not part of the **TNT** products. In other words, each menu selected branch in the macro script could export selected elements from the view, a layer, or some other object to a specific remote machine and then start some other program on that machine using that file. For example, you select some elements in the current view with a region, then select a macro script to extract these elements to a temporary vector object. When complete, the next step in the script automatically exports them to a Shapefile and erases the temporary object. Then the script starts ArcView using an ArcView Project File (*.apr) that uses this Shapefile and adds other Shapefiles and images designated by your menu choice. Most of the actions of this script would be common for all menu choices and the specific choice only designates how the external program is supposed to start up with the exported geodata. Sample scripts to illustrate these kinds of actions are currently being developed (see section below entitled New/Revised Scripts since **V6.40** CDs).

Other Features.

The Edit button allows you to edit your macro script. The Test button will run the script with the currently selected menu choice or automatically if the Type button toggle is set to "Simple Button."

* Tool Scripts.

The **TNT** tool box provides a selection of generic interactive tools. However, each individual project, client, and discipline often requires special and/or unique geospatial analysis tools. These specialized tools may be similar to those provided in the **TNT** products but specialized to provide extended information. Or, the tools you create could

be quite different from those already available. You can now create your own suite of tools with **SML** scripts, associate an icon with them, and add them to the toolbar. When the icon is selected, the sequence of tool actions outlined in the **SML** script are immediately performed. A templating approach and sample **SML** tools are provided to help you create new **SML** tool scripts.

Sample Tool Scripts.

> Note: The color plates illustrating sample **SML** scripts have portions of that script on the reverse with annotated comments. Each script file also contains extensive comments (omitted from many printed versions) to assist you in understanding and modifying them.

Area Statistics *(included on CD).*

There are already several ways in the **TNT** products in which you can draw a polygon on a view and compute the statistics for the portion of the raster it encloses. However, an Area Statistics tool script is provided as an example of how a tool script can be used for this common procedure. This script supports the interactive drawing of a polygon in the view and then performs operations on the raster cells it bounds after you right-click. This script illustrates how you can construct a script that starts by drawing a polygon. It then computes a suite of statistics for the cells inside the polygon in the active raster layer. After the tool script detects that the interactive polygon is available it automatically continues on to compute and present a window containing the statistical properties for all cells inside the polygon in the coregistered DEM layer if it is the active layer in that group. The attached color plate entitled Area Statistics illustrates the script being used to draw a polygon around a fire scar on an image but computing statistics from the coregistered DEM. You can modify this script to do other things with the interior of the polygon. The simplest change you might make is to find the lines in the script that compute and display the properties. You can then add similar equations for new properties. A more complex modification would be to change this script to use 2 objects and combine each bounded cell to compute a vegetation index. The statistical properties could then be computed, shown, and saved for the vegetation index or any other combination of the cells.

Region Statistics *(can be downloaded).*

The Region Statistics tool script yields exactly the same window and statistical results for the raster to which it is applied as does the Area Statistics tool script. However, with it you define the region by using the mouse to select one or more polygons in an overlaying vector layer. The attached color plate entitled Region Statistics illustrates the use of this script and the polygon selection portion of its **SML** code.

The Area Statistic tool script demonstrates an **SML** script that uses the polygon drawing tool to create a temporary region. Tool scripts starting with this procedure are used to digitize an area that does not exist in any layer in the composite view. You could use this script to create regions on a simple view of an image or a composite view of many layers. The remainder of this script can be modified so that the polygon you draw is used in a combination of a wide variety of additional operations: saved, converted to another format, exported, used to extract elements, ...

Selecting existing polygons is a common means by which a region can be created for use in a tool script. You already use this kind of procedure when these digital areas already exist in a vector object: soil type, land use, timber types, or some complex com-

bination of polygons formed from multiple vector objects. Often this vector layer is registered and overlaid in a composite view of layers such as a recent image and other vector and CAD reference layers. The resulting view provides the basis for your visual selection of polygons for some subsequent action. The Region Statistics tool script demonstrates the initial steps required in an **SML** script to select one or more polygons with the mouse and save them as regions. These temporary regions can then be used in a modified script for many other operations.

ViewMarks *(included on CD).*
This tool script lets you mark and name any number of views as you move around viewing large geodata sets while zoomed in. It functions somewhat like the bookmarks you can save in your browser. However, it simply permits marking the current view for revisiting and reuse by recording its position and scale. It then stores this as a named view. Every time you run this tool script you can also pick from the list of named views you have saved. Your current view will then pan to the geo-point and scale of the bookmark, unless it is not covered by the visible layers used in the current view. Please note that a ViewMark does not store the layers or their location for the current view. As a result, a ViewMark will not recreate a previous view unless you are still displaying the same composite view. To provide this broader capability, the script would have to create and work with layouts and deal with missing, moved, or altered objects.

Flow Path *(included on the CD).*
Flow Path illustrates the kind of new, complex, useful interactive tool that can be immediately added to any **TNT** product (except **TNTserver**) by writing a tool script. This tool was also created to highlight that 50 new watershed functions that have been added to **SML**. The color plate entitled Flow Path illustrates the operation of this tool script and highlights some of its script's components. This script uses a DEM layer to immediately compute and display any, or all, of the following for any point selected in the view and for the coregistered DEM: 1) the drainage line from the selected point to the edge of the DEM (in blue); 2) a buffer zone on either side of this drainage line for a width you select (in yellow); and 3) the polygon boundary of the watershed that drains into the selected point and thus into the drainage line.

Please see the section below entitled New/Revised Scripts since **V6.40** CDs for recent modifications to this script.

Run Browser *(can be downloaded).*
This is an example of a more complex, specialized tool script illustrating a variety of **SML** procedures that you may wish to use in one of your tool scripts. With it you can select an element in a vector object or cells in a raster object. Each cell value or an attribute of the element can then be associated with a URL that is saved. Subsequently, when a matching element is selected anywhere in the layer, your browser is opened as a separate window. The browser then automatically uses that specific URL to retrieve the page it specifies from the designated Internet web site. The use of this tool script is illustrated on the attached color plate entitled Run Browser. This tool could be used to retrieve information about what you are viewing from any Internet web site that provides detailed entry points about materials, services, locations, ...

A simple example of the use of this type of tool script in the United States, with modifications, is to use a vector object of zip codes to retrieve any local weather image. The weather.com web site accepts a URL with a zip code to show you your local or regional

radar weather image updated every 15 minutes. To access this site from any **TNT** product you would prepare a layout consisting of an image or some other representation of the United States and a hidden vector layer of all the zip codes. Using a tool script similar to this example, you could click anywhere on the view of this layout and your browser would open and show the local or regional radar image of that specific area.

A new Browse Views tool script, introduced below, has just been prepared to provide you with a simpler example that illustrates the use of **SML** to start another program with data from your view.

Find Streets *(can be downloaded).*
This tool script uses a query to locate specific streets in the attributes of a vector object containing a detailed French map layer. When a unique street is located, it automatically zooms this map layer to a 1:30,000 scale if the street will fit in this view, or if the street is longer, it zooms to the smaller scale required. More details on how this script operates can be found in the attached color plate entitled Find Streets.

This tool script illustrates the uses of a query in its **SML**. It can not be used unless you have the specific vector layers it requires. Should you wish to try this tool script, ask MicroImages for the sample CD atlas that contains it. However, you can modify and use the query concepts and **SML** that this tool script illustrates on your own vector layer. Typical sources of vector objects with similar attributes are the United States Geological Survey's digital line graph (DLG) maps of varying scales and the Census Bureau's 1:100,000 TIGER maps, both of which can be obtained from their Internet sites.

Template Approach.
The attached color plate entitled: Tool Script Templates illustrates how you create and/or add a tool script(s) to the menu bar in the View window. The built-in **SML** tool script template automatically provides a skeletal tool script for you to rename and modify. This template script is automatically provided when you select the "New Script" button in the Customize Tool Script window. This start up script contains a sequence of function calls with liberal comments. Most of these calls contain operations you may want to perform in your special tool.

This template uses many common **SML** functions that are commented out. The function of these suspended capabilities are to provide general structural capabilities to your tool. They are documented in the associated comments. If you wish to add these kinds of operations to your tool, you can remove the comment code and add the functions appropriate to your specific tool. Now insert your own functions and operations into these subsections to perform your special, interactive tasks. Remember, if you do not find a function you need, please ask MicroImages about providing it. Since **SML** is an interpreted language, you can interactively alter this template script and immediately test each alteration until you tune your tool to meet your special need.

New/Revised Scripts since V6.40 CDs.

Note: MicroImages will soon remodel the **SML** script exchange at microimages.com to help you identify and obtain all sample scripts.

Browse Views *(can be downloaded).*
This macro script pops up a menu of file formats (for example, JPEG, PNG, ...) and as soon as a format is selected the current contents of the view are copied from the display

buffer to a temporary raster file. This raster is next exported to the selected file format. The script then opens your browser, which displays the original view. It is likely that your system already has your browser logged as the creator of files of the JPEG and PNG format and the macro will operate completely automatically if one of these formats is selected from the popup menu. However, you might select a format for which you have not specified a creator, in other words, it has no associated application. If this happens you will be prompted from Windows to pick a creator, just as if you had doubled clicked on an "unknown file type" without a creator specified in your Windows.

The kind of operation provided by this sample script can be accomplished in a few steps by many other products. But, this macro script was created to provide a simple template to show how to save, export, and start a non-**TNT** product. You may frequently use a view created in **TNTmips** or **TNTedit** inserted into another product (for example, as TIFF files). First confirm that **TNTedit** and **TNTmips** can export the appropriate file format and that it can be associated with and start the application (in other words, it starts when double clicked). If this is so, your first, and simplest **SML** creation might be to make a few modifications to this macro script to start your application from and using any View window. Please remember that, by design, **TNTview** and **TNTatlas** can not export or use the **SML** export functions.

Revised Flow Paths *(can be downloaded).*

The Flow Path tool script has been modified to allow you to use a toggle to set the option for the selected seed point to be any point in the DEM (as in the color plate) or to automatically snap the selected point to the nearest position on the actual drainage. When the selected point is automatically snapped, the upstream watershed can be interpreted as all the area that could be contributing to the conditions (flood, pollution, ...) observed in the drainage at that point. When the snapping option is not used, points can be selected 1 after another to explore how a very small local area might drain.

Custom Scripts.

Note: MicroImages will contract to create public **SML** scripts that contain reusable generic elements. New functions will be added to **SML** as needed by such scripts.

MicroImages will contract for the creation of custom **SML** scripts if the script can be posted to expand the sample script library for use or alteration by all clients. However, you may have a private portion of a script devoted to a specific proprietary model or feature. Contract scripts prepared by MicroImages can omit this proprietary model, substituting a simple common process of general interest. You, or someone else, can then substitute your specific model into the script and encrypt this modified version of the generic script we create. MicroImages can also locate others who will contract to create and protect your property rights in complete proprietary, encrypted scripts.

New Functions.

The 67 new functions and 15 new classes outlined below have been added to both **SML/X** and **SML/W**. One goal in rewriting the watershed analysis process was to satisfy your requests to provide the functions it uses within **SML**. The 50 functions added to **SML** by this effort make up the new watershed process. To demonstrate this, the Flow Path **SML** tool script, discussed in detail above, was created from these functions. You can now create your own, unique kinds of tools for landform analyses with these functions. However, please be forewarned that there is an ordered sequence required

when combining some of these watershed functions together. The Flow Path SML tool script illustrates the order of use of some of these functions.

Drawing functions. (1)
DrawInterfaceText
Draw text using the interface font.

CAD functions. (2)
CADAttachDBRecord
Attach a database record to a CAD element.

CADUnattachDBRecord
Unattach a database record from a CAD element.

Math functions. (1)
Sign
Return -1, 0, or 1 depending on sign of argument.

Database functions. (2)
OpenCADDatabase
Open the database subobject of a CAD object.

OpenTINDatabase
Open the database subobject of a TIN object.

Georeference functions. (1)
CreateImpliedGeoref
Create an implied georeference subobject.

Widget functions. (4)
CreateList
Create an XmList widget.

CreateScrolledList
Create an XmScrolledWindow and XmList widget.

CreateUnitOptionMenu
Create an option menu for unit selection.

SetPopupDialogParent
Set the widget to use for the parent of any Popup message dialogs.

Raster Watershed functions. (50)
WatershedClose
Close an open watershed handle.

WatershedCompute
Computes different hydrological features dependent on flags.

WatershedComputeElements
Computes different hydrological elements as flow paths, basins, ridges dependent on selected set of seed points and/or flags.

WatershedConvertRegionToMask
Convert region given by filename and objectname to mask according an operation.

WatershedFillDepressions

Fills depressions in different ways dependent on selected set of watersheds with depressions and/or flags.

WatershedGetBasin
Get current basin value.

WatershedGetBranch
Get current branch value.

WatershedGetIDOfWatershedPolygonForVectorPolygon
watershed polygon ID in watershed system for given vector polygon element ID.

WatershedGetInlet
Get current inlet value.

WatershedGetMask
Get mask as filename and object name.

WatershedGetNumberOfDoublePours
Get number of double pour points in watershed system.

WatershedGetNumberOfObjects
Get number of output objects that were calculated.

WatershedGetNumberOfPours
Get number of pour points in watershed system.

WatershedGetNumberOfVectorPolygons
Get number of vector polygons in watershed system.

WatershedGetNumberOfWatershedPolygons
Get number of watershed polygons in watershed system.

WatershedGetNumberOfWatershedPolygonsWithDepression
Get number of watershed polygons with depression in watershed system.

WatershedGetObject
Get object as filename and objname.

WatershedGetOutlet
Get current outlet value.

WatershedGetPour
Get pour object.

WatershedGetStatus
Get status of watershed process.

WatershedGetWatershedPolygon
Get watershed polygon object.

WatershedInit
Initialize watershed (returns handle).

WatershedIsValleySeparated
Is valley set separated?

WatershedMaskInverseValue
Inverse value for all cells in mask.

WatershedMaskSetValue

Set value for all cells in mask.

WatershedPolygonClose
Close an open watershed polygon handle.

WatershedPolygonGetIDOfLowerPour
Get ID of lower pour point by index.

WatershedPolygonGetIDOfUpperPour
Get ID of upper pour point by index.

WatershedPolygonGetIDOfVectorPolygon
Get element ID of vector polygon by index.

WatershedPolygonGetMaxZ
Get maximum z value inside watershed.

WatershedPolygonGetMinZ
Get minimum z value inside watershed.

WatershedPolygonGetNumberOfLowerPours
Get number of lower pours in watershed.

WatershedPolygonGetNumberOfUpperPours
Get number of upper pours in watershed.

WatershedPolygonGetNumberOfVectorPolygons
Get number of vector polygons in watershed.

WatershedPolygonGetZ
Get minimum z value on watershed boundary.

WatershedPolygonHasDepression
Does watershed polygon have a depression?

WatershedPolygonIsValid
Is watershed polygon valid?

WatershedPourClose
Close an open watershed pour handle.

WatershedPourGetElementIDOfVectorPoint
Get element ID of vector point.

WatershedPourGetLeftWatershed
Get left watershed ID.

WatershedPourGetPoint
Get location of pour point as POINT3D in original DEM coordinates.

WatershedPourGetRightWatershed
Get right watershed ID.

WatershedPourGetType
Get type of pour.

WatershedPourIsValid
Is pour valid?

WatershedSetBasin
Set value as current basin value.

WatershedSetBranch
  Set value as current branch value.

WatershedSetInlet
  Set value as current inlet value.

WatershedSetMask
  Set mask from external binary raster by filename and objname.

WatershedSetOutlet
  Set value as current outlet value.

WatershedSetValleySeparation
  Set valley separation by given value.

New Classes.

CADINFO
  Info for CAD objects.

MieCDED
  Import/Export parameters: Canadian Digital Elevation Data.

MieCGM
  Import/Export parameters: Computer Graphics Metafile.

MieHDF4_1
  Import/Export parameters: Hierarchical Data Format (V4.1 R3).

MieHDFMODIS
  Import/Export parameters: Hierarchical Data Format - MODIS.

MieJERS1
  Import/Export parameters: JERS1 Format (RASTER).

MieNIMA_CADRG
  Import/Export parameters: NIMA CADRG format.

MieNIMA_CIB
  Import/Export parameters: NIMA CIB format.

MieNITF21
  Import/Export parameters: NIMA National Imagery Transfer Format 2.1.

MieSUNRASTER
  Import/Export parameters: Sun Raster Format.

TININFO
  Info for TIN objects.

Watershed
  Handle used with watershed functions.

WatershedPolygon
  Handle used with watershed polygon functions.

WatershedPour
  Handle used with watershed pour functions.

XmList
  X/Motif Widget containing list of items.

Upgrading.

If you did not order **V6.40** of **TNTmips** and wish to do so now, please contact MicroImages by FAX, phone, or email to arrange to purchase this upgrade or annual maintenance. Entering an authorization code when running the installation process allows you to complete the installation and immediately start to use **TNTmips 6.4** and the other **TNT** professional products it provides to you.

If you do not have annual maintenance for **TNTmips**, you can upgrade to **V6.40** via the elective upgrade plan at the cost in the tables below. Please remember that new features have been added to **TNTmips** with each new release. Thus, the older your current version of **TNTmips** relative to **V6.40,** the higher your upgrade cost will be.

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 upgrade increment.

TNTmips Product	Price to upgrade from **TNTmips**:				**V5.80**	
	V6.30	**V6.20**	**V6.10**	**V6.00**	**V5.90**	and earlier
Windows/Mac/LINUX	$500	750	950	1100	1250	+150/each
DEC/Alpha via NT	$650	1000	1350	1600	1800	+175/each
UNIX single user	$800	1250	1650	2000	2250	+200/each
UNIX 2 user fixed	$950	1550	2150	2550	2850	+250/each
UNIX 3 user fixed	$1100	1900	2550	3050	3500	+300/each

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

TNTmips Product	Price to upgrade from **TNTmips**:				**V5.80**	
	V6.30	**V6.20**	**V6.10**	**V6.00**	**V5.90**	and earlier
Windows/Mac/LINUX	$600	900	1150	1400	1600	+150/each
DEC/Alpha via NT	$750	1200	1550	1800	2000	+175/each
UNIX single user	$900	1400	1850	2200	2500	+200/each
UNIX 2 user fixed	$1050	1600	2200	2600	2900	+250/each
UNIX 3 user fixed	$1150	1950	2600	3100	3550	+300/each

Installed Sizes.

Loading **TNTmips 6.4** processes onto your hard drive (exclusive of any other products, data sets, illustrations, Word files, and so on) requires the following storage space in megabytes.

	for **V6.30**	for **V6.40**
PC using W95, W98, WME, NT, or W2000	72 MB*	83 MB*
PC using LINUX (with Intel) kernel 2.0.36	94 MB	111 MB
Mac using MacOS 8.x or 9.x	80 MB**	97 MB**
SGI workstation via IRIX	117 MB	145 MB
Sun workstation via Solaris 2.x	100 MB	120 MB
IBM workstation via AIX 4.x (with PPC)	143 MB	169 MB
COMPAQ/DEC workstation via Tru64 UNIX (with Alpha)	146 MB	176 MB

* W95, W98, WME, NT, and W2000 installation size also includes the native **SML 6.4** interpreter for Windows.

** The Mac installed size includes the JAPAN1.OF font of 10.4 MB, which is automatically installed. Delete this font if you do not require the use of Japanese.

V6.40 of the HTML version of the Reference Manual, including illustrations, requires 36 MB. Installing all the sample geodata sets for **TNTlite** and **TNTmips** requires 187 MB. The 54 Getting Started booklets require a total of 80 MB.

Computers

Innovation Resumes.

Previous versions of this MicroImages MEMO recommended at least one premium choice for desktop and/or portable computer to use with **TNTmips**. These machines were usually in the $4000 to $5000 range and represented our choice for a quality high-end, power machine that would wring the most results in the shortest time from **TNTmips**. In other words, using these computers would yield the most productivity from the staff time expended to use **TNTmips**.

This section has not been included in recent MEMOs as innovations in microcomputers slowed, they temporarily became generic, and selection was based solely on low-price. Today most desktop and portable computers are well equipped to run **TNTmips**. There has been nothing to recommend the use of any particular brand or product configuration.

Innovation and choice is again becoming part of the market with a variety of platforms: pocket, lap, portable, desktop cheap, desktop powerful, ...; storage options: CDR, DVD, CDRW, SCSI fast versus IDE cheap, small or big hard drive, RAID, ...; single or dual processor; USB or firewire; monitors: flat or analog and single or dual; video cards: AGP built in versus card, PCI, amount of memory, TV out, digital capture, ...; and operating systems: LINUX, W98, WME, NT, and W2000.

Recommended Power Workstation.

For this release there is a new Dell configuration that stands out of the routine choices to markedly increase the ease of use of **TNTmips** and the results it produces. It is illustrated on the attached page, reproduced from a new Dell catalog. It shows dual 17" flat panel monitors that can be combined with the dual processor computers on the reverse. Staff time is an organization's most expensive component. While this recommended platform is expensive, it is a powerful workstation that will increase the productivity of any user of **TNTmips**.

Dual Flat Panels.

Until recently, all 18" flat panel monitors were unrealistically priced at over $3000 each. Now these 17" monitors are $1500. They appear to be equivalent to the 17" flat panel monitor as just introduced into the general market by Samsung at $1500. Yes, $3000 for 2 monitors is expensive. They are equivalent to dual 19" analog monitors in viewable area and can be run with comfort with less eye fatigue at even a higher pixel resolution due to the rock solid nature of flat panel images. These monitors can be coupled with the universal support of multiple monitors extended to all qualified and new **TNT** products in **V6.30**. **TNTmips** productivity is directly related to screen area. You can achieve this dual screen space economically with dual 17" analog monitors and a Matrox G400 board (now about $100) or with a better quality, higher resolution on the 17" flat panels. More and more processes work best with dual screens, and changes in the **TNT** products will move further in this direction. To name just a few: comparing 2 ge-

olocked views, comparing a 2D and 3D view, using the new GeoCatalog process to view many thumbnail images and testing them in a 2nd large view window, and others.

Dual Display Boards.

MicroImages is now outfitting its computers without difficulty with dual display boards, one in the AGP slot and one in the PCI bus, for full dual monitor support (usually only 1 AGP slot in each machine). Using 2 boards you can take advantage of the latest fast, inexpensive boards built for the computer gaming industry. You can request that Dell set up this machine as shown in their illustration with dual, inexpensive display boards each capable of 24-bit color and a resolution of up to 1600 by 1200 pixels.

Dual Processors.

All the Dell computers on the reverse side of the illustration are dual processor capable (meaning you can order them with a 2nd processor or buy and add it later). Dual processors will provide faster throughput for **TNTmips**. Modifications underway for future **TNTmips** releases will provide even more performance benefits from dual processors, especially when used with dual monitors.

W2000 Versus LINUX.

All these Dell computers come with W2000 installed. Windows 2000 requires 128 Mb of memory to run efficiently. MicroImages has observed that some **TNTmips** processes run 30% faster under W2000 than Windows 98 or ME. W2000 is definitely more stable than any other Windows. Dell will also deliver these machine with the latest version of RedHat LINUX installed. It is then possible to set up a dual boot configuration to run both LINUX and Windows. MicroImages is now setting up all its new platforms to use a hard drive that is removable. You install a $20 tray in a drive bay and connect it to your controller. Put the accompanying slide tray on a hard drive. Using several drives with slides, it is easy to pop them in and out to change operating systems and storage units. Contact MicroImages for information on these inexpensive innovations.

Support

A client in South Africa has brought to MicroImages attention an innovate, inexpensive product when they used it as part of a request to obtain technical support for a particularly complicated set-up problem. This product is called ScreenCorder 2.1 from Matchware and is free for a 30 day trial and $39 after that. When installed, it simply records all your screen actions as an animated AVI file, which can be "played back" later with your movie viewer. The product has many other features as outlined on the attached summary and in more detail at matchware.net.

To help MicroImages diagnose the problem, they sent us a ScreenCorder file that played back all the steps that were being taken. Support was able to use this to assist in diagnosing the problem, which had been previously hard to adequately describe in words. MicroImages would be pleased to receive ScreenCorder files as part of your requests for support as we have found it to be fully compatible with the **TNT** products, including all uses of the X Server. To use it, simply turn it on, run through the series of steps up to the error and send us the ScreenCorder file attached to your email or by CD. ScreenCorder also has other potential uses on your desktop such as in automatically preparing self running demos and preparing short "how-to" visual instruction sets for staff.

Internationalization and Localization

New Languages.

Hungarian

A translation for Hungarian is currently being prepared.

Burmese

Negotiations are underway for an official translator for Burmese.

Nepalese

Negotiations are underway for an official translator for Nepalese.

Note: If your language is not being translated, please contact MicroImages for information on our plans to add it or to discuss becoming its official translator.

Additional Features.

Attached to this MEMO is a color plate illustrating a sample geological map. MicroImages believes that everything in this plate, especially the new and attractive legends it illustrates can be prepared in any language supported by **TNTmips** and probably others. It is also our belief that no other product can produce this kind of hard copy map product in your language and any other.

The "Tip of the Day" window now uses the HTML widget and can be localized via the TNTHELP.TXT file.

The "Tip of the Day," context-sensitive help, and Getting Started Reminder windows all now support selecting a font to use for text display and as a result can be translated.

Arabic support has been improved by adding the clearlyu.bdf font.

Use of TrueType Fonts.

Almost everything in the **TNT** products can now be used in all the languages supported. If you find this is not the case contact MicroImages. However, it is becoming apparent that it is hard for you and MicroImages to locate the required BDF fonts and that, when located, they provide very limited selection of sizes and styles. At present MicroImages is concentrating its Internationalization and Localization effort toward the possible use of TrueType fonts in the user interface. As you might expect, key to this result is the modification of the MicroImages X Servers to support TrueType. This has been accomplished by upgrading of the server for Windows products from the X11R5 standard to the X11R6 level (this is not released in **V6.40**). To support this, a font server managing TrueType fonts has also been created. These components are now being assembled and these improvements will be provided for your use via microimages.com. The Macintosh version of the MicroImages X Server has always been X11R6 compliant. More information will be released on this important localization topic when these modification are available.

MicroImages Authorized Dealers

Five new dealers were added (Taiwan, Nepal, Myanmar/Burma, Malaysia, and South Carolina) during the past semester and 2 expansion locations opened in South Africa in Johannesburg and Cape Town. MicroImages' product sales are principally made through our excellent dealers or by referrals from our current valued client base. As a result, new dealers are being aggressively sought, especially in nations without any.

Additional dealers are also sought in larger nations where our current dealer(s) have specialized in one particular application area of geospatial analysis. Any MicroImages client or anyone else interested in becoming a dealer, please contact Terry Peterson (peterson@microimages.com). Inquiries are welcome from anyone, big or small.

For a complete list of all the current MicroImages Authorized Dealers please check microimages.com/dealers for an updated address, email, phone, FAX, services, and web site information.

Taipei - Expand Technology Co., Ltd.

MicroImages is pleased to present Expand Technology as a new dealer in the Republic of China. Since 1994 Expand has been engaged in providing CAD services to major corporations such as Toyota, Honda, and Mitsubishi and government agencies such as Taiwan Power, Railway Administration, and the Transportation Ministry. These services include reduction of drawings, sale of AutoCAD and the installation of integrated, multi-user CAD systems, and related software development. Expand will use the **TNT** products to expand its scope to provide AM/FM/GIS solutions to its clients. For further information contact Sam Hsu by voice at (8862)2221-8460 or FAX (8862)2221-8506 or email at sam@email.expand.com.tw or mail at 6th Floor - No. 110, Chung Shan Road, 3rd Section, ChungHo, Taipei Shien, Taiwan, ROC.

Kathmandu - Guragain Law Associates.

MicroImages is pleased to present Guragain Law Associates (GLA) as a new dealer in Nepal. GLA has been in business in Nepal providing legal and business advice as well as training in the use of software to Nepalese companies, municipalities, and government agencies since 1990. They will use the **TNT** products and related services to expand the scope of their business services to their clients. For further information contact Binod Kumar Guragain by voice at (977)142-1444 or FAX (977)125-2931 or email at binod@guragain.wlink.com.np or mail at Sahid Marga, 33 Gyaneswor, Kathmandu, Nepal.

Yangon - Suntac Technologies, Ltd.

MicroImages is pleased to present Suntac Technologies, Ltd. as a new dealer in Myanmar (Burma). Suntac has provided technological services in Myanmar to businesses and government agencies in digital photogrammetry, GIS, remote sensing, and surveying since 1999. Their clients operate in basic mapping, forestry, wildlife management, municipalities, water resources, railroads, and other industries. Suntac is the Space Images distributor for Myanmar as well as distributing SPOT, IRS, and Landsat 7 images. For further information contact Maung Maung Khin by voice at (951)664-463 or FAX at (951)664-740 or email at suntac.group@mptmail.net.mm or mail at 151 (B), Thiri Mingalar Lane, 8th Mile, Mayangone Township, Yangon, Myanmar.

Kota Kinabalu, Sabah State - Dunco Sdn. Bhd.

MicroImages is pleased to present Dunco Sdn. Bhd. as a new dealer in Malaysia. Incorporated in 1988 Dunco is one of several retail and technological companies owned by the Ming Kiang Group. Dunco provides sales and service of computers, networks, software, and technical services in Sabah, Labuan, Brunei, and Sarawak through 200 dealers. They also operate AMC College. AutoCAD is one of their areas of product specialization. Dunco also maintains a staff of software engineers who design Oracle databases and web tools using JAVA. They will market the **TNT** products to expand

their offerings into the geospatial area while using them to offer project contract services. For further information contact Frederick Venantius by voice at (608)842-0887 or FAX at (608)843-3000 or email at <u>dunco@tm.net.my</u> or mail at P.O, Box 13819, Kota Kinabalu 88844, Sabah, Malaysia. (web at www.dunco.com.my).

Cape Town - GEODATEC cc.

MicroImages is pleased to announce that GEODATEC, a MicroImages Authorized Dealer in South Africa, has opened a new office in Cape Town. This expansion is designed to provide easier local access to their consulting, service, and sales operation in southern South Africa. Dr. Robin Harris has moved to Cape Town to manage this new office and can be reached by voice at (2721)554-4395 or FAX at (2721)554-0082 or email at geodatec@netactive.co.za or mail at B304 The Bay, Shell Road, Bloubergrand 7441, South Africa. (web at imaginet.co.za/geodatec)

Johannesburg - GEODATEC cc.

MicroImages is pleased to announce that GEODATEC, a MicroImages Authorized Dealer in South Africa, has opened a new office in Johannesburg. This expansion is designed to provide easier local access to their consulting, service, and sales operation in the national and commercial center of South Africa. T.D. Tregoning will manage this new office and can be reached by voice at (2711)849-3219 or FAX at (2711)849-3219 or email at treggi@global.ca.za or mail at 56 Bayley Street, Farramere, Benoni 1518, South Africa. (web at imaginet.co.za/geodatec)

Rock Hill - EPIC Creative Services

MicroImages is pleased to present EPIC Creative Services as a new dealer in the United States. EPIC, organized in 1974, specializes in the use and sales of graphics and publishing software. **TNT** products have been added to their product line to provide advanced map making capabilities. For additional information contact Michael J. Maloney by voice at (803)366-6763 or at FAX (803)366-0346 or email at mmaloney@epic-isti.com or mail at 1075 Nalley Road, Rock Hill, SC 29732. (web at www.epic-isti.com)

Papers on Applications

<u>Geologist Relies on GIS to Assist in Unraveling Complex Geology in Iceland.</u> by Kevin Corbley. EOM September 2000. Volume 9 No 9. pp. 12 -15.

<u>Maryland Makes GIS Data Available on the Web. by Kevin P. Corbley.</u> The Maryland Surveyor. July 2000 pages 24- 28.

Sample Poster: Hawaii.

A poster entitled <u>OAHU in 2 and 3 Dimensions</u> is attached. The poster is also available in PDF format at microimages.com for printing at a larger size.

This poster combines a NASA space shuttle image from a hand-held camera, digital elevation from the GTOPO30 elevation raster (available for the whole world), and linework from the United States Geological Survey's (USGS) Digital Line Graphics (DLG).

Appendix: Abbreviations

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

<u>W95</u> = Microsoft Windows 95.

<u>W98</u> = Microsoft Windows 98.

WME = Windows Millennium Edition.

NT or NT4 = Microsoft NT 3.1, 3.5, or 4.0 (3.1 and 3.5 are error prone, and thus the **TNT** products require the use of NT4.0 and its subsequent Service Packs). NT4 now has a Service Pack 6 available. Windows 2000 now has Service Pack 1 available.

W2000 = Microsoft Windows 2000.

Mac = Apple Macintosh using the PowerPC GX processors and MacOS 9.x.

MI/X = MicroImages" X Server for Mac and PC microcomputer platforms and operating systems.

GRE = MicroImages' Geospatial Rendering Engine, which is at the heart of most Micro-Images products. The current **GRE** will respond and render for requests from either X/Motif or Windows.