25 April 1995
Release of V5.00 TNT products

Introduction

Prologue.

The MicroImages MEMOs, which have accompanied each of the 35 software releases and interim MEMOs, have gradually evolved into an informal newsletter and also somewhat of an editorial forum. New clients periodically ask "who writes these MicroImages MEMOs"? Eventually most clients learn that all the MEMOs are written by me, Lee D. Miller, one of the leaders of the MicroImages team. This sometimes onerous and sometimes pleasant task stops upon my desk.

I continue to write this growing periodic communication with you as it provides me an opportunity once or twice a quarter to make sure that I, the MicroImages team members, and our clients actually understand what is happening within MicroImages, where product developments stand, and where we are all going. I spend a lot of my time each day on the bureaucratic issues of managing a small, high-tech company and the general technical details of the product development. Thus, I do not necessarily know how everything fits together until this MEMO is complete.

In many ways I find my job to be somewhat similar to that of publisher of a newspaper (quarterly instead of daily or weekly and on CD-ROMs as well as paper). This is not something you can do in the last week of the quarter. Everyone at MicroImages must know and do their daily jobs to make sure it all comes together at the date of publication.

Needless to say, everyone at MicroImages contributes to the content of these MicroImages MEMOs. They provide the software features, illustrations, lists of new features, speed tests, printing, packing, billing, shipping, and so on. In fact, every staff member reads and edits every one of these MEMOs for technical correctness before it is finished and reproduced.

Slick publication and detailed editing is deliberately avoided in the MicroImages MEMOs. Such an orientation toward a magazine format and away from the newspaper format reduces the content to a lower-common-denominator, significantly delays the release of needed information while the "glossy" features are added. This costs more, reducing the frequency, timeliness, content, and page count due to the increased expense.

Status of Client Base.

MicroImages is pleased to distribute **V5.00** of the **TNT** products and the 35th consecutive quarterly release of the Map and Image Processing System. The passage from **V4.90** to **V5.00** as usual represents three months of additional work. However, this was the first quarter in more than 3 years in which less than half of the software effort was invested in the recreation and perfection of the MicroImages products across a much broader base (multi-user, multi-platform, and multi-focus with windows). As a result, **V5.00** has extra significance in that it represents a more business-as-usual quarter at MicroImages wherein a majority of the software development effort was invested in adding new and innovative features to your **TNT** products.

So what is the result of MicroImages' past three years of conversion grief as measured in the marketplace? It is MicroImages' pleasure to report the following results from **V4.90** over the past quarter.

Oldest. The earliest and first **DOS** based system ever shipped by MicroImages (**MIPS V0.90** sold and shipped in 1986) was reactivated by its original purchaser from **DOS MIPS V3.33** and upgraded through **V5.20**.

Most. More full-price, new **TNTmips** systems were shipped in March of 1995 than in any month since MicroImages was incorporated in 1986.

Biggest. The most expensive multi-user, single-processor **TNTmips** system to date was shipped.

Smallest. As a counter balance, lowest-cost, single-user **TNTmips** for use on portables with 640 by 480 resolution at $3000 were also shipped with exactly the same application features.

Largest. The largest single sale of **TNTmips** multi-user and multiple workstation platforms was shipped.

Improved Reliability.

Quality control of complex software requires constant vigilance. At this point it appears that **V4.90** of the **TNT** products were not particularly more or less reliable than those of other separate image processing and **GIS** systems shipped from competitors who also supply massive software products. Software defects in any product are of major concern to you when they suddenly occur in the middle of a critical project. You may think that developers do not check for, or care about such product defects. However, they are even more of a concern to the developers like MicroImages who then have to solve these problems at hundreds or thousands of sites around the world at considerable cost in money, reputation, and other forward motion.

MicroImages does take particular pride in the speed in which our inevitable defects are resolved. When the X server defect created by Microsoft was discovered last quarter, a general correction was immediately shipped because it affected every client. And, the questions that arise in about 80% of the voice calls for technical support are answered within 24 hours. The majority of the defects reported by **FAX** and email take somewhat longer as they usually require written answers. During this quarter MicroImages will be setting up complete versions of **TNTmips** on our **FTP** site so that you can more easily obtain a corrected copy of any and all processes throughout the quarter. This will enable you to automatically obtain the correct processes and will also provide earlier access to features being added for the next quarterly release. Details on this new service will be provided as they become available.

Take a minute to review the record of the big boys in the software business for the last 3 months.

• Apple has just released the first general fix for the several ways you can hang the **Mac OS 7.5** and which has been shipping for over a year (MicroImages ordered this fix 6 weeks ago and still does not have it).

• Microsoft is about to release a free "maintenance upgrade" for defects in Microsoft Word 6.0 which has been shipping for 9 months for the Macintosh (announced 3 months ago but has not yet shipped to anyone).

- Microsoft has just released a free "maintenance upgrade" for Windows **NT 3.5** to **3.51** (this was shipped to MicroImages promptly under our developer support - part of it is available to all as a patch via Internet).
- Microsoft Office **4.2** for the Mac is in such bad shape that they not only have had to offer a free upgrade to **4.2.1**, but add on a 90 day money back guarantee for the upgrade to get buyers to even try it (This was offered 4 weeks ago and probably will not be received for some time unless you buy a new product).
- Windows 95 final beta release crashes when multiple tasks are started (simply wait for the next beta release).
- And of most importance, Microsoft has needed to release a free "maintenance upgrade" for Windows 3.1 for at least 2 years.

And these are the operating systems and tools we all have to deal. Certainly the world would be an easier place for all of us if Bill Gates adopted a policy (which it seems he may now be doing) that his products do have defects and set out to more promptly fix them (perhaps with quarterly upgrades via generic **CD**s?).

It may seem that the specific software you have purchased has all the defects while the competition does not. This perception is often created by the fact that your expectations and knowledge are rightfully high for the product you selected and purchased but that correspondingly you are unaware of the defects in the competing products. Complex software products will have defects. It's how they get fixed that really counts!

After these excuses, MicroImages is able to report that fewer defects were reported and resolved in **V4.90** than in any previous version of the **TNT** products. However certain processes still remain defect prone until they are rewritten, restructured, and modernized. The processes for interactively editing vectors and **CAD** objects will continue to have defects and idiosyncrasies even in **V5.00**, albeit fewer than before. The good news is that the completely new **TNT** object editor is well underway and has been released in **V5.00** as an incomplete work in progress for your inspection and comments. This new editor is now more than 1/2 complete and will be finished for **V5.10**.

Some minor irritating defects also remain in the 3D display process. However, this process is also scheduled for a complete overhaul for rerelease in **V5.10** with better integration with the 2D display process as well as advanced features.

The DEM/ortho process has been significantly improved but will receive additional intense effort for **V5.10**.

Other current, minor processes which are usable, but which require minor overhaul, modernization, and extension are the Fourier Analysis, Raster Watershed, Progressive Transform, Polygon Fitting (vector home range), and Trend Removal processes.

New Features.

The most significant modification in **V5.00** of the **TNT** products is the addition of the pyramiding of rasters to the **RVC** Project File structure. This markedly increases the speed with which rasters are used in those processes which have been modified to support it, particularly 2D display. Raster objects may now be automatically pyramided when you import them. Existing raster objects can be pyramided in place without rewriting them using an **RVC** maintenance operation. Furthermore, the addition of pyramiding to the 2D display process uncovered several ways to decrease display time in almost all **TNT** processes, even when the raster object is not pyramided!

Several clients at **V5.00** beta sites have reported that the significance of this new concept is equivalent to that of buying a new and faster computer. The implementation and integration of this feature with the tiling, buffering, and other advanced features in the **RVC** structure took only a few days. MicroImages is thus reflecting on why this feature was not added earlier, since it was designed over 18 months ago when everyone was using those sluggish **486** based machines with display boards designed for **DOS**. It was only added at this point because of a client's need to handle an existing massive RVC based image dataset. Actually, a lot of little pieces had to be added to the **TNT** product design over the last 18 months to make this important feature "easy to add".

The first of many "pink" **TNT** Advisory windows will now pop in when you display a raster object(s) which would display much faster if you took the time to pyramid it (them). This was a last minute addition to **V5.00**, but you will see more and more of these unobtrusive advisory windows in processes where many approaches are available to you, but one is more effective (faster, more accurate, less memory intensive, less drive space used, etc.).

The interface of 2D display and several other processes have been markedly changed by the addition of toolbars with color button icons and ToolTips (pop-in icon titles as used in Microsoft Word 6.0). In all, 64 color icons have been added (with more coming). The purpose of each is easily determined by simply touching the cursor to the icon button to instantly see its 1 to 3 word ToolTip description before selecting it (e.g., Open, Straighten Line, Copy Element, Zoom 4X, etc.). Using icons significantly increases the speed with which you can interact with those processes that contain them.

Other significant changes have been added for the display of rasters. First there is the extension of the geographic locking feature first introduced in **V4.80**. It has now been expanded to support the setup, display, locking, scrolling, etc. of stereo images in high quality full color or black and white. Only an inexpensive stereo viewing device is required. Another, often requested addition, is the provision for the display and control of other color models including **HIS**, **HBS**, **RGBI**, and **RGBB** for such purposes as the direct combination and display of images from mixed sensors.

The rewrite of a second generation DEM/orthophoto process is well underway, resulting in a completely new and more accurate relative orientation process (epipolar solution) coupled with improved and more flexible controls. A new related process is available which finds the points of inflection in a surface raster (mountain peaks, bottoms of holes, etc.) and creates a vector object from them. Another new tool shows a profile and statistics of a line interactively drawn in the display of a **TIN** object.

A new process for filtering vectors is provided to assist you in screening and correcting your complex vector objects for such artifacts as overshoots and sliver polygons as well as supporting the thinning of lines by several methods. These new functions may be used in an automatic fashion with your parameters in a vector-object-in / vector-object-out (**VIVO**) fashion.

Two new kinds of raster legends can now be created for addition to your final products. A color spread legend can be designed for such situations as those using a color-coded grayscale image. A color class or cell identification legend can also be constructed.

The **DOS MIPS** classic "color crispy filter" has been improved and released. It allows the sharpening of any **RGB** display by automatically converting the rasters used to hue, intensity, and saturation, applying the sharpening filter you select or design to the intensity

component, and then converting back to **RGB** raster objects. Also a new process for applying morphological functions has been added to the menu.

The **ISOCLAS** clustering or unsupervised image processing feature which was not complete in time for inclusion in **V4.90** is now available.

This version of the **TNT** products for Microsoft Windows 3.11 (**MSW3.11**) can be installed with its **MI/X** server for immediate operation under the prerelease version of Microsoft Windows 95.

And last, but not least, is the long awaited release of the **TNTmips** products for both the Apple Macintosh and Power Macintosh platforms. These particular versions of the **TNTmips** products have and are causing almost as much effort to MicroImages as the original support of the **UNIX** based platforms. Perhaps this is why almost all of our major competitors' products are not available for these Macintoshes?

Plans for V5.10.

Some of the more significant new features which have already been undertaken for possible release in **V5.10** are as follows:

- icons for all main menu items and some subprocesses (e.g., each import / export function) can be selected and placed into user created and customized toolbar windows for direct access;
- display 3D will be rewritten and integrated with display 2D and incorporate new features (thus display 3D becomes a part of **TNTview** as well);
- stereo viewing process will be integrated with display 2D and 3D and offer a much wider range of stereo visualization options (e.g., contours, DEM/ortho, perspective, **TIN**, and other 3D surfaces can be selected and displayed for viewing in the stereo);
- a floating drawing tool approach will be added to allow simple 3D measurement tools to be used while viewing in stereo;
- multiple database records will be viewable in a single scrolling window with control over its layout and a column or field summary line at the bottom;
- a thematic (choropleth) mapping interface will be added to more easily use attributes to control the display of polygons (e.g., show the polygons of each state filled with color according to population over 21 years of age);
- interactively designing a chain or pipeline of several vector operations in a new process;
- direct interactive application of spatial filters only to the inside of a polygon;
- ability to query and display information from one object based upon an area selected in the currently displayed object (e.g., show all the drainage and wells in a hydrologic vector object for a polygon area drawn on a view of a highway vector object or an orthophoto);
- compute and optionally save additional real and fuzzy properties of vector objects with associated display tools (e.g., a histogram display for the frequency of occurrence of all lines which might be overshoots as a function of length);
- quintic surface interpolation process to produce smooth contours from **TIN** objects;
- new autocorrelation process to complete the revised DEM / ortho process;
- linking of **CAD** objects in **RVC** Project File directly to the AutoCAD ***.DXF** and MapInfo ***.MIF** files for direct reading, display, and other processes without any need to import these files;
- new installation process to automatically set up icons to run all **TNT** products under Microsoft Windows 3.1; and
- **MI/X** (MicroImages X Server) for the Macintosh and Power Macintosh.

Windows NT 3.5

Microsoft has issued a maintenance upgrade for Windows **NT 3.5** designated as service patch 2. Patch 2 has been included on your CD-ROM with **V5.00** of the **TNT** products and can also be obtained via Internet from ftp.microsoft.com. This service patch solves at least one problem which is that now at least the quad speed CD-ROM drives using the **IDE** controller in the Gateway 2000 will now work with **MSNT3.5** as patched.

As a developer, MicroImages has also just received a Microsoft CD-ROM containing a "maintenance release" identified as **V3.51ß**. At this writing the defects solved by this release have not yet been evaluated. Thus, MicroImages continues to recommend that there are no particular performance reasons to move your **TNT** products to **MSNT** unless you want access to the expanded network features it provides (and a lot of new installation headaches).

IMPORTANT NOTICE: MicroImages hereby announces that this shipment of **V5.00** of the **TNT** products is the last version which will support Microsoft Windows **NT 3.1**. Effective with the shipment of **V5.10** of the **TNT** products MicroImages will be able to provide support and products only to those clients who have upgraded to run **MSNT3.5**. At, or just after the shipment of **V5.10**, MicroImages will purge all copies of **MSNT3.1** from our development machines.

Windows 95

MicroImages has just received a developers copy of the "final" beta release of this Microsoft product. Some of you also have noted that you have this early prerelease version as well. MicroImages is pleased to announce that **V5.00** for **MSW3.11** of the **TNT** products including the **MI/X** Server installed normally and operated immediately under W95 without alteration. The speed of the user interface is approximately the same as operating directly under **MSW3.11**. Simply install and use the **MSW3.11** version of **V5.00** if you are already experimenting with **W95**.

MI/X (MicroImages' X Server)

X Server for Apple Mac. The development of X Servers for the Apple Macintosh and Power Macintosh has absorbed quite a bit of effort this quarter. Unfortunately, it is difficult to judge at this time what portion of this complex task has been completed.

Upgrading from DOS MIPS

A total of 87% of all MicroImages clients since 1986 are now using a version of **TNTmips**. However, there are still some holdouts continuing to use the **DOS MIPS** product. Each quarter some of the old **DOS MIPS** (or early **TNTmips**) users upgrade from way back to the current version. More and more frequently this is happening because their old equipment has failed and can no longer be repaired or replaced to operate **DOS MIPS**. An example of at least one software package which outlasted its host machine. Also many have gradually found that they have stressed the limits of **DOS** (file sizes, flexibility, etc.) which they also find as limits within **MIPS**.

MicroImages understands that a few clients with early versions have gone on to other activities, left the company, or become unhappy with MicroImages. However, MicroImages finds over and over in contacts with most clients who still operate **MIPS**, that they report

that they do not yet have appropriate equipment (e.g. still using a slow **386** with 1 to 4Mb of memory) or dislike windows oriented software. Obtaining proper equipment for the operation of **TNTmips 5.0** is no longer a major impediment for many as the most advanced workstation equivalent Pentium 100 MHz, complete with a 17" 1280 by 1024 pixel display is now only $3000 from Gateway, Dell, and other vendors with no extras needed (see details below).

Correspondingly, those clients who have resisted the onslaught of windows oriented software are now rapidly discovering that many other popular software packages or upgrades also cannot be obtained for **DOS**. For example, there is no major **IPS** or **GIS** software which is not windows oriented. This easily predicted evolution in the operation of all desktop software is the reason MicroImages and all other commercial software vendors undertook the conversion to windows interfaces over the last 3 years. Fortunately, this conversion has lead to a modularity within the **TNT** product line whereby MicroImages can more easily add new functionality to adapt to the needs of our client base.

MicroImages would like to remind the remaining users of **MIPS** that by updating to **TNTmips 5.0** for less than $1000 (see tables below) that they will have the most current version of a modern, state-of-the art, integrated **IPS** and **GIS** software system whose current purchase price would be $5000 to $8000. It thus seems logical to consider spending $3000 on a computer which is many times faster than the old one you are using and secure a completely new and faster software system.

TNTmips™ 5.0

If you have subscribed to **TNTmips 5.0**, please proceed to install it from the **V5.00 TNT** product **CD**s following the instructions provided by the INSTALL process on either disk or in the Detailed Installation and Optimization Manual. If you did not order **TNTmips 5.0**, and wish to do so now, please contact MicroImages by **FAX** or phone to arrange to purchase your quarterly upgrade to **V5.00**. MicroImages will immediately supply you with an authorization code by **FAX**. Entering this code when running the installation process will allow you to complete the installation and immediately start to use **TNTmips 5.0** and the other **TNT** products.

If you do not have an annual subscription to **TNTmips**, you can purchase **V5.00** under the elective upgrade plan at the cost in the table below. Please remember that new features have been added to **TNTmips** with each quarter. Thus, the more quarters you are behind **V5.00**, the higher your upgrade cost, up to a limit. Upgrades from all previous versions of **MIPS** and **TNTmips 4.51** or earlier are the same, fixed cost shown below. As usual, there is no special additional charge for the upgrade of the peripheral support features, **TNTlink**, or **TNTsdk** which you may have added to your basic **TNTmips** system.

Within the **NAFTA** reselling area (Canada, U.S., and Mexico):

Product Code	Price to upgrade from **TNTmips**:				**MIPS**:	**V4.90**
	V4.80	**V4.70**	**V4.60**	**V4.51**	any version	
D30 to **D60** (**CD**s)	$250	450	600	700	750	750
D30 to **D60** (floppies)	$300	560	750	875	940	940
D80	$375	675	900	1050	1125	1125
M50 (replaces **U45**)	$250	450	600	700	750	750
U100	$450	800	1000	1200	1300	

U200	$780	1400	1875	2200	2350
U300	$1030	1850	2475	2900	3100

For all other nations:

Product Code	Price to upgrade from **TNTmips**:				**MIPS**:	**V4.90**
	V4.80	**V4.70**	**V4.60**	**V4.51**	any version	
D30 to **D60** (**CD**s)	$300	560	750	875	940	940
D30 to **D60** (floppies)	$350	600	800	925	990	990
D80	$425	800	1050	1225	1300	1300
M50 (replaces **U45**)	$300	560	750	875	940	940
U100	$500	850	1050	1250	1350	
U200	$830	1450	1925	2250	2400	
U300	$1080	1900	2525	2950	3150	

M50 is the new product code for the Apple Macintosh **Mac OS 7.x** versions and replaces their older designation as **U45** for the Mac using **A/UX**.

Loading a full installation of **TNTmips 5.0** onto your hard drive (exclusive of illustrations) requires the following storage space in megabytes.

PC using **WFW3.11**	89
PC using **MSNT3.5** (Intel)	130
DEC Alpha using **MSNT3.5**	144
Mac using **Mac OS 7.1** (680xx)	69
Power Mac using **Mac OS 7.5** (Power **PC**)	72
Hewlett Packard workstation using **HPUX**	97
SGI workstation using **IRIX**	120
Sun workstation using Solaris 1.x	88
Sun workstation using Solaris 2.x	79
DEC workstation using **OSF/1**	134
IBM RS/6000 using **AIX**	143

There are no **V5.00 TNT** products on these CD-ROMs for the **DEC** 3000 or 5000 workstation platforms using **ULTRIX** or for the Data General workstation platforms using Aviion. These versions were temporarily deleted to make room on the 2 CD-ROMs for the 2 new Macintosh versions. **V5.00** of the **TNT** products for the Aviion or **ULTRIX** platforms are not widely used and thus will now be provided on individual, custom made CD-ROMs. Subsequently, to accommodate these lower use products, a reduction in the size of all the executable files may be effected or a third **CD** will be added, particularly if support for one more new platform is added.

IMPORTANT NOTICE: MicroImages will no longer be able to supply the **TNT** products on floppy disks. Not a single copy of **TNTmips 4.9** was requested for shipment on this media. It now appears that the conversion of professionals to CD-ROM is complete. In fact, more and more complaints are reported in the magazines leveled toward Microsoft and others for delivering their large products only on floppy disks. For example, Microsoft Office **V4.2** is being supplied on 34 floppies and is very cumbersome to install.

TNTsdk™ 5.0 for TNTmips 5.0

No special features were added to **TNTsdk** other than the quarterly improvements in existing functions and the additional functions added to **TNTmips**.

TNTview™ 5.0

All the applicable changes in the display program noted below including the use of pyramided raster objects are similarly available when **TNTview 5.0** is installed.

TNTatlas™ of San Francisco

Those clients familiar with Microsoft Windows have pointed out that it is quite easy to print any of the San Francisco **TNTatlas** screens at any point in the operation of this HyperIndex® stack without purchasing the separate Pizzaz Plus color printing product. Simply start the clipboard (**MSW3.1**) or clipbook (**MSNT3.5**) program. At any place in **TNTatlas** (or any **TNT** product) capture the contents of the display screen to the clipboard by pressing the Print Screen key. Then suspend the **TNTatlas** and access the clipboard / clipbook with the other software within which you wish to use the screen and trim, annotate, insert, and print it (Paint Brush works well). Finally, simply reactivate and continue using **TNTatlas** from the point of its suspension. If you can use the clipbook program (in **MSNT**), then you can capture multiple screens at various points during the operation of a **TNT** product and similarly access and use all of them later.

A list of your suggestions for the improvement of the prototype San Francisco **TNTatlas** has been maintained. If you do not see your ideas below please communicate them to MicroImages.

• Support a "demo" or self running mode for unattended operation.
• Add manual entry of **GPS** values.
• Improve the art work of the screens.
• Supply more technical information regarding installation, **X** Server problems, etc. in an appendix of the manualette.
• Incorporate pyramiding concept *(done)*.
• Reformat 8.5 by 11" paper printed data index.
• Provide a fully automatic install program for **MSW3.11** *(underway)*.
• Add a smaller, simpler Crow Butte stack with smaller objects for faster demonstration.
• Change measurement tool to eliminate white on white.
• Provide notice to user that the select action is underway.
• Set the "Show Index Areas" to default to off *(done)*.
• Modify **TNTlink** so that author can set index areas on/off by object.
• Reprocess SPOT and color-infrared air photos with revised DEM/ortho process.

TNTdemo™ 5.0

No changes have been made in the **TNTdemo** software or program for this quarter except that purchasers will not automatically receive the **DEC ULTRIX** or Data General Aviion versions unless they specifically request them.

On-Line Documentation

Two documenters have recently left MicroImages to start their own businesses. This is a total of three in the past year. This is a good score for MicroImages' spin-off business incubation, but it also takes time to hire and train such staff. Thus, several of the new

features added to **V5.00** are not yet documented even though the size of the printed version increased by 85 pages to a total of 1822 singled-spaced printed pages.

Seven small last minute documentation sections were completed for the newest features in **V5.00** after the master disks were created for the reproduction process. These 33 additional pages are included in supplemental, printed form as follows.

Multiple Component Raster Display (4 pages)
Relief Shading (4 pages)
Raster Pyramiding (4 pages)
Vector Filtering (6 pages)
Raster Morphology (9 pages)
Appendix 2: **TNTmips** Icons (6 pages)

Apple Macintosh via System 7.x.

The **TNT** products on CD-ROM for **V5.00** now include versions for the Apple Macintosh computers using either Motorola 68030, 68040, 601, or 603 processors. All internal **TNTmips** processes and capabilities are available for either Mac or Power Mac platforms and have been tested reasonably thoroughly. There may still be undiscovered defects and idiosyncrasies in the Mac versions which are unique to this platform and any reported will be immediately fixed.

For acceptable performance, MicroImages recommends that the **TNT** products be used on Macintosh models which are equal or faster in performance to a Quadra 700 and only with an auxiliary math coprocessor chip. This math coprocessor is an integral part of the Power Mac but is optional with some 680xx Macs. The version of **TNTmips** for the Quadra and other 680xx Macs is compatible with **Mac OS 7.1.x** or **7.5.x**. The **TNT** products for the Power Mac require **Mac OS 7.5** or **7.5.1**. The suggested minimum **RAM** memory is 16 megabytes.

X-Server. As has been previously announced, MicroImages has only partially completed developing an **X** server for the Mac platforms. It is planned that this **MI/X** server will be available with **V5.10** in June. For **V5.00**, MicroImages will purchase and ship without extra charge the eXodus **X** server manufactured by White Pine software with each copy of **TNTmips** ordered for use on a Macintosh. A flier describing this eXodus product is enclosed. The eXodus **X** server has been used exclusively during development and testing by MicroImages for the Mac platform and will be provided with versions for the 680xx and Power **PC** systems.

The eXodus **X** server is not protected but is a copyrighted and licensed commercial product. Therefore it cannot be placed on the **V5.00** CD-ROMs for the **TNT** products. However, MicroImages will also provide a copy of this eXodus product (normal cost of $300) at our volume cost of $170 plus shipping for any existing client who also wants to use either or both Mac versions. Before ordering, please remember that to use either Mac version you will need to have an authorization key available with a current **TNT** product code of **D50** or **U100** or higher since these Macintosh products use a product code level of **M50**.

Performance. The following chart provides comparative performance for **TNTmips 5.0** on the Macintosh and **PC**s using Microsoft Windows **3.11**. All computers had built-in or add-on floating point processors! All tests were performed with data which is available on the CD-

ROM of the San Francisco sample **TNTatlas** but which was transferred to an external **SCSI** hard drive on the test machine. The times listed <u>do not include</u> the time to load the particular process but only the time to perform the analysis operation described. The Mac computers used in the tests were standard machines unaltered except for the addition of the larger external **SCSI** hard drive.

[test A] <u>Raster</u>. Displaying a 10 Mb single band 8-bit grayscale image which is stored as a linked **TIFF** file. This was the blue band of photo 145 in the Hayward NHAP airphoto series titled 145_BLUE.TIF. The entire image was displayed which required resampling of the entire raster object. The final view was rotated and rescaled somewhat so that extensive use was made of the affine transformation. The raster object was transferred for this test to the local hard drive.

[test B] <u>Raster with Pyramiding</u>. The same as [test A] except the raster object was pyramided.

[test C] <u>Vector lines only</u>. Displaying all the line elements from the 10 Mb of the Solano County vector object imported from the TIGER data of that county. Since all the line elements were displayed, this required that all their coordinates be recomputed in the process using the affine approximation method. Only the simple default color line styles were selected for the display.

[test D] <u>Vector lines and polygons</u>. Displaying both line and polygon elements from the 10 Mb of the Solano County vector object imported from the TIGER data of that county. Since all elements were displayed, this required that all their coordinates be recomputed using the affine approximation method. Only the simple default color line and polygon styles were selected for the display.

All test times within the tables are in seconds and are preceded by the ratio of the time required to that required on the **486/25** base or reference machine. Thus (**2.7X**) 205 indicates that the time to complete was 205 seconds which is 2.7 times as longer than the same test on the **486/25** reference machine. The Quadras all used **Mac OS 7.1** and the Power Mac used **Mac OS 7.5**.

	PC **486/25**	PC **386/20**	Quadra 700	Power Mac 6100
[A]	(**1.0X**) 75	(**2.7X**)205	(**3.7X**) 275	not tested
[B]	not tested	not tested	43	37
[C]	(**1.0X**) 43	(**2.5X**) 106	(**4.9X**) 212	(**2.5X**) 106
[D]	(**1.0X**)178	(**2.2X**) 388	(**3.7X**) 651	(**2.0X**) 357

	Quadra 800	Quadra 800 via remote X terminal
[A]	(**3.9X**) 292	not tested
[B]	not tested	not tested
[C]	(**5.2X**) 225	(**6.8X**) 291
[D]	(**2.6X**) 462	not tested

The tests on the Quadra 800 with eXodus and also without eXodus via remote **X** terminal were performed to determine the impact of the eXodus **X** server on the performance of **TNTmips** on the Mac. The results show that the use of this **X** server in the operation of these **TNTmips** processes on the Mac did not have a particularly detrimental effect, in fact

TNTmips use via a remote **X** terminal was slower. The reason for the additional time required for remote access can be attributed to network overhead although these tests were run with minimal network traffic.

Additional tests were performed on the Power Macs using the 680xx versions **TNTmips** in emulation mode but provided slower results than when used directly on a 68040 based Quadra. This method of operation is not warranted as the native Power **PC** version of **TNTmips** is available.

Comments on Performance. The general interpretation of these tables is that both Macs are slow in comparison to **PC**s, and even the original Power Mac 6100 is approximately 1/2 the performance of the **486/25**. Every Mac owner knows this but pure speed is not their criterion for the selection and use of a Mac. Ease of use and performance of the user interface are more important criteria. For example, the interface activity in **TNTmips** via eXodus on the Mac is considerably faster than via **MSW3.1** and approaches that of a workstation using an **X** server.

An additional plus for the Mac is that it treats the **X** Window used by **TNTmips** as just another window opened by an application. It can be resized, repositioned, and operated just like anything else on the Mac desktop. Thus you may use any amount of Mac display area you have which provides 256 or more colors (e.g. 8-, 16-, or 24-bit color). Existing dual or triple screen display setups are automatically supported. For example, where a Mac window can be expanded or dragged across color monitors to create a larger desktop spanning several monitors, then your **TNTmips** display window can be expanded to that size.

MicroImages may also be contributing to the slower performance on the Mac in managing the way in which the **Mac OS** multi-finder currently runs independent programs by sharing time equally between the 3 processes: **X** server, **TNT** Menu, and a **TNT** application (e.g. 2D display). This is similar to the way things started out on the PC platforms. Eventually MicroImages figured out how to properly control this sharing to balance the time of service from the system software and **CPU** for the **X** server, **TNT** Menu, and **TNT** application process. This interprocess tuning is the area in which MicroImages needs to expend effort but which will be more fruitfully spent when our own source code is available for the **X** server.

Mac users are also quite familiar with the fact that the **Mac OS** does not yet dynamically reallocate real or virtual memory as does Microsoft Windows. Memory being used by other currently suspended processes in the **Mac OS** finder is not reallocated to the active process. Serious Mac users overcome this by putting more real memory into their Macs than **PC** users employ.

Unfortunately, the software engineer must allocate a fixed amount of memory for each individual Mac process to use. This allocation can be subsequently altered by the user of the software but is still fixed in amount. Adding virtual memory to the **Mac OS** does nothing to alter this situation except provide more memory (and much slower memory) for manual allocation. All Mac users are familiar with the effect of this limitation where they must manually make more memory available to a particular software package to do a more complicated task.

The MicroImages software engineer has the problem that if too large a block of memory is allocated as the default, the process will always "virtualize" to get this memory and thus

drastically slow down. The default allocations of memory for **TNTmips** on the Mac platforms will complete moderately sized tasks. However, the memory allocation for a specific **TNT** process may have to be increased for a larger task as MicroImages cannot automatically reallocate any unused available memory or the memory used by other active, but suspended programs (e.g. **Mac OS**, **X** server, Menu, etc.).

Comparison between Macs. It is important to note when comparing their performance that the Mac Quadras and current Power Mac both use the same bus, drive speed, and format. Furthermore, Apple has not yet rewritten the **Mac OS** file system - the software that deals with disk I/O - to run in native mode on Power Macs. Every software package compiled in native mode for the Power Mac must still go through 680xx emulation and switching each time between 32-bit to 16-bit for every read or write operation performed. This includes those conditions under which software executing on a Power Mac has to begin to use virtual memory instead of real memory. Thus, for any native Power Mac application such as **TNTmips** which requires massive **I/O** activity (alternating between reading, processing, and writing massive data sets) the slowdown can become particularly significant as the process switches millions of times between native and emulated mode. As a result, and probably at least until **Mac OS 8.0** is released, those **TNTmips** operations which require a lot of disk I/O in relation to computation will not vary greatly in performance between the two types of Macs and can even be slower on the Power Mac, whereas those with intense mathematical operations will be significantly improved on the Power Mac.

A chart enclosed with **V5.00** from MacWorld verifies this. It shows that computationally oriented **CAD** and image processing processes run as much as 3 times faster in native code on a Power Mac relative to a 680xx based Mac. Conversely, Microsoft Word 6.0 for the Power Mac, even in native code is only 1.1 times as fast on a Power Mac as on a 680xx based Mac as word processing is almost all string manipulation and disk access. Also notice for many products on the chart that disk I/O operations such as opening, sorting, importing, and print to disk are often slower on the Power Mac.

Prices. The prices for either, or both Mac versions of **TNTmips** are shown on the new price sheet enclosed. Please note that the price of **TNTmips** for the Mac is independent of the display resolution, in contrast to the **TNTmips** prices for the Microsoft Windows based platforms which are still based upon maximum display resolution.

Peripherals. Only limited, direct support for Mac peripherals is currently available. Scanner support is not of particularly high priority since every scanner added to a Mac comes with software which will scan into a **TIFF** file which can be immediately linked to and used by **TNTmips**. **X-Y** digitizers are not yet directly supported. Printing and film recorder can be used if the product code **P8** is available to support the creation of **TIFF** and PostScript files but direct printing to PostScript printers is not yet working.

Free Upgrade. Since there may still be idiosyncrasies in a few processes on the Mac and the support of peripherals, MicroImages will automatically upgrade anyone ordering **TNTmips 5.0** [product **M50**] for the Macintosh to **V5.10** (June) and then add on the free-for-registration version **V5.20** (September).

Authorization Key. The **V5.00 TNT** products for the Mac require a blue or red serial key which will be provided with the appropriate adapter to connect to the small Mac **DIN** serial connector. Your Mac must an have an available, empty serial connector to attach this key.

V5.10 of the **TNT** products will also offer an alternate type of key for the Mac. This key is unique to the Macintosh products and does not require any standard port since it attaches anywhere in the Apple Desktop Bus (**ADB**) and is transparent. The **ADB** is the special bus which connects the Apple mouse and keyboard to the main chassis. This **ADB** authorization key is simply a 10 centimeter piece of cable with a small bulge in the middle for the electronics and with male and female connectors which allow it to be placed anywhere "in-line". MicroImages has these **ADB** keys, but they were not yet supported at the time of the preparation of CD-ROMs for **V5.00**.

Installation. The Mac installation program was not available at the time of the cut-off of the preparation of the **V5.00** CD-ROMs. It will be supplied for **V5.00** as a Mac program on a Mac formatted floppy disk which will be shipped along with the eXodus **X** Server to existing or new clients ordering the Mac version.

TNTdemo. The $200 access via **TNTdemo** to try **V5.00** on the Macintosh platforms is not directly available. MicroImages is currently supplying the copyrighted $170 eXodus **X** Server with each **TNTmips** for the Mac. It was not possible to include this unprotected eXodus product on the standard CD-ROM for the purposes of supporting the **TNTdemo** concept. When the **MI/X** Server for the Mac is complete, it will be possible to include it (and the installation program) on the normal CD-ROMS to support the routine demo trial of both of the Mac versions. However, temporarily a special **TNTdemo** kit can be assembled including eXodus for both the Macs (and all other platforms as usual) for $370 which would then be refunded upon subsequent purchase of **TNTmips** for the Mac.

TNTatlas. Again, since the unprotected **MI/X** server is not available, it is not yet possible to add the Mac software to the "run-time", keyless, licensed version of the **TNTatlas**.

New Price List

A new composite price list is enclosed. Please note that it does not reflect any changes in prices but simply adds the minor price changes and adjustments announced in previous quarters. These past adjustments, which are consolidated together in this price list include the increased subscription price for the international sites to pay for the express shipment of upgrades, the revised price for the native Macintosh products, the deleting of printer support **P15** from the workstation bundle, and other previously announced minor adjustments.

The complete contents for a new **TNT** Price and Reference Information folder (previously distributed with a green cover) are now complete and ready for reproduction. This reference folder will be distributed to all clients in a separate mailing during the next quarter. This same folder has, and will continue to be sent, together with the separate product brochures and sample **TNTatlas CD** to all parties who request material about the **TNT** products directly from MicroImages.

New TNTmips Features

* Paragraphs or main sections preceded by this symbol "*" introduce significant new processes, or features in existing processes, which are released for the first time in **TNTmips 5.0**.

System Level.

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* The **X** Window System window manager (**TWM**) has been modified to provide an icon on the menu bar line to raise or lower the current window.

* A preferences option has been added to tell processes not to wait for "OK" to be pressed in the status dialog when the process completes. This can save time in repetitive tasks.

The cursor is now automatically moved to a newly-opened dialog if that dialog must be closed before proceeding. This option may be turned off using Support / Setup / Preferences.

The last-used zone for each map coordinate system is retained as the default for the next time that coordinate system is used. For example, the last-used **UTM** zone will be automatically selected the next time the UTM coordinate system is used.

Project File Maintenance.

The size of the currently selected object (in bytes) is displayed in the object information window.

* User Interface.

Now that more software engineering time is available, MicroImages is putting a portion of it into improving, streamlining, simplifying, and organizing the user interface of the **TNTmips** products. This is not simply a matter of making interfaces "prettier" but also making them more efficient to use.

In general MicroImages is not trying to invent new user interface components, but simply applying approaches used in other popular **PC**, Mac, or workstation packages. Microsoft Word 6.0 was the model for the new interface changes added in **V5.00** except for the drop-down dialog box extensions which are common in Mac software.

User interface alterations do not automatically become part of every **TNT** process overnight. A specific software engineer is assigned the responsibility or volunteers to implement the library functions and changes and then modifies one or more of their processes to reflect the improvements. This takes most of a quarter so these improvements may only be introduced in a couple of processes. Subsequently, all other software engineers must take the time to modify all the processes for which they are responsible to use these new, standard interface components. Thus please be patient while these and future interface changes migrate into other processes.

Icons. By popular demand, 64 push-button style, color icons are being introduced in **V5.00** in the display (viewing), feature mapping, and *prototype* object editor as well as several miscellaneous situations. These icons may be best thought of as push-buttons as they are not the larger, "free roaming" program icons with fixed text descriptions under them popular in representing programs and datasets in **MSW3.1** and the **Mac OS**. Push-button icons generally occupy defined positions within a toolbar, window frame, or some other outlining structure.

A color reference chart of the **V5.00** icons is attached. They can also be directly viewed with more expanded description in Appendix 2 of the on-line documentation. Where some sort of standard icon was already in wide use, its appearance has been duplicated. Where unique **TNT** actions are being represented, the icon is of MicroImages' design. More icons will be added as the need for them occurs during the upgrade of other processes to use them. However, all icons are read from a common reference file so that each process will use the same icon for the identical action.

The dominant color of a push-button icon will often tell you the functional group to which it belongs. For example, blue is the dominant color of the view icons, and yellow is used for file oriented actions. Characters will not be used within **TNT** icons, thus the typical "**ABC**" is not used to represent access to character actions (except for the temporary use of the letter "**A**"). Incorporating Roman characters into icons is not good design for internationalized software and begins to defeat the purpose of using icons. However, Arabic numbers are allowed, such as in the integer zoom icons, as MicroImages has found that almost everyone, world-wide, at all educational levels, immediately recognizes them.

<u>Toolbars.</u> A toolbar is a strip or row of icons presented along one edge of a window to provide rapid, easy mouse selection of specific actions. The **TNT** toolbar presents the icons in fixed positions across the top of the window. Icons for closely related actions are grouped close together in the bar with somewhat more space between these functional groups. The total length of every toolbar is currently limited so all of it will be exposed on the screen of a portable 640 by 480 pixel screen which has the window open to its maximum extent.

In Word 6.0 you can take icons on and off the toolbar; move the bar to the top, bottom, left or right of the window; and create several toolbars. These features are not available at this time in the **TNT** products, and the **TNT** toolbars are fixed across the top of the window. It is more important at this time to get toolbars and icons into more processes before adding these cosmetic and user customizing features.

<u>ToolTips.</u> Microsoft first introduced the concept of ToolTips in Word for Windows 6.0 At least three lines of toolbars of many push-button, color icons can be optionally displayed in Word 6.0. This, coupled together with the large number of icons in Word, and potentially in the **TNT** products, necessitates a very quick way of associating a brief description of the action they take.

A ToolTip is simply a small box with a yellow background containing generally 1 to 3 words of text which will pop-in next to and below the icon. Simply moving the cursor over the icon and hesitating for 1/2 second without any selection action (mouse click) will automatically expose the ToolTip for that icon. Move the mouse off the icon and the ToolTip will disappear.

After a few minutes of use of this simple, but innovative concept you will quickly realize how well the human brain integrates 1 or 2 small words of text and a color drawing into a temporary list of actions. Often this "local" use of your short time memory is not retained until the next day or even between processes, but is very easily restored to short term memory in just one minute of reassociation. Simply traverse the mouse along the toolbar stopping over each icon to reassociate its ToolTip description with the icon's appearance. In many ways it is one of the simplest, yet most useful, interface components recently introduced into "point and click" graphical user interfaces!

Text for all the ToolTips is contained in the **TNTMIPS.RES** file with the menu, button, and other similar text. ToolTip text can be converted to your language if you can currently translate your user interface using 1-byte character sets. A non-English user of the **TNT** products will get the greatest language change benefit from a translation of this ToolTip text so that the push-button icon and the text are associated immediately in your native language. A lot of the associative properties of this approach are lost if the English version of the ToolTips must be constantly, mentally translated to your native language, even for those very familiar with English as a second language. Please note that when translating the English text to your language, it is not necessary to preserve any equivalent or fixed

number of characters or glyphs as each ToolTip can be of any character length up to the width of your screen.

TNT Advisory Window. A new interface component is introduced in **V5.00** to help you make the transition to applying pyramiding to your Project Files. This new **TNT** Advisory window has a pink background to attract your attention and will pop into your view while you display any raster which has not been pyramided and if the display operation would benefit from it. It does not stop or delay the display in any way but will advise you that the raster might display faster if you first applied pyramiding to it.

TNT Advisory windows will appear in other processes in future releases where flexibility and multiple means are provided to accomplish a task, but where advice from MicroImages is appropriate to indicate that a more efficient procedure is available. Examples of other possible future uses of a **TNT** Advisory windows would be when it is detected in the repetitive use of a complex map layout that you are continually rotating a raster 90 degrees. Another example would be to indicate that a given process such as an image classification would be much faster if read from one hard drive and written to another.

You can control whether or not each individual Advisory window appears and at what frequency (e.g. once every 5 times you use that not-pyramided raster). Software agents and advisory subsystems which monitor your use of software, but over which you have complete control, are a concept which will become popular, especially in connection with the use of Internet.

Drop-down dialog boxes. The initial exposure of some dialog boxes will now begin to appear smaller and simpler. The modified dialog boxes will present the basic controls and fields most often used and also used by beginners. However, they will now also provide one or more toggle buttons for access to more complex controls. When such a button is selected, the bottom of the dialog box is immediately expanded to present this new, functionally related group of controls. If you push the toggle button again or complete the action, the added or extended box area and controls will be immediately closed and the dialog box will be made smaller. In general, these functions are similar to the "more" button in other Mac and **MSW3.1** applications.

The use of this concept is incorporated into **V5.00** in the new Group Controls dialog box which is described in more detail below. This revised Group Controls dialog box now looks much smaller and simpler in its new form, but shows buttons for the drop-down of 3 extensions.

This change in the user interface is in response to many requests to make the **TNT** user interface easier and faster to use for everyone as well as less intimidating and complex to beginning or part-time users. These requests had to be balanced off against those of you (including MicroImages) who keep asking for more and more features and complexity in every process. It also addresses the problem of the continuous gradual tendency for the growth of all dialog boxes relative to the limited size of the displays of currently available portables. This drop-down approach was first suggested as a compromise by a client two years ago at **AUW6** as although he was an advanced user, but was constantly dealing with other less experienced users.

*** Raster Pyramiding.**
Why was this added? The design and plans for the addition of the pyramiding to the Project File have been on the list of things to do for a couple of years. The need first became

apparent when someone wanted to use **DOS MIPS** to mosaic color scans of all the 1:1,000,000 maps of Saudi Arabia into a single raster object. While it would work and would fit, displaying a full view screen area would take hours. These kinds of project needs and demands lead to the design of the tiling, pyramiding, buffering, etc. in the **RVC** Project File's raster objects.

About a year ago these needs were reinforced when **TNTmips** users began to acquire and process the Russian Priroda monochrome satellite images in single raster objects as large as 400 megabytes. At that time it also became apparent that the future 1 to 4 meter resolution commercial imaging satellites scheduled for launch in 1995 to 1997 could generate some very large raster objects.

The final spur to add this new feature was the release of the San Francisco **TNTatlas**. The time to view the predesigned image steps in this **TNTatlas** is quite reasonable. However, the first time you attempted to view at some other image scale things ground to a crawl. This was known to be a limitation on the **TNTatlas** but it was released to finally get some larger sample data into your hands. It was also marked (as noted above) as the first thing to solve to increase the usefulness of a **TNTatlas** containing large images. Frankly, had MicroImages realized how useful this alteration would become in the general use of **TNTmips** it would have received a higher priority much earlier. But, better late than never!

What is it? The raster pyramiding concept has been added to the tiling structure in the **TNT** Project File (***.RVC**). This modification greatly speeds up all slower image displays in the **TNT** products on all platforms. The table below illustrates the remarkable speed increases which can be achieved by this feature. This benefit is not "free" as it does expand the size needed by a large raster object usually about 8%. However, with the cost of hard drive space plummeting monthly (currently US$0.35 per megabyte) this 8% loss is a very economical tradeoff since its use gives you back a great deal of your personal and computer time.

Conceptually pyramiding involves the automatic creation and management of subobjects called tiers (as in tiers of a pyramid) under each primary raster object.   Please do not call them layers as this word is already defined for other uses in the **TNT** products. Furthermore, it is hoped that the word tiers conveys the appropriate mental image of each one being successively smaller than the base or primary raster object.

The sampling intervals used to produce the pyramid tiers or subobjects are determined automatically by an algorithm designed to optimize performance for commonly performed **TNT** processes while minimizing the overhead in added disk space requirements. Each new tier is created by sampling and storing the previous tier or the original raster object if no tiers yet exist. The sampling interval is determined by examining the dimensions of the previous tier (or the raster object itself). If the sum of the number of lines and columns is less than 4096 and both dimensions are greater than 512 the next sampling interval will be 2 by 2. Otherwise the next sampling interval will be 4 by 4. Tiers are created until either dimension is less than 16 or when both dimensions are less than 128. Further sampling beyond that point is of no benefit due to the way raster objects are stored in the Project File and buffered during access. The reason for the variable sampling intervals is to minimize the time to display a "full view" of the raster object within windows ranging from 128 by 128 pixels up to 2048 by 2048 pixels which covers most currently available display systems.

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How does it help? In **V4.90** and previously, when you zoom out from 1X (toward full view) the display process had to sample the entire raster. Now the display process simply selects the appropriate tier to resample and display. For example, if you request a full view, which is very common, there will always be a tier available which is just somewhat larger and which can be very rapidly read, buffered, and resampled.

The management of the pyramid tiers is transparent to you. Any raster object you import will be automatically pyramided unless you shut this feature off. But, for the time being, you must make a deliberate effort to create the pyramids for any raster object which you created in **V4.90** on your system. And, the automatic pyramiding option has not yet been incorporated into all internal processes which can create a raster object, thus you will need to pyramid them as well so it is initially a display oriented feature. Eventually, all processes which can generate a new raster object will be adjusted to use, create, and manage a pyramided raster object. This will also add increased speed to some aspects of the application of these other processes.

The greatest increase in performance by pyramiding is with the biggest files and in a display situation which previously required the greatest resampling. For example, showing an entire SPOT image resampled to fit entirely in the current display window (i.e., the full view display of large color or monochrome raster objects). This is because these situations previously required the greatest amount of time to read and resample the large original raster object. However, the large relative improvement in such cases is also because the other situations such as 1:1 or full resolution displays were already very fast based upon tiling and other buffering schemes built into your Project Files over the past year.

Pyramiding does not discard the performance gains added via earlier changes in the Project File structure, but is integrated with them. Thus you end up with raster objects which are pyramided with each tier tiled using a tile size suitable for that tier. Then a sophisticated buffering scheme gets individual tiles (in most processes) from the most appropriate tier or horizontal or diagonal rows of tiles for processes which use the entire raster.

MicroImages does not claim to have invented any of the individual concepts now integrated into your Project Files. It is their careful blending and integration which continues to provide increased performance as raster sizes grow. Please also note that a variation on these schemes will eventually be added to Project File for vector, **CAD**, and **TIN** objects as they grow in size. It is one of MicroImages' often written technical claims that the data structures of an integrated **GIS**, **IPS**, **CAD**, ... , desktop mapping system is very important to its long term potential and continued usefulness. Since the early days of **MIPS** on 8086 and 8088 based desktop computers with 1 megabyte of memory and 20 megabyte hard drives MicroImages has spent a lot of time thinking about how to best manage these kinds of data structures for maximum performance.

How do I apply pyramiding? Raster objects which you import from other formats are automatically pyramided unless you turn the option off. An option to pyramid existing raster objects in a project file is located on the main menu at Prepare / Raster / Pyramid. It allows you to select the raster object(s), automatically performs the pyramid process and attaches the tiers as subobjects to the primary raster object.

It is important to note that the time required to pyramid an existing large raster object can be significantly less than attempting to display it a single time as full view! You will be alerted every time you display a raster object(s) which has not yet been pyramided and

which will take more than 10 seconds to display. This unobtrusive advice is supplied via the new **TNT** Advisory window described above in the section on Interface Changes.

What are the benefits? The following presents comparative display times for **PC**s using **486** and **586** processors and with rasters displayed from CD-ROM and from hard drives. The times listed do not include the time to load the 2D display process but only the time to perform the display described. All images used in these tests are those provided on the San Francisco **TNTatlas** prototype CD-ROM and were displayed from **CD** or hard drive as noted.

The test **486/50** machine used **MSW3.11**, 16 Mb of memory, a 1X speed CD-ROM, a 2 mb Smartdrive, and 700 by 700 pixel window size of 8-bit color.

The test **586/90** machine used **MSW3.11**, 16 Mb of memory, a 4X speed CD-ROM, 2 mb Smartdrive, and a 1 Gb fast hard drive, and 700 by 700 pixel window size of 8-bit color.

All times in the tables are in seconds preceded by the ratio of the display time required in the test display to that of the same display test on the **486/50** base or reference machine. Thus (**1.6X**) 5 indicates that the time to complete display was 5 seconds which is 1.6 times as fast as the 8 seconds for the same display on the **486/25** base machine.

Test Screen. Direct 1X view of SPOT image index on the San Francisco CD-ROM as 8-bit composite color from 413 by 622 pixel raster object.

SF CD on 486/50	Pyramid CD on 486/50	Pyramid HD on 486/50	SF CD on 586/90	Pyramid CD on 586/90	Pyramid HD on 586/90
(**1.0X**) 8	(**1.6X**) 5	not tested	(**4.0X**) 2	(**12X**) 1	(**12X**) 1

Test SPOT. SPOT grayscale image, 6000 by 6000 pixel raster object linked to a compressed, tiled TIFF file.

[test *S1*] 1X view of a small portion of the SPOT image.
[test *S2*] a full 100% view of the same SPOT image.
[test *S3*] a 2X zoom in from the full 100% view of the same SPOT image.

	SF CD on 486/50	Pyramid CD on 486/50	Pyramid HD on 486/50	SF CD on 586/90	Pyramid CD on 586/90	Pyramid HD on 586/90
[*S1*]	(**1.0X**) 20	(**.9X**) 21	(**1.7X**) 12	(**2.5X**) 8	(**2.5X**) 8	(**4.0X**) 5
[*S2*]	(**1.0X**) 1849	(**154X**) 12	(**308X**) 6	(**6.2X**) 300	(**616X**) 3	(**925X**) 2
[*S3*]	(**1.0X**) 15	(**1.1X**) 14	(**2.0X**) 7	(**3.8X**) 4	(**3.8X**) 4	(**7.5X**) 2

Test Airphoto. Color-Infrared airphoto via **RGB**, 3669 by 3681 pixels raster objects each linked as a compressed, tiled TIFF files.

[test *A1*] 1X view of a small portion of the image displayed from 3 separate raster objects in the compressed, linked **TIFF** raster.
[test *A2*] the 100% view of the same full view of the same image.
[test *A3*] a 2X zoom in from the full 100% view of the same image.

	SF CD on 486/50	Pyramid CD on 486/50	Pyramid HD on 486/50	SF CD on 586/90	Pyramid CD on 586/90	Pyramid HD on 586/90
[*A1*]	too long	not tested	29	1121	174	19
[*A2*]	too long	not tested	3	507	7	3

[*A3*] too long   not tested   5   482   13   4

    SF CD = directly from prototype San Francisco **TNTatlas** CD-ROM shipped with **V4.90**.

    Pyramid **CD** = prototype2 CD-ROM of San Francisco **TNTatlas** reprepared simply by pyramiding all raster objects from **SF CD**.

    Pyramid **HD** = same Project File as Pyramid **CD** but transferred from CD-ROM to the hard drive.

Conclusions. Many kinds of raster displays in 2D display, and subsequently in most other **TNT** processes, will now be interactive in nature requiring 3 to 10 seconds on **586/90** and **586/100** based **PC** desktop computers. **TNTmips** systems on workstations will no longer be significantly faster for display simply due to their higher computational power. Even on a **486/33 PC** machine, it will take <u>less than 40 seconds</u> to display <u>any portion</u> or all of any black and white or any **RGB** image of <u>any size</u>. This includes full size map scans or complete SPOT, Landsat TM, or 450 Mb Priroda images. This also includes displays made at any fractional zoom, rotation, and projection change.

The small remaining time to display most images in the **TNT** products is now directly controlled by the drive and bus access speeds of your computer platform. **TNT** products cannot display faster than your drive can be read and the data can be moved over the computer bus. Since the same hard drives are now being integrated into **PC**s, workstations, and Macs, the differentiating factor in raster displays in **TNT** products becomes the operating system's drive format and buffering, the type of drive controller used (**SCSI**, fast **SCSI**, **IDE**, etc.), and the bus transfer rates.

The advanced, unique **TNT** Project File data structure is not available in ERDAS, ERmapper, PCI, and other **IPS** systems. Thus, they are currently unable to come close to matching the display speeds in **V5.00** on any of the platforms they support. It should be possible for these vendors to add pyramiding as an optional feature for raster management. However, controlling which raster has pyramids and keeping track of where they are will be more difficult for their users due to the absence of the integrated Project File structure.

* 2D Viewing.

Even Faster Viewing. The display of rotated rasters (pyramided or not) has been improved in all processes through the use of all-integer computation for the affine resampling process. This improvement is most noticeable on pre-Pentium machines (e.g. **486** based) where floating-point computation is much slower than integer computation. In addition, the display time when the "Null cells transparent" option is used has been dramatically reduced. With these improvements, and the use of pyramiding, it is now possible to realize display performance gains on your **486** based portables to out perform a Pentium based machine using **V4.90**! As one **V5.00** beta tester comments below, if you are using a **486** based portable machine, using **V5.00** is equivalent to buying a new Pentium based portable or desktop computer.

Part of this display improvement is a new function based on all integer computation that replaces the floating point computations in the resampling used in the viewing of a raster(s) via the "affine" (i.e., via reprojection) mode. This significantly decreased the time to view rasters in these modes to approximately equal the third "none" view mode available in **V4.90**. This "none" mode allowed only integer zooms (... 1/4X, 1/2X, 1X, 2X, ...) and only an upright orientation of the raster(s) which caused confusion. Also, almost every view you

request uses some sort of resampling (fractional zoom = 1.27X, rotation, projection change, etc.). As a result the confusing "none" view mode has been moved to the Group Controls Window (see below) and all your complex displays are also significantly faster.

General Controls. A toolbar has been added in the View window which contains color icons for each option on the View menu. The "Draw", "Skip" and "Stop" icons were changed into color and moved onto the toolbar at the upper left.

A "Previous View" option has been added which will return to the previous position and zoom factor used after a zooming or panning operation.

A "Previous Zoom" option has been added which will return to the previously used zoom factor centered around the current location.

Groups can now be hidden using a new option. Like hidden layers, hidden groups still occupy space for positioning and attachment. They simply do not draw. This allows for more rapid viewing of the features within a group or with groups currently being altered. The hidden state of each group is recorded with the layout and therefore hidden groups will not print either. Note that when a group is "unhidden" it is not automatically drawn.

The reading of layouts having large numbers of groups and layers has been sped up. This was identified as a problem by users of the prototype San Francisco **TNTatlas**.

Object Selection. A "Quick-Add / Any..." option has been added which allows selection of any combination of raster, vector, **CAD** or **TIN** objects for adding as layers.

A "Quick-Add / Multi-Group..." option has been added which will automatically create a new "group" for each selected object layer. This allows rapid setup of "tiled" displays involving several objects (e.g. multi-band imagery).

Group Controls.
The Group Controls dialog will be automatically opened when the user double-clicks on a group in the list of groups.

The Group Controls dialog box has been extensively redesigned. It now presents a main panel with the most frequently used basic controls. Three additional drop down panels can be turned on and off from the main panel via toggle buttons. As explained above in the section on Interface Changes, these panels provide the more detailed controls in these 3 functionally related, optional, extended dialog boxes.

The most important new option on the Group Controls dialog box is the "Auto-Match" option. When set, this option will override the orientation, rotation and projection settings and will use the appropriate layer to control these settings. This will result in the object being displayed "upright" in its coordinate system, which will not necessarily put North or the Projection northing at the top. In the case of rasters, this is equivalent to the Options / Resampling / None selection formerly available.

Also available on the Group Controls dialog box is a field for specifying the rotation of the group. Using this field allows the group to be rotated to any desired angle. A button is provided to automatically set the angle so that the currently selected layer appears "upright" in its object's coordinate system. Note that the Auto-Match option must also be set to "None" to use this feature.

The Options / Resampling selection has been renamed to "Positional Accuracy". The "None" option has been removed as it is now controlled using the Auto-Match option on the Group Controls dialog as described above.

Shaded Relief. An option has been added to the Raster Display Controls dialog to turn relief shading on and off. Relief shading enhancement settings are now saved with layouts and automatically used by the printing process, allowing shaded-relief images to be printed.

When relief shading is performed on **RGBI** or **RGBB** color combinations of rasters, the shading is done using the fourth raster. This shading is used to "modify" the intensity computed from the **RGB** rasters, rather than replace it. This allows production of full-color shaded-relief displays. Also, with proper orientation of the position of the sun, it is possible to reduce some of the shading effects visible in most satellite imagery and airphotos.

Color Models. Additional multi-band raster combinations have been added. These are hue-intensity-saturation (**HIS**), hue-brightness-saturation (**HBS**), red-green-blue-intensity (**RGBI**), and red-green-blue-brightness (**RGBB**). The **HIS** and **HBS** color models allow direct display (and printing) of rasters representing hue, intensity / brightness, and saturation without first having to convert these rasters to **RGB**. In addition, contrast enhancement may be performed on the intensity / brightness and saturation components. The **RGBI** and **RGBB** modes allow substitution of a co-registered raster for the intensity / brightness.

The traditional use of these models is to use higher-resolution panchromatic imagery (e.g. SPOT) for the intensity with lower-resolution color imagery (e.g. **TM**) for the **RGB** components to produce a "synthetic resolution" color composite. An illustration of this application occurs in the illustration of the Buckingham Place grounds in the enclosed paper entitled Yesterday's spies. However, it is only fair to note that Ren Capes prepared this illustration with an earlier version of **TNTmips** which required the more tedious sequence of steps involving many raster-object-in and raster-object-out (**RIRO**) operations.

In the more direct **V5.00** implementation, all component rasters must still have the same dimensions and extents, so it is necessary to resample the lower resolution rasters to the same cell-size as the high-resolution raster. A future version will eliminate the need for this extra step. It will allow the direct fusion and viewing of any common area of images collected by different sensors with different cell sizes, map projections, scales, orientations, and so on.

* Profiles. It is now possible to display complex raster cell profiles in a Profile window. This feature is provided by the measurements tool. Profiles can be shown for multiple connected straight line segments, rectangles, circles, ellipses, and polygons. The resulting profile is displayed in the Profile window and you can select to display its Nth-order polynomial trend, first and second derivatives, semivariogram, autocorrelation, residuals, and grid lines. The following statistics can also be displayed: length, minimal, maximal, mean elevation, variance, standard deviation, corrected sum of squares, polynomial regression coefficients, goodness-of-fit, and multiple correlation coefficient. Multiple Profile windows may be opened each displaying a profile for the same feature but from several different raster objects (not being viewed). Each profile can also be saved as a 3D vector line in a vector object.

* Stereo Viewing *(a work in progress).*

A new stereo image viewing option allows the easy display, fusing, and movement of stereo pairs of images. It initially supports the use of mirror stereoscopes, "cross-eyed" stereo viewing, and the Cyberscope viewing device. It will allow fast stereo image alignment and "stereo locking" as it solves the epipolar corrections on the image pairs as they are displayed, zoomed, panned, and scrolled around. It was implemented in **V5.00** by adding to the functionality of the previously introduced geographic locking feature. In stereo viewing the stereo pair of images seem locked together as before but are also altered in relative geometry as you change your viewpoint.

Selecting tie points in **V5.00** is not yet a direct part of the direct stereo viewing process. Use the prospective projection step in the stereo to DEM process (Prepare / Raster / Stereo to DEM) to create tie points for the two raster objects. The File / Save ... option in the Correlation Point Selection window saves your tie point list as a subobject. When you select to stereo viewing this saved collection of tie points will be used and stereo fusion and display will proceed automatically. **V5.10** will provide a direct means within the stereo viewing process for selecting these tie points (but before stereo fusion is achieved by the relative geometry solutions).

Future Plans. Just the mention of high quality, low-cost stereo viewing and applications has generated a lot of interest and questions with the few clients to which it has been announced. Considerable additional software engineering effort will be expended in this area during the next and future quarters. Some of the next logical steps into this area for **V5.10** were outlined above including the support of a floating drawing device (such as a joy stick) and some initial 3D measurement tools. However, a significant advance in the stereo viewing of all your 3D objects (vectors, **CAD**, ...) is the next logical step. With this major addition for visualization planned for **V5.10**, most application features added in stereo (e.g. stereo "heads up" digitizing) in subsequent quarters will not be restricted merely to stereo images, after all the **TNT** products are supposed to integrate a variety of spatial data types.

Viewing Devices. MicroImages has been asked by many of you for help in determining how to obtain the low-cost Cyberscope used for stereo viewing (MicroImages has 1 unit). Descriptive material on this product has been shipped previously and an order form is enclosed again. Unfortunately all efforts to date to communicate with its manufacturer have failed. The phone number provided in their materials is answered with a recorder offering to take orders which are not being filled. Calls left at this number are not returned. The **FAX** number for international orders is disconnected. While this Cyberscope device works well for low cost stereo viewing, it appears to be manufactured by an individual who is not really interested in selling it.

To view in stereo it will be necessary for the time being for you to come up with some sort of temporary viewing device. MicroImages is seeking a source for a low-cost ($200 to $400) viewing device. The small pocket lens stereoscopes do not work well as the lenses are not needed and the lens separation is too small. Small mirror stereoscopes are very expensive unless you already happen to have one. While mirror stereoscopes work, they are clumsy as they are designed for vertical rather than horizontal use. Leica has a mirror stereoscope designed for use with monitors included with their stereoviewing and measurement package, but will not sell it separately.

Communication from clients with regard to the availability of suitable, inexpensive stereo viewers would be greatly appreciated. This certainly seems like an area in which someone could manufacture an inexpensive device for viewing monitor displays. The device would

require only 4 mirrors and a support mechanism. All zooms, movement, rotations, etc. will be computer generated and no lenses are required: only a sliding mechanism to adjust the spacing of the larger, outer mirrors for various monitor sizes.

The anaglyph or 2-color glasses method of viewing may be added to **V5.10** but is not particularly practical as a professional tool as it is limited to almost graytone stereo of only grayscale displays. However, it is a useful curiosity effect whereby MicroImages could supply a cardboard pair of glasses with every system. This would allow an immediate examination of a stereo image and the associated processes to determine if a more professional, full color viewing device should be purchased.

Edit Raster.

Edit raster has been modified to use color icons (New, Open, and Save).

TIN Formation.

A typical test run was completed with the process which computes a **TIN** object from a vector object. The computer was a **486/66** with 16 mb of memory. The vector object was read from, and the **TIN** object written to, the same internal hard drive. The vector object contained a contour map and generated a **TIN** object in 49 minutes containing 910204 edges, 606580 triangles, and 303695 nodes. About 20 minutes of the computation time was used in reading the vector object, computing the **TIN** structure, and writing the **TIN** object. The remaining 29 minutes was used to compute and record the standard attributes and database attributes.

* TIN: Important Point Extraction.

This process is available at Prepare / Convert / Raster to Vector / Extract Important Points and creates a vector object containing the important surface points in the raster object. This vector object may then be converted into a **TIN** object that efficiently portrays the surface of the area. The output of this process is a set of irregularly located 3D points or a regular 3D mesh. You can specify the number of point features to be extracted from input raster object such as local minimal and maxima, saddle points, and different types of extremes. Alternately you can specify the spacing of the mesh to be applied.

* TIN: Profile Analysis.

This process located at Interpret / **TIN** / Profiles allows you to interactively extract, display, and analyze a profile from a **TIN** object of a surface. Each profile can also be saved as a 3D vector line in a vector object. The resulting profile is displayed in the Profile window and you can select to display its Nth-order polynomial trend, first and second derivatives, semivariogram, autocorrelation, residuals, and grid lines. The following statistics can also be displayed: length, minimal, maximal, mean elevation, variance, standard deviation, corrected sum of squares, polynomial regression coefficients, goodness-of-fit, and multiple correlation coefficient.

SML.

A new, up-to-date <u>SML Language Reference</u> is included in the form of an Appendix for the 1992 **SML** Application note. During the writing of this reference list each **SML** function was tried and any defects corrected.

New **SML** functions added to **V5.00** are as follows. Their use is described in more detail in the new reference.

ResampleRasterToMatch ( ) resamples a raster to match the size and projections of another raster.

DeleteTempRaster ( ) deletes the temporary raster specified.

CloseRaster ( ) frees up a locked raster.

CreateHistogram ( ) creates a histogram for a raster object.

CreatePyramid ( ) creates a pyramided raster object.

PopupString ( ) opens a window and asks for a text string.

Import/Export of Rasters.

* Importing any foreign raster will now automatically create the pyramid subobjects for the resulting **RVC** raster object(s). Should you not wish to have the raster object(s) expanded the 8% by pyramiding an option is provided to omit it.

Rasters can now be imported from the **AVHRR** Bi-Weekly Composite Image, a CD-ROM containing a bi-weekly mosaic of the **AVHRR** continental United States.

When importing a **TIFF** file, if a ***.TFW** file exists in ARC/INFO "world" format and then you specify a projection, then georeference will now automatically be created for the imported rasters. This is especially useful for the CD-ROMs of color scans of topographic maps beginning to be distributed by the U.S. Geological Survey in the Digital Raster Graphics (**DRG**) format.

Surface Fitting.

In the profiles method the upper limit on the range has been removed. This allows the profiles to extend over an arbitrarily large extent which can occur for widely-spaced contours.

In the "minimum curvature" method a control parameter has been added which allows the specification of a user-defined variation from the original data values. Allowing a small variation does not force the resulting surface to pass through the original data values. This produces a much smoother surface from contour data. The effect is most noticeable when relief shading is performed on the output surface.

* Raster Morphology.

A new **RIRO** process containing a selection of raster morphology operations has been added at Interpret / Raster / Morphological Functions. Some preliminary documentation for the operation of this process has been provided in printed form.

The following operations are provided for manipulating shapes in a binary raster object. A shape is any area of 1s or 0s in the binary raster whose cells contact up, down, left, right, or diagonally.

• Dilation: expands the boundary of all shapes in the raster object.

• Erosion: contracts the boundary of all shapes in the raster object.

• Opening: smoothes the shape of all contours, breaks across narrow isthmuses, and eliminates small islands and sharp peaks.

• Closing: smoothes the shape of all contours, fuses narrow breaks and long thin gulfs, and eliminates small holes.

• Region filling: fills a hole in a single shape when provided with a cell within that hole.

• Connected components: eliminates all other shapes except that shape identified by a single cell within that shape.

The functions which have been provided for use on grayscale rasters include:

• Dilation: has the effect of increasing the overall intensity of the image while increasing the size of the higher intensity (higher value) shapes.

• Erosion: has the effect of decreasing the overall intensity of the image and increasing the size of the lower intensity (lower value) shapes.

• Opening: removes small, high intensity (higher value) shapes while leaving lower intensity shapes undisturbed.

• Closing: removes small, low intensity (lower value) shapes while leaving higher intensity shapes undisturbed.

These morphological functions have subsequently been added to the **SML** process for **V5.10** and can be requested now from technical support.

A detailed source of information on these and other morphological functions is: Digital Image Processing. by Rafael C. Gonzalez and Richard E. Woods. 1992. Addison-Wesley Publishing Co. 716 pages.

Filtering Rasters.

A binary mask can now be used to select the areas of a raster to which a filter is applied.

* A color filter may now be more readily applied to **RGB** raster objects constituting a color image. This color filter was previously available in **DOS MIPS** and was commonly called the color crispy filter. It automatically converts the **RGB** raster object to hue, intensity, and saturation (**HIS**). It next applies the filter you have selected (usually an edge enhancing filter) to this intensity or grayscale component and uses the result as a new intensity raster which is automatically used in the inverse conversion back from HIS to the original **RGB** image. The net result is a color image in which features have been sharpened to produce an apparent increase in resolution without a change in the image's colors. This same process could have been completed in **V4.90** through a longer series of **RIRO** (raster-object-in and raster-object-out) operations. This new implementation in the filter process makes it much simpler to achieve this useful enhancement.

Feature Mapping.

The feature mapping process has been modified to add the toolbar and the push-button color icons to provide easy access to the view and action options. This significantly reduces the need to use the menu when switching between actions (formerly referred to as "tools"). Icons for viewing at 2X and 3X zoom have been added to allow rapid zooming so that individual raster cells are visible and more easily selected.

Feature mapping will now also automatically generate new distinct colors for new feature and category classes.

Classification.

* The **ISOCLAS** unsupervised classification process has been revised and reintroduced. This process now supports the use of all numeric types of raster objects (8-, 16-, 32-, 64-bit integer and floating point).

* DEM/Ortho.

This process is being totally rewritten to improve it into a 2nd generation approach. The objectives of this rewrite are to improve accuracy and speed and add additional interactive interface features. For **V5.00,** a revised function for the determination of the relative

orientation of the stereo pair has been integrated into the process yielding an improved solution for the epipolar geometry of the stereo model. The results of this improvement are illustrated in the images on the attached page and supplemental description. A somewhat modified, fast approximation version of this same function was incorporated into the new stereo viewing process discussed earlier to provide and maintain stereo fusion in the viewing of a "raw" stereo image pair.

These new developments have, and will continue to parallel the objectives of the stereo viewing process outlined above. For example, the stereo viewing process will eventually be introduced into this DEM/Ortho process to provide a basis for easier selection of tie and control points (to make sure to include mountain peaks), moving and editing tie points (identifying points which fall on trees), drawing drainage and other edge or break features, identifying and drawing in lakes and other special conditions, and so on.

The inverse of the joint development of these processes will be that the **DEM** and Orthoimage raster objects are one kind of input into a new, integrated, stereo and 3D viewing process planned for **V5.10**. It will compute and display a pair of pseudo-ortho images from the **DEM** and ortho raster objects. These images will only differ from the original ortho-image by the addition of left and right horizontal parallax to induce stereo. This ortho-stereo image can be rapidly generated so that scrolling, zooming, and other conditions of interactive stereo viewing will be supported. Simple 3D measurement tools controlled by the mouse or a separate joystick will then be added to support drawing a 3D surface feature and computing its 3D properties (e.g. surface and projected area of a crop field on a steep slope, length of a drainage, etc.). Subsequently these added features will lead to "heads-up" digitizing of stereo images, 3D editing of other object types, and other synergistic applications.

User Interface. The camera parameters interface in the Orientation Parameters window was confusing and has been redesigned. You can now specify the units in which you wish to enter calibrated focal length of the camera (inches or millimeters). Similarly the film scanner resolution can be designated in dots-per-inch or dots-per-millimeter. The requirement that both these parameters be entered in the same units has been eliminated and values can be expressed in mixed units (such as focal length in millimeters and scanner resolution in dots-per-inch).

The Correlation Point Selection window now contains all of the standard display tools and icons described earlier. In particular, an Enhance menu has been added so that you can select or design separate display contrasts for the left and right objects.

The Prospective Projection process in **V4.90** allowed the selection of any subarea of the stereo overlap area for test processing as long as the selected area contained at least four ground points from your georeferencing of the objects. However, confusion arose because it was not easy to use the selection box to inscribe a small area which contained at least the minimum 4 ground control points. You can now insure this requirement is met as the Correlation Point Selection window displays the location of all the ground control points which you provided. Tie points are represented by the "+" symbol and ground control points are represented by the "+" symbol inscribed with a box. Elimination of the requirement for four ground control points to occur in the test window will be implemented in **V5.10**.

Relative Orientation. This process rotates and resizes both of the original stereo images to produce a new left and right pair that have the same cell size and orientation. **V4.90**

produced inaccurate results in some portions of images. This subprocess has been completely rewritten to increase its speed and accuracy.

Remember that a good relative orientation result depends on your accurate placement of correlated tie points in the stereo image pair. To assist you in this activity an Evaluate selection is now available on the File menu that computes the relative orientation solution for the current set of tie points and identifies pairs of points that do not fit well in the solution. These results are shown in a new Statistics window that contains a scrolling list of all tie points, highlighting candidates for removal. You can adjust the statistical selection threshold to identify more or fewer unsuitable pairs and you can manually select, deselect, remove, recompute, and save the revised pairs based on your inspection of the list.

Autocorrelation. This portion of the process is generally unchanged from **V4.90**. One minor modification incorporated now tests for, and eliminates areas with insufficient information for any correlation (large shadow areas) and makes substitutes and an approximation of the surface for these areas. This eliminates major artificial "hills and pits".

The sampling was changed to enable it to run the defective 8 by 8 sample situation. More important than simply correcting this defect, sampling produces good results for 2 by 2 and 4 by 4 sampling which markedly speeds up the preparation of a suitable DEM.

A total rewrite of this autocorrelation subsection is underway for release in **V5.10** with the objective of eliminating more of the smaller residual "posts and holes" effect of poor local cell correlation due to shadows of bushes, absence of distinct features, and so on. The rewrite may speed up this process and will allow the subsequent incorporation of additional features such as observing drainage breaklines, lake surfaces, and so on.

Fill Pattern Editor

The color bitmap fill pattern editor (now alias the "icon editor") has additional features. This editor is used by MicroImages to create the various icons used in **V5.00**. The pattern being created can now be shifted up, down, left, and right within the larger size limits of a fill pattern. The pattern can be inverted or flipped horizontally and rotated 90 degrees left or right. The view can also be restored to a 1X zoom level.

Style Editor.

The deletion of symbols, line, and bitmap fill patterns in the style editor is now supported.

Import/Export of Vectors.

The multi-file selection and processing capability has been added for imports from the Intergraph ***.SIF** format.

An option was added to the import process which creates vector objects from the ARC/INFO Export (***.E00**) files to allow attachment of attributes either by "internal" **ID** or "user" **ID**. MicroImages has recently encountered some **E00** files that are designed for attribute attachment by user **ID**. In addition, this revised import process will automatically choose the best method for attachment in case of a conflict. The "internal **ID**" and "user **ID**" of the **E00** files are now imported as attributes.

The default extension of the defect log file for the import processes has been changed from ***.TXT** to ***.ERR** to avoid confusion with normal text files.

Map and Poster Layout.

Improved Speed. As in the past, for maximum speed, you are advised to make sure all your raster(s) are rotated so as to orient their lines in the general direction of the final print lines.

This process is memory limited on small machines where buffering a complete row of the image tiles (not single image lines) has been most efficient. Making large raster rotations during the computation of a print file will work but will slow the process. This may be a minor inconvenience if the final print raster is only prepared once. However, where repeated test printing is common in complex image map designs, total time to finish will be improved by providing proper orientation.

For those who find these raster preparation steps inconvenient, a new diagonal tile buffer scheme has been added to **V5.00**. It buffers all the tiles in a straight row or in a diagonal row if the image lines are not parallel to the lines of data in the print file. The worst case is a 45 degree line where the buffer size will increase to 141% of the former implementation. This additional memory is often available for reasonably sized prints and will increase speed of the production of these kinds of print files.

Improved Line Dithering. You can now select better dither patterns to be used when printing (not plotting) features in non-raster objects from the Page Setup dialog even if rasters are involved. In other words, you may now select a separate dither pattern for your line work and your rasters. This significantly improves the appearance of plotting via the printing process in place of direct plotting in limited pen colors. The error diffusion dither patterns are not provided in this option as these dither algorithms do not work well for predominantly linear features (no place to "diffuse" to without smearing lines).

Shaded Relief. Raster layers displayed with relief shading can be directly printed as part of a layout. Previously this was accomplished by creating a relief shaded raster object with the **RIRO** (raster-object-in and raster-object-out) process and then using the new raster object in the layout. This added feature makes it much easier to use shaded relief as a background image and control its appearance (e.g., changing the shade properties from test to test).

Scale Legends. Color scale legends can now be designed and generated for a grayscale or color-coded raster portion of an image map. This style of legend is often placed next to a color-coded map of thermal images, a gravimetric or magnetic map, a sea state, etc. A sample color print prepared on the **HP 1200C** is attached to illustrate this new legend feature and its variations.

Cell Value Legends. Legends corresponding to specific combinations of cell values can now be designed and generated for a feature oriented raster portion of an image map. This style of legend is often placed next to a feature map or a classification map. Previously you have been forced to "hand-make" such legends. The same attached color print illustrates this new legend feature and its variations.

* Object Editing *(a work in progress).*
The new object editor is released in **V5.00** in partially complete form. This new process will be complete in **V5.10**. It is a total and complete rewrite and extension of the concepts in the previous edit vector and edit **CAD** processes. These earlier editors will also continue to remain a part of **TNTmips** for the indefinite future until no longer useful. However, new features will not be added to them and it is becoming progressively more difficult to fix any defects identified.

The partially complete object editor is being provided with **V5.00** to demonstrate its status and that it is now a priority effort. Please experiment with it and provide feedback into its design as it will eventually provide for your data creation and editing needs as well as many

new interactive **GIS** functions. During this quarter, you may request interim versions (say monthly) of this new function to use "at-your-own" risk if you are actively testing and providing feedback into its design. At the present time there is no on-line documentation for this process as it is still rapidly changing from day-to-day. The following sections summarize what is totally new (not in edit vector and edit **CAD**) as well as the major components of the previous editors which are still missing.

New Features. Vector topology is now internally validated and no longer requires saving and reloading the vector object.

Multiple vector objects and associated database tables can now be selected, displayed, and edited in the same window in a single session and view.   In the finished form you will be able to select, view, and edit vector, **CAD**, **TIN**, and database tables in a single session.

Automatic removal of overshoots is provided when adding new lines.

Automatic snapping is provided for closing undershoots when drawing lines or for lines selected by any other method such as via the mouse, all within a polygon, by query, and so on. Lines can be snapped to nodes, points, and lines. Three closing modes are provided: add-a-vertex, move-a-vertex, or extend-a-vertex.

The add-a-vertex mode adds a new line segment to the end of the dangling line which is perpendicular to the crossing line. The new vertex is on the crossing line.

The move-a-vertex mode moves the last vertex in the dangling line into the crossing line. This last or dangling vertex is moved by the shortest distance to the crossing line (i.e. along the perpendicular from its original position to the crossing line). Thus, the orientation of the last line segment in the dangling line is changed.

The extend-a-vertex mode also moves the last vertex in the dangling line into the crossing line. However the orientation of the last or dangling line segment is not changed and it is merely lengthened.

All these line snapping modes will change the last or new vertex into a node if the object being edited is a vector object and lines are selected for snapping. If you select to snap only to nodes then the last vertex will be snapped to the nearest node and the entend-a-vertex mode is not allowed.

The many segments of a jagged line can be reduced to a single line segment between two nodes without any intermediate vertices. The collection of lines can be selected by any of the many selection tools available such as via the mouse, all within a polygon, by query, and so on. Since the nodes will not be changed, the topology is preserved.

Lines can now be thinned between nodes using functions similar to those described in the following section on the new vector filter process such as the minimum distance or minimum ratio techniques. The lines to be thinned can be designated by any one of the many selection procedures such as via the mouse, all within a polygon, by query, and so on. Since the nodes will not be changed, the topology is preserved.

For the element selected you may now view the extent, number of vertices, number of islands in polygons, label type (e.g. a query, text, ...), and so on. These are shown in the Single Element Selection window via the "raw data" button

The measurement tools in the display process in **V5.00** are now available for use with any layer in this process via the measurement icon.

<u>Missing Features.</u>   The major <u>earlier</u> features missing from the new object editor in **V5.00** include **X-Y** digitizer set-up and support and interactive line following. Also **CAD** objects cannot yet be edited.

<u>Vector Merge.</u>

* This process now gives you greater control over how you wish to join database tables. Joined tables usually result in saving space and processing overhead, and make any subsequent operations on the tables easier, especially querying. As before, you can simply copy each table over to the new merged vector. But now you can elect to join the tables. The table fields presently have to be alike in every respect; field name, field order, and field type to be eligible for a join. Joining options include: remove excess records when joining, join tables regardless of table names, or when names are not the same.

<u>* **Vector Filtering**</u> *(a work in progress).*

The management of the accuracy and integrity of your topological vector objects requires an expanding suite of tools and processes. These include gradually improved editing, filtering, copying, merging, and related functions. A new vector-object-in and vector-object-out (**VIVO**) filter process is released in **V5.00** to assist you in this activity. Its objectives are similar to a parallel filter process in ARC/INFO but several additional filters remain to be added in **V5.10**, especially one to handle undershoots.

As an interactive system, MicroImages differs by offering 2 distinct approaches: this new **VIVO** filter approach and the alternate interactive location, inspection, and correction of each artifact. The interactive approach is the "pan-by-query" approach first introduced into the vector editor of **MIPS** where each possible artifact is automatically panned to and displayed for manual correction if desired. It is important to understand the basis for the selection of one versus the other of these correction procedures.

The application of vector filtering in a **VIVO** fashion to automatically correct hundreds or even thousands of defects in a vector object will never be foolproof. Such an approach can commit defects of omission (to miss a digitizing spur) and commission (to delete a cul-de-sac road). If the **VIVO** filtering process can eliminate thousands of spurs resulting from digitizing with very low probable defects of commission and omission it may be very suitable for your particular application. For example, most natural resource applications of **GIS** do not require 100% accuracy in the vector features. After all, many boundaries and linear features are photointerpreted judgments in the first place. However, if your vector object is to be used in connection with an application for routing a fire truck to a burning house, then any defects of commission and omission such as accidentally deleting a very short cul-de-sac road cannot be tolerated.

Many **GIS** applications require highly accurate vector objects and should only be subjected to this new **VIVO** filtering with great care.   Those developing such objects should give careful consideration to using the parallel interactive filtering processes such as pan-by-query being added into the new object editor. This interactive location and inspection of each artifact forces you or your technicians to view each and determine if it should be released for automatic correction by the **TNT** process, corrected manually by the editor, or skipped as a correct condition (therefore avoiding a defect of commission). Defects of omission can-not be detected by this approach. For example, a cul-de-sac road which was not digitized will obviously not be detected or more realistically, a cul-de-sac road which has been digitized but does not have its attributes attached correctly. Such defects of omission

require other kinds of filters such as identifying them during the attachment of street addresses or other attributes to the missing cul-de-sac road.

Thus, in applying vector filters in the **VIVO** or the interactive approach you are playing a probability game. The **VIVO** approach requires careful inspection and knowledge of the contents and condition of each vector object to which it applies. This knowledge can then be coupled with a careful selection of the filter parameters to minimize the possible defects of commission and omission. Only then should the **VIVO** process be applied in which this **TNT** process takes over completely to do <u>exactly</u> what you told it to do.

Even when you intend to use the **VIVO** approach, you can study its effects and results by testing the same filter in the interactive approach to be provided in the object editor for **V5.10**. MicroImages has also recognized the need for, and begun the addition of, a series of interactive inspection tools to display the properties of vector objects. These are analogous to the histogram, data translation, and other inspection tools needed to support the use and maintenance of raster objects. For example, the important parameter defining a digitizing spur is its maximum length. Thus inspecting a histogram display of the lengths of all "dangling lines" in a vector object might help you select the proper measurement to separate spurs from real dead end roads.

The new vector filter process will assist you in filtering out or correcting unwanted vector artifacts from a vector object. Initially three types of filters are available: line thinning, sliver polygon removal, dangling line removal. Unfortunately the filter for detecting and optionally fixing undershoots was not ready for release in **V5.00** but is nearly complete. Future filters may include: line thickening (densification of vertices), reversing line points, checking attributes, and others.

Each available filter and corrective action can be applied to a vector object and the results can be immediately seen in a display window for testing purposes. You can then create a new filtered object, if desired.

<u>Dangling Lines.</u> The dangling line or spur filter removes lines that "overshoot", or lines that are not attached to anything, and that are less than a user-defined distance.

<u>Sliver Polygons.</u> The sliver polygon filter is used to locate and remove unwanted polygons that are too small or insignificant. You can remove all polygons less than a given surface area or by a "shape factor" such as thinness. The creation of sliver polygons is quite common, sometimes many of them, when you have merged vector objects which have some similar polygon edges. For example, a soil map, a geological map, and a vegetation map may contain some nearly coincidental polygon edges. Alternately, extensive data sets exist in which a single vector object and theme preserves hundreds to thousands of small slender polygons which delimited the wildlife habitat in the long narrow strips between the road and the cultivated field. Defining what is, and what is not a sliver polygon, may be a delicate decision for you and MicroImages. Designing additional automated procedures which help you define, select, and correct these conditions requires continuing research.

<u>Line Thinning.</u> New line thinning filters are provided to reduce the density of vertices defining a vector line. Line thinning can significantly reduce the size of the vector object and the time required to use it in many processes, for example during display. Three different methods of line thinning are available: Douglas-Peucker, Minimum Distance, Minimum Ratio. Other algorithms for line thinning can be added as you or MicroImages identifies the need for them. In suggesting new line thinning procedures, please make sure that the request is

accompanied by a paper containing an explanation and the equations used. Also please remember that a particular line thinning approach may seem easy in concept, but may not be useful at all where vector topology must be rigorously maintained. For example, some curve fitting approaches may not apply at all because they throw the revised edge of a polygon irreconcilably across the topological requirements of other elements also being thinned or otherwise altered.

Buffer Zones.

A new feature has been added to buffer zones to separate them by attributes. It is now possible to create separate buffer zones for each key field in a database table. This feature is analogous to creating a buffer zone for each key field and then merging all the buffer zones together.

Thai Localization.

The modifications for the use of the Thai language to show in labels and for creating maps in Thai have been completed and tested in Thailand by our Representative, Earth Intelligence Technologies. The initial release of this support is restricted to the PCs using **MSW3.1**.

A sample map annotated in Thai is attached to illustrate this result. Please note that this map was printed on the Canon **BJC-4000**, one of the lowest priced color printers available. While this is one of the slowest and least sophisticated color printers available, the tiny red type rendered without Postscript, is marginally readable. The appearance of this small type and the shape of all characters in all languages will be improved by the pending release of TrueType support in the **TNT** products discussed below.

Each of these sample Thai maps took 11 minutes to print on this Canon printer. The map which results can be compared to the similar map (but with English annotations) which was included with the MicroImages MEMO shipped with **V4.90** and dated 20 January 1995. The earlier sample map, printed on an **HP 1200C** without Postscript required 2 minutes to print. Clearly the **HP** print is superior in quality but the Canon print is acceptable if time to print is unimportant.

Japanese and Chinese Localization.

The modifications for the use of the Japanese and Chinese languages to show labels and for creating maps in Japanese and Chinese have been completed. The initial release of this support is restricted to **PC**s using **MSW3.1**.

TrueType.

The core of the new rendering function which directly uses TrueType has been completed including a new variable font cache buffering scheme to efficiently deal with larger, 2-byte fonts. Good quality glyphs are now being drawn by this function. A new variable memory caching scheme for large Japanese, Chinese, and Korean fonts based on "most frequently used characters" has been added to this new function. Remaining to be added are the functions for hinting, which is a complex process by which a character is adjusted in appearance when it must be rendered in a small number of pixels (e.g., using tiny characters in a low screen resolution mode); kerning; and some other technical details. However, since the basic rendering function is complete, it is anticipated that TrueType fonts and rendering will be used in **V5.10** on all platforms in parallel with the use of the existing ***.OF** fonts and their rendering engine.

New Image Printers/Plotters Supported

Canon **BJC-4000**.

Support for this new, very low-cost color printer is available in **V5.00** under printer level **P3**. This printer supports page sizes of 8.5 by 11", U.S. legal, and **A4**. It sells for less than $400 in the stores in Lincoln. The resolution provided is 360 dpi for color and 360 by 720 dpi for the black and white in "smoothing mode" for text only. As noted above, the attached map annotated in Thai was printed on this Canon printer and required 11 minutes to print each individual page.

Xerox 4700 II Printer.

This Postscript printer has been supported at the **TNT** product level of **P8**. The printer supports 300 dpi color printing at page sizes up to 11 by 17". It is as large as a desktop photocopier. MicroImages cannot comment on its printing speed or quality as the printer was not directly tested but supported by modifications to Postscript.

New Scanners Supported

The Altek alias Vidar truScan 800 large format grayscale scanner has been supported for Microsoft Windows and Sun Solaris 2.x. This scanner has direct optical resolutions of 75, 100, 150, 200, 300, and 400 dpi. The maximum width for the material to be scanned is 36" and the length can be 72". Direct support and use of this scanner from within **TNTmips** requires **TNT** product **S15**.

Howtek has officially released the Scanmaster 2500 as a replacement for the discontinued Scanmaster III+. A copy of a brochure is enclosed for this new scanner showing its price and technical characteristics. MicroImages will try to obtain and support this scanner for **V5.10**. Frankly, its advanced features and resulting price leave a big gap in the market place that the Scanmaster III+ previously occupied and this is the need for a 11 by 17" scanner with transparency back selling at about $6000 dollars!

International Travel

Over the past several years MicroImages has limited both the domestic and international business travel of its staff members so as not to interfere with the management of the conversion from **DOS MIPS** to **TNTmips**. Since this conversion is complete, it is now feasible for MicroImages staff to conduct such travels for meeting and to provide assistance in system design, consultation, training, and related activities.

Steve Sizer, manager of the technical support team, had the pleasure of spending more than two weeks in Jakarta, Indonesia providing intermediate level training to the staff of Citradata and several of their clients.

Exclusive International Representatives

Papua New Guinea.

MicroImages' products will now be exclusively available in Papau New Guinea (**PNG**) from Geo Mapping Technologies (**GMT**); 6 Nyora St.; Everton Hills; Brisbane; Queensland 4053; Australia; voice (617)353-0533; **FAX** (617)353-0534 and ask for the Director: David Moore. The principal objective of **GMT** is to apply **GIS** and remote sensing technologies to geological and environmental projects. **GMT** will open a project office in Port Moresby, **PNG** in May and the first **TNTmips** system has been installed in **PNG** at an oil palm

research laboratory. **GMT** was established in 1994 and has been using **TNTmips** since that time as a client working closely with Technical Solutions, MicroImages' Representative for Queensland. The staff of **GMT** have their professional and academic experience in geography, ecology, geology, and geophysics in addition to their technical skills in computers, **GIS**, and remote sensing.

NAFTA Resellers and VARs

Helena, Montana.

Integrated Geoscience and Engineering (**IG&E**) is now a **NAFTA** reseller of the **TNT** products.   **IG&E** can be reached at 2969 Airport Road, Helena, MT 59601; voice (406)443-0766; **FAX** (406)443-5628; ask for Stuart Blundell.   Stuart, a long time MicroImages' client, has created this new environmental and geoscience consulting firm to provide desktop GIS and spatial database management services using the **TNT** family of products.   Stuart has degrees in Geophysical Engineering and Geology and was the recipient of a research grant by the Jet Propulsion Laboratory in 1987-88 for work in basin analysis studies in Wyoming. It was during this project at the University of Wyoming in 1988 that Stuart first began working with **DOS MIPS**. After graduation from Wyoming, Stuart spent four years working for British Petroleum in Alaska doing 3-D seismic interpretation and geophysical modeling before returning to Big Sky country to work in contaminant hydrology.

Omaha, Nebraska.

GEOMAX, Inc. is now a **NAFTA** reseller of the **TNT** products. **GEOMAX** can be reached at 1010 Douglas-on-the-Mall, Omaha, NE 68102; voice (402)341-4599; **FAX** (402)341-8375; ask for Dr. Tomas Murauskas. Tom will be immediately recognized by many as a former writer for MicroImages Press for the past two years and will still pursue such activities part-time under contract. Tom's previous experience has been primarily in teaching geography in the academic world. **GEOMAX** has been organized by Tom to provide consulting and services in the use of integrated **GIS**, image processing, electronic mapping, and related projects.

Sunnyvale, California.

Geo-Digi-Graphics, Inc. is now a reseller source of MicroImages' products as an adjunct to Paris and Associates in Fresno. **GDG** can be reached at 1095 East Duane Ave., Suite 212, Sunnyvale, CA 94086; voice (408)481-9903; **FAX** (408)481-9907. This new firm has just been organized by Dr. Richard Ellefsen, a Professor of Geography at San Jose State University and Dr. Jack Liu, Electrical Engineer and long-time MicroImages client. Richard and Jack were the author of the study which employed **DOS MIPS** and yielded the paper on Urban Terrain Zone Based **GIS** for **MOUT** (Military Application of a Geographic Information System) referenced in the MicroImages MEMO dated 20 January 1995. The objective of their new company is to conduct research, development, consulting, and service contracting in the analysis of urban processes.

Former Resellers.

During the past quarter the following **NAFTA** resellers have been disenfranchised. All clients previously dealing with these resellers for sales or service for the **TNT** products should now contact MicroImages or one of the other **NAFTA** resellers.

• Prime\Ware Associates in Philadelphia.

- COMP-TRON in Baltimore and all of their adjunct offices.
- INFOPLAN Technologies in Dorval (Montreal).
- Advanced Programming Concepts in Austin.
- John Day in Santa Barbara.

MicroImages wishes to thank each of these firms and the individuals involved for the assistance they have provided in the promotion and sale of our products. Since you all have **TNTmips** products, you remain as our valued clients and will receive the same support and service as all other clients.

Why these Changes?

During the previous quarter, several International Representatives were disenfranchised as distributors of MicroImages' products. During this quarter these adjustments were made in the **NAFTA** distribution channels. It is possible that additional adjustments in the marketing and distribution of the MicroImages products will be required.

The several criteria upon which these changes were made have been communicated to the effected companies as well as all other Resellers and Representatives. However, it is clear to all involved, including clients, that the combined activities of **GIS**, **IPS**, **CAD**, desktop mapping, and related are rapidly evolving with the introduction of inexpensive desktop software products, very inexpensive fully assembled powerful desktop computers, wider general knowledge of the use and application of these combined technologies, and so on. In fact, the word **GIS** is no longer an appropriate description of the multifaceted activity in these newly integrated technologies.

It is not possible to exist as a provider in this rapidly integrating desktop mapping technology area by acting only as a system integrator deriving primary income from combining hardware, software, and training. Even those who provide data preparation services (both businesses and government centers) are no longer protected by the cost, complexity, and mystique of their Intergraph and ARC/INFO systems which require teams of experts to operate them. Products such as **TNTmips**, and others have made it possible to walk into the nearest discount store and cheaply buy a powerful computer and immediately begin to prepare your own data and results. Thus individuals, businesses, governmental agencies, and others increasingly prepare their own data or contract this out to those who can prepare it on small systems at lower prices. Clearly, the use of these desktop mapping technologies is on the threshold of a major shift which will mandate adjustments on the part of all of us, businesses and clients alike. Those who do not anticipate, recognize, and find a mechanism for coping with these changes will not survive this transition.

Staff Additions

No new staff members joined MicroImages during this quarter. It is anticipated the "new hires" during this next quarter will be a scientific writer and a new advertising, design, and promotional specialist.

Promo Materials

TNTview.

You will find enclosed a new **TNTview** product brochure. It is quite similar in layout and content to the previous brochure except for the cover.

TNTdemo.

You will find enclosed a new **TNTdemo** product brochure. It is quite similar in layout and content to the previous brochure except for the cover and some minor changes in the terms and order form.

A revised version of the **TNTsdk** brochure is at the printers now. The revised versions of the **TNTatlas** and the **TNT** products Price and Reference Folder (formerly the green cover item) are complete except for minor details in cover illustrations and printing. All these materials will be shipped later during this quarter.

AUW7

AUW7 was acclaimed by many who attended as the best workshop to date where clients representing many application interests and the MicroImages staff "put our heads together" to design a better 1995 product. Attendees from as far away as New Zealand, South Africa, Chile, Russia, and elsewhere ensured that the varied ideas and problems of the far corners of the earth were represented. As advertised, a significant portion of this workshop dealt with integrating new ideas from various disciplines and viewpoints with a review of the current and planned features and capabilities to design a truly new generation system for spatial data preparation, management, analysis, and visualization.

Inputs at **AUW7** and other means now point the way toward the need for even closer amalgamation of **GIS**, image processing, remote sensing image collection, **GPS**, desktop mapping, desktop map production, databases, statistical analysis, spreadsheet analysis, and so on. Unfortunately, the word **GIS** no longer has the scope to describe what you now imagine doing and want MicroImages to supply in the next year or two. Ignoring for the moment that **GIS** has somehow become analogous with ARC/INFO, the English language just does not seem to have a word with the scope to describe what we are now all involved in and one may have to be made up. Perhaps **TNTmips** best describes it for the moment.

Digital Chart of the World

An enclosed MicroImages MEMO entitled **DCW** Available in **RVC** Format (15 March 1995) describes how to obtain this data set directly from MicroImages since it is no longer available from its original sources. The U.S. **CIA** does not seem to be very effective in anticipating demand for its "products".

Computers

Pentiums. The following are typical prices for the Gateway 2000 Pentium computers currently used and recommended by MicroImages. The first review of the newest Pentium lines are out and as usual, can be found in **PC** Magazine as follows.

120-MHz Pentiums: Speed First, Ask About P6 Later. Presents the results of the first benchmark tests of the Gateway, Dell, and several other of the first 120MHz Pentiums. No author. in PC Magazine dated 25 April 1995, pages 37-40.

Typical systems from MicroImages' neighbor to the north, Gateway 2000, are as follows.

most economical P5-100 ($3160)   **more powerful P5-120** ($6000)

Intel 100 MHz Pentium   Intel 120MHz Pentium
16 Mb **RAM**   16 Mb **RAM**
256 Kb Cache   256 Kb Cache

1 Gb 10 ms **IDE** Hard Drive	1.6 Gb Hard Drive
PCI Enhanced **IDE** Interface	2 **PCI** and 4 **ISA** slots
17" Vivitron Color Monitor (Trinitron)	19" Vivitron Color Monitor (Trinitron)
64-bit **PCI** Graphics w/ 2 Mb **DRAM**	64-bit **PCI** Graphics w/ 4 mb **VRAM**
Quad-Speed CD-ROM	3-disk changer w/ quad-speed **CD**
3.5" diskette drive	3.5" diskette drive
7-bay desktop case	Tower case
Keyboard and **MS** mouse	Keyboard and **MS** mouse
WFW3.11 and other software	16-bit sound board and speakers
	28.8 Kbps fax/modem
	WFW3.11 and other software

The days of putting a faster model **PC** together for yourself for **TNTmips** seem to be in renaissance as the Pentiums settle into the market. Clients report good success at assembling their own "hot" **PC** based systems from components and which on the average out perform the standard machines offered by Gateway, Dell, and related system vendors by an average of 2 times faster. These machines are not necessarily more expensive, but simply incorporate advanced components which are not yet widely used in the generic products. For example, many **TNTmips** processes with large requirements for display and disk access are now becoming disk **I/O** bound and not computationally bound and can thus be improved markedly by faster access drives and buses.

Just a sampling of the components of this do-it-yourself approach are the use of a wide band **SCSI** controller and drive, the Number Nine 128-bit graphics board, more memory than 16 Mb, fast network cards with more cache, fast color laser and solid ink printers, and so on.

Display Boards. Number Nine seems to have the edge this quarter in display boards with hot new products and reliable drivers with extra features as follows:

Model 9FXMotion 531: 2 Mb of 64-bit **DRAM**, 1280 by 1024 pixels at 256 colors, 72 MHz refresh at $249.

Model 9FXMotion 771: 4 Mb of 64-bit **VRAM**, 1600 by 1200 pixels and 24-bit color (at lower resolution), 150 Mhz refresh at $499.

Model Imagine 128 Pro: 8 Mb of 128-bit **VRAM**, 1600 by 1200 pixels and 24-bit color, 150 Mhz refresh at $2000.

Virtual Desktop. The availability and idea of using more advanced and expensive display boards is again becoming popular as the overall price of the Pentium machines decreases. $1000 to $2000 will now purchase a display board with 6 to 8 Mb of memory and a **MSW3.11** windows driver that actually works and provides a large virtual desktop (large addressable area). This desktop is a 2048 by 2048 or 2048 by 1280 pixel work area viewed through a good quality 17" or 19" monitor of 1280 by 1024 pixels.

A Number Nine 128-bit display board with 4 Mb of memory is standard on Dell's Pentiums. Their **MSW3.11** driver for this board supports a virtual desktop of 2048 by 768 pixels with a monitor view of 1024 by 768 pixels. MicroImages' clients report this is a very good choice for the 17" monitor which comes with this system. The display window is opened in the middle of this 2048 width to match the 1024 by 768 pixel viewable area (requires product **D60**). Auxiliary control windows and other processes are opened on either side of the

display window.   Then by moving the cursor to the left or right (or where **TNTmips** does this automatically) you gain immediate access to these controls and other processes with minimum conscious thought or effort. Similarly, if you have a 15" monitor or a portable computer, you may be able to set up to use a 640 by 480 or 800 by 600 pixels views and scroll over a desktop of 1024 by 768 pixels (requires product **D40**).

Please remember that if you are planning to do this, your **TNTmips** product resolution level actually controls which of the Windows display drivers you can use.   Only **TNTmips** product **D60** allows the unlimited use of any size, shape, color bit depth, and total addressable memory (the virtual area) of your display board. Regardless of the capability of your display board, **TNTmips** will only operate if you use a MSW3.1 display driver (virtual or not) which has equal or less pixels in both dimensions than the license level you have purchased. You can not choose a display driver of 2048 by 2048 pixels and use it with your license for 1280 by 1024 pixels (product **D50**) but only with the unlimited resolution of 1600 by 1200 pixels or greater (product **D60**).

Dual and Quad Processors. MicroImages has no direct experience with **PC**s or workstations with dual or quad based processors (Dell, Compaq, Sun 20, etc.). Thus, no advice can yet be provided on the benefits of such systems for those who are already this far ahead of the technology curve.   These individual processors are controlled and allocated by the operating system and thus their use should be transparent to the **TNT** products. MicroImages would appreciate it if those clients using a multiprocessor computer with **TNTmips** would let us know about their results and benefits.

For those who are power hungry for their desktop, the following multiprocessor computers have been announced:

HP: 4-**CPU** Pentium at 75, 100, 120, 133 Mhz with wide **SCSI** drive **in April**,
Compaq: 4-**CPU** Pentium at 100, 120, and 133 Mhz with wide **SCSI** drive **in May**,
Dell: 2-**CPU P6 in June**, and
Gateway: nothing announced as yet.

T128 or **T130 SCSI** Cards. Two to four years ago MicroImages sold a large number of Trantor (now alias Adaptec) **SCSI T128** and **T130** interface cards for use with external optical and hard drives. These were inexpensive 8-bit based **SCSI** cards and were reasonable to use with the **386** and slower **486** based computers of that era. If you are buying a new machine, please do not plan to reuse these **T128** and **T130 SCSI** cards. It might be reasonable to replace them with 16-bit cards on any existing **486** based computer.

Adaptec now has inexpensive 16-bit **SCSI** cards (e.g. model 1520) for less than $100. Since the rewritten and improved **TNTmips** processes are now becoming upper bounded by your computers **I/O** rates, anything you do to speed up access to your external drives will immediately produce faster results. Substituting a simple 16-bit **SCSI** card for these older 8-bit cards can increase your read and write access to an external hard drive by as much as 3 times. You can easily test the before results (with your **T128**) and after results (with the Adaptec **1520**) using the read file test built into TNTmips.

Digital Raster Graphics

A new U.S. Geological Survey (**USGS**) map product called a Digital Raster Graphic (**DRG**) has been announced. A **DRG** is a scanned image of a **USGS** topographic map. Samples of this product are available without cost in the TIFF format. Additional descriptive material

provided by **USGS** on the **DRG** product has been reproduced and is provided with **V5.00** for your reference.

USGS has always been one of the premier U.S. Government operations providing important leadership and products in the earth resources area. However, this is one of the few times they seem to be lacking in their vision, yielding a great idea but a poor implementation. Upon examination of the sample **CD**s, this product does not measure up to what is needed in this area. Obtain their sample **CD** or **FTP** the samples from their Internet site. You will find that the glaring defect is that the brown contour lines are full of gaps and consist merely of a series of cells which "hint" at the presence of a contour line. Viewed at coarse resolution you get the general idea that a contour is present. Upon zooming in, more holes than brown cells appear making automated line tracing or other forms of conversion highly improbable.

The original scanning of the paper maps at 500 dpi and the subsequent reduction to 250 dpi would easily preserve the contour lines. However, it appears that in an overzealous effort to reduce the file size, only 8 colors are recorded. The net result is that most of the color cells which are only tan (white plus brown cells) are being set to white. Any **TNTmips** client who has worked with our sample data, or zoomed into a full 8-bit, 256 color scan of a **USGS** topographic map at 150 to 250 dpi immediately recognizes the difference.

The nice, continuous brown or tan contour line in a 256 color scan is actually made up of a few brown cells, some tan cells, and then a lot of filler and edge cells of various light colors including pinks, yellows, and other shades related to brown and tan. This amalgamation makes a nice looking, continuous, distinct, tan contour on the display and provides the continuity for a raster to vector conversion process.

This **USGS** fixation on reducing the file size of the **DRG** at the expense of utility is foolish. It grows out of a perception that users do not, or will not soon have the hard drive space needed to store and use a larger file. For example, it would mean delivering a map of a full 256 color image of 80 mb instead of 8 Mb. Based upon the experience of MicroImages, if properly scanned, fewer colors than 256 would easily suffice (say 64 or maybe 32 colors) so some color reduction is reasonable. Users of these larger **DRG** files can always reduce the color depth to 8 or 16 colors with simple utility programs which read directly from the larger **CD** files and produce new color compressed **TIFF** files for their specific application.

The net result of all of this is that the **DRG**s, as currently planned, will be nice to look at on today's and yesterday's computer displays as long as you do not look too close. However, the map displays will not hold up in next year's higher resolution, fast zoom, and related applications. But, even more importantly, they will not support your preparation of the vector and **CAD** contour and raster **DEM** products you so desperately need for serious work in your project area. MicroImages' suggestion: obtain the samples, examine them, and then let **USGS** know about this or it will all have to be done over again in 5 years, and in the meantime you will still have to pay someone to scan and calibrate the public domain paper maps.

Testimonials

Yes, MicroImages does still receive some negative feedback, but not a lot. *Recently, such input has been focused about specific defects in specific processes.* MicroImages greatly

appreciates the positive comments on the **TNTmips** products which are now being received. MicroImages sincerely wishes that **TNTmips** was perfect for everyone.

None of the comments below were solicited or taken "out-of-context". All comments were received in written form, and reproduced exactly as received except for [editor] noted alterations or comments. Please note that the frequent comments below from International Representatives are from various nations and not the same Representative. Representatives and Resellers tend to be very active, as well as communicative users of **TNTmips** in their contract and demonstrational efforts. On the other hand, Resellers and U.S. clients almost always communicate with MicroImages via phone, and thus their comments cannot be *accurately reproduced* herein.

Most of these comments are from experienced clients who have diligently and patiently stayed with MicroImages over the rough and early versions of **TNTmips** and faithfully and meticulously reported their problems and suggestions, some pretty strongly. Now these faithful clients are our best salespersons. Thank you, it is these future sales which such testimonials promote that will generate the income to improve the **TNT** products and **TNTmips** for you and everyone else.

From a non-client outside the U.S. who tried the free San Francisco **TNTatlas**.
*"I just received your **CD** and installed it. It works great. I'll play with it and let you know how we like it."*

From a client in Australia.
"On re-reading our [a communication]*I note an inexcusable omission, I neglected to compliment your company on its remarkable achievement in developing the best Image Processing and **GIS** system available for less than $100,000. I have found **TNTmips** a pleasure to work with and am constantly amazed at the breadth of its capabilities. The technical staff at MicroImages have always been helpful and prompt in responding to my inquiries. We will promote your products with enthusiasm, confident that our efforts are in the best interests of our clients."*

From an International Representative.
"I have loaded it [**V5.00** beta]*on the **P66** and have imported some rasters which are about 4 Mb in size. These fit in with some other rasters as a mosaic in Display **2D**. The difference in display speed for rasters with pyramiding compared to originals is amazing. How do you do that? It almost negates the need to go for a high end laptop [he has a fast **486** laptop] as the pickup in raster display speed probably accounts for the increased cost of a faster machine."*

From an International Representative commenting on an experienced client.
*"It was interesting to note that for any government work he tenders for he always specifies that he has Arc/Info to firstly get the job and then when he gets the job he does it all using **TNTmips**. Then he just exports to* [an ARC/INFO]*format."*

From an International Representative.
"[A prospect] have ER Mapper and ARC/INFO in the office and 3 users on the system. In the field he currently uses Dimple and MapInfo. [He]says that if the publicity material reflects the usefulness of the product [**TNTmips**], *then it will serve as a replacement for their considerably more expensive systems! Absolutely correct. He also sees a need for their field offices, which are PC based, to have similar software."*

From an International Representative.

"We have bad news about the tender for [a prospect]*. ARC/INFO beat us even though our price was lower and our specification was better. The reason was that they didn't want to take any risk since MicroImages was new to them. The wining contractor was **IBM** using ARC/INFO even though they told us that they will suffer a financial loss of $17,000. They did this because they expect to get the next tender in 1995/1996 budget for about 24 sets on workstations.* [but will they be willing to lose $17,000 each on 24 units?]*"*

From an International Representative.

"Congratulation. The user interface is much more friendly in 5.0 and some of our clients are really happy with that especially [a name]*). It is also very useful in notebooks because you can have all the **TNT** power in small scaleable windows when you need it."*

From an experienced client in Germany.

*"The latest Version of 4.9 of **TNTmips** is a great step forward."*

From an another experienced client in Germany.

*"First I have to do a testimonial (? is it correct ?): **TNT** is running excellent, the file-exchange via ftp [Internet] has the result, that the bug-fixing is very quick."*

From an client in Australia experienced with both **TNTmips** and ARC/INFO.

"[client name] *is delivering a paper at the* [a national meeting]*next week.* [client name]*is going to castigate the government departments for their masochistic obsession with that obsolete 1970s technology called ARC/INFO."*

From a client in South Africa with a problem in **V4.80.**

*"Thank you for your advice on georeferencing. When we received **4.9**, I tried it again. I am glad to say that georeferencing is a dream on **4.9**."*

From publication of a U.S. client who has 3 **TNTmips** and just ordered 2 more.

"The main software used by [the organization]*Laboratory is the Map and Image Processing System (**MIPS**) developed by MicroImages of Lincoln, Nebraska. It is a powerful and easy to use analysis package which provides image processing, geographic Information System (**GIS**), and database capabilities."*

From a written request for information.

*"We are currently running GRASS on an **HP** 9000 workstation network and are quite unhappy with it. We are a small geology dept. in a liberal arts (undergrad only) school that is trying to make greater use of Remote Sensing and **GIS** in our program. ..."*

From an advanced client in Finland.

*"Gradually you are getting pieces of **TNTmips** together and functioning. Congratulations! A lot of my difficulties have been also caused by myself. I think I have also supplied to your technical support several comments on the software in a different way and for applications you might not have thought of."*

"OK, everything looks quite good at the moment!"

From an International Representative.

"I'm back in [a city]*with a lot of work waiting for me. At least the weather is better than in Lincoln in winter. Anyway, besides the cold weather, that was a very good week at MicroImages and I'm very pleased with the workshop."*

*"Finally the Silicon [Graphics] people found the problem with the display board and now **TNTmips** is running on 24 bits* [display]*! This is an Indigo2 machine and working with **TNT** on it is really fantastic."*

From a purchaser of a **TNTdemo** in Germany who is now a client.

*"Today we gave the P.O. for an **U100** to* [a Representative]*. Indeed we had not much problems with using **TNTdemo** (except for some with the **TCP/IP** sockets under WinNT). As a consequence we decide to buy the system."*

... ...

*"Additional we had the impression that the price/power ratio of **TNTmips** is outstanding and it got many features you are missing on much higher priced systems. Finally the support and service staff at MicroImages really deserves the term support, i.e. they know what to tell you and the printed materials you are providing are proving that they know what they are talking about. Well as you told we had not to use them very often, but this impression we got out of our correspondence. It's a good idea to provide excellent documentation in order to take the charge of everyday's questions away from the support people. Thus they are able to provide answers to even more difficult questions."*

... ...

"I'm looking forward to a good relationship and maybe we'll find the time to visit MicroImages this year or even to attend training at your place."

From an International Representative.

[to Technical Support] *"There's hardly any bugs left now, you will have to put some in, or you will be out of a job!"*

[then later] *Thank you for your prompt reply to my query faxes - I'd like to make clear that my reference to the lack of bugs in **V5.00ß** was very much a compliment - I've been using it for about 2 weeks now and am astounded by how much better it is that version **4.5**, the first I used. It's now certainly a lot better than most systems, and it's fun to use!*

From a typically more frequent kind of inquiry.

"[a prospect]*, who I spoke to yesterday, uses Techbase, MapInfo, ARC/INFO, and Earth Vision (3D petroleum package). They are looking for a **GIS** that is much more advanced than MapInfo, though not as difficult to learn as ARC/INFO. **TNTmips** is certainly the obvious choice."*

Technical References

Technical references.

Power Mac Software Soars. MacWorld Lab uncovers which software benefits most from the PowerPC boost. by Jim Heid. March 1995. in MacWorld 12(3)87-92. See especially table on page 89.

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Bangs Canyon - A Valley of Boulders. by Edmond W. Holroyd III. in Creation Research Society Quarterly. Vol. 31(2), Sept. 94, pages 99 to 109.

Yesterday's spies. by Ren Capes. in **GIS** Europe. Dec. 1994. page 14. (reprint enclosed)

GIS Supports Urban Rezoning. by Charles A. Moore, Christine F. Donaldson, and Roxyanne C. Burrus. in GIS World. Feb. 1995. pages 61 to 63. (reprint enclosed)

<u>Evaluation of a Digital Camera System for Natural Resources Management.</u> by Tom Bobbe and Jim McKean. in Earth Observation Magazine. March 1995. pages 46 to 48.
This article contains a review of this sensor and a sample image and mosaic. (reprints being ordered for shipment with **V5.10**)

<u>Price-wise performer.</u> by Peter Ireland. in Mapping Awareness. April 1995. pages 40 to 42.
This article is a review of **TNTmips**. (temporary copy enclosed - color reprints have been ordered and will be shipped with **V5.10**)