

**THE STUDY ON MAPPING POLICY AND TOPOGRAPHIC MAPPING  
FOR THE INTEGRATED NATIONAL DEVELOPMENT PLAN  
OF  
THE PHILIPPINES**



**EDITION 1**



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## 1. Introduction

The purpose of the Softcopy Exploitation Tool (SOCET SET®) software is to support imagebased softcopy applications such as map-making, mission rehearsal, and photo-interpretation.

SOCET SET generates databases and products such as Digital Terrain Models (DTM), reports, vector databases, orthophotos, image maps, and image mosaics. SOCET SET supports a wide variety of applications, including:

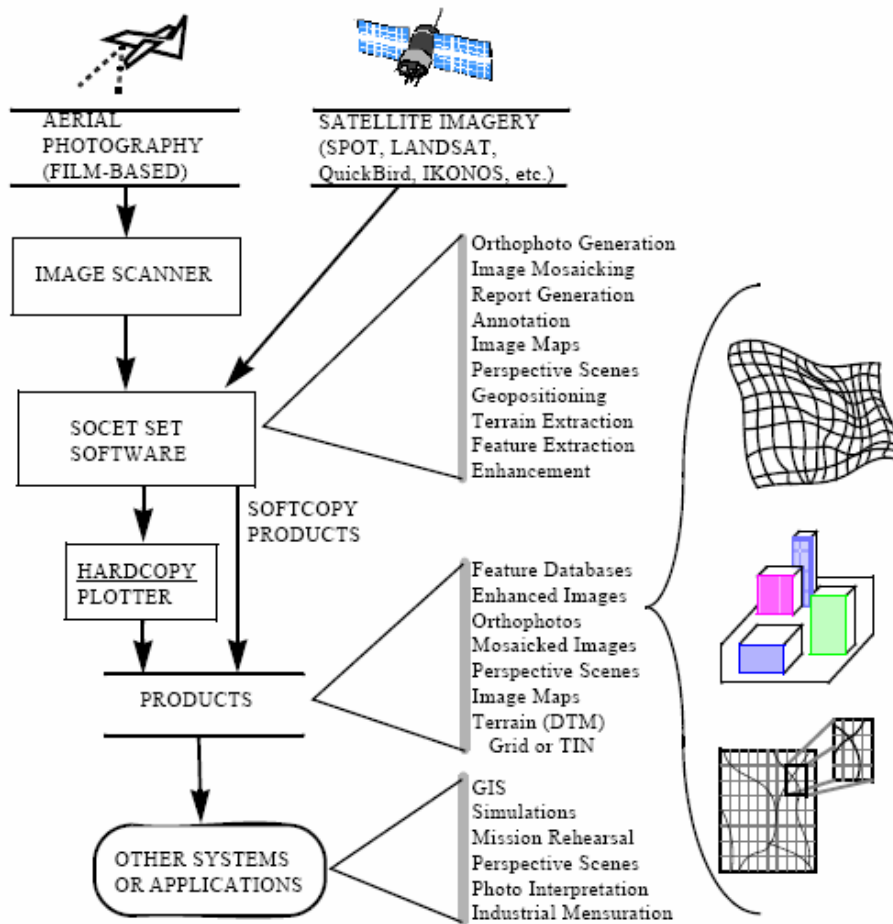
- Populating a GIS database (vector or raster)
- Producing image maps
- Civil engineering
- Mission planning
- Targeting
- Mission rehearsal
- Sensor research and development

The SOCET SET software consists of over sixty application functions that can be chained together to form a processing flow that inputs imagery, performs the requisite analysis, and produces the final hardcopy or softcopy products. This User's Manual describes the application functions in detail, including the following:

- Data import capabilities for imagery, feature, and terrain data
- Automatic extraction of Digital Terrain Model (DTM) elevation data
- Interactive graphical editing of DTM data
- Interactive two and three-dimensional feature data extraction
- Orthophoto generation
- Perspective scene generation
- Point positioning, three-dimensional mensuration, and targeting
- Image mosaicking
- Image enhancement
- Data export functions for softcopy databases (imagery, feature, and terrain data), and hardcopy products (image maps)

## 2. Typical Product System Flow

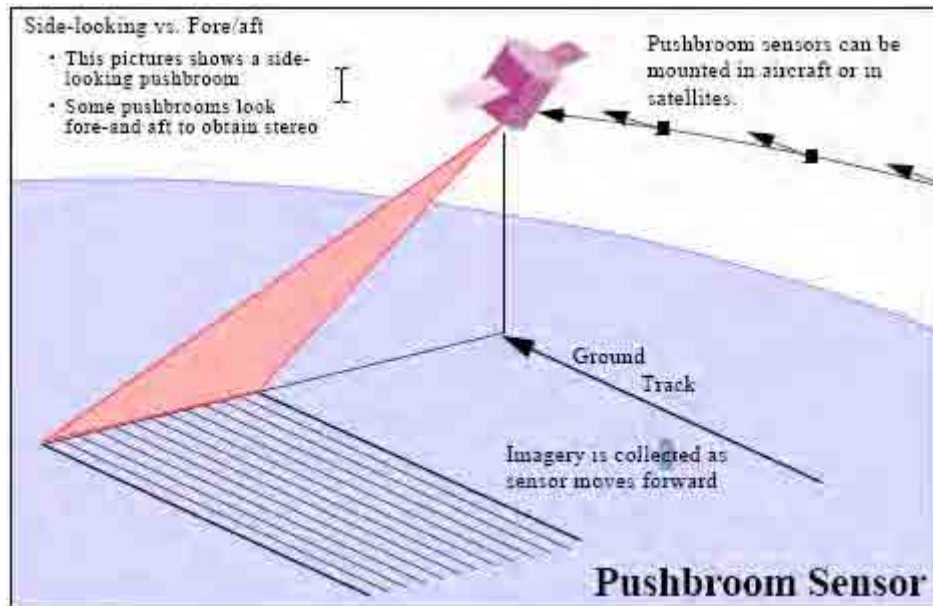
Imagery is input to SOCET SET from either a digital softcopy source, such as SPOT or Landsat, or by scanning film-based imagery. The workstation products are in either softcopy format (such as DTMs, vector databases, orthophotos, etc.) or hardcopy format (such as image maps or photorealistic perspective scenes).



### 3. Using Satellite Imagery

#### Overview of SPOT, JERS, and IRS

SPOT, JERS, and IRS Imports read imagery and geo-referencing information from CD-ROM, magnetic tape, and disk media into SOCET SET. SPOT imagery is available from SPOT Image Corporation and other distributors. JERS imagery is distributed by NASDA. IRS imagery is available from various distributors.



#### When to Use SPOT Image Import

You use SPOT Import when you have SPOT data and you want to exploit the image in the data set. You run SPOT Import after creating a project to hold the imagery. After importing a SPOT image, you can proceed with Triangulation and then data extraction. SPOT Import works in projects with the Geographic, UTM, or Grid coordinate systems, but not the LSR coordinate system.

#### Formats Supported

SPOT imagery is supplied in a variety of formats and processing levels. The various formats are described below.

Categorized by spectral type, SPOT comes in several types:

- Multispectral without short-wave infrared (SWIR) (known as MLA or Xs) (3 bands)
- Multispectral with SWIR (known as Xi or I) (4 bands)
- Panchromatic (known as PLA, PAN, P, or M)

SOCET SET imports all the above types of SPOT imagery.

SPOT multispectral imagery comes in two formats: Band Interleaved (**BIL**) or Band Sequential (BSQ). SPOT panchromatic imagery always comes in BSQ format. SOCET SET imports both

BIL and BSQ formats.

Your SPOT imagery may have been preprocessed by your supplier to assist with control or georeferencing.

There are four processing levels available from SPOT:

- 1A – Raw. This is unrectified data and the pixels may have non-uniform GSD.
- 1B – Rectified. The imagery has been resampled and geo-coded to a uniform GSD.
- 2 – Controlled. Controlled support data is provided that is based on GCPs.
- S – Stereo. A relative orientation has been performed on this SPOT stereo pair.

SOCET SET accepts processing levels 1A and 1B only. Processing level 1B is the most common type of SPOT imagery.

SPOT Image has introduced the DIMAP format. They are distributing all SPOT 5 data in this format and will be transitioning data from previous satellites to DIMAP. If you have a DIMAP data set, you must import it with SPOT DIMAP Import. SOCET SET supports the same SPOT DIMAP products as with previous formats, that is, SPOT full-scene 1A and 1B in both panchromatic and multispectral.

Finally, the SPOT tape format varies between SPOT distributors. SOCET SET accepts imagery in the standard format of the SPOT Image Corporation and in the standard format of the Canada Centre for Remote Sensing (CCRS) and Australian Centre for Remote Sensing (ACRES). The image formats processed by SOCET SET are taken from The SPOT Scene Standard Digital Product Format (S4-ST-73-01-SI), SPOT Image Corporation, 1995, and *Standard SPOT MLA/ PLA CCT Format* (DMD-TM85-428A), Canada Centre for Remote Sensing, 1985. SOCET SET supports the “CAP” data format.

Some CCRS SPOT data sets have a defect which causes the image to be shifted to the east or west. You can set a special environment variable when starting SOCET SET to fix the problem. There are two ways to set the variable. One is to add `-setenv_no_arg CCRS_ROLL_INVERT` to the file `<install_path>/socet_xxx`, where “xxx” is the name of the machine you are working on. This method will always perform the correction for all CCRS SPOT imports until you edit the `.socet_xxx` file and take the instruction out. The other way is to start the SPOT Import task manually by typing:

```
% <install_path>/bin/start_socet -setenv_no_arg  
CCRS_ROLL_INVERT -single spot 1 xxx.prj
```

where “xxx” is the name of your project. This method only performs the correction for that particular import session.

Some SPOT images in the CCRS (Canadian) format contain an error in the sensor attitude data on the tape header, which make it impossible to control the image with SOCET SET. If you find this to be true, ask your tape supplier for a replacement tape. This is not a problem with SPOT tapes produced by the SPOT Image Corporation.

### **Using SPOT images**

When creating a project which will include SPOT images, the geodetic datum must be based on an earth-centered ellipsoid such as WGS 84. The reason for this is that the SPOT satellite ephemeris and attitude data are based on an earth-centered system. Before importing your data, make sure your project has an origin near the center of your SPOT or JERS data set. It should be in the same hemisphere for Geographic projects, or the same UTM zone for UTM projects.

Interior Orientation is not required with SPOT images, since the sensor is a digital camera, resulting in a known, fixed relationship between each image pixel and the sensor lens.



SOCET SET can accommodate images from different sensors simultaneously. From the user's point of view, there is little difference between triangulating a block of frame images, SPOT images, or a mixture of both. When triangulating SPOT images, there are thirteen parameters which can be adjusted: the focal length, the 6 parameters of position and attitude, and the 6 first degree components of position and attitude with respect to time. A priori estimates for these are obtained from the SPOT header data.

The recommended number of ground control points is 4–6 per model (or per multiple image strip if all images are from a single orbital pass.) Pointing accuracies range from 6–20 meters. If there are no ground control points available, the expected absolute distance error is approximately 500 meters. A single control point can correct for model offsets due primarily to timekeeping errors.

Two control points can correct for offset and azimuth errors.

### **Outputs**

Outputs consist of an ASCII support file and a binary image file which is tiled with a header in a tiled format. The support file is created in the data directory used by the current project file. The display of support data is provided by the window popped-up from the main SPOT menu.

### **Importing From CD-ROM**

SPOT Import recognizes the data format for SPOT Scene and CCRS CD-ROM products. On Unix, the CD-ROM must be mounted on the directory "/cdrom." If this is not the case, ask your system administrator to mount it there. The root directory of the CD ROM must have subdirectories called "scene01," "scene02," etc. for each scene on the disk. If you have difficulty importing, you can also try identifying the files with the Importing From Disk interface.

## Importing From Disk

SOCET SET can use disk files for the SPOT data. There can be one single large file containing the Volume Directory File, Leader File, Imagery File, Trailer File, and Null Volume Directory File or these files can be kept separate. If the files have the SPOT Scene naming convention, e.g. vold\_01.dat, lead\_01.dat, imag\_01.dat, trai\_01.dat, null\_01.dat, then you can click on just one of them and the rest will be filled in automatically. The disk file selection box also allows you to select more than one file. You can use this feature if you are having difficulty in importing a set of files and would like to try a different file ordering. The files are read in the order that you click on them. You can specify multiple files by clicking on them while holding the Control Key.

### Transferring Data From Tape to Disk

You might want to transfer your data from a tape to disk so that it can be subsequently imported from disk on a different workstation. The steps to do this are as follows:

1. Mount the 9-track **CCT** on a tape drive. In this example the device name of the tape drive will be /dev/rmt/7n.
2. Use the <install\_path>/bin/tape\_struct executable to determine the files and record size.  
% <install\_path>/bin/tape\_struct /dev/rmt/7n  
As a result of this command the messages should reflect the file number and block size of the records in each file.
3. Edit the <install\_path>/bin/copy\_spot\_to\_disk script to reflect the input record block size. This script file should reflect the following commands which must be correct in order to copy records verbatim to disk files

```
dd ibs=360 if=/dev/rmt/7n of=vold_01.dat
dd ibs=3960 if=/dev/rmt/7n of=lead_01.dat
dd ibs=8640 if=/dev/rmt/7n of=imag_01.dat
dd ibs=1080 if=/dev/rmt/7n of=trai_01.dat
dd ibs=360 if=/dev/rmt/7n of=null_01.dat
mt -f /dev/rmt/7n rewind
```

Some older SPOT images were on two tapes at 1600 bpi for a single image. If there is a second tape involved, then repeat these first three steps for the second tape as well using \_02.dat in place of \_01.dat for the output files.

Strip off the first 8640 bytes from part 2 of the image which is imag\_02.dat using the following command:

```
dd if=imag_02.dat of=strip_02.dat bs=8640 skip=1
```

Second, you then concatenate the following input files into one output file:

```
cat vold_01.dat lead_01.dat imag_01.dat strip_02.da
trai_01.dat null_01.dat > scene1
```

4. Now proceed to import the disk image file, as described under importing from disk.

## Tips for Triangulating Particular Sensors

### SPOT Images

Several sensor types are known generically as “pushbroom,” because of the method of collection, have unique characteristics that the user should be aware of. This includes the SPOT sensor and several of the National Technical Means (NTM) sensors. *See “SPOT, JERS and IRS Import,” Chapter 11.* These sensors continuously collect imagery as the sensor passes over the ground. Rather than store the entire image in one huge digital file, the data is broken into pseudo “frames” with overlap regions created to allow later triangulation into a consistent block. The problem develops because the overlap areas are, in fact, the same image with the same exposure station parameters. To determine the elevation of a point ( $Z$ ) the software projects a ray through an image point in one image and intersects the ray with the same point in the overlapping image. In this case the two rays are parallel and never intersect causing the  $z$  value calculation for the point measurement to fail. The  $x,y$  values of the sample are still valid for connecting the images together but the  $z$  is worthless. When the solution function attempts to adjust the ground positions it fails as well. The problem can be avoided by changing the tie points between these pseudo images to “Vertical” type control points. This treats the point as a  $Z$  control point and does not try to adjust the  $Z$  image parameters. The  $x,y$  adjustments are done as usual to tie the pseudo frames together. An additional tie point between strips is still needed (if there are multiple strips in the block) to connect adjacent images, since these are independent and do not share the same exposure location values. If you have SPOT 5 images without control, try the second degree attitude ( $q0\_0, q1\_0, q2\_0, q0\_1, q1\_1, q2\_1, q0\_2, q1\_2, q2\_2$ ) to a small sigma value, e.g. 0.00001. Disable all other parameter adjustments.

### 3.1 Triangulation

#### 3.1.1 Preparation

##### 3.1.1.1 Create new Datum (e.g. PRS92) and Grids (e.g. PTM and UTM)

To add a new datum or grid, the ASCII files in this directory (C:\SOCET\_SET\_5.3.0\Internal\_dbs\GEODETIC) must be edited before running Create Project.

#### SUMMARY OF FILES OF **GEODETIC.DAT** AND **GRID\_PARAMETERS**

-----

geodetic.dat - Contains numerical definitions of all datums, including names.  
- \*\*\*\*\* N O T E : \*\*\*\*\*  
Do not change any of the datum names contained in this file!!!  
\*\*\*\*\*

grid\_parameters - Defines grid coordinate systems (state plane, etc.)

geoid84.dat - Defines mean sea level geoid; Binary (non-ASCII) file

ellipsoid.dat - Defines reference ellipsoids

geodetic.doc - For reference only; not used by SOCET SET software

#### DATUMS

-----

To create a new datum, you must add the appropriate information to file geodetic.dat

- \*\*\*\*\* N O T E : \*\*\*\*\*  
Restrict new datum names (including the ID NUMBER) to 80 characters or less.  
\*\*\*\*\*

The values for each datum in the geodetic.dat file are arranged in pairs of lines. The values for each column are as follows.

Line 1: Num D\_name  
----

Line 2: **E\_code A F dA dF\*10^4 dX eX dY eY dZ eZ G\_code s**  
**rX rY rZ use\_approx**

-----  
-----  
The last 5 values (s, rX, rY, rZ, use\_approx) are optional.

Num = serial number of the entry within the file.

D\_name = name of the datum (sometimes abbreviated,  
should be 80 characters or less).

E\_code = 2 character code for the reference ellipsoid  
corresponding to this datum

A = equatorial radius (semi-major axis) in meters.

F = flattening (defined below).

dA = difference between this datum's radius and  
WGS84\_radius (reference only)

dF\*10<sup>4</sup> = difference between this datum's flattening and  
WGS84\_flattening multiplied by 10,000 (reference only).

dX, dY, dZ = offset of this datum's ellipsoid with respect  
to the centroid of the earth (WGS84), expressed in meters.

eX, eY, eZ = error estimates for the datum offsets (+ or -,  
expressed in meters).

G\_code = EPSG Geographic CS Type Codes, Based on EPSG Datum.  
Numbers 4200-4999: valid codes  
Number 0: undefined  
For details, see the website:

<http://www.remotesensing.org/geotiff/spec/geotiff6.html#6.3>  
.2.1

s = scale for 7 parameter transform.

rX, rY, rZ = Rotations for 7 parameter transform.

use\_approx = if 0 use rigorous 7 parameter transform  
if 1 use approximate 7 parameter transform

NOTE: Use meters to specify earth radius and XYZ offsets.  
DO NOT USE FEET. If you are working in a feet-based project,  
the conversions will be performed automatically for you by  
SOCET SET. Use radians to specify rotation.

The file 'geodetic.doc' is provided for reference and is  
not used by the workstation. However, you should add an  
entry to the geodetic.doc file, for reference purposes.

#### GRIDS

-----  
The file "grid\_parameters" defines the various grids the  
operator may choose from when running the Project Creation  
function in SOCET SET.

This file is used by the Project Creation process to create  
a menu for the operator to select a grid. A grid must be  
added

to this file BEFORE running the project creation process if you want to use the grid. The format of the file is defined in comments in the file itself.

A grid is a localized coordinate system based on a map projection that is well suited to the local region. Every state has one or more grids defined, called 'State Plane' coordinate systems.

## EARTH SHAPE

-----

The oblateness of the earth may be expressed three different ways:

```
flattening          = (a-b)/a;
eccentricity        = sqrt ( (a**2 - b**2) / a**2 );
eccentricity_squared = (a**2 - b**2) / a**2;
```

Where a = equatorial radius, and  
b = polar radius.

To compute ecc\_squared from flattening, use this formula:

```
ecc_squared = f * (2 - f);
```

## FEET VS. METERS

-----

All distances in these files are measured in METERS.  
Distance values include:

- the earth radius
- XYZ offset of the datum
- XYZ offset error estimates of the datum
- false easting and northing

Do not use FEET units in these files!! If the coordinate system you are using is feet-based (as are many State Plane systems) don't worry: enter the data (false easting and northing) in these files in METERS, then select "Units = FEET" during the project creation process. Thereafter, all your input and output will be in FEET units. For more information, see the Project Management chapter of the DPW SOCET SET User's Manual.

## Sample file of geodetic.dat

```
VERSION 1.0
#####
#####
#
# DO NOT CHANGE THE FIRST LINE (the 'VERSION' line)
#
# This file contains the parameters for specifying datums.
# Parameters for the standard datums are taken from
# NIMA document "Department of Defense World Geodetic System 1984,
# Its Definition and Relationships with Local Geodetic Systems",
# TR8350.2, Third Edition, Amendment 1 (3 January 2000),
# Appendices A.1, B.1-B.10 and C.1-C.2.
#
# NOTE: This file replaces old versions of both datum.dat
#       and geodetic.dat.
#
# You can add lines to this file, to specify other datums, if you
# wish. If you do, be sure to follow the existing format. The
# values for each datum in this file are arranged in pairs of lines.
# See internal_dbs/GEODETIC/README for the format.
#
#####
#####
1 WGS_72
  WD 6378135.00000 0.0033527795    2.000 0.00031000  0.0 1.0  0.0 1.0
0.0 1.0 4322
2 WGS_84
  WE 6378137.00000 0.00335281066475  0.000 0.00000000  0.0 1.0  0.0
1.0 0.0 1.0 4326
3 [ADI-M]_ADINDAN(Mean_Solution)
  CD 6378249.14500 0.0034075614   -112.145 -0.54750714 -166.0 5.0 -15.0
5.0 204.0 3.0 4201
4. PHILIPPINE_(PPCS)
  CC 6378206.40000 0.00339007530393  -69.400 -0.37264639 -127.6220 0.0 -
67.2448 0.0
  E code      A              F              dA              dF*10^4
dX      eX      dY      eY
-47.0431 0.0    0 0.99999893998 0.000014872241633 -0.000023769979580 -
  dZ      eZ G_code      s              rX              rY
0.000007649875327 1
  rZ      use_approx
```



**Sample file of ellipsoid.dat**

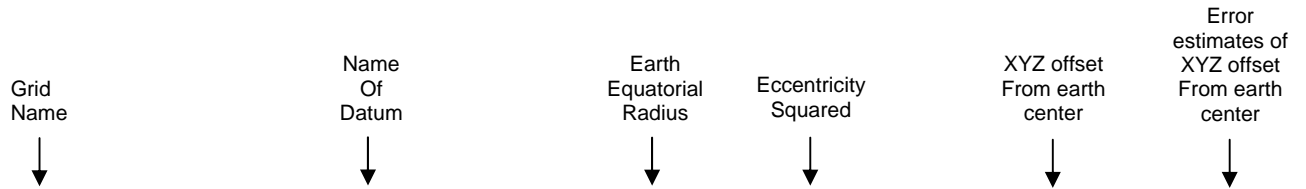
```

VERSION 1.0
#####
#
#
#
# DO NOT CHANGE THE FIRST LINE (the 'VERSION' line)
#
#
#
# This file contains reference ellipsoid names and their
# associated constants. Refer to NIMA document TR8350.2,
# Third Edition, Amendment 1, 3 January 2000,
# "Department of Defense World Geodetic System 1984",
# Appendix A.1
#
# You can add entries to this file if you desire.
# When doing so, please use the following guidelines.
#
# 1. Use underscores (_) instead of spaces in all
#    ellipsoid names.
# 2. Make sure that you specify a unique 2-character
#    ID code for the new ellipsoid. This will be
#    the same code that you will use in file
#    geodetic.dat for any datums that will use the
#    new ellipsoid.
# 3. If you want to specify subclasses of ellipsoids
#    (similar to the Bessel 1841 and Everest
#    ellipsoids), the first character of the
#    subclass line must be a space.
# 4. Equatorial radius, flattening and eccentricity
#    squared values are included in this file for
#    reference, but are not used by the software.
#    It is not critical that these values be
#    accurate in this file.
#
#####
#
#
# Ellipsoid Name           ID Code  Equat. Rad(a)  Flattening(f)
# Ecc_squared
# -----
#
Airy_1830                  AA      6377563.396    0.003340850641
0.006670539999
Australian_National        AN      6378160.0      0.0033528918692
0.0066945418545
Bessel_1841
Ethiopia,_Indonesia,_Japan_and_Korea  BR      6377397.155    0.003342773182
0.006674372231

```

Namibia	BN	6377483.865	0.003342773182
0.006674372231			
Clarke_1866	CC	6378206.4	0.00339007530393
0.00676865799729			
WGS_1972	WD	6378135.0	0.0033527795
0.0066943179			
WGS_1984	WE	6378137.0	0.00335281066475
0.00669437999014			





```
GRID_TYPE al_e_27 DATUM_NAME [NAS-C]_NAD_27(CONUS) DATUM 6378206.4 0.00676865799729 OFFSET -8 160 176 ERROR 5 5 6
```

```
# The numbers on this line can be in scientific notation (e.g. 6.69E-03) or in normal
# floating point notation (e..g 0.00669).
#
# The XYZ offset is measured from the center of the WGS_84 ellipsoid (Z axis up thru
# North pole; X axis thru Greenwich meridian; Y axis thru +90 degrees longitude).
#
```

```
# (2) The middle lines describe the projection. The possible projections are:
```

- # TRANSVERSE\_MERCATOR\_PROJECTION
- # CASSINI\_SOLDNER\_PROJECTION
- # HOM\_PROJECTION (Hotine)
- # LAMBERT\_CONFORMAL\_PROJECTION
- # MERCATOR\_PROJECTION
- # POLAR\_STEREOGRAPHIC\_PROJECTION
- # POLYCONIC\_PROJECTION
- # STEREOGRAPHIC\_PROJECTION
- # TRANSVERSE\_MERCATOR\_PROJECTION
- # UTM\_PROJECTION
- # NEW\_ZEALAND
- # SINUSOIDAL\_PROJECTION

```
# Each projection has a 2 to 4 lines of definition.
# The content varies depending on the projection. The syntax
# for each projection is described below in the "sample" grids.
# For example, for UTM:
```

```
#           keyword
#           defining the
#           projection
#           |
#           v
# PROJECTION_TYPE UTM_PROJECTION
# ZONE 1
```

```
# (3) The last line holds false easting and false northing (in meters).
```

```

#   These are positive offsets added to the projection coordinates to force
#   most values to be positive. Generally, the Positive and Negative
#   false eastings are identical. IMPORTANT: If your grid does not
#   work properly, make the first and second numbers the same and
#   the third and fourth numbers the same, e.g.
#
#   F_NORTH_POS 10000000 F_NORTH_NEG 10000000 F_EAST_POS 500000
#   F_EAST_NEG 500000
#
# FEET VS. METERS
# -----
# All distances in this file are measured in METERS. Distance values include:
#
# - the earth radius of the datum
# - XYZ offset of the datum
# - XYZ offset error estimates of the datum
# - false easting and northing
#
# Do not use FEET units in this file!! If the grid coordinate system you
# are using is feet-based (as are many State Plane systems) don't worry:
# enter the data (false easting and northing) in this file in METERS, then
# select "Units = FEET" during the project creation process. Thereafter,
# all your input and output will be in FEET units. For more information,
# see the Project Management chapter of the SOCET SET User's Manual.
#
# FALSE EASTINGS AND NORTHINGS
# -----
# XY Coordinate values in a grid coordinate system are often negative (e.g.
# X values are negative to the West of the origin point). However, many grids
# are defined to force the XY values to be always positive. This is achieved NOT
# by moving the origin point, but rather by adding artificial offsets to the
# mathematically correct XY values. These offsets are called "false northing" and
# "false easting". These are usually large positive numbers.
#
# There are two false values for X: false easting positive and false easting
# negative. The former is used when the X value is positive, and the latter
# when the X value is negative. The same for Y: false northing positive and
# false northing negative.
#
# The false easting positive and false easting negative should be identical
# (we are not aware of any coordinate system in which they differ).
#
# The false northing positive and false northing negative are usually identical,
# but will be different in some rare cases. For example, the UTM grids
# (transverse mercator, with origin at the equator) use different values
# for false northing positive and false northing negative.
#
# The false eastings and false northings are always defined in this file in
# meters, even if you are defining a feet-based grid. If you are using a
# feet-based grid, you may find the following conversion

```

```

# table useful (note: these values are based on the
# International Foot definition; if you are using the U.S. Survey Foot, these
# values are not valid):
#
#      FEET      METERS (use in the grid definition below)
#      -----
#      100,000   30,480
#      500,000   152,400
#      1,000,000 304,800
#      2,000,000 609,600
#
#
# LATITUDE / LONGITUDE
# -----
# All latitude and longitude locations are specified in radians, not degrees.
# Degrees WEST of Greenwich are expressed as NEGATIVE radians. For example,
# 118 degrees west is represented as -2.059488517353309 radians.
# If you have a location in degrees, and you need to convert it to radians, use
# the degree-to-radian conversion program (activated under the Tools menu on the
# main SOCET SET menu).
#
#
# SCALE REDUCTION FACTOR:
# -----
# The central scale factor is another way of expressing a scale reduction:
# e.g. a scale reduction of 1:10,000 corresponds to a scale factor of 0.9999
# This is used in transverse mercator, hotine oblique mercator, and
# stereographic projections.
#
#
# STATE PLANE DATUMS
# -----
# The entire Unites States is covered by 122 grids called the State Plane grids.
# There are two versions of the State Plane grids: an older set based on the NAD 27
# datum and a newer set based on the NAD 83 datum. This file contains both
# the old and the new state plane systems. For example, California Zone 6 is
# ca_6 (old, NAD-26) and ca_6_83 (new, NAD-83). For reference, the two datums
# used for State Plane grids are:
#
#      Datum      Equa.Radius  ecc_squared  XYZ offsets      XYZ Accuracies
#      -----
#      NAD 27      6378206.4   0.00676865799729  -8.0 160.0 176.0 5 5 6
#      NAD 83      6378137.0   0.00669438002290   0.0  0.0  0.0  2 2 2
#
#
# COMMENT LINES
# -----
# All lines in this file beginning with '#' are treated as comments and ignored.
#
#
# ECCENTRICITY AND FLATNESS
# -----

```

```

# The oblateness of the earth may be expressed three different ways:
#
# flattening      = (a-b)/a;
# eccentricity    = sqrt ( (a**2 - b**2) / a**2 );
# eccentricity_squared = (a**2 - b**2) / a**2;
#
# Where a = equatorial radius, and
#       b = polar radius.
#
# To compute ecc_squared from flattening, use this formula:
#
#   ecc_squared = f * (2 - f);
#
# GEOTIFF
# -----
# Each grid definition may be followed by an optional GeoTiff ID number line.
# The format is:
#   GEOTIFF <id_number>
# This line is optional, and if it does appear, it must be the final line
# of the grid definition. The ID numbers are obtained from the GeoTiff

```

**(a) Coordinate System**

Coordinate system for all control points carried out under the Philippine Plane Coordinate System (PPCS) in 1992.

The characteristics of the PPCS are:

- $\frac{1}{\rho} = 0.00037168782$
- PR92
- (i) Spheroid Projection  
 Clarke's Spheroid of 1866 ✓  
 Semi-Major Axis : 6,378,206.47  
 Semi-Minor Axis : 6,356,583.8  
 Flattening : 1/294.98  
 X Shift to WGS84 : -127.6220m  
 Y Shift to WGS84 : - 67.2448m  
 Z Shift to WGS84 : - 47.0431m  
 X Rotation to WGS84 : 3.06762 arc seconds  
 Y Rotation to WGS84 : -4.90291 arc seconds  
 Z Rotation to WGS84 : -1.57790 arc seconds  
 Scale Correction to WGS84 : 0.06002ppm  
 0.11999893972
- (ii) Projection  
 Transverse Mercator, in zones of two (2) degrees net width
- (iii) Point of Origin  
 Intersection of the Equator and the Central Meridian of each zone, with Northing of 0 meter and Easting of 500,000 meters.
- (iv) Scale factor at the Central Meridian : 0.99995

Zone No	Central Meridian	Extent of Zone
I	117°	116° 00' to 118° 30'
II	119°	117° 30' to 120° 30'
III	121°	119° 30' to 122° 30'
IV	123°	121° 30' to 124° 30'
V	125°	123° 30' to 127° 00'

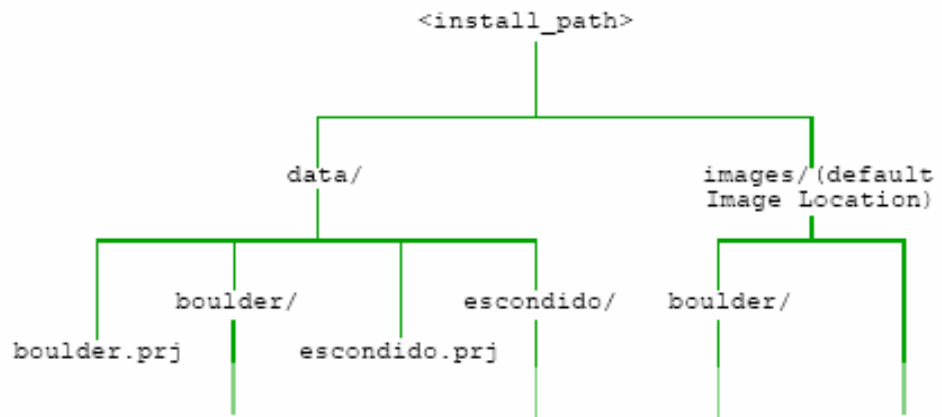
Zone III was occupied for the project. Two (2) existing GPS stations, namely NVY-1 and ISB-2, which were established by National Mapping and Resources Information Authority (NAMRIA) in 1992, were chosen and applied as the Northing and Easting geographical coordinates datum for the project.



### 3.1.1.2 Establishing the path/directory where the images are to be located.

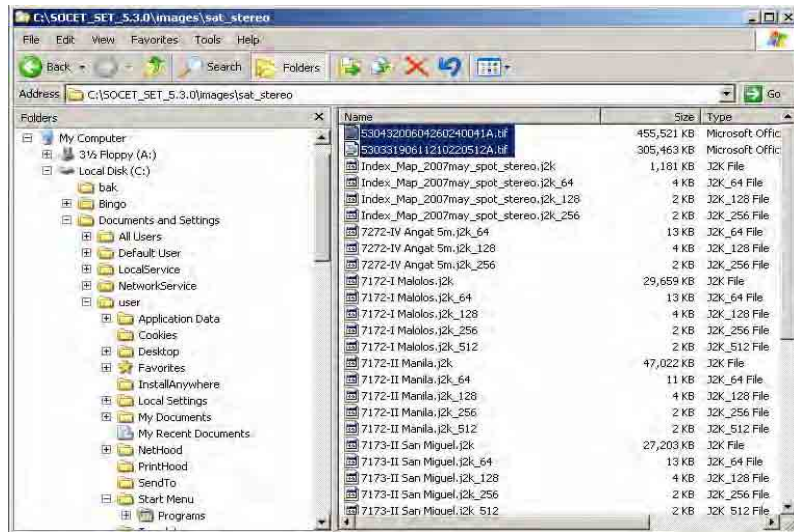
Before you can import or display imagery with the software, you must create a project. You can think of a project as a container holding the data for a set of images you are going to utilize. The data you extract from a set of imagery will be stored in the project directory that contains that set of imagery. When you create a project, you specify the coordinate system and datum to use for the project. You also will specify the disk directories of where the project and imagery data will be stored. Most importantly, you give your project a name. The name of the project file is the name you assigned to the project with the extension.prj when it was created. The software stores the definition of a project in a special project file.

SOCET SET uses the computer file system to store its project data. The following figure depicts the directory tree the software uses to store its data.



Most software applications require that you first load a project. Once you have loaded a project, you can then operate on the imagery and other data contained therein. You can import images into the project, triangulate the images, perform feature and terrain extraction, and create image products to export. The locations of the image files are defined by entities called Image Locations.

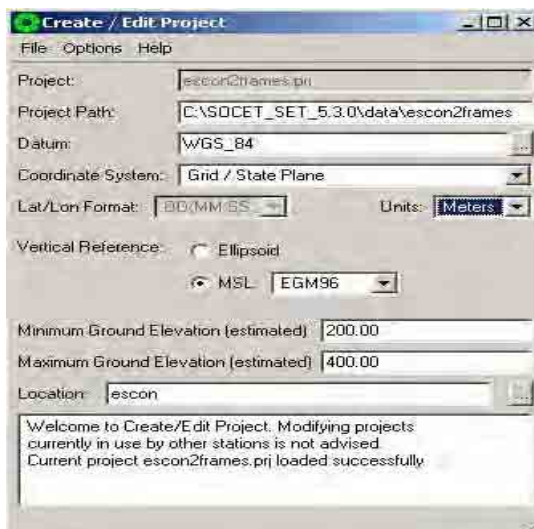
1. Create the path/directory location of the image file.



2. Open “SOCET SET 5.3.0”. Click ”Project”, select “Create/Edit Project”




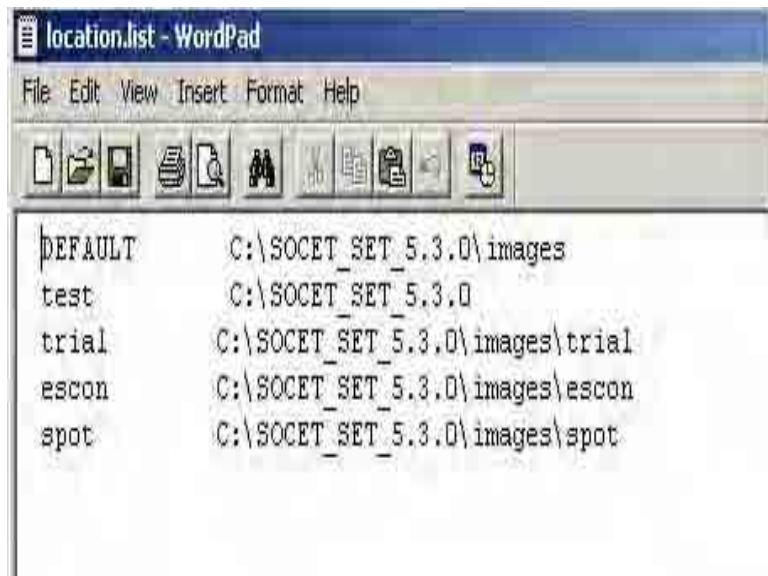
3. A “Create/ Edit Project dialog box will appear. Click the browse ... button in the “Location “box.



4. A “File Location” dialog box will appear. Click “Edit Locations” Edit Locations button



5. A “location.list-WordPad” dialog box will appear. Type the directory (e.g. C:\SOCET\_SET\_5.3.0\images\spot). Then click “Save” .




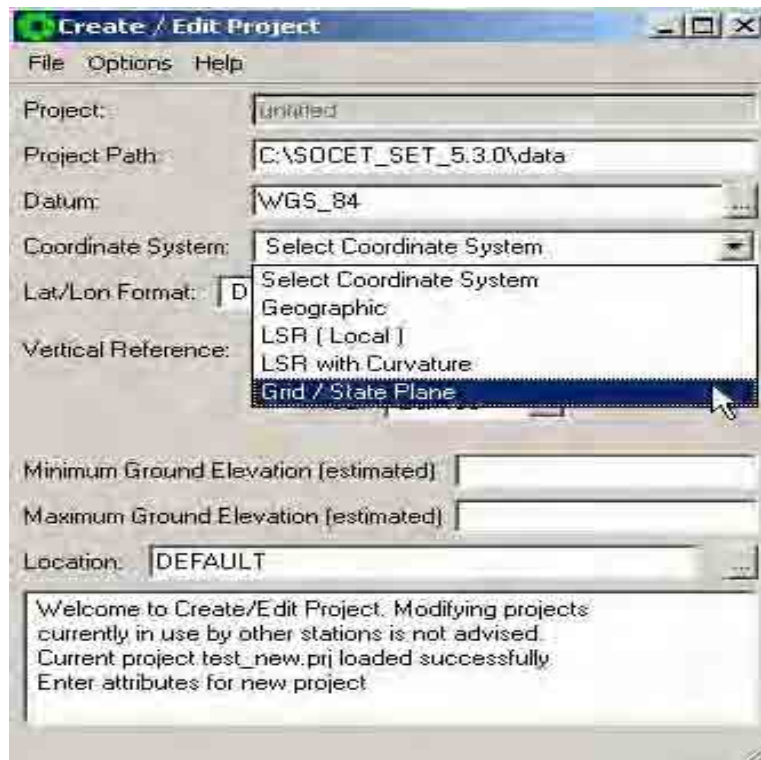
### 3.1.1.3 Creating Project.

You use Create/Edit Project to create your project. Since most SOCET SET applications require a project to be loaded, you must create a project before you can proceed with importing and extracting data.

1. Click “File”, select “New”.




2. Click the down arrow  in the “Coordinate System” box and select “Grid / State Plane”.



3. A “Select a Coordinate System” dialog box will appear. Scroll down the arrow and select the desired coordinate system (e.g. Philippine\_UTM\_51N). Then click “OK”.

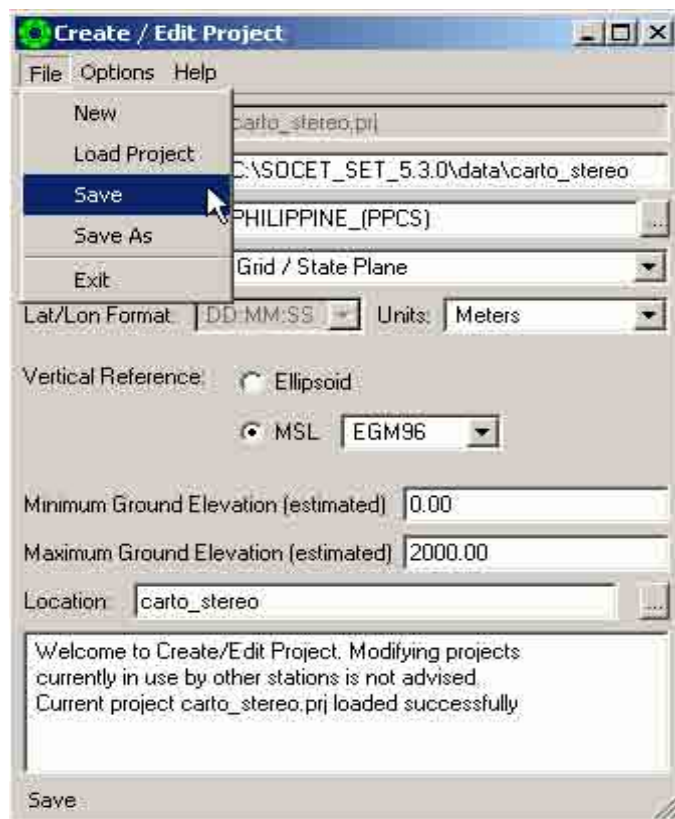


- Click the browse  button in the location box. A “File Location” dialog box will appear. Select the image file location [e.g. spot (211451.2mb)] Then click “OK”






- Type 0 in the “Minimum Ground Elevation (estimated) box and 1800 in the Maximum Ground Elevation (estimated) depending on the highest elevation of the project area. Click “File”, then click “Save”.

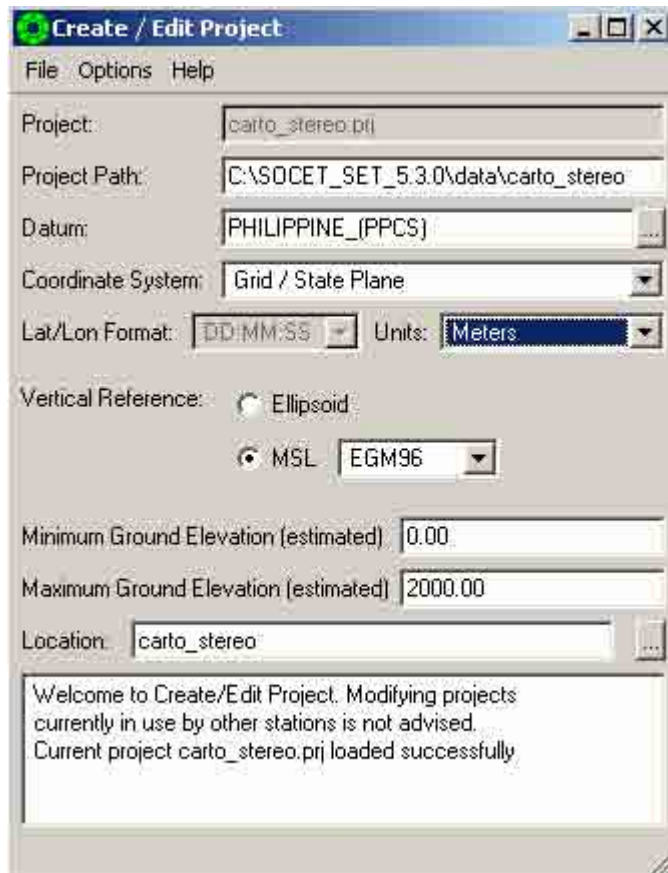




6. A “Project Name Selection” dialog box will appear. Type the desired project name (e.g. monospot) in the “Enter Project Name” box. Then click “OK” .



7. Check the bottom box of the “Create / Edit Project“ dialog box, if the project “carto\_stereo” was created.




#### 3.1.1.4 Importing the Image (SPOT DIMAP)

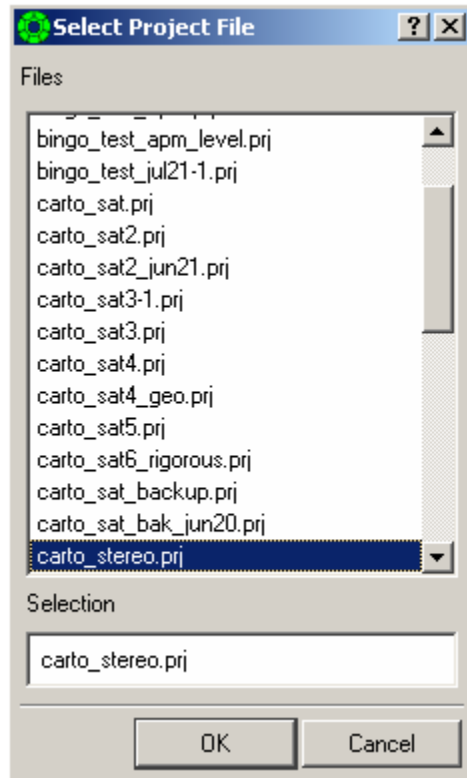
If you are importing SPOT data with three bands, you will see a “All Bands (color)” the three bands will be merged into a single color (3-band) image file. The name of the support file will be what you entered in the name box. If you select “All Bands (grays)” the three bands will be put out as three separate monochrome images. The name of the support file(s) will be what you entered in the name box concatenated with “\_band\_n.sup,” where “n” is “1” “2” or “3” for the three bands. If you select “Band n only,” it will behave the same as “All Bands (grays),” except only the single band you select will be imported. For SPOT4, four bands are available.

1. Click “File”, select “Load Project”.

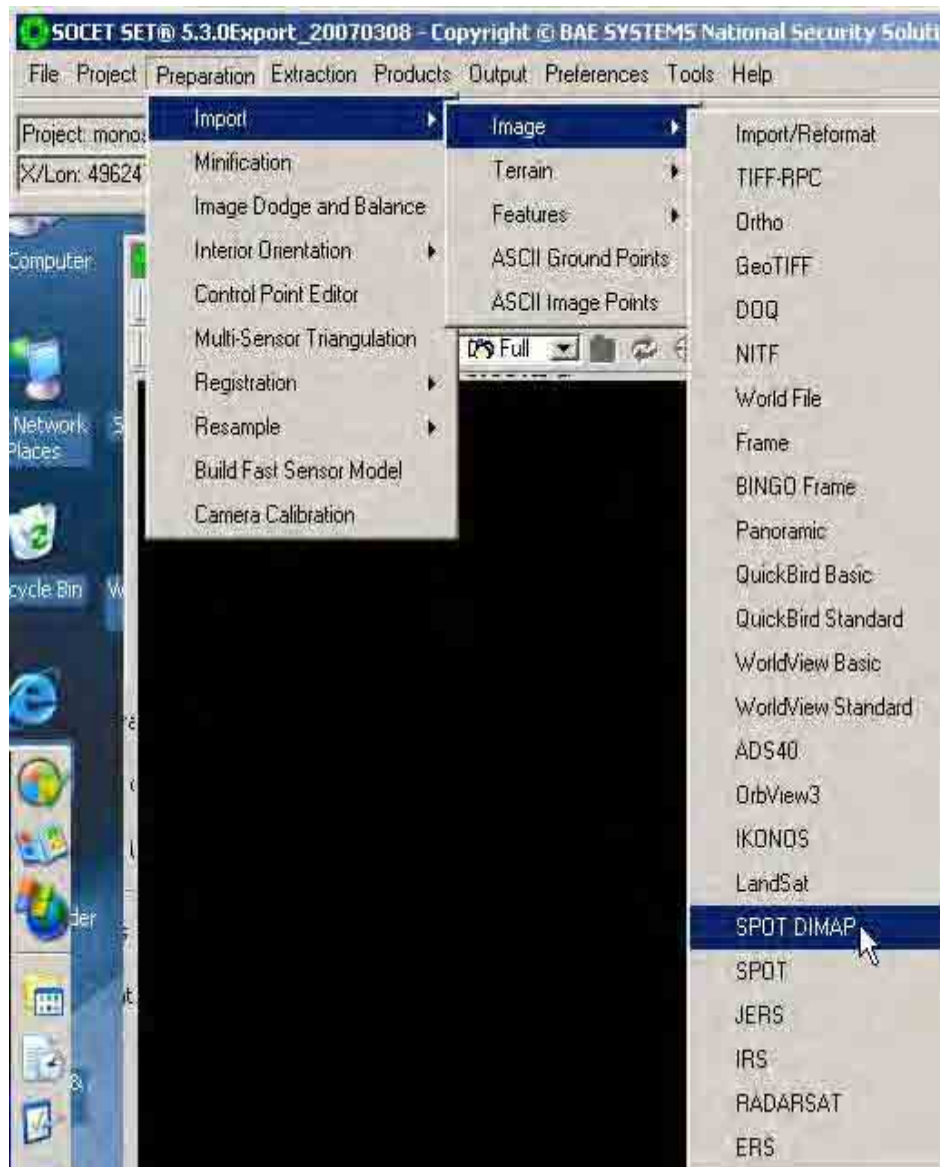




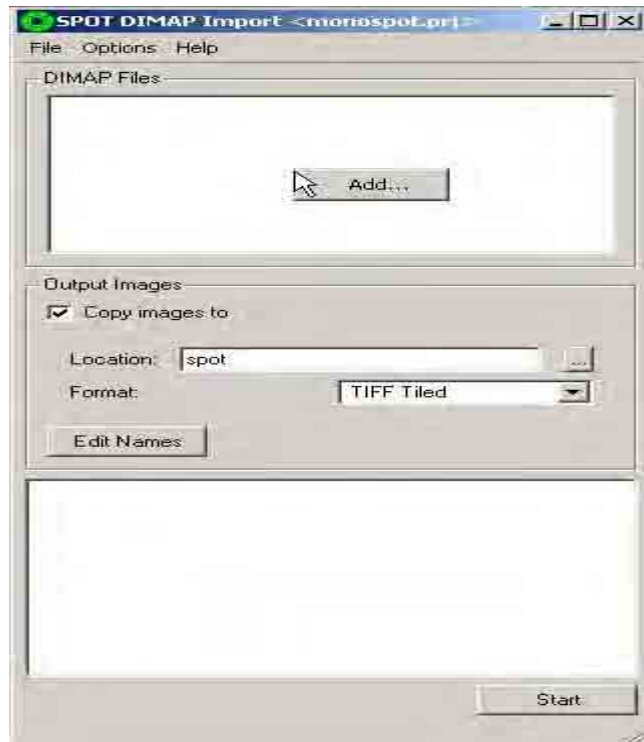
2. A “Select Project File” dialog box will appear. Select the project name (e.g. carto\_stereo.prj) that was created. Then click “OK” .



3. Click “Preparation”, select “Import”, select “Image” and then click “SPOT DIMAP”.

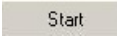


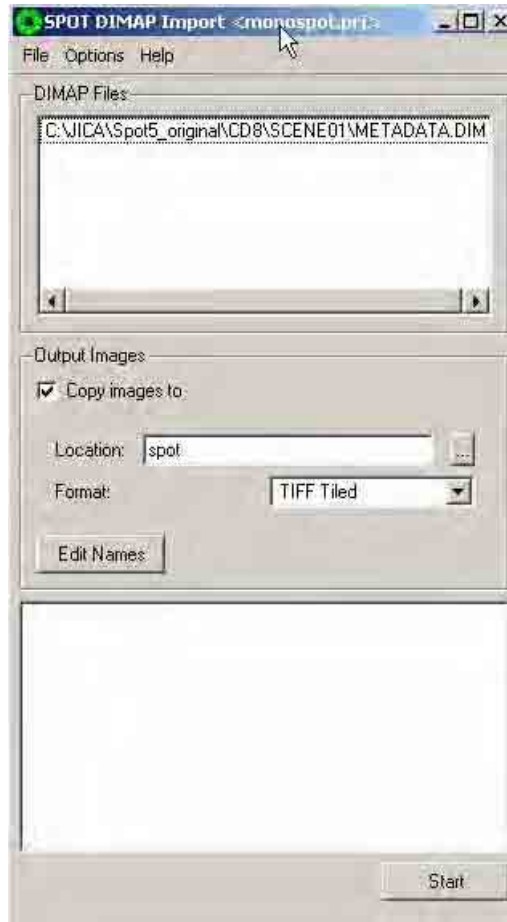
4. A SPOT DIMAP IMPORT<monospot.prj> dialog box will appear. Put mouse arrow inside the "DIMAP files box and click right mouse button. Click the "Add" button.



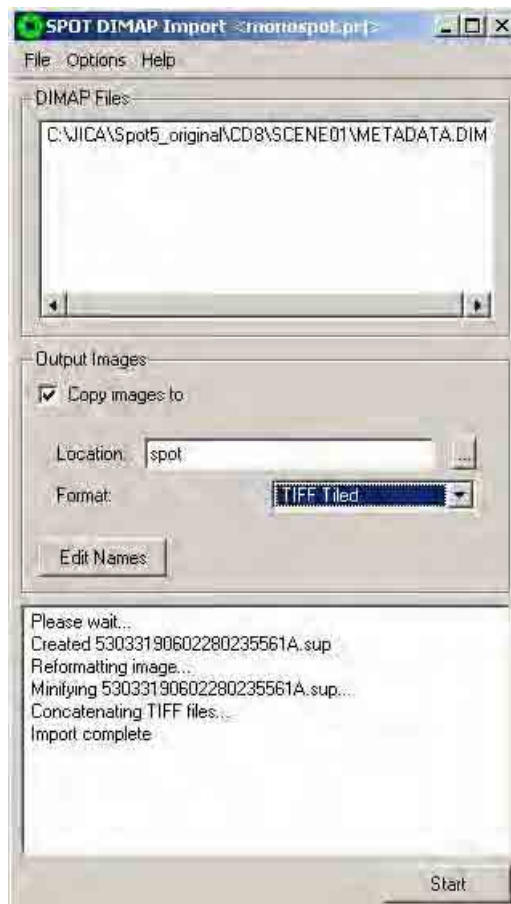
5. A "Select one or more files to add" dialog box will appear. Use the down arrow in the "Look in" box, browse and locate the image file (e.g. METADATA.DIM) to add. Then click "Open" .



- The selected image file will be reflected in the “DIMAP Files” box. Set Format to TIFF TILED. Then click “Start”  


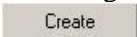


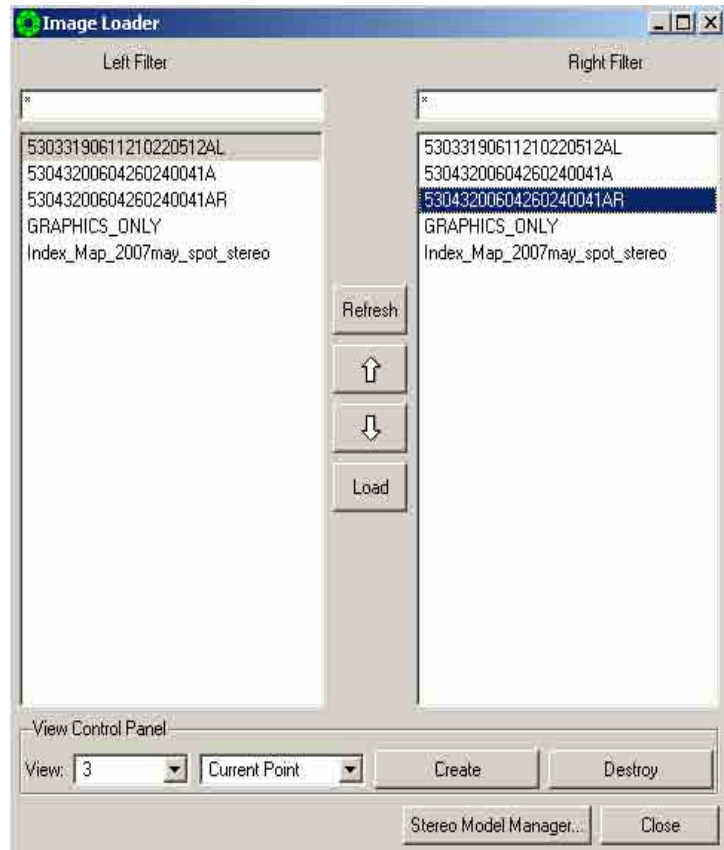
7. See information at the bottom box and check if import is complete.



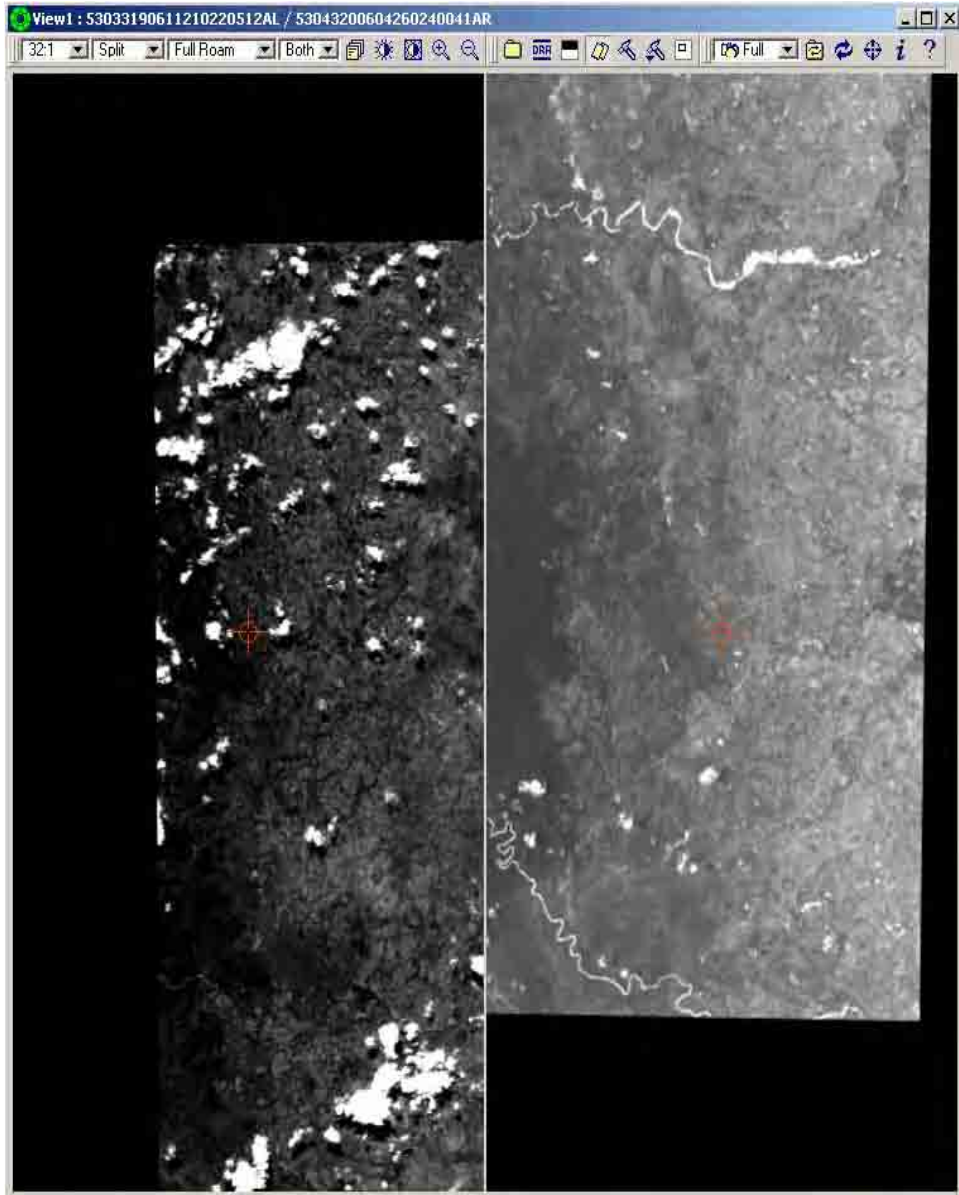
8. After importing the image, click “File”, select “Load Images”.



9. An “Image Loader” dialog box will appear. Click “Create”  to create a view window. Select the first image file (e.g. 53033190611210220512AL) in the left file box and select the second image file (e.g. 53043200604260240041AR) in the right file box. Then click “Load”.



10. A view window will appear displaying the imported image (e.g. SPOT).

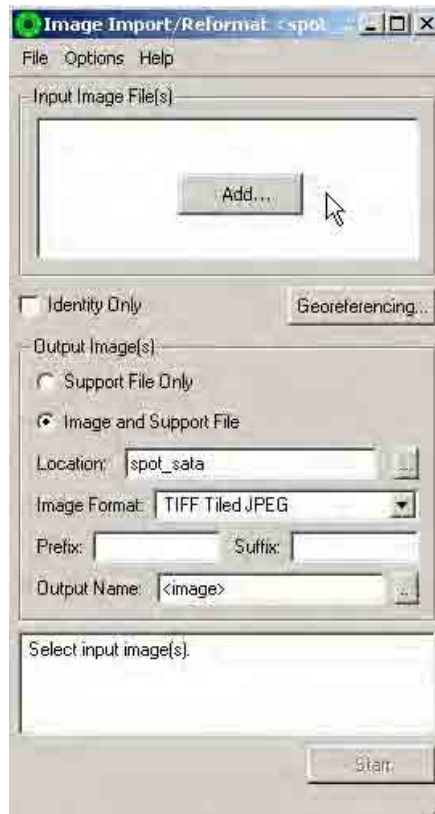


### 3.1.1.5 Importing the Image (Index Map\_Control Point)


1. Click “Preparation”, select “Import”, select image, and click “World File”.

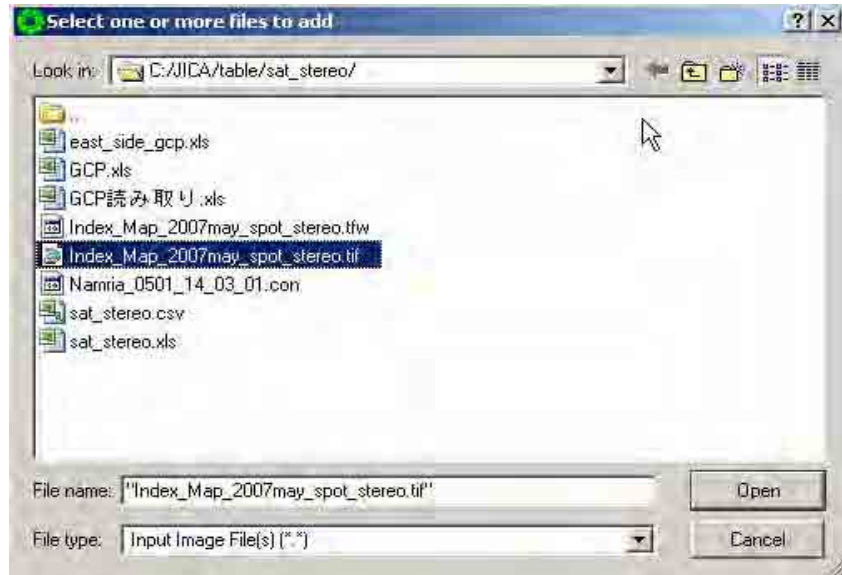


2. An “Image Import” dialog box will appear. Put mouse arrow inside the “Input Image Files” box and click right mouse button. Click the “Add” button.

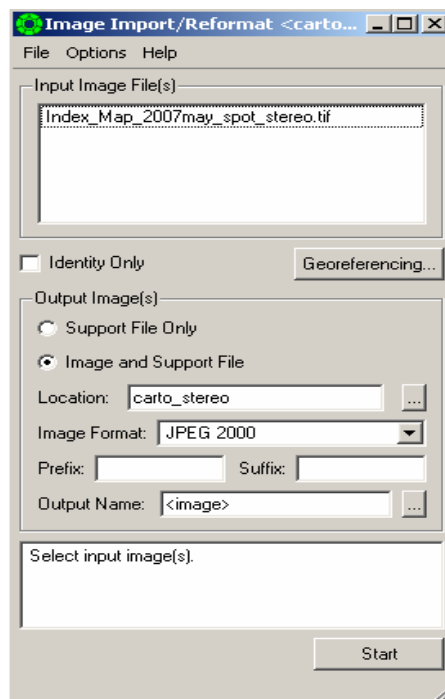




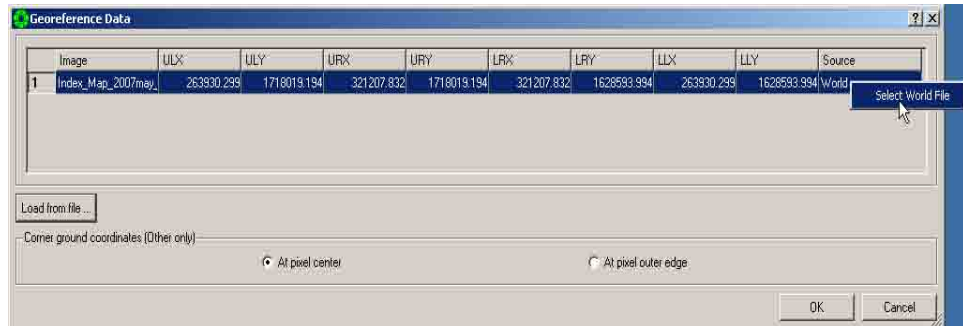
3. A “Select one or more files to add” dialog box will appear. Use the down arrow ▼ in the “Look in” box, browse and locate the image file (e.g. Index\_Map\_2007may\_spot\_stereo.tif) to add. Then click “Open” .



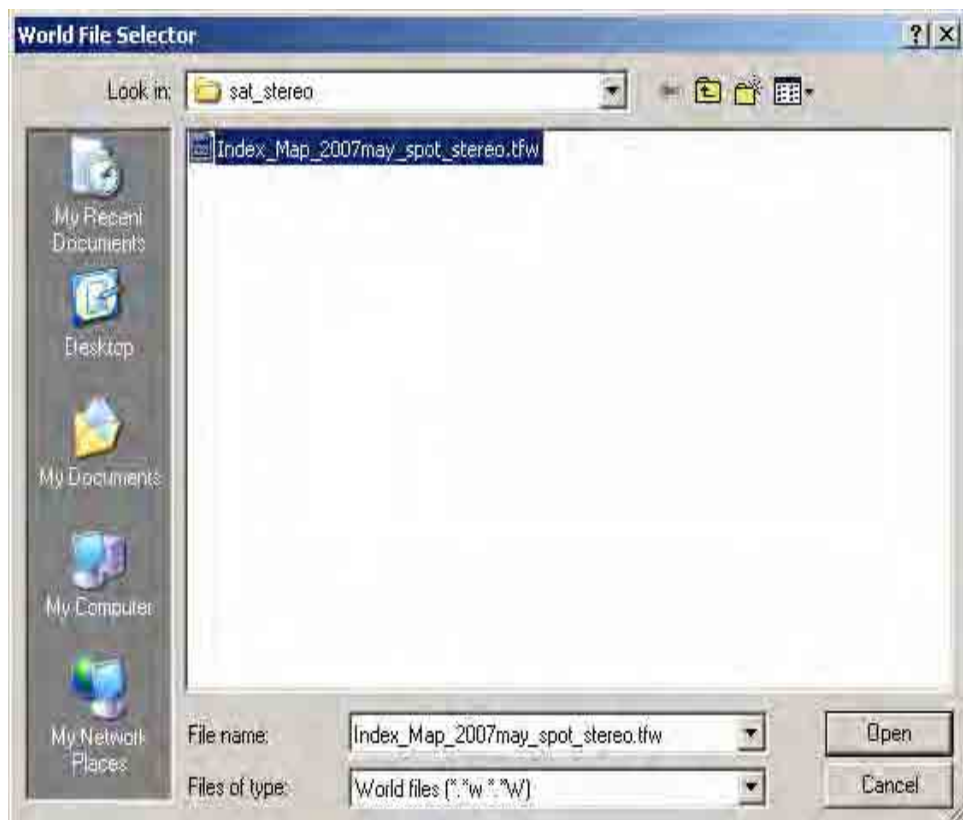
4. The selected image file will be reflected in the “Input Image Files” box. Click “Georeferencing”.



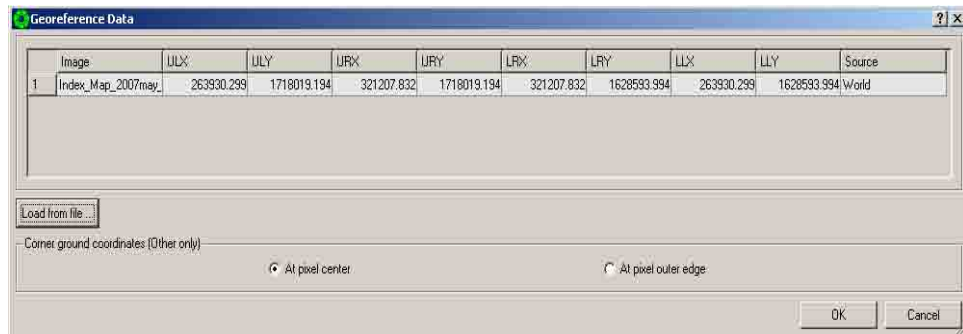
5. A “Georeference Data” dialog box will appear. Select “Other” under “Source” column. Click “Select World File”. Click right mouse button.



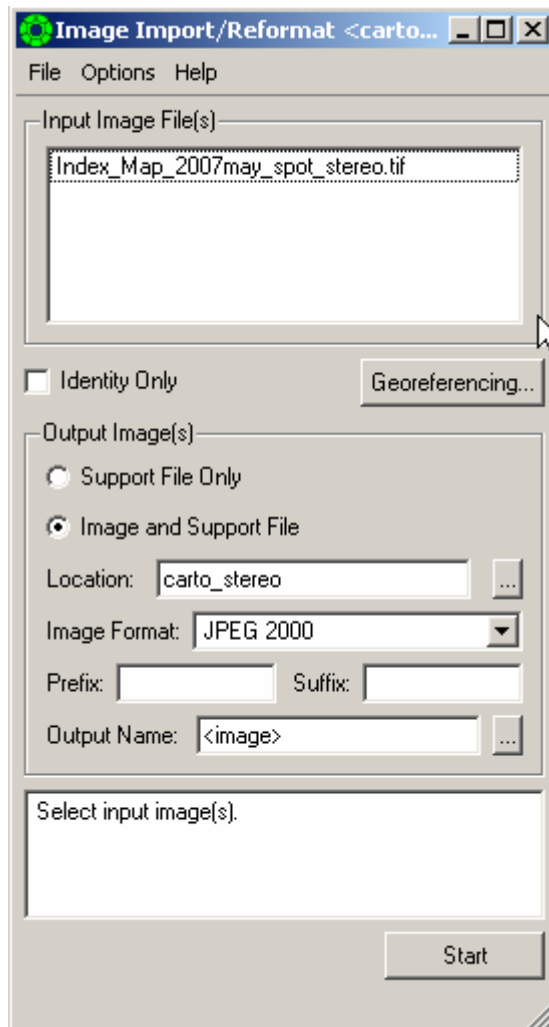
6. A “World File Selector” dialog box will appear. Select the required world file (e.g. Index\_Map\_2007may\_spot\_stereo.tfw). Then click “Open”.



- The world file parameters will be reflected in the “Georeference Data” dialog box. Then click “OK”.



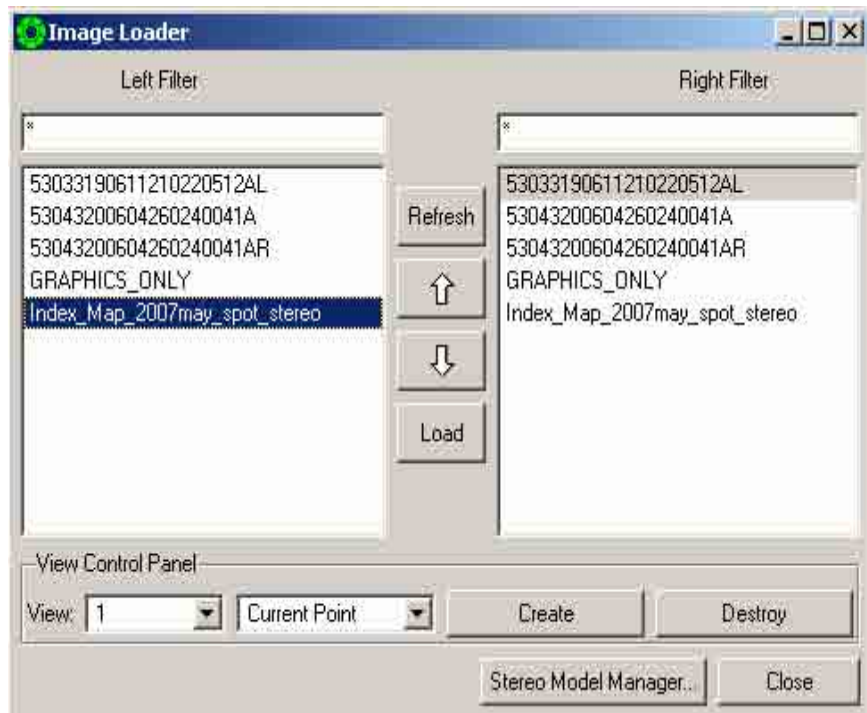
- Set Image Format to JPEG 2000. Then click “Start”.



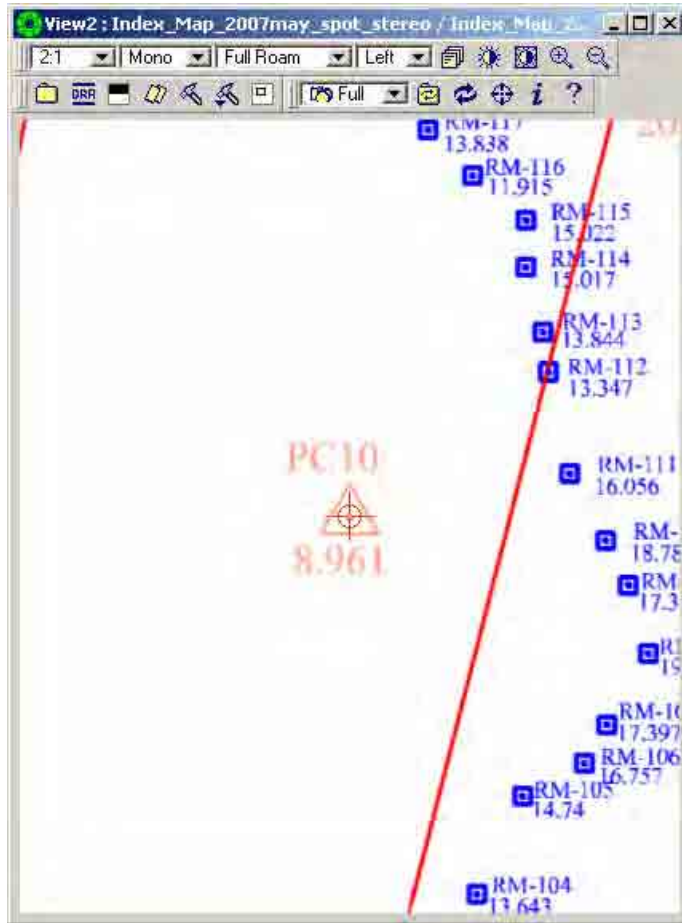
9. After importing the image (e.g. Index\_Map\_2007may\_spot\_stereo.tif) is done, click “File”, select “Load Images”.



10. A “Image Loader” dialog box will appear. Click “Create” to create a view window. Select the image file name (e.g. Index\_Map\_2007may\_spot\_stereo) and click “Load”.



11. A view window will appear displaying the imported image (e.g. Index\_Map\_2007may\_spot\_stereo.tif).



### 3.1.2 Import Ground Controls

Ground Point Import reads ground point data in an ASCII format into the internal Ground Point File Format. The input ASCII file is restricted to one ground point per line. Each ground point contains a point ID along with an (X,Y,Z) coordinate. This information can be in any order, but it must all be on one line. Obtaining this window is as simple as clicking **Preparation > Import > ASCII Ground Point Import** on the main workstation.



Ground point control types of horizontal, 3-dimensional, and vertical are used within SOCKET SET. Ground points which have a value of 0.0 exactly will cause the control point type setting to change. If your data has a control point of 0.0 0.0 3.2, the point type will be set to vertical (Z only). If your data has a value of 2456.8 23778.9 0.0, the point type will be set to horizontal (X and Y only).

You use ASCII Ground Point Import to translate and import ground point data from an external source into the native SOCKET SET ground point file format. The units of the data can be either decimal for UTM, grid, LSR, or Geographic projects (see below), or degrees minutes seconds for any project. Degrees minutes seconds must be entered as “+-DD:MM:SS.SSS”. The presence of two colons is mandatory. When you create a Geographic project, you specify a preference for coordinate display. If you import a file with decimal numbers into a Geographic project whose display preference is “dd.dddd” the numbers will be interpreted as decimal degrees. For all other Geographic projects, decimal numbers will be interpreted as radians.

#### **Edit Input Format Option**

This window provides you with a way to specify the order of the information in the input file. Click **Options > Edit Input Format** on the ASCII Ground Point Import window. You can save this ordering in an input format file for later use with other ground point files.

The Fields column on the right of the ASCII Ground Point Import window (above), indicates the current order. To change a field setting, select the desired format from Format Selection on the left. Then click on the appropriate field on the right.

There are seven format settings from which to select: ID, X, Y, Z, Code, Ignore, and Illegal.

- “Code” has no meaning for ASCII Ground Points.
- “Ignore” is used to ignore any information that may be specified in a field.
- “Illegal” indicates that a field should not contain any information. The entire point is discarded should any information be found in a field marked as “Illegal.” The following are some examples of legal settings for the input fields.



EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
1: ID	1: Y	1: Ignore

EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
2: X	2: X	2: X
3: Y	3: Z	3: Y
4: Z	4: Illegal	4: Z
5: Ignore	5: Illegal	5: Code
6: Ignore	6: Illegal	6: Ignore

### 3.1.2.1 Edit Ground Control Points file.

The GPS Ground Control Points file has several Field columns that need to be edited based on the seven Field column Format settings (ID, X, Y, Z, Code, Ignore, and Illegal) being used in SOCETSET.

1. Open GPS Ground Control Points (text file) in Excel.

Microsoft Excel - sat\_stereo.xls

File Edit View Insert Format Tools Data Window Help

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	A	B	C	D	E	F
1	RM-112	280498.3611	1681111.478	13.36		
2	RM-113	280404.8499	1681730.245	13.84		
3	RM-114	280235.7847	1682861.066	15.02		
4	RM-115	280104.2226	1683767.52	15.02		
5	RM-116	279324.2696	1684465.11	11.92		
6	RM-117	278513.7908	1685292.39	13.84		
7	RM-118	277618.309	1686293.545	12.74		
8	RM-119	276696.0963	1687761.304	13.69		
9	RM-120	275987.1559	1688946.544	13.26		
10	RM-128	271866.0584	1689828.985	14.14		
11	RM-A	275951.6498	1637872.66	3.072		
12	RM-B	276763.5497	1638340.173	3.167		
13	RM-1	277675.2729	1638884.291	11.209		
14	RM-2	278362.2933	1639044.223	5.124		
15	RM-3	279024.4756	1639342.594	6.691		
16	RM-4	279641.7973	1639825.988	8.849		
17	RM-7	281358.4815	1640945.261	10.875		
18	RM-8	282137.3567	1641290.109	32.212		
19	RM-8A	282561.4235	1642146.067	33.285		
20	RM-10	283501.8717	1643639.405	36.208		
21	RM-11	284140.5201	1644438.708	46.343		
22	RM-12	284903.3686	1645035.903	50.384		
23	RM-13	285759.2129	1645837.805	68.99		
24	RM-14	286291.0279	1646570.386	75.381		
25	RM-15	287438.3213	1647882.203	71.757		
26	RM-16	288332.6862	1648183.005	64.762		
27	RM-17	288882.5566	1648908.949	60.774		
28	RM-18	288465.0843	1649143.753	59.051		
29	RM-20	287780.1449	1650526.764	40.447		
30	RM-21	287874.483	1651354.678	36.88		
31	RM-22	287164.6899	1652689.626	32.559		
32	RM-23	287606.3598	1653061.586	34.767		
33	RM-24	288497.9165	1653082.423	36.343		
34	RM-25	289069.1731	1653673.163	33.737		

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Ready NUM



2. Delete unnecessary Field Columns. Then save file to \*.csv format.

	A	B	C	D
1	501	274572.52	1698191.53	33.00
2	502	284407.35	1689629.16	34.00
3	503	285036.27	1686969.12	42.00
4	504	278627.80	1706457.48	37.00
5	505	282713.07	1714043.42	46.00
6	506	291496.24	1717591.18	55.00
7	507	293956.31	1719087.12	77.00
8	508	299401.51	1724409.00	74.00
9	509	300977.67	1729218.00	83.00
10	510	310398.82	1731545.73	202.00
11	511	304110.74	1730564.91	100.00
12	512	300660.70	1730234.01	72.00
13	513	300486.72	1731078.03	76.00
14	514	297375.89	1737378.17	88.00
15	515	296363.88	1737489.20	90.00
16	516	280582.30	1722327.55	52.00
17	517	278239.21	1720170.60	54.00

### 3.1.2.2 Import edited Ground Control Points File.

1. Click “Preparation”, select “Import, and click “ASCII Ground Point”.



2. An ASCII Ground Control Point Import dialog box will appear. Click the browse button in the “Input File Format” box.



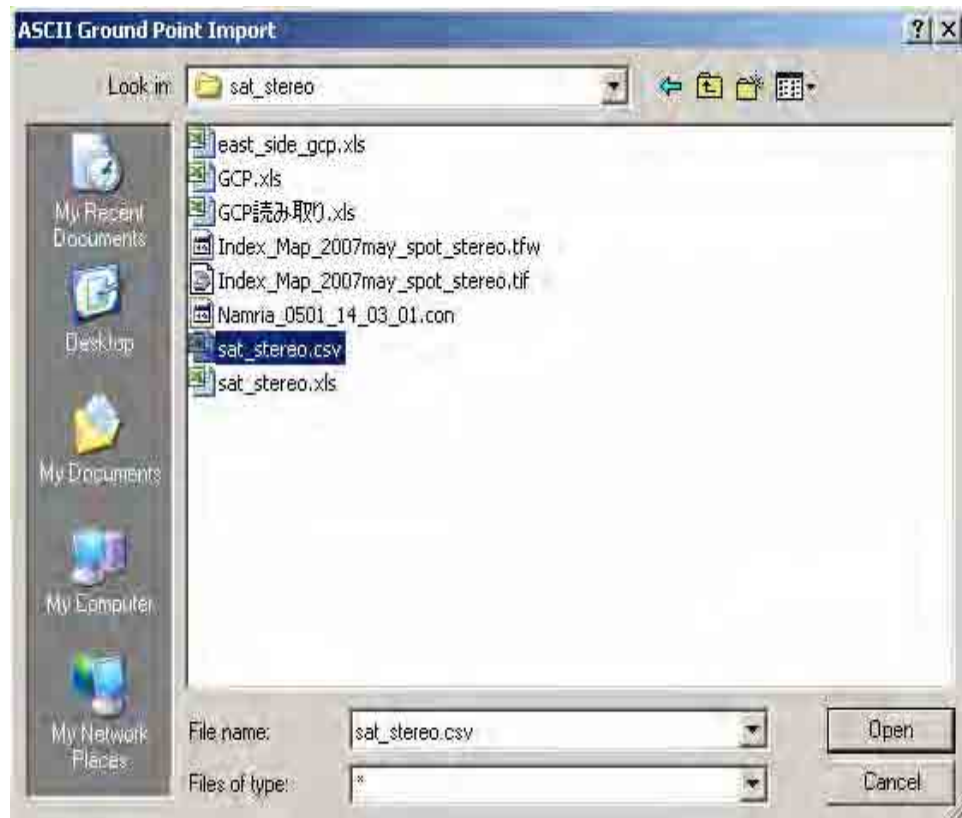
3. Another ASCII Ground Control Point Import dialog box will appear. Select “Default.gcp”. Then click “Save”.



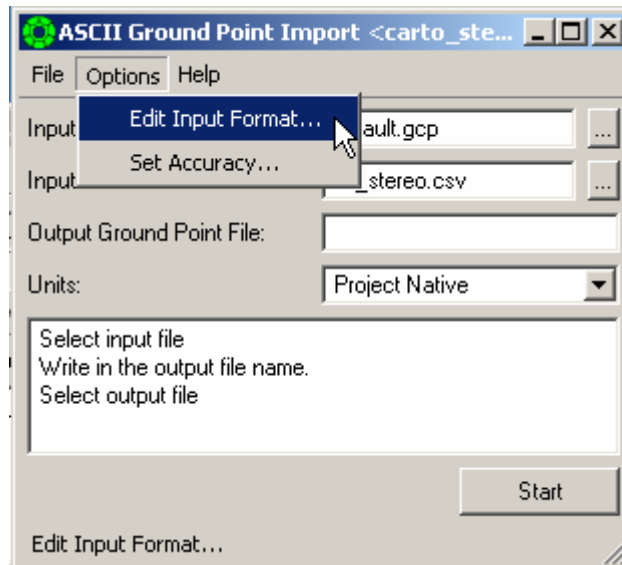
4. Click the browse button in the “Input ASCII Ground Control Point File” box.



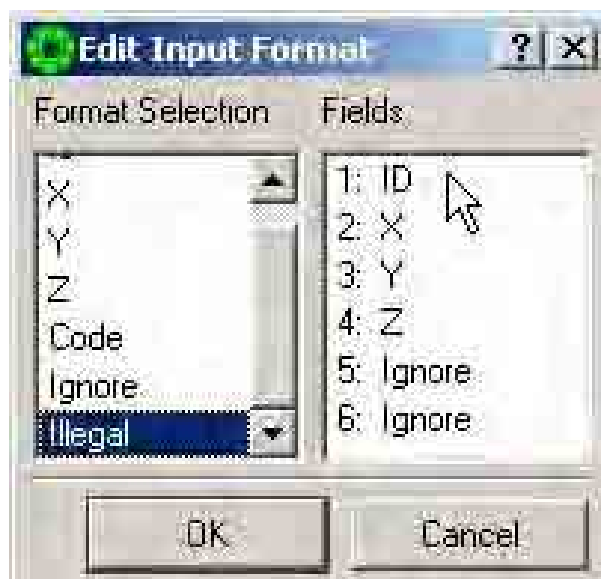
5. An “ASCII Ground Control Point Import” dialog box will appear. Click the down arrow, browse and locate the directory where the gcp text file is located. Select the file (e.g. “gcp\_list.txt”). Then click “Open”.



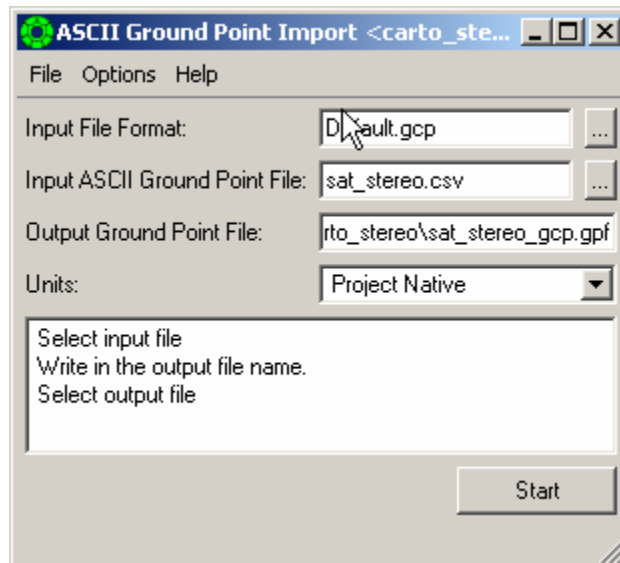
6. Click “Options”, select “Edit Input Format”.



7. An “Edit Input Format” dialog box will appear. Select the settings in the “Format Selection” box the fields (e.g. ID, X, Y, Z) that were used in your gcp text file. Then click “OK”.



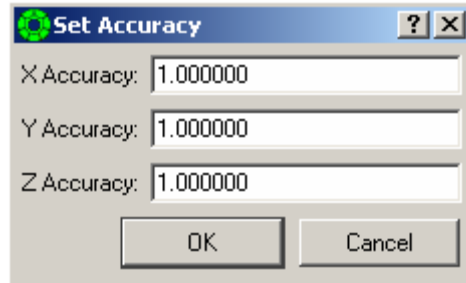
8. Type output ground point file name (e.g. gcp\_spot) in the “Output Ground Point File” box.



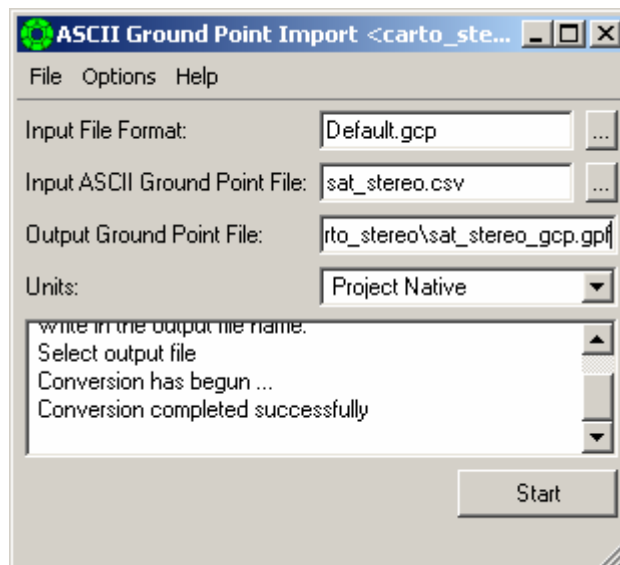
9. Click “Options”, select “Set Accuracy”.



10. A “Set Accuracy” dialog box will appear. Type “7” in “X Accuracy” box, type “7” in “Y Accuracy” box, and type “10” in “Z Accuracy” box. The values are the handheld GPS accuracy level in XYZ. Then click “OK”.



11. Click “Start”. Check the bottom box if conversion was successful.



### 3.1.2.3 Using Control Point Editor

Control Point Editor creates a file of control points, which are used by Triangulation. Use the Control Point Editor to create, view, edit, or change a file of control points.

One of the important features of the Control Point Editor is that it lets you input the control point data in one coordinate system, and save the file in a different coordinate system. Selecting an alternative datum changes the display and input values. These are converted to/from the underlying project datum for storage in the .gpf file. This could be used, for example, when you have a pair of well-controlled images in a UTM project, but you want to collect control points for a State Plane project.

The major capabilities of the Control Point Editor are as follows:

- Creates a new ground point file or modifies an existing ground point file.
- Saves the ground control points to the current project or a different project.
- Converts the list of points to any project's coordinate system and datum.
- Measures (in three-dimensional space) ground points from controlled imagery.
- Drives the extraction cursor to a three-dimensional ground point location for any point in the list.
- Displays and accepts control point data in the current project's coordinate system or an arbitrary coordinate system and datum.

There are four ways to build a file of control points:

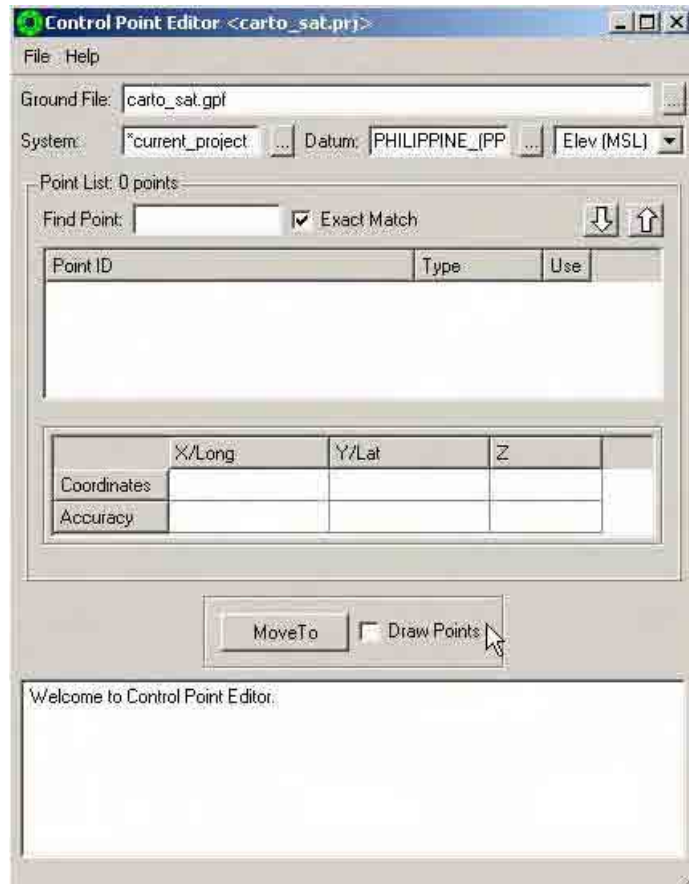
- The Control Point Editor,
- The Interactive Point Measurement window of Triangulation,
- Ground Point Import, and
- Coordinate Measurement Log.

If you decide to use Control Point Editor for inputting your control points, you should run it after you create a project, but before running Triangulation. If you are going to use well-controlled imagery (e.g. PPDB) to fabricate control points, you must import the well-controlled images before running Control Point Editor.

1. Click “Preparation”, select “Control Point Editor”.

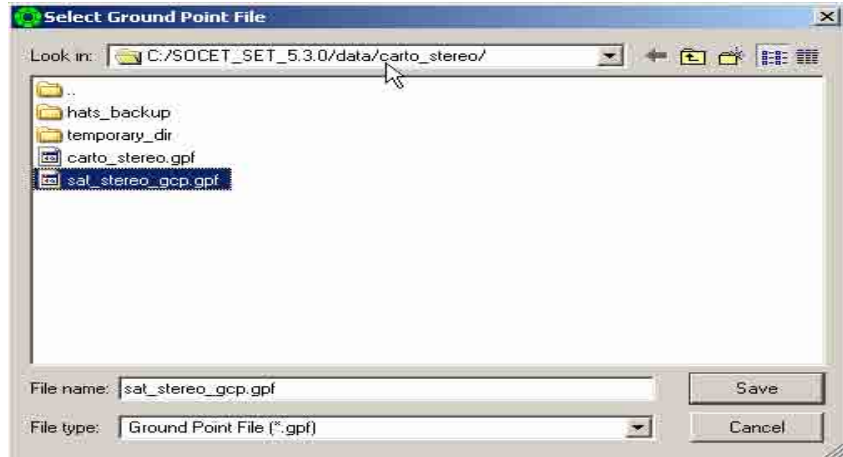


2. A “Control Point Editor” dialog box will appear. Click the browse button in the “Ground File” box.

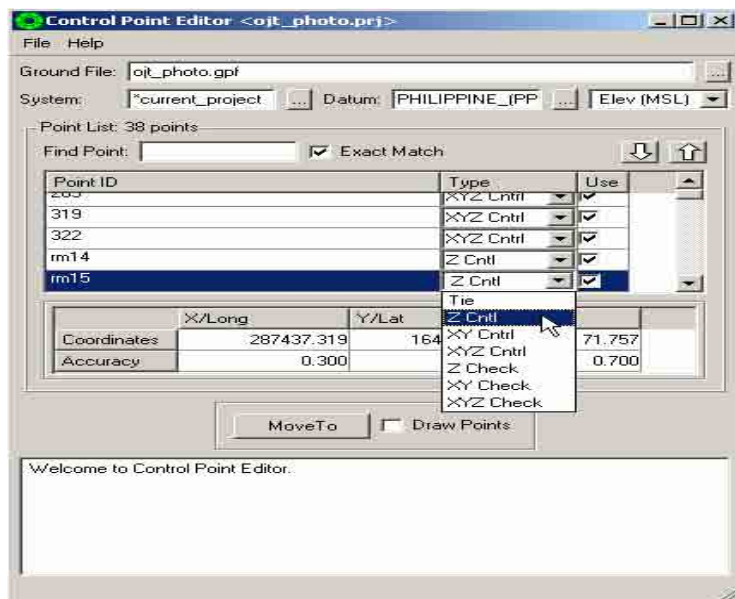




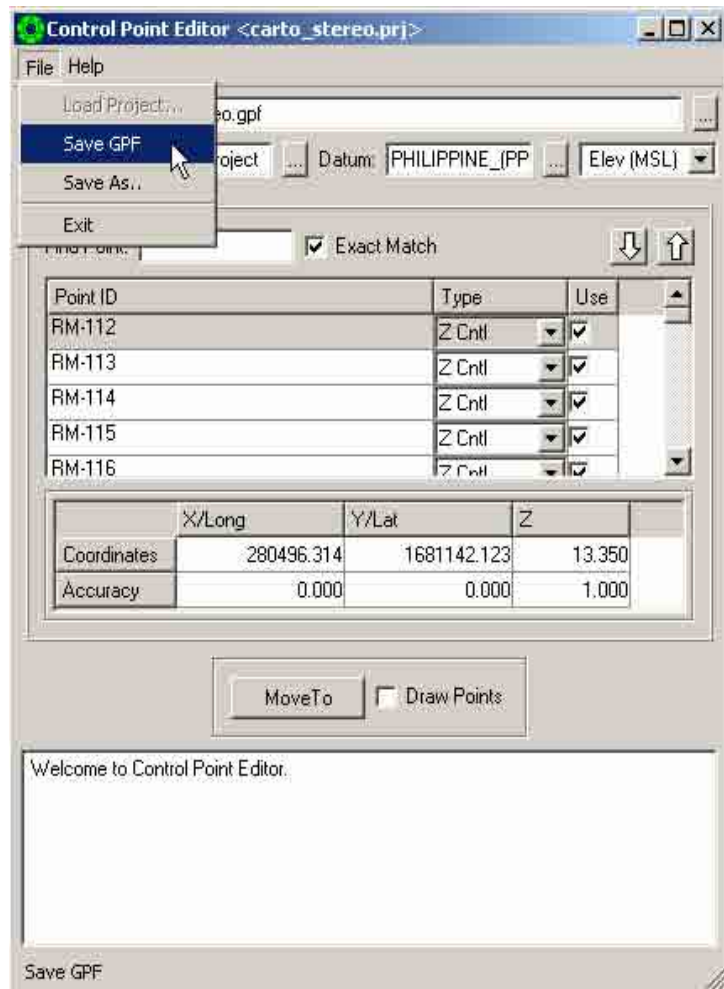
3. A “Select Ground Point File” dialog box will appear. Click the down arrow button in the “Look in” box and locate the folder of the imported ground control point. Then click “Save”.



4. The GCP point ID will be reflected in the Point ID box. Select one point ID (e.g. RM 112), the coordinates XY and elevation Z will be shown in the Coordinates box. Click down arrow and select “Z Cntrl”. Change all “XYZ Cntrl” type of leveling point id to “Z Cntrl”. Edit the Accuracy values with respect to X/Long, Y/Lat, and Z.. Select another point ID and edit the accuracy. Repeat the procedures until all the needed point ID have been edited.



5. Click "File", select "Save GPF".



### 3.1.3 Measurement of Image Coordinates (Points)

There are four ways to measure ground points in imagery:

- Automatic Point Measurement (APM) (in Triangulation)
- Interactive Point Measurement for APM
- Interactive Point Measurement (IPM) for Blunder Detection
- Interactive Point Measurement for Simultaneous Solve

The decision of whether to run IPM before or after APM depends on the kind of ground points you have. The following table gives some guidance:

#### WHAT TO RUN SITUATION

<b>APM before IPM</b>	You have a few control points; and you want to Solve (after APM) before running IPM so that it is easier to find the control points in IPM.
<b>IPM before APM</b>	You measure some control points and some tie points in IPM (in one image only), then you run APM to transfer these points to other images and to measure additional tie points.
<b>IPM only</b>	You have just one image. Or, you have lots of control points and you don't need tie points.
<b>APM only</b>	You have no control points. To interactively review the tie points measured by APM, you use IPM. Neither APM or IPM You have measured the image points on an analytical plotter, and imported them with ASCII Image Point Import, and are using Triangulation only for the Solve process.

**Control Points** are points with known ground coordinates (XYZ, or XY, or Z). You must enter the location into the IPM window. Triangulation stores this data in the project Ground Point File. You must also use the extraction cursor to identify the control point in all the images in which the point is located. The image space positions are stored in the Image Point Files (IPF).

**Tie Points** are points on the ground that you can identify in two or more overlapping images, but you don't know the ground coordinate. You use the extraction cursor to identify the point in all the overlapping images. The image locations are stored in the Image Point Files (IPF). An entry is created in the Ground Point File (GPF) for each tie point. APM will create tie points automatically.

**Check Points** are points with known ground location (XYZ) that are not used in the solution, but are provided to help the operator perform a quality control check after the solution is complete. Check points are also called diagnostic points.

**Ground Point** is an umbrella term that includes Control Points, Tie Points, and Check Points.

**Image points** are the image space locations (in lines and sample coordinates) of Ground Points. A single image point is stored for every instance of a ground point in an image. For example, if a tie point is located in 4

overlapping images, and you measure it in 3 of the images, then 3 image points are stored. Image points are stored in the IPF files. An image point must be associated with some ground point. If you somehow have points in IPF files which are not reflected in the GPF file, transfer them using the **Reset > Transfer Image Points** menu selection.

### Ground Point Selection

Ground Point consists of two tables containing ground point information. The upper table lists all ground points in the current Ground Point File. Clicking the LMB on any point in the table moves the extraction cursor to that point and loads the measured and unmeasured images.

### Image Point Section

This area contains the image status list which displays all images containing the selected ground point. The point status is either locked or unlocked, measured or unmeasured. An X in the appropriate field indicates locked or measured. The Master field indicates which images are loaded left or right. The left master image is always used as the master when Auto Two or Auto All is selected.

#### 3.1.3.1 Opening an Automated Triangulation file.

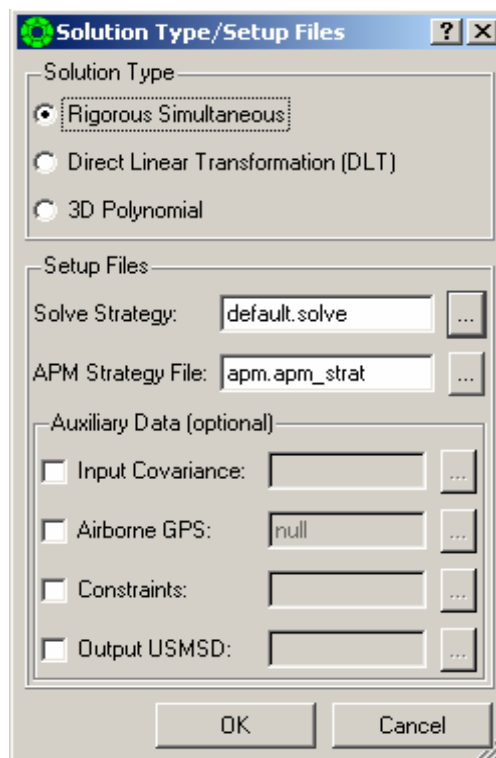
1. Click “Preparation”, select “Multi-Sensor Triangulation”.



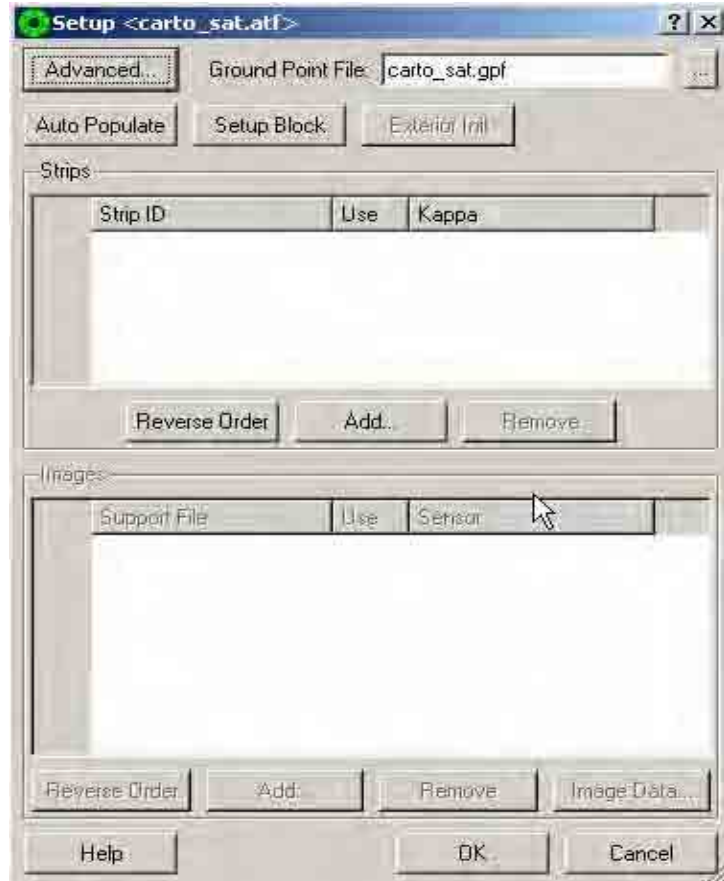
- An “Automated Triangulation” dialog box will appear. Click “Setup”.



- A “Setup” dialog box will appear. Click “Advanced”. Click “Rigorous Simultaneous” in “Solution Type”.





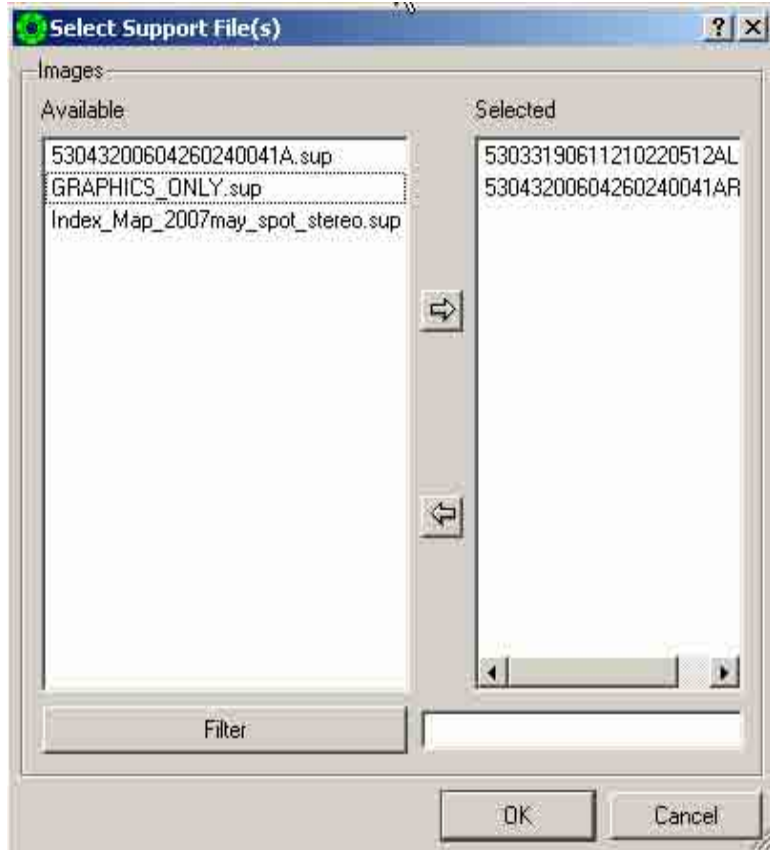
4. A “Setup” dialog box will appear. Click “Add”



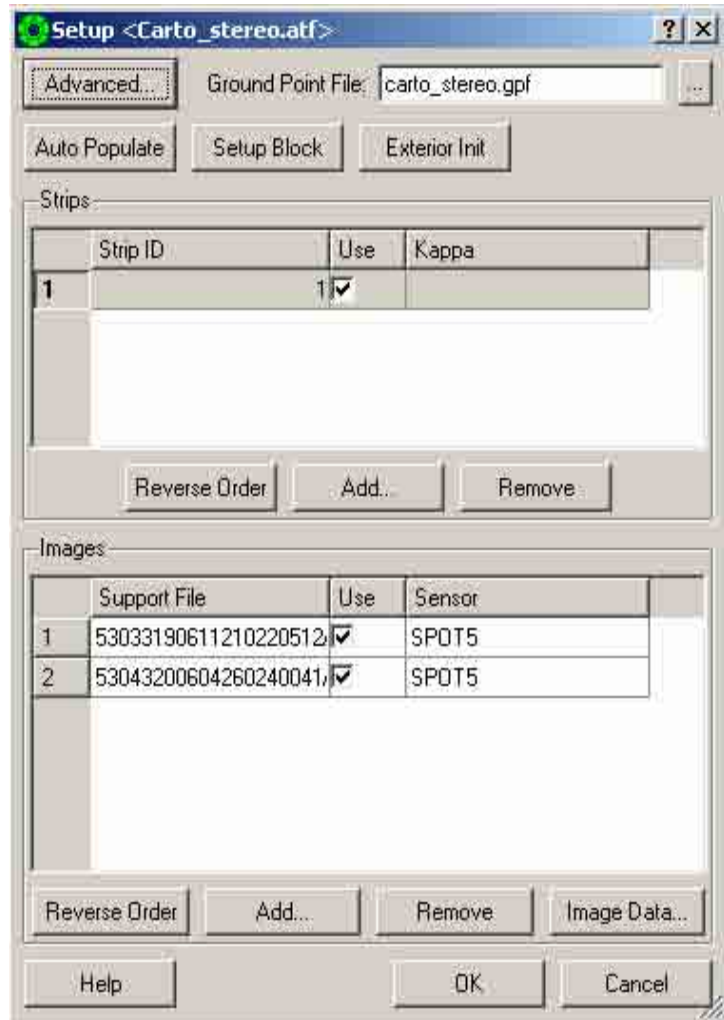
5. A “Strip ID Sequence” box will appear. Type a number (e.g. 1). Then click “OK”



6. A “Select Support File(s)” dialog box will appear. Select the images (e.g. 53033190611210220512AL.sup and 5304320060426240041AR.sup) in the “Available” box. Click the arrow  to copy the selected image to the “Selected” box. Then click “OK” .



7. The created strip 1 will be reflected in the “Strips” box and the selected images (e.g. 53033190611210220512AL.sup and 5304320060426240041AR.sup) will be reflected in the “Images” box. Click “OK”.

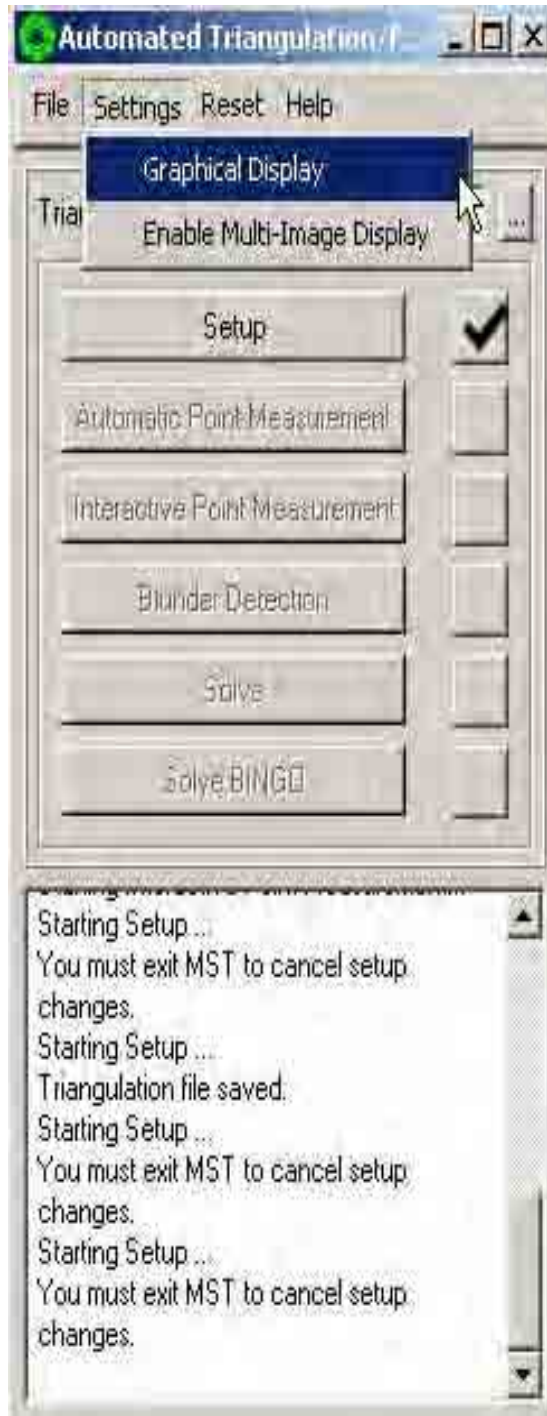




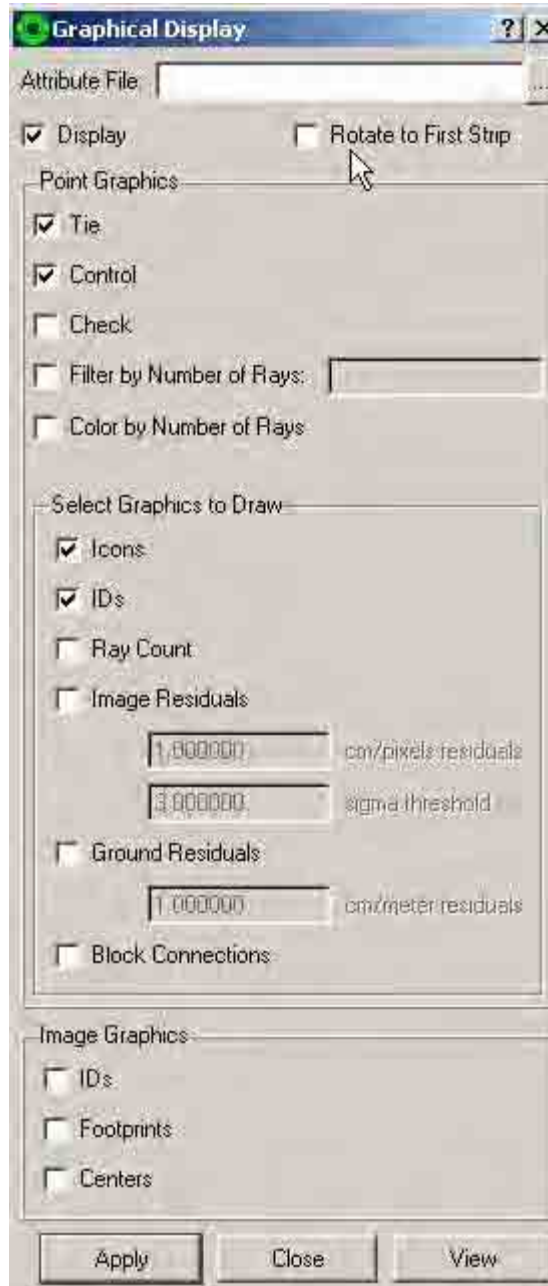
8. Click "Settings" and select "Enable Multi-Image Display".



9. Click "Settings", select "Graphic Display".



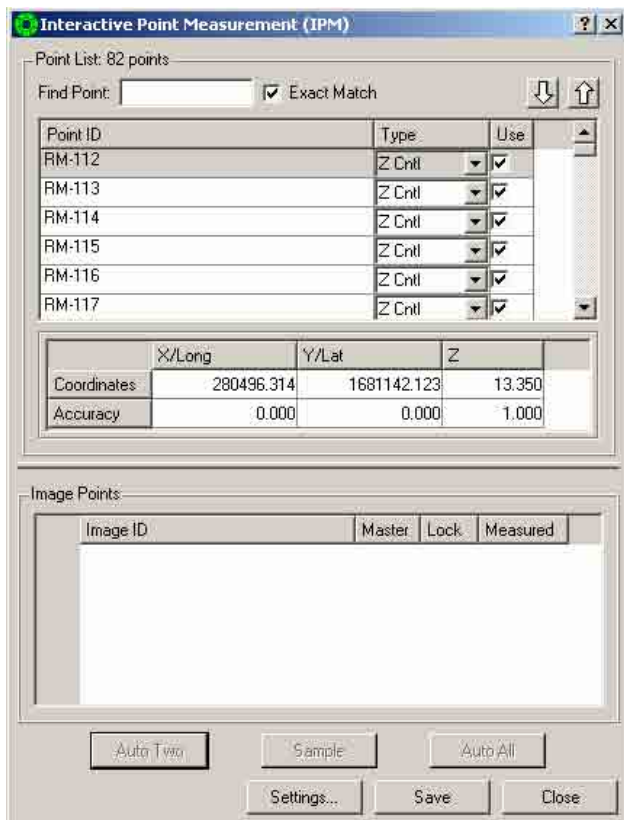
10. A “Graphic Display” dialog box will appear. Check “Tie” box, “Control” box, “Icon” box, and “IDs” box. Click “Apply” . Then click “Close”



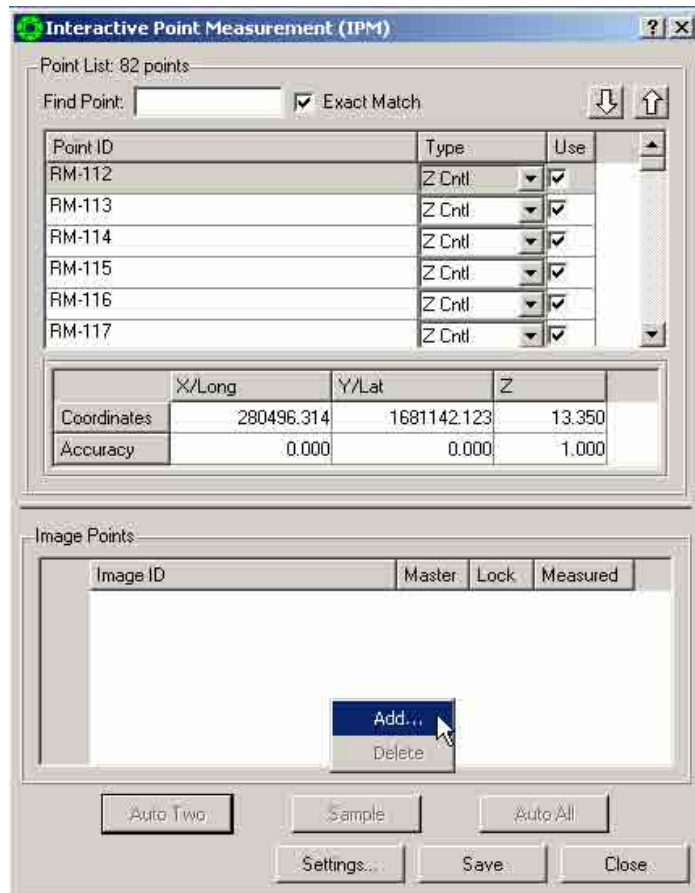
11. Click "Interactive Point Measurement".



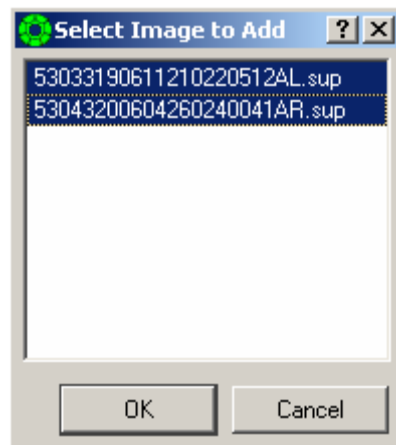
12. An "Interactive Point Measurement" dialog box will appear.



13. Select a Point ID (e.g. RM-112). Put arrow inside Image Points box, click right mouse button and select "Add".



14. A “Select Image to Add” dialog box will appear. Select the needed images (e.g. 53033190611210220512AL.sup and 5304320060426240041AR.sup). Then click “OK”.

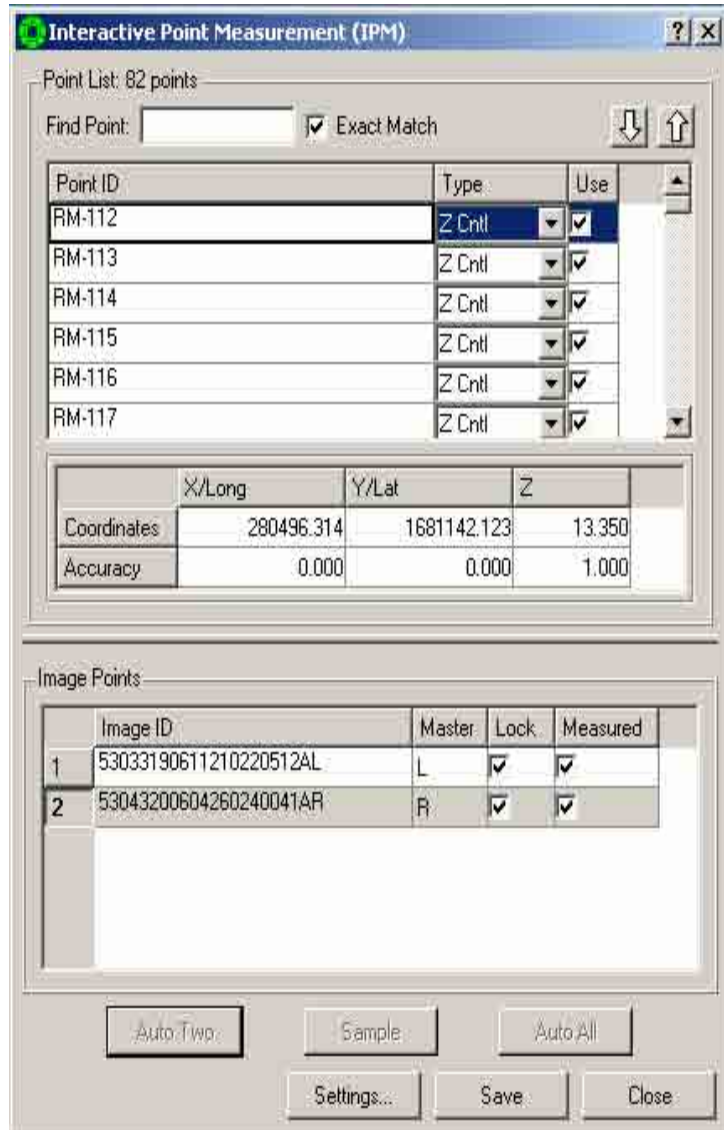


15. The position of selected point ID (e.g. RM-112) will be shown on the image. Using the Description of Bench Mark as reference, move the cursor if necessary to adjust the location of the control point.



DESCRIPTION OF BENCH MARK			
STATION NO.		Operated by	
RM-112		Checked by	
		Date	
Zone No	UTM 51 N		
	N	E	H
PCP	1,681,040.59	280,641.51	
Supplementary Point			
Sketch-Map of Station and Neighborhood			
Photo-Control Point			

16. Once you have moved the cursor to the exact location, check the “Lock” box of the first Image ID (e.g. 53033190611210220512AL). Click “Auto Two” button if the image point Id is within two or more images. Click “Save”.



o

**te: If control point is only within 1 image, just click “Sample” and then click “Save”**

17. Repeat steps 13 and 16 until all the required gcp’s have been measured.



### 3.1.4 Calculation/Inspection

#### 3.1.4.1 Simultaneous Solve.

Simultaneous Solve performs a rigorous triangulation adjustment of a block of images to refine the estimates of their Triangulation parameters. Simultaneous Solve uses the weighted least squares method of adjustment in an iterative manner. It is capable of simultaneous adjustment of blocks of images taken by different sensors such as frame, panoramic, etc. It is also capable of recovering the interior geometry of the sensors via added parameters.

Simultaneous Solve requires the following input: image coordinates of control and tie points and their accuracies (image point files), ground coordinates of control points and their accuracies (ground point file), estimates of Triangulation parameters and their accuracies (support files and Triangulation file), and the interior geometry of the sensors (support files). All these data are automatically accessed by Simultaneous Solve without your intervention.

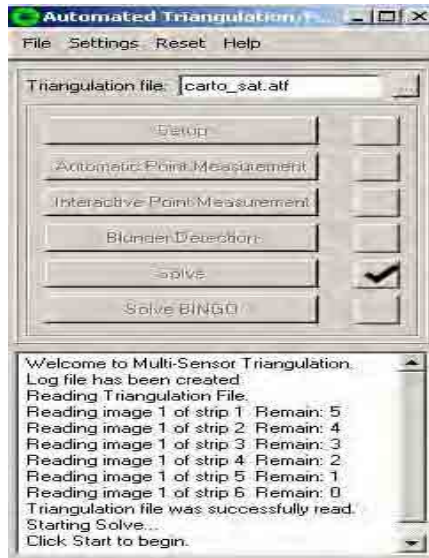
Simultaneous Solve uses a method known as “bundle adjustment” to determine the set of individual image parameter coefficients that minimizes the relative line/sample differences between points measured in overlapping images. The goal is to adjust the image parameters so that the position of a point in one image corresponds to the same point position in the other. If ground control is included, the parameters are adjusted so that the same image point corresponds to the same absolute position on all the overlapping images.

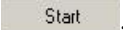
The method constructs a matrix of the linear equations and iteratively adjusts each of the independent image parameters until the solution converges below a pre-defined acceptance threshold. There are generally two problems that can happen with Simultaneous Solve: failure to converge, and excessive RMS residual error.

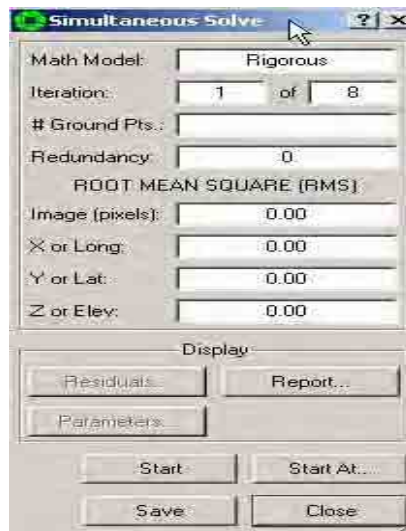
When you accept the solution, Simultaneous Solve will:

- Update the residual fields in the Ground Point File.
- Update the residual fields in each of the Image Point Files.
- Update the sensor model parameters in each of the Image Support Files.
- Write a Solution Accuracy Quality Report file (with extension .rep) in the project directory summarizing the image points, residuals, and solution quality.
- Write a second, more detailed Accuracy Summary Data report <atfilename>.atf.utri\_rep. This contains information on QA statistics not available under the regular solve bundle adjustment method.

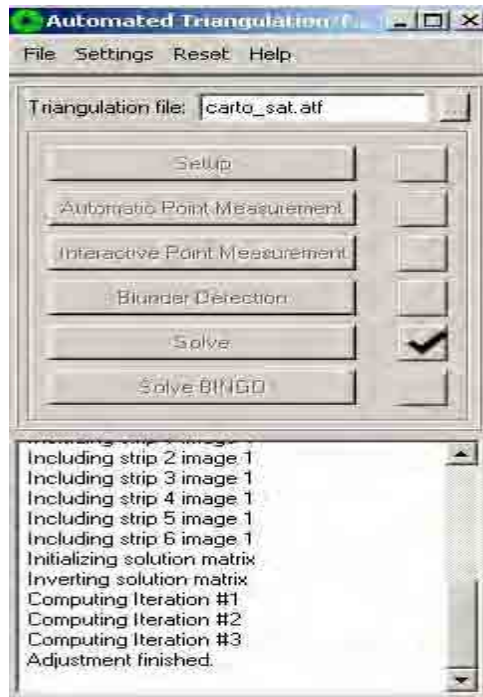
1. After measuring all the needed gcp, click “Solve” in the “Automated Triangulation” dialog box.



2. A “Simultaneous Solve” dialog box will appear. Click “Start” .



3. Check if adjustment of measured gcp is finished shown at the bottom window.

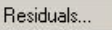


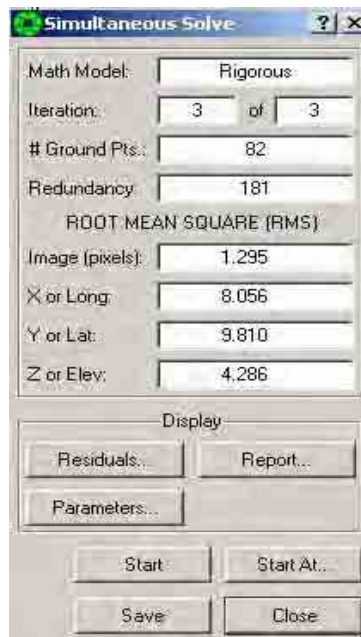
#### 3.1.4.2 Multi-Sensor Triangulation Residual

This window displays the residuals of image coordinates of all points and the residuals of ground coordinates of all control points. The residuals are displayed in a largest to smallest order based on image residuals.

The display residuals window provides a flexible interface to perform the following procedures:

- View lists of residuals
- Change the ground point type
- Toggle ground points ON and OFF
- Toggle individual image measurements ON and OFF
- Re-measure points

1. Click “Residuals”  in the “Simultaneous Solve” dialog box.



2. A “Multi-Sensor Triangulation Residual” dialog box will appear. An RMS (Root Mean Square) **below 1** is acceptable. If your RMS is above 1 you probably made a mistake in measurement. Review the residual values of each gcp and check the point ID which you think needs to be re-measured.

Point ID	State	Type	Lon/X	Lat/Y	Ht/Z	Image ID	Measured	Line	Sample
4						5304320060426	X		0.08
5	RM-28	X	Z Cntrl			-0.15	5304320060426	X	-0.70
6						5303319061121	X		0.70
7	RM-112	X	Z Cntrl			-0.16	5303319061121	X	-0.65
8						5304320060426	X		0.65
9	RM-23	X	Z Cntrl			+0.08	5304320060426	X	0.61
10						5303319061121	X		-0.61
11	RM-24	X	Z Cntrl			+0.31	5303319061121	X	-0.52
12						5304320060426	X		0.52

### 3.1.4.3 Reviewing and correcting GCP measurement with residual errors.

#### **Excessive RMS residual error**

The RMS of all the image residuals for the block is reported once convergence has been achieved. The acceptability of the RMS residual error depends on the sensor type and GSD but should be less than 1.0 pixel in most cases. Values greater than this indicate that one or more points is mismeasured and is skewing the solution excessively.

The Display Residuals menu can be selected to view the current image and ground residuals for all the measured points sorted by magnitude. Unfortunately, the largest residual points may or may not be the culprit in skewing the solution.

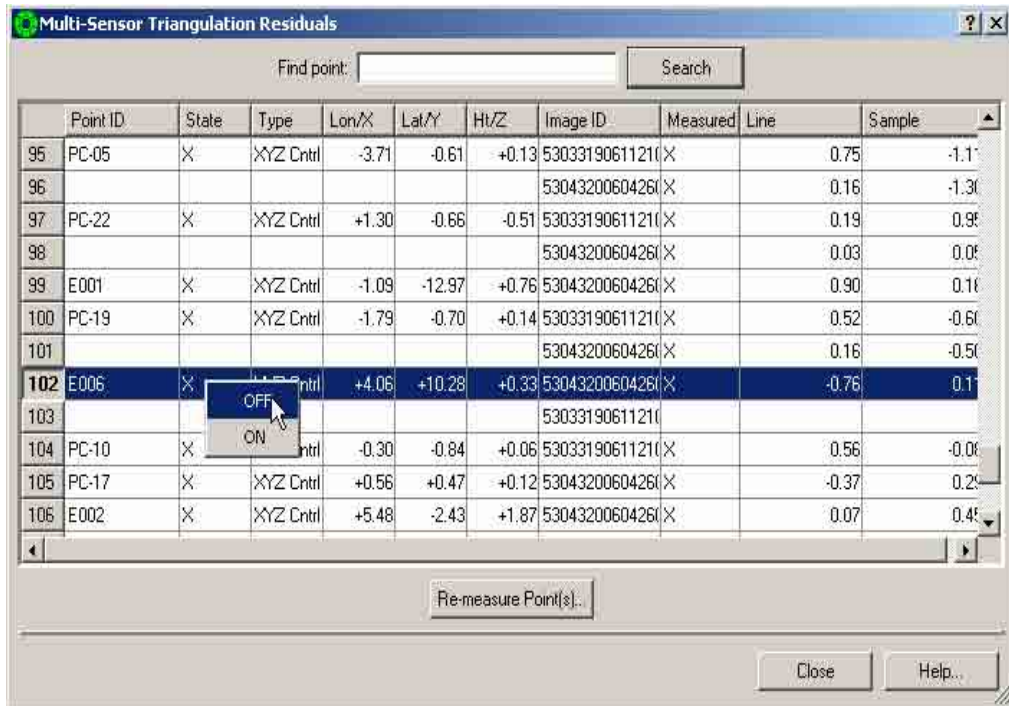
The first strategy should be to turn off all control points and attempt a relative solution first, unless the bad tie point is obvious.

If you examine a point with a high residual and it looks like it was well measured, you can skip it and try other points until you find one that is mismeasured. Examine points with even numbers of image overlaps over 2 (4, 6) and check the points between the first, third, fifth, etc. images to make sure that the point is measured at the same location.

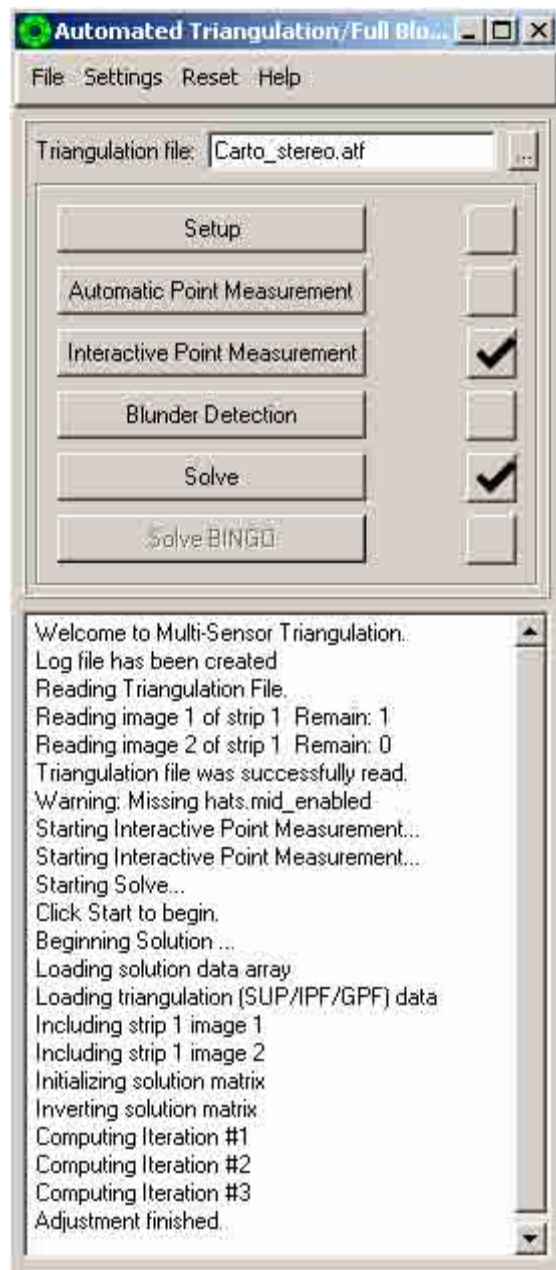
Also, move and remeasure points which are on rooftops or in trees. Trees tend to move somewhat in windy conditions, or are difficult to measure accurately and distort the solution when used for tie point locations.

It is recommended that solutions with excessive RMS error should be discarded and not Saved. It is likely that the resulting math models are degenerate, or at least worse than the existing approximate math model. If the relative solution (control points OFF) shows good RMS error results, the math model can be Saved and the control points can be later remeasured. Usually the problem is not the measurement but the absolute ground position specified for the point. You should confirm from the original hardcopy control database, or other sources, that you have the right coordinates for the right image point, and that the elevation data is consistent with the project units (feet vs. meters, MSL vs. Ellipsoid) as specified.

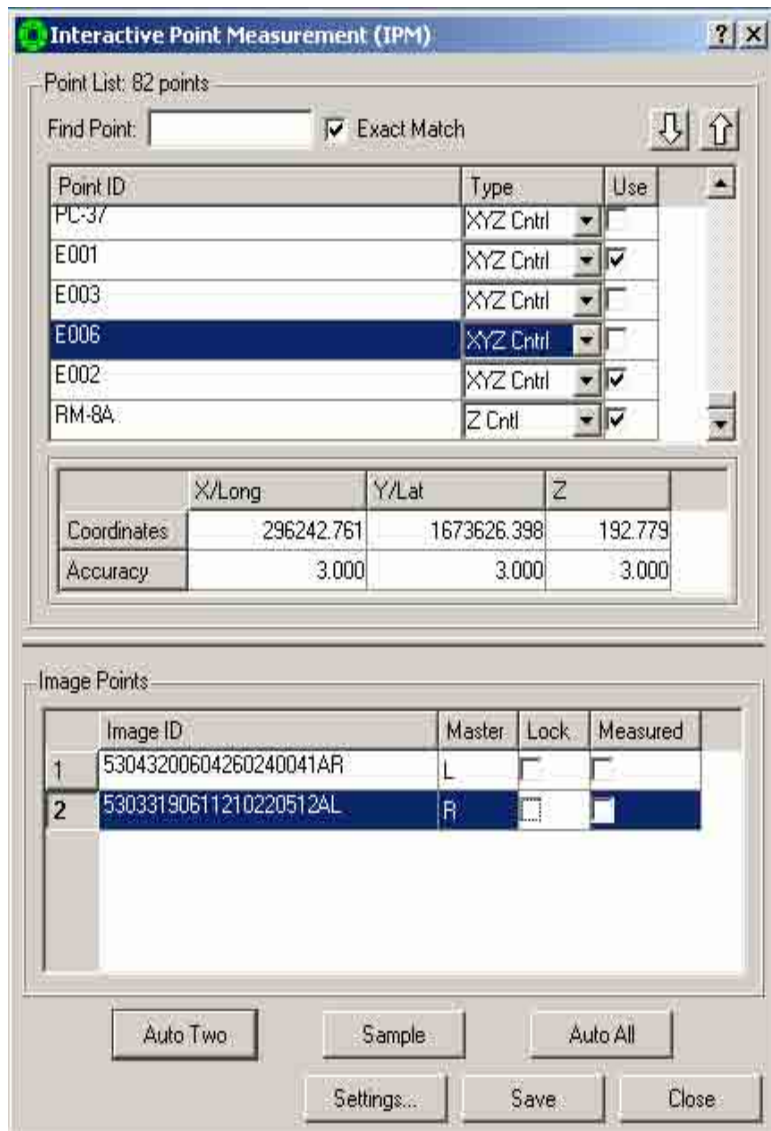
1. After all the measured points have been calculated, using the “Multi-Sensor Triangulation Residual” dialog box, identify and select point ID’s (e.g. E006) which has a large Lon/X and Lat/Y value. Click right mouse button and select “OFF”.



2. In the “Automated Triangulation/Full Block” dialog box, click “Interactive Point Measurement”.

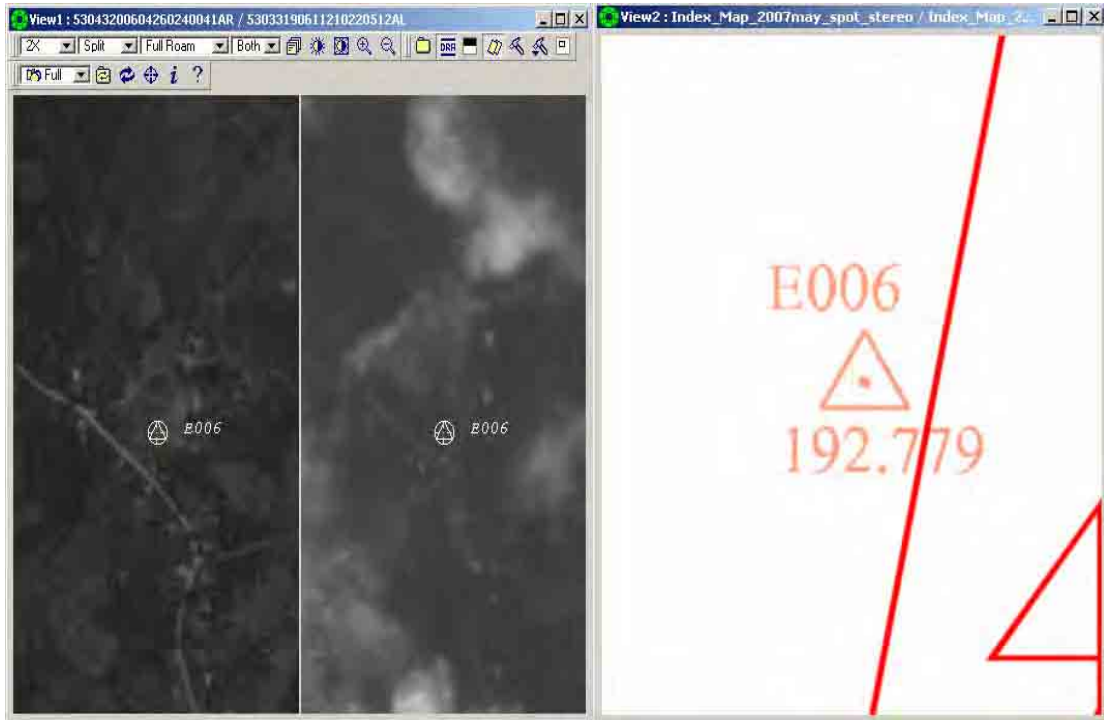


- An “Interactive Point Measurement” will appear. Click the down arrow. Locate and select control points (e.g. E006) that were turned off.

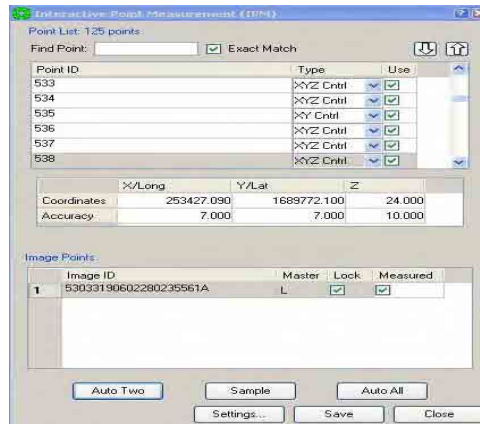




- The position of the select point ID (e.g. 538) will be identified on the image in view 1 and also in the gcp index in view 2. Set active view 1 and move cursor to a new position.

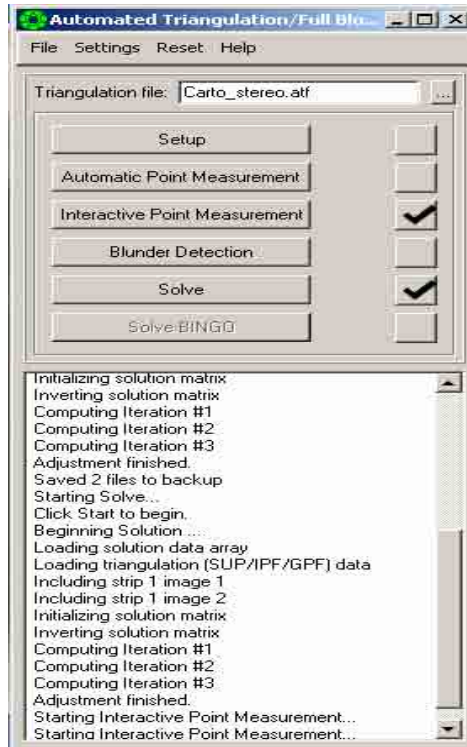


- Check “Lock” in the “Image Points” box, select “Sample” and click “Save”.

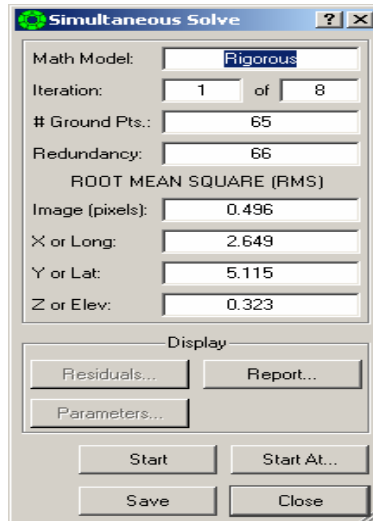


**Note:** Repeat steps 3 - 5 until all the control points that were turned off were selected, viewed and remeasured if necessary.

- Click "Solve" in the "Automated Triangulation" dialog box.



- A "Simultaneous Solve" dialog box will appear. Click "Start". Then check the RMS if value result is less than 1. Then Multi-Sensor Triangulation is ok.



### 3.1.5 Product

Spot image with all the measured control points



### 3.2 Creating DTM (SOCETSET)

You create a DTM within the ATE or ITE applications. Depending on which application you are running, do the following to interactively create a new flat DTM:

Click Extraction > Terrain > Automatic Extraction

or

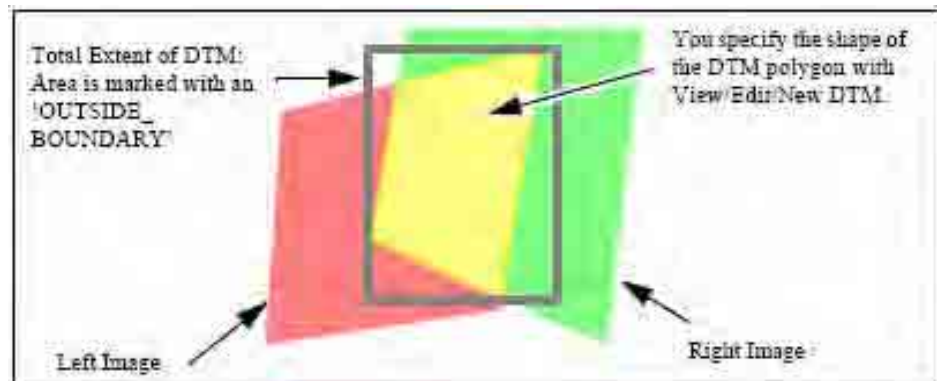
Click Extraction > Terrain > Interactive Edit

Click File > Create DTM... on the ATE or ITE windows.

To create a DTM, you must select an ATE Method (either Adaptive ATE or Non-Adaptive ATE) and the images to be used when generating the DTM data (for explanations regarding Adaptive ATE and Non-Adaptive ATE, see Choosing an ATE Method section below). See “Adaptive vs. Non-Adaptive ATE” on page 35-1 for greater detail. If you select more than two images, the images must not be rectified. You must also define the boundary of the DTM. The DTM boundary can be:

- A polygon
- A minimum bounding rectangle around a polygon
- A rectangle defined by its Lower-Left and Upper-Right corner coordinates

If you are going to run ATE next, the DTM boundary should cover the overlapping area shared by at least two images, as shown in the figure below (for the case of only two images: left and right).



The DTM you create will always be rectangular. When using a polygon to define the DTM boundary and the polygon is not rectangular, the posts outside of the polygon will be marked with a Figure Of Merit (FOM) value of OUTSIDE\_BOUNDARY and will not be considered as valid posts by any SOCET SET application. For TIN DTM formats, there will be no mass points and breaklines outside of the polygon. See the figure above for an illustration.

There are four ways to define DTM boundary:

- |                |   |
|----------------|---|
| Use Polygon    | Use Minimum Bounding Rectangle around Polygon         |
| Use ATE Images | Specify Lower-Left and Upper-Right Corner Coordinates |

You must also specify the new DTM's post spacing, and a strategy or a number of DTM Filter parameters. You can then start Automatic Terrain Extraction to collect DTM data.

After you create a DTM, your next step is to run one of the following applications:

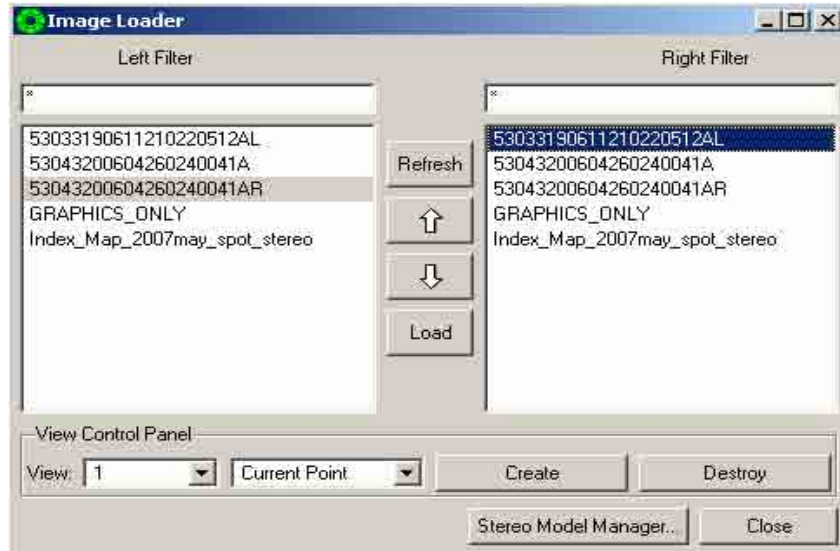
- ATE—For all rural imagery and for small-scale imagery of urban areas. After ATE, you will run Interactive Terrain Editing or DTM/Feature Merge.
- ITE—For large-scale imagery of urban areas. You can use ITE to build the DTM manually.
- DTM/Feature Merge—If you have a vector database containing features such as drains, breaklines, and ridges.

### 3.2.1 Extract DTM Points

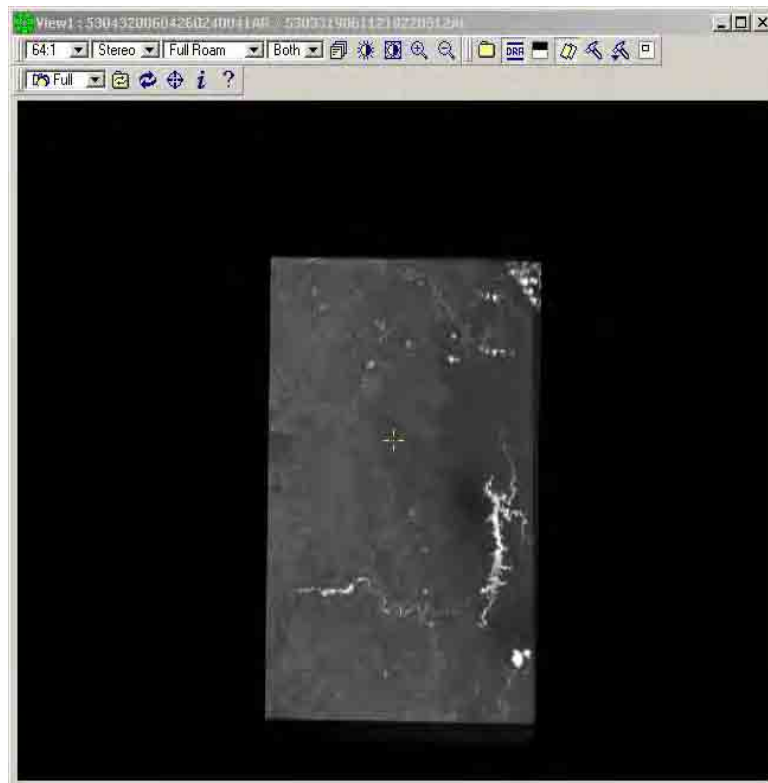
1. Click "File" and select "Load Images".



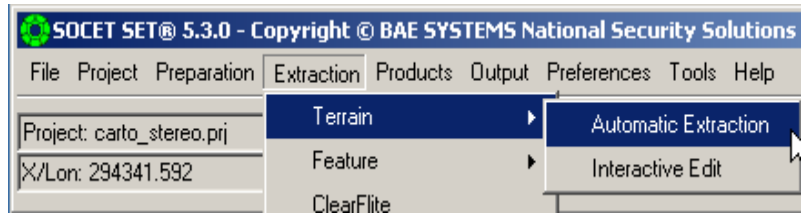
- An “Image Loader” dialog box will appear. Create a view and select the required images to be used.



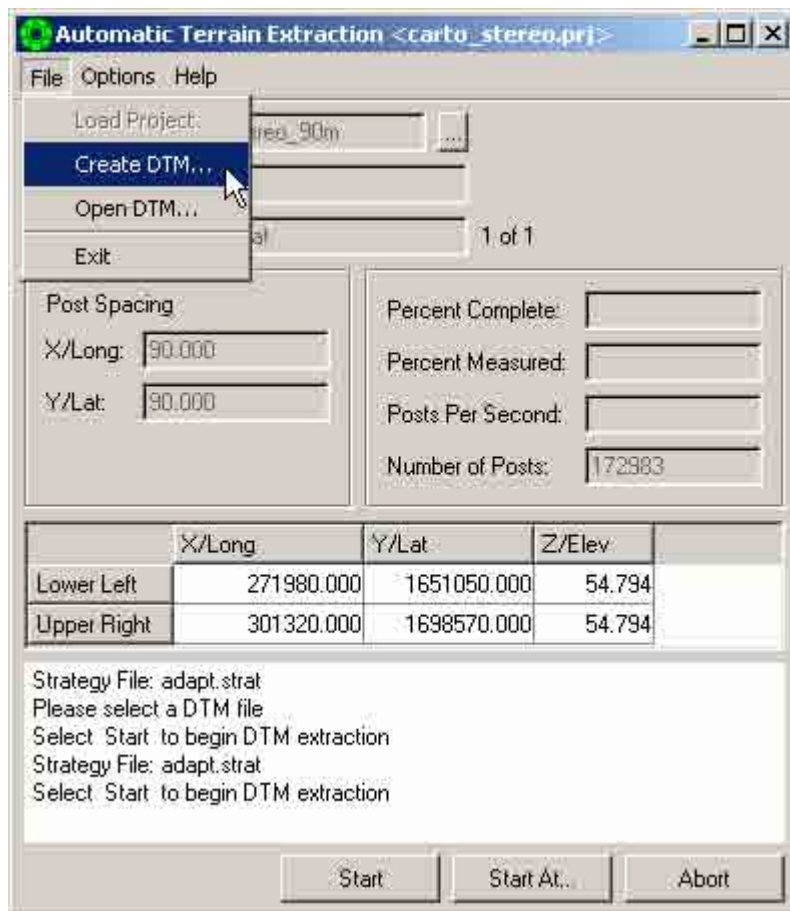
- The selected image (e.g. 53033190611210220512AL.sup and 5304320060426240041AR.sup) will be displayed in the view box created.



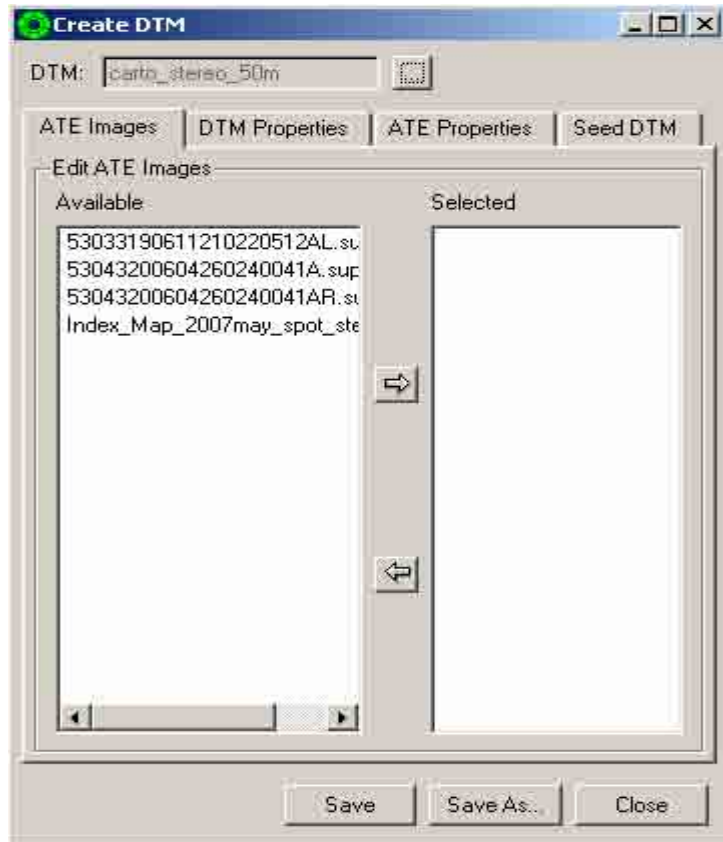
ick “Extraction”, click “Terrain”, and select “Automatic Extraction”.



- An “Automatic Terrain Extraction” dialog box will appear. Click “File” and select “Create DTM”.



6. A “Create DTM” dialog box will appear. Select the SPOT images in the available box, click the arrow. Click the browser button on the left side of the DTM box.

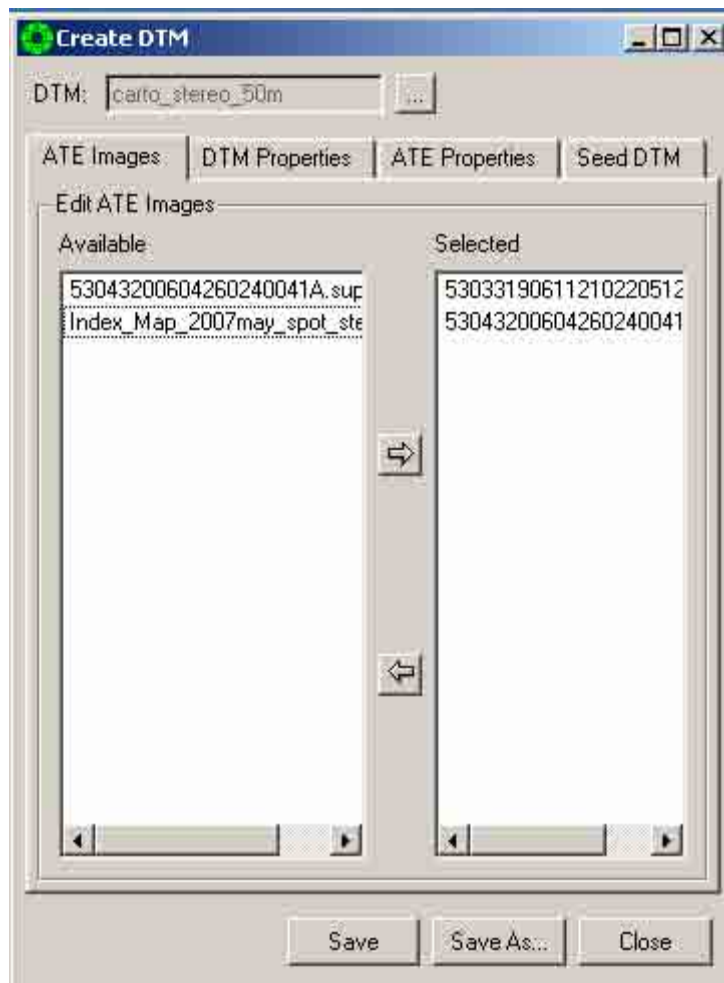


7. A “Select a DTM” dialog box will appear. Type the DTM name (e.g. carto\_stereo\_50m). Then click “OK”.

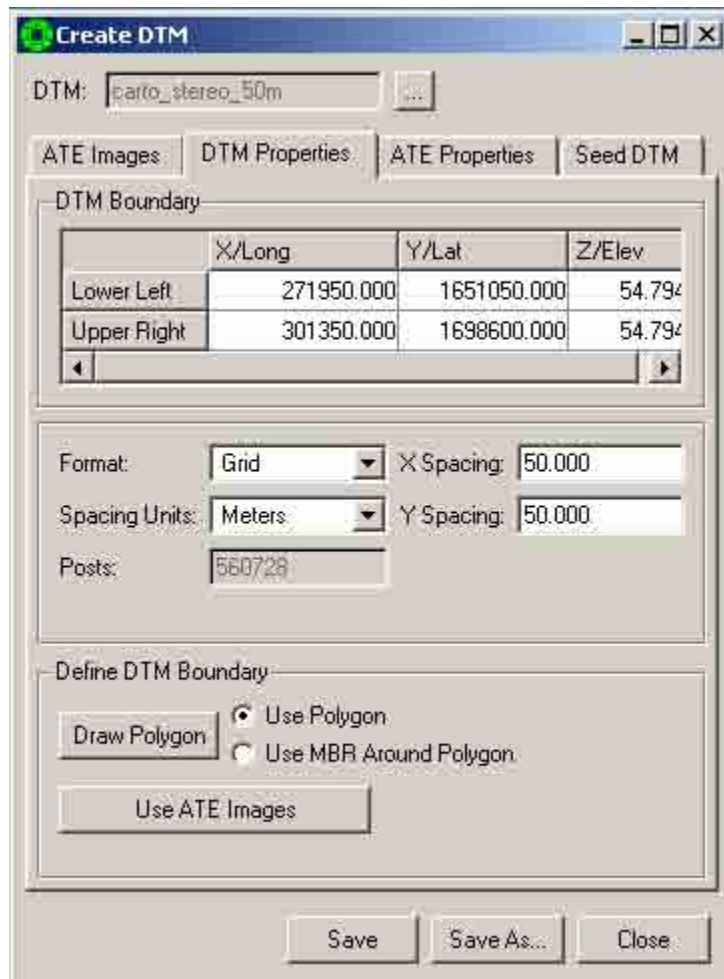


8. Select the SPOT images and click the arrow to transfer the images into the “Selected” box. Then click the “DTM Properties” tab.

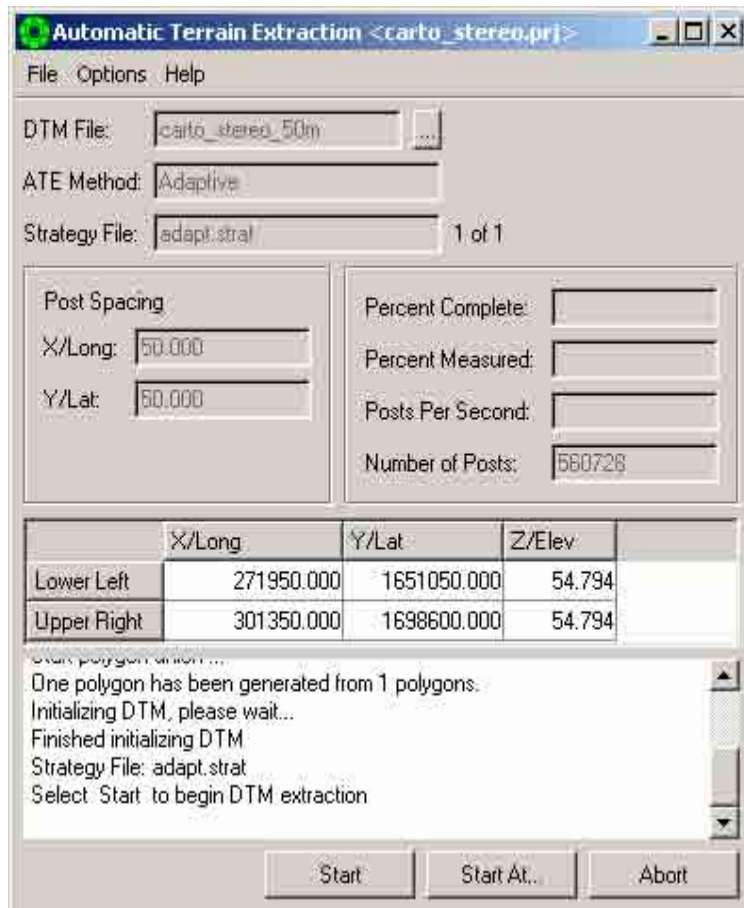




9. Click the “Use ATE Images” button. Type “50” in the “X Spacing” box and “50” in the “Y Spacing” box. Then click “Save”.



10. Click “Start”. Wait until the system process the data.



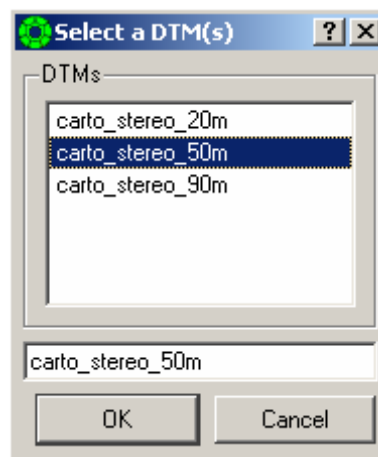
11. Click “Extraction”, click “Terrain”, and select “Interactive Edit”.



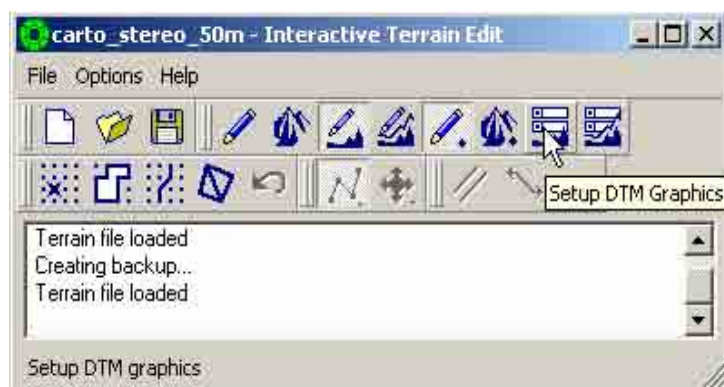
12. An “Interactive Terrain Edit” dialog box will appear. Click the “Open DTM“ icon.



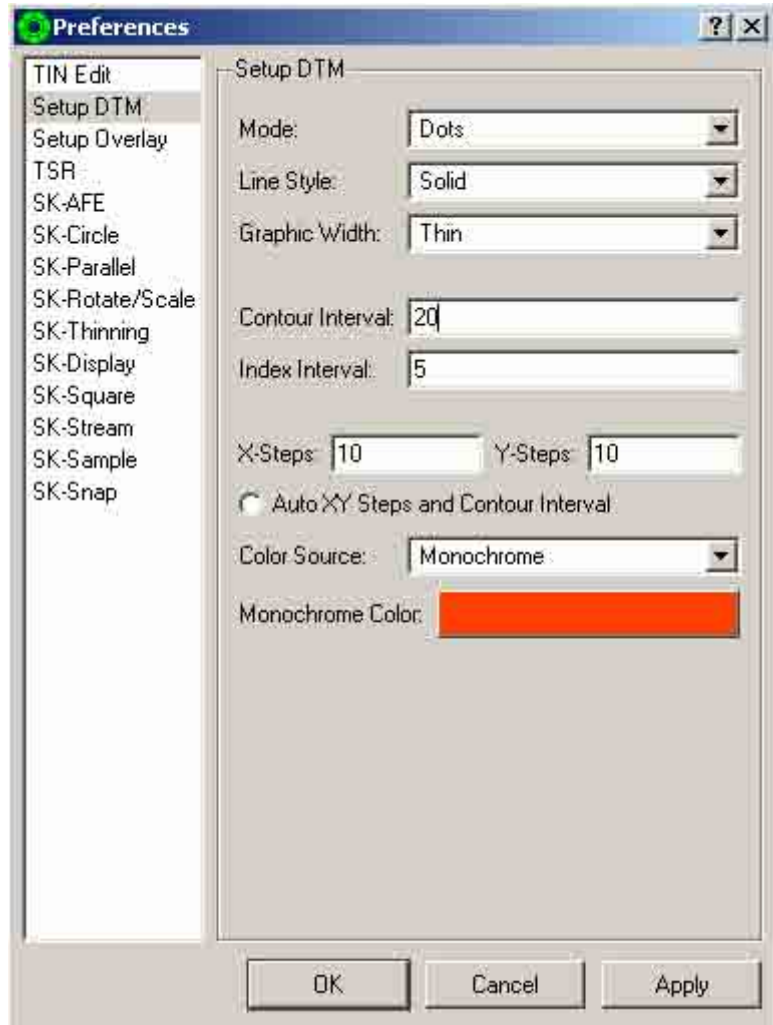
13. A “Select a DTM” dialog box will appear. Select the dtm file (e.g. carto\_stereo\_50m\_dtm). Then Click the “OK”.



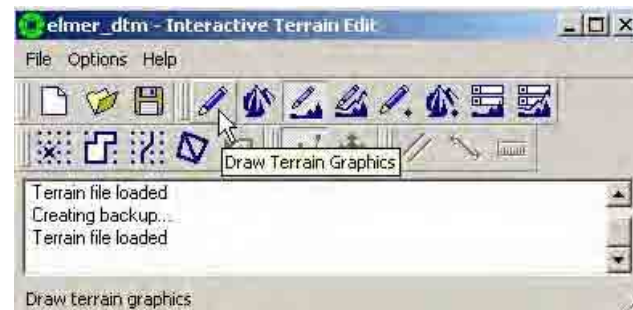
14. Click “Setup DTM Graphis” icon in the “carto\_stereo\_50m” – Interactive Terrain Edit” dialog box.



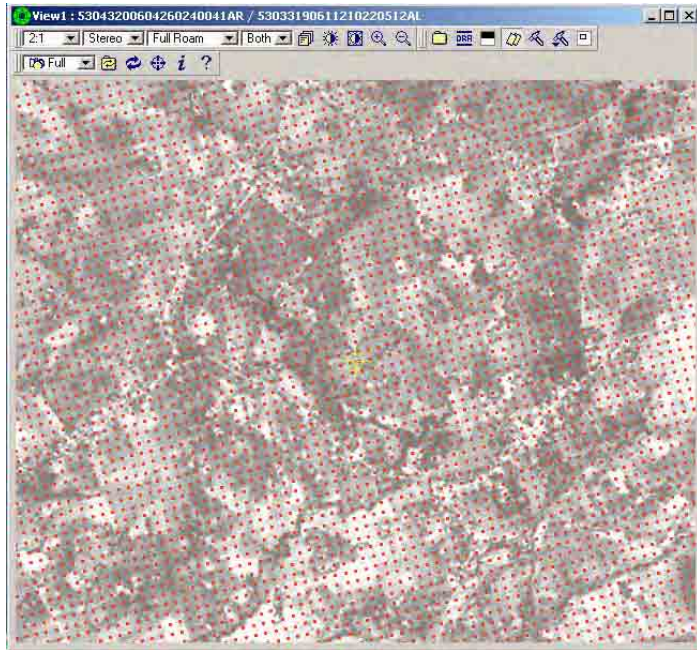
15. A “Preferences” dialog box will appear. Select “Elevation” in the “Color Source” box. Set “20” for “Contour Interval”, “5” for index Interval”. Set “10” for “X-Steps and “10” for “Y-Steps”. Then click “OK”.



16. Click the “Draw Terrain Graphics” icon.

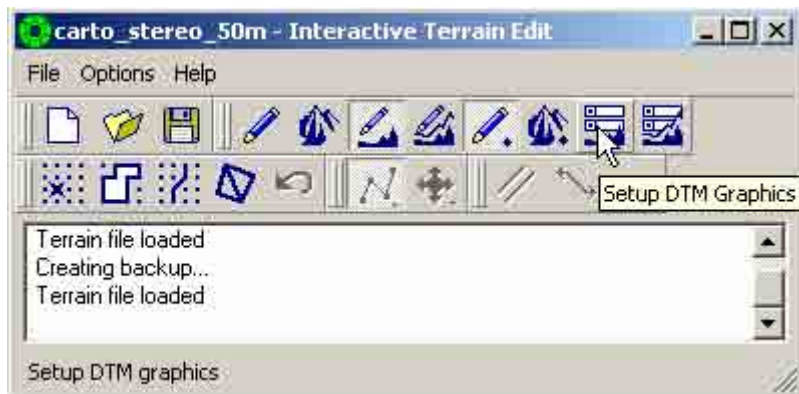


17. The mode (dots) selected in the “Preferences” dialog box will be displayed on the image.

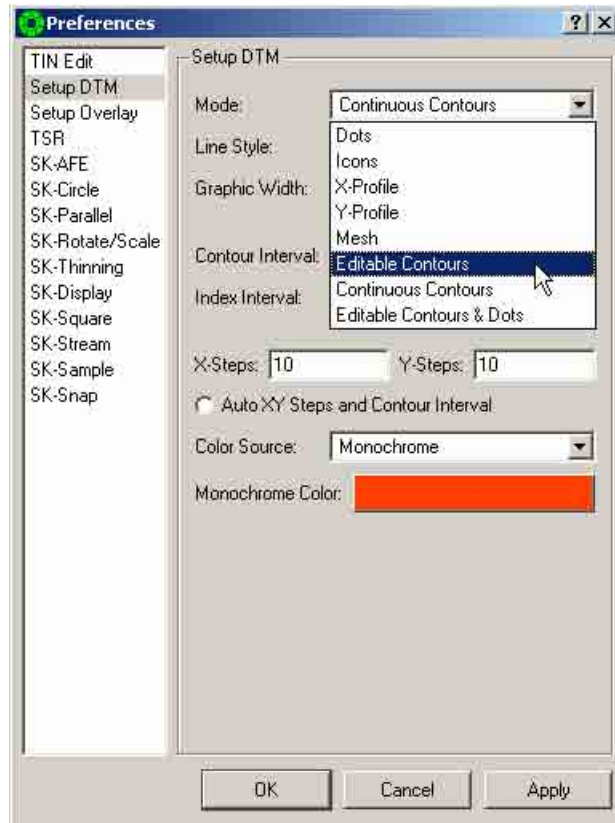


### 3.2.2 Generate Contours

1. Click “Setup DTM Graphics” icon in the “carto\_stereo\_50m” – Interactive Terrain Edit” dialog box.



2. A “Preferences” dialog box will appear. Select “Continuous” in the “Color Source” box. Set “20” for “Contour Interval”, “5” for index Interval”. Set “10” for “X-Steps and “10” for “Y-Steps”. Then click “OK”.

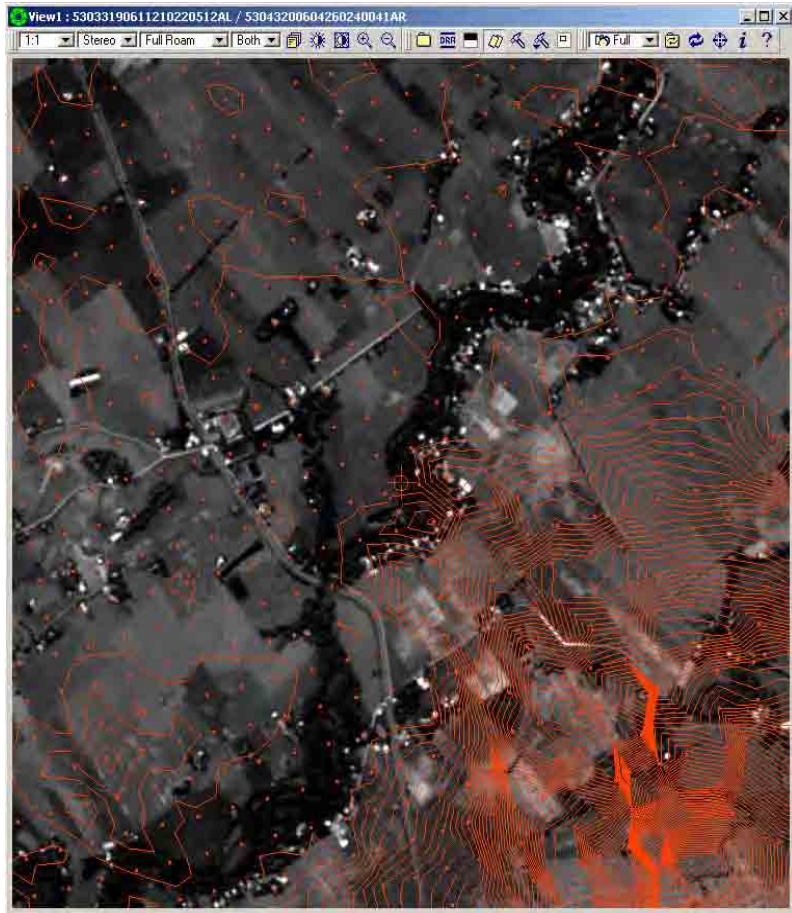


3. Click the “Draw Terrain Graphics” icon.



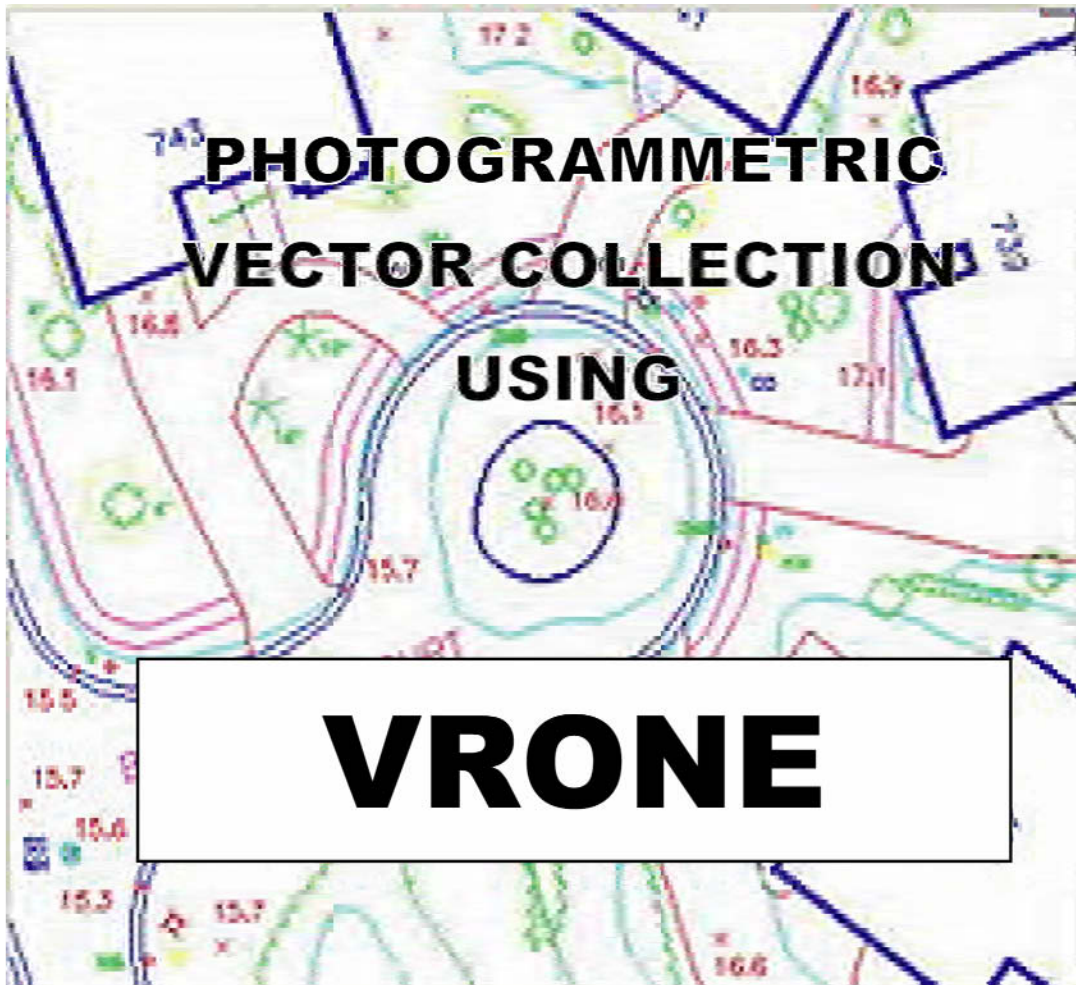


4. The mode (Editable Contour) selected in the “Preferences” dialog box will be displayed on the image.





**THE STUDY ON MAPPING POLICY AND TOPOGRAPHIC MAPPING  
FOR THE INTEGRATED NATIONAL DEVELOPMENT PLAN  
OF  
THE PHILIPPINES**



**EDITION 1**



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## 1. Introduction

VrOne is a powerful photogrammetric vector collection and editing package with image display capability. Photogrammetry today requires the mapping professional to deliver vector, image and digital terrain model (DTM) data as digital products. VrOne addresses many of the problems encountered in handling the collection, editing and plotting of vector, image and DTM data. Map update and revision may also be done with VrOne.

VrOne Mapping Software The NEW standard in photogrammetric mapping • Over 130 interactive mapping applications • Over 40 batch mapping applications • Digital Terrain Modeling (DTM) with draping • Function Key, Macro and Python user programming • Image backdrop display • Stereo 3D and 3D vector viewing windows • Data translators including DXF, SHAPE, ASCII, CAICE, KDMS and CADMAP • Optional Microstation data translator • Drivers for various analytical/analog stereo plotters and xy digitizing tablets • Drivers for BAE Systems SOCET SET Softcopy • Image scratch and blob removal and edit • Hard copy plotting • Available for Windows 2000/XP VrTwo Softcopy Adds the power of stereo to VrOne • Real-time, seamless integration with VrOne • Interactive single model orientation program • Model import support in orientation program • Supports VrOne interactive vector data collection and edit • Static image display • Roaming image display • Cursor vector masking and image magnification • Single or dual screen solution • Z support from mouse thumbwheel or 3D mouse • StereoGraphics active or passive stereo viewing support • NuVision stereo viewing support • VrTwo includes VrOne (VrOne is embedded in VrTwo and a stand alone license of VrOne is included) VrOne, VrTwo Viewing • VrMapping Data viewing in stereo and mono • VrOne/VrTwo data-base compatible • View VrOne graphics files • View stereo models from VrTwo • Create highlight layers for later processing in VrOne/VrTwo • Stand-alone program Orthophoto Production made easy • Batch Processes large jobs • User definable orthophoto areas • Interactive single photo resection • Ability to import exterior orientations • Transparent DTM data import from VrOne • Support for TIFF (tiled/raster/jpeg) • Stand-alone program Aerial Triangulation Collection Innovative, familiar • Layout mode allows viewing of all photos and data • Interactive point measurement with auto-correlation and stereo modes • Blunder detection during point measurement • Flexible project management • Export to various Air Triangulation formats • Stand-alone program Aerial Triangulation Adjustment Adds adjustment to VrAirTrig • Seamless integration of collection and adjustment • One button strip and block adjustment • Full strip and block error reporting • Requires VrAirTrig Image Stitching and Balancing • Better Control of the Mosaic Process • Real-time image preview during seam line placement and editing • Interactive or batch sheet output • Image balancing between images and entire job (version 2) • User defined variable feather width per line or per segment • Ability to down/up sample resolution of final images • Ability to compress final images • Support for 8/24 bit TIFF raster or tiled images • Support for JPEG compression within TIFF • Flexible project and orthophoto management • Ability to output seams in standard DXF format • Stand-alone program Image Balancing and Tone Matching Make multiple images balance as one • Available inside VrMosaic or as stand-alone program • Fast balancing computation • Uses advanced methods to balance image color and intensity across all images in the project • Real-time display of global balance results before final images • User control over adjustment parameters • Batch adjustment of all images in a project Computations between Surfaces Volume computations using DTMs • Runs inside VrOne/VrTwo • Computes volumes between two DTM surfaces • Seamless integration • Flat surface DTM surface available • Requires VrOne VrOne/Microstation In/Out Translators Time tested translator designed by users • User friendly interface • Runs inside VrOne • Cross references mapping properties during translation • Uses native VrOne/Microstation

data-base libraries • Supports line-styles, line-patterns • Able to use client cell libraries • Requires VrOne

## 2. General VrOne Configuration

### a) VrOne Configuration

The VrOne Configuration can be accessed by either double-clicking on the Vr SOCET Configuration icon, or by using Windows Explorer to navigate to the \vr\bin\ directory and double-clicking on vrconfig\_ss.exe.



In the VR Configuration window:

#### **Project > Project Parameters**

Use default directories? **No**

#### **Configuration > XYZ Digitizer**

XYZ Digitizer **BAE SYSTEMS SOCET SET**

#### **Configuration > Keypoint**

Keypoint Type **Keypoint 252 USB or Serial (if using a Keypoint) None (if not using a Keypoint)**

If the user wishes to always start with either the Mouse or XYZ Input:

- Vr SOCET Config: General > Start input device. Select Mouse or XYZ Stereoplotter and press OK.

But from within VrOne, either input mode can be selected by entering digmou or digxyz in the VrOne key-in window.

If the user wants to use customized data files:

- Vr SOCET Config > Configuration > General > Function Key File  
Enter or browse to the custom file and press OK.
- Vr SOCET Config > Configuration > General > Keypad Command File  
Enter or browse to the custom file and press OK.
- Vr SOCET Config > Configuration > General > Macro File  
Enter or browse to the custom file and press OK.
- Vr SOCET Config > Configuration > Vector Graphics > Symbol File Name  
Enter or browse to the custom file and press OK.
- Vr SOCET Config > Configuration > Vector Graphics > Pen Table File Name  
Enter or browse to the custom file and press OK.

The colors used with VrOne (VrSOCET Config > Configuration > Vector Graphics > Use pen table?) can be defined in one of two ways:

If this is set to Yes, then VrOne will use the specified pen table (which is one line above the "Use pen table?" line) and will map out the colors by VrOne layers. If the default

VrOne pen table (\vr\data\default.pen) is opened with a text editor, the Layer / Entity Type / Pen Number (color) is shown. Each VrOne layer (1–10001) can have a separate pen number for line entities, splines, symbols and text. This means that the colors will always be fixed based on the entity type for a specific layer. (For example, all lines found in layer 35 would have the same color.) The default is to have one pen number (color) for all of the entities within a layer, but this isn't a requirement. If desired, one VrOne layer could have different colors for each of the four entity types.

If “Use pen table?” is set to Yes, it's possible to cycle through the available colors with the following:

1. Insert a line into a VrOne file.
2. Pick the line with Pen > Change Pen.
3. Press Button 2 to increment or Button 3 to decrement the pen number (color). The Change to pen number and color are shown in the main VrOne menu window.

If “Use pen table?” is set to No, then the user will define colors to be used and won't be forced to use the same color for all of the elements within a particular Layer-Entity type. This would then allow for the placement of utility valve, water valves, gas valves, ... into the same VrOne layer, but each could have a different color.

Lastly, VrOne doesn't display all color combinations to the screen, but only goes up to pen number 70. The screen display colors are determined by \vr\data\defaultscreen.ct, and this file also provides a cross-reference of pen number to color name.

Please refer to Appendix A – Pen Table Colors for a listing of the default screen display colors.

#### b) SOCET SET Configuration

Once SOCET SET is running, VrOne can be loaded by selecting the VrOne SOCET icon from the desktop or by selecting VrOne > VrOne SOCET from the SOCET SET Extraction pull down menu.

The current SOCET SET versions should include VrOne SOCET and VrOne Config in the SOCET SET Extraction pull down menu. If VrOne is not present, it is possible to manually add those items to the menu as follows:

1. Open \usr\geoset\internal\_dbs\CONFIG\standard\_NT.cnf with a text editor.
2. Add the last three highlighted VrOne lines, below, to the Extraction section.  
Please note that tabs must be used to indent the lines, spaces will not be recognized.

```

Extraction|0|0|0
Terrain|0|0|0
    Automatic Extraction|0|2|0|$(EXEDIR)/ate PREF
    Interactive Edit|2|1|0|$(EXEDIR)/ite PREF
Feature|0|0|0
    Feature Specification Editor|0|0|0|$(EXEDIR)/spec_ed
    Feature Extraction|2|1|0|$(EXEDIR)/fei PREF RT
    Feature Database Merge|2|1|0|$(EXEDIR)/fdbm PREF
ClearFlite|2|1|0|$(EXEDIR)/clearflite
Merge|0|2|0|$(EXEDIR)/dtm_ftr PREF RT
Annotation & Counting|2|1|0|$(EXEDIR)/annot PREF

```

## VrOne|0|0|0

VrOne SOCET|0|1|0|\$(VRHOME)/bin/vrone\_ss

VrOne Config|0|0|0|\$(VRHOME)/bin/vrcfig\_ss

### c) VrOne-SOCET Button Definitions

As with other SOCET SET applications, it is possible to cross-reference the 12 VrOne buttons to the SOCET SET 3D input device with the following:

1. Copy \vr\bin\vrone.acc to the SOCET SET events directory (e.g.,  
\usr\geoset\internal\_dbs\EVENTS or  
\SOCET\_SET\_5.3.0\internal\_dbs\EVENTS).
2. Rename...\internal\_dbs\EVENTS\vrone.acc  
to...\internal\_dbs\EVENTS\VRONE.  
Please note that VRONE must be upper-case.
3. Save a copy of the current SOCET key definitions:  
copy \$HOME\.socet\_keys.localhost \$HOME\original\_keys
4. Start up SOCET SET and activate the Keyboard/Trackball Accelerator  
Mapping window (SOCET: Preference > Keyboard/Trackball Accelerator  
Mapping).
5. From within the Keyboard/Trackball Accelerator Mapping window, press  
the Restore All Defaults button to remove the current button definitions.  
Before doing this, please ensure that a copy of those button definitions has  
been made as suggested above.
6. Select VrOne from the Application option menu. The events for the twelve  
VrOne buttons will appear in the list box.
7. Select the VrOne button whose hot key you want to change in the box. Use  
the Change Mapping, Add New Mapping, or Remove Mapping buttons as  
desired. When you select Change Mapping or Add New Mapping, a dialog  
box will appear instructing you to press the key you wish to assign to the  
event.
8. Repeat the above step for each VrOne button that you wish to cross-  
reference.
9. Click OK to save the mappings or Cancel to exit without saving.
10. It is also possible to define unused device buttons to events in the Main  
Image Display. For example, it might be useful to assign the Zoom In and  
Zoom Out events to two unused buttons.
11. After defining the VrOne-SOCET button events, exit SOCET SET and save  
a copy of the current VrOne-SOCET key definitions:  
copy \$HOME\.socet\_keys.localhost \$HOME\vr\_keys
12. Then, if required, two batch files can be created with a text editor (and sent  
to the Desktop as short-cuts) to easily set the button definitions for the  
current SOCET SET session:
  - Create \$HOME\vrkeys.bat (to re-initialize the VrOne SOCET button  
definitions)
  - Copy \$HOME\vr\_keys \$HOME\.socet\_keys.localhost
  - Create \$HOME\socet\_keys.bat (to re-initialize the original SOCET  
button definitions)
  - Copy \$HOME\original\_keys \$HOME\.socet\_keys.localhost



### 3. Starting VrOne

With SOCET SET running (and an absolute oriented model displayed), VrOne can be started by either:

- Selecting the VrOne SOCET icon from the desktop, or by
- Selecting VrOne SOCET from the main SOCET SET menu (SOCET: Extraction > VrOne > VrOne SOCET).

### 4. Exiting VrOne

The normal procedure for exiting VrOne can be done with any of the following:

- VrOne: File > Exit
- Enter **exi** <Return> in the VrOne Key-In dialog box.
- Clicking the Close button (X) in the upper right-hand corner of the VrOne Main Window.
- Double-clicking on the VrOne icon in the upper left-hand corner of the VrOne Main Window.

### 5. VrOne Help

VrOne has extensive local Web-based Help pages that can be accessed from the About pull down in the VrOne Main Window.

- VrOne: About > Help – Presents the top-level help and general usage selections.
- VrOne: About > Global Help (key-in: **ghelp**) – Lists and describes the global key-ins that are available.
- VrOne: About > Local Help (key-in: **help**) – Calls up the help section for the currently active VrOne command. For example, if the Reverse Line command is active, selecting About > Local Help or entering **help** in the Key-In dialog box will load the Reverse Line help page in your specified Web browser.

### 6. Opening an Existing VrOne File

While VrOne is running, one or more VR files can be opened with:

1. VrOne: File > Open VR Files.
2. Navigate to the directory containing the VR file(s) to be opened.
3. Using the mouse to select and the arrow buttons, move the files to the Files to open section in the right portion of the window
4. Press OK in the Open VR File window

### 7. Creating a New VrOne File

While VrOne is running, a new VR file can be created with:

1. VrOne: File > Open VR Files
2. Navigate to the directory into which the new file will be created.
3. Select the New File button in the lower-right portion of the window.
4. Enter the New File Name, when prompted
5. Press OK in the Open VR File window
6. Define the VR file parameters in the Workspace window.

- Target Scale (1:n): whether for feet or meters, enter the ratio. For example, 1:1200 (for 1"=100') or 1:2000 or ...
  - Units: select US Foot or Meter or International Foot
  - Coordinate Format: select State Plane or UTM
  - State plane zone
  - UTM zone
  - Description

## 8. Closing an Existing VrOne File

VrOne files can be closed with:

1. VrOne: File > Close VR Files.
2. Using the mouse to select and the arrow buttons, move the files to the VR Files to close section button in the right portion of the window.
3. Press OK in the Close VR File window

## 9. Starting an Application(Command)

VrOne applications can be started through a number of different methods.

- Pulling down a menu and selecting an item may start commands.
- Commands may also be started from a key-in using the command name. Each command name is the first three letters of the first two words on the pull down. For example, the key-in command name for Insert Line is **InsLin**.
- Selecting the command from a pre-programmed input device, such as a Keypoint.

## 10. Custom Symbol and Line Font Creation

### a) Define a New VrOne Symbol File

The default symbol and line font file is `\vr\data\default.sym`, but it is recommended that a custom file with a different name (e.g., `\vr\data\SomeOtherName.sym` or `D:\safe\baesystems.sym`) be created to prevent the inadvertent overwriting of the file during VrOne upgrading. Since the default VrOne symbol file contains numerous examples of symbols and line fonts, it may be more practical to *copy* the default file to a new name and location and then modify that file.

See Appendix B for a listing of the default VrOne line fonts and symbols.

The Symbol file to be used by VrOne is specified with

VR Configuration > Configuration > Vector Graphics > Symbol file name.

### b) Create a New Symbol or Line Font

Custom symbol and line fonts are easily and quickly created with VrOne. A normal procedure would be as follows:

1. Start with a new (empty) VrOne file or go to a blank area in an existing file.
2. Turn the Grid Display ON (Graphics > Grid On or **grion**). This allows for the symmetrical placement of the font components.
3. If necessary, set the Grid Display Resolution (Graphics > Set Grid Resolution or **setgri**) to a reasonable size.

4. Draw the components that will be included in the new symbol or line font entity with Insert Line (Insert > Insert Line or **inslin**). A line font will contain the components needed to complete one complete unit of the font. (For example, the creation of a new fence line font only needs to include a single unit length of line with a single X.) The scale is not important, since symbols and line fonts are scaled at plot time.
5. Call up the Create Symbol application (Insert > Create Symbol or **cresym**).
6. Place a window box that includes the entities to be used for the new symbol or line font, and Accept or Reject the selection.
7. Digitize the origin of the new symbol or line font that corresponds to the center of a symbol or the beginning of the line font.
8. Specify whether it is a new symbol or line font.
9. Enter the symbol or line font number (1-1000).
10. Enter the symbol or line font name.
11. Enter the symbol scale factor (usually 1.0) or the repeating line font length (which defines the plotting length for one line font segment when plotting the line font).

c) Using a New Symbol or Line Font

A newly created symbol or line font can be placed into the current VrOne file by selecting Insert Line (**inslin**) or Insert Symbol (**inssym**) and manually entering the number of the new symbol or line font:

**grp=83** (or 27 or 473)

Or, as for other feature types, a function key containing the newly created symbol or line font number can be defined and used.

1) Zoom and Window Display Functions

Zooming into and out of the VrOne graphics window can be done from the VrOne menu pull-downs (Graphics > Zoom) or from key-in commands:

Zoom Center	<b>zooc</b>	Zoom in	<b>zo0.5</b>	Zoom Right	<b>zoor</b>
Zoom All	<b>zooa</b>	2x Zoom	<b>zo0l</b>	Zoom Down	<b>zood</b>
Zoom Left	<b>zo0l</b>	Last Zoom Window	<b>zo0w</b>	Zoom Out 2x	<b>zo02</b>
Zoom Up	<b>zoou</b>	Zoom Previous	<b>zo0p</b>		

The Zoom Left/Right/Up/Down commands are also keyed to the four keyboard arrow keys. And the Zoom In/Out commands are keyed to the two keyboard Page Down/Up keys.

The graphics can be replotted to all VrOne windows with

Graphics > Replot **rep**

The VrOne window rotation can be defined with

Graphics > Set Window Rotation **winrot**

This is useful if the operator wants to have the VrOne cursor move and track in the same direction as the SOCET SET floating mark.

The window rotation can be set to a specific value (such as 0 or 30 or -45 degrees) with:

Environment > Set Parameters Rotation about the Z axis 0 (or 30 or -45)

The **rotz** key-in command can also be used to define the window rotation angle:

**rotz 0** (or **rotz 30** or **rotz -45**)

Please note that the rotation defined by a **rotz** key-in command might also require that one of the above zoom commands be applied before the new rotation value will become apparent.

The VrOne window can be configured to automatically re-center whenever the cursor touches the edge of the graphics window with:

Graphics > Toggle Window Shift **togwin**

Additionally, this parameter can be set globally with:

Vr SOCET Config: Configuration > General Graphics > Window Shift > select Off or On

## 11. Zoom and Display

### a) Displaying Line Fonts

A normal behavior when VrOne entities are displayed to the screen is that lines appear to “lose” their fonts. This is “normal” because as the display scale gets smaller than a certain size, line fonts, symbols, and text will be displayed by VrOne in a simple format as unfonted lines (lines), single dots (symbols), and as lines (text).

The solution is to zoom in and out with the Page Up or Page Down keys, or to use zoom window (**zoow**) to zoom in to a smaller area, or to manually change the display scale (Environment > Set Parameters > Scale (1:n): 2000). As the display scale gets larger, the line fonts will re-appear.

VrOne Config (Global Default): Configuration > Vector Graphics > Minimum Text Size and Minimum Symbol Size

VrOne SOCET (Session Default): Environment > Edit Configuration > Minimum Text Size and Minimum Symbol Size

Also, issuing a Zoom All (**zooa**) command will display unfonted lines. Provided that the display scale is not too small, issuing a Replot (**rep**) command will display the line fonts.

### b) Display Data Disappears with ZoomAll

The **zooa** command (Zoom All) displays and fits the entire contents of the VR file to the graphics screen. If there’s an outlier at say x=0 and y=0, the screen scale might be extremely small and no data would be visible.

If this happens, one of the following might help:

1. Do a Pack VR File (File > Pack VR File) and then a Zoom All. This will permanently remove any deleted VR entities and will resize the XY file dimensions.
2. If step 1 doesn't work, and a small dot of data is visible on the screen, try to zoom into that area. If this is successful, use Insert Line and draw a box around the outside of the "good" area. Then use Cut Polygon (Edit > Cut Polygon or **cutpol**), set the parameters to Cut from outside and Throw data away, pick the newly drawn box, and accept the action.
3. If it is not possible to see even a small dot of data, get the Range XY (File > Range XY or **ranxy**), make note of the Maximum X and Y, and then use Set Graphics Parameters (Environment > Set Parameters or **setpar**) to define the lower left east and north and scale to "sane" values.

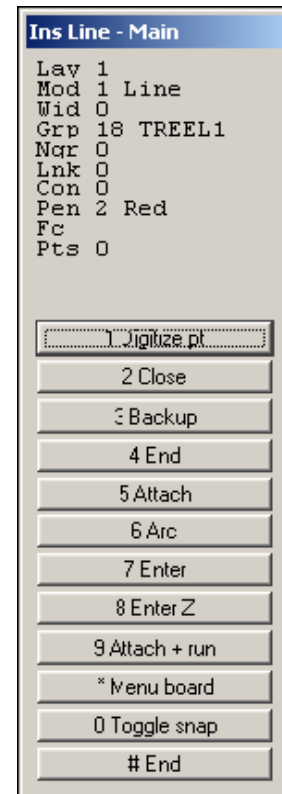
## 12. Data Collection

VrOne has numerous routines for the interactive insertion of line, symbol, and text entities. For example: Insert Line, Insert Fly Line, Insert Parallel Line, Insert Symbol, Insert Annotated Symbol, Insert Text, Insert Line Text, etc. These applications are typically found under the Insert pull down in the VrOne Main Window.

When an insertion application is started, a Menu Keys dialog window is displayed. At the top of the window is the command name. The next area displays the entity parameters. This information is command dependent and normally shows where the data is to be stored on insert commands or where the data came from on edit commands.

The third area is the menu keys area. These show what functions are assigned to the 12 menu key buttons. These keys are normally mapped onto an input device such as the keypad. They are also mapped onto the 12 function keys on a standard keyboard.

Following are a few examples for inserting various types of data into a VrOne file. Specific help can be called up for each of the insertion routines with:



VrOne: About > Local Help or key-in **help**

For these examples:

- Open a new VrOne file.
- Initialize the Target Scale to 1:1200 if using English units, or 1:1500 if using metric units.
- Using the Page Down and Page Up keyboard keys, set the VrOne display scale to approximately 1:1200 or 1:1500.
- Use the system mouse as the input device (Input > Digitizer Mouse or **digmou**).

a) Insert Line

The Insert Line function would be used to collect linear features where each data point is digitized manually, such as roads, sidewalks, fences, railroads, etc.

1. Insert > Insert Line (**inslin**)
2. Move the system mouse cursor into the VrOne graphics window. (While in this window, the cursor should change to a cross.)
3. While moving the mouse, press and release the left mouse button (or press the F1 key) to digitize points.
4. To back-up along the active line, press Button 3 (Backup) or F3.
5. To end the line, press Button 4 (End) or F4.
6. To end the Insert Line function, press the # Button or F12.
7. During the insertion of a line, B2 (F2) will *close*, but not end, the line and B6 (F6) will place an Arc through the last three digitized points.
8. The mode can be changed from line mode (mod=1) to spline mode (mod=2).
9. The line font (graphic pointer) can also be changed by entering **grp=18** (which is a treeline if using the default VrOne symbol file).
10. The active layer can be changed by entering **lay=4**

#### b) Insert Fly Line

The Insert Fly Line function would be used to collect linear features where the data points are automatically collected in a streamline mode, such as treelines, water features, contours, etc

1. Insert > Insert Fly Line (**insfly**)
2. The Fly Line filtering parameters can be defined by pressing B7 (F7), which will load a Parameters window with: Tube Width, Maximum Distance, Dither Distance, and Z Tube Width. As described in the local help for Insert Fly Line, these parameters affect and determine the frequency with which data points are sampled and stored.
3. Move the system mouse cursor into the VrOne graphics window. (While in this window, the cursor should change to a cross.)
4. While moving the mouse, press and release the left mouse button (or press the F1 key) to automatically digitize points. The points will be sampled, filtered and stored based on the filtering parameters.
5. To back-up along the active line, press Button 3 (Backup) or F3.
6. To end the line, press Button 1 (End line) or F1.
7. During the insertion of a fly line, B2 (F2) will close and end the line. Button 4 (F4) will Force points that won't be removed by the filtering parameters. B5 (F5) allows for a manually digitizing mode, and B6 (F6) lets the operator go back along the active line and splice in a new section.
8. The mode can be changed from line mode (mod=1) to spline mode (mod=2).
9. The line font (graphic pointer) can also be changed by entering **grp=16** (which is a water line if using the default VrOne symbol file).
10. The active layer can be changed by entering **lay=6**

#### c) Insert Square

The Insert Square function is used to collect linear features where the internal segments are placed at right angles to each other.

- Insert > Insert Square (**inssqu**)

- The squaring parameters include options to square to the Longest Side, First Side, Mean of All Sides and Azimuth. A Squaring Tolerance can also be defined that tells Insert Square to not square segments that fall outside the specified angle.

#### d) Insert Symbol

Symbols can be placed into the VrOne file with this function.

- Insert > Insert Symbol (**inssym**)
- Symbols can be inserted with a fixed or pre-defined radius and rotation. Or the size and rotation can be interactively defined as part of the digitizing process.

#### e) Insert Text

Text can be placed into the VrOne file with this function.

- Insert > Insert Text (**instex**)
- Text can be inserted with a fixed or pre-defined size and rotation. Or the size and rotation can be interactively defined as part of the digitizing process.
- Ten different justifications can be used when placing text as well as numerous graphical attributes.

#### f) Insert Annotated Symbol

The Insert Annotated Symbol function is used to collect symbols with the inclusion of a text string, such as spot elevations, annotated fire hydrants, annotated manholes, etc.

- Insert > Insert Annotated Symbol (**insann**)
- The local help for this function lists the various key-ins commands that can be used when defining entity to be inserted. This is particularly useful when accessing this application from a Function Key definition.

See Appendix B for examples of the different types of Annotated Symbols.

#### g) Insert Line Text

The Insert Line Text function is used to insert text onto an existing line. This routine would typically be used to place annotations on index contours.

- Insert > Insert Annotated Symbol (**inslte**)

### 13. Changing the Graphical Attributes

Whenever a VrOne insertion command is started, the graphical attributes from the last usage are active. One of the ways in which these attributes can be changed is by manually keying in the new attribute(s). For example:

- To change the current layer (1-10001), enter **lay=4** (or **lay=125** or **lay=2065**, etc.)
- To change the current line mode (1-2), enter **mod=1** (line) or **mod=2** (spline)
- To change the current line width (1-256), enter **wid=1** (or **wid=2** or **wid=7**, etc.)
- To change the current graphic pointer (1-1000), enter **grp=11** (or **grp=24** or **grp=38**, etc.)
- To change the current pen code (1-256), enter **pen=3** (or **pen=4** or **pen=14**, etc.)

The better solution to the manual changing of VrOne graphical attributes is the use of pre-defined Function Keys, which is addressed later in this document.

## 14. Entity Search Radius

The VrOne entity search radius can be defined in two different ways:

1. As the default (global) value from within the VR Configuration program  
VR Config: Configuration > Vector Graphics > Entity search radius (in ground units)
2. As a session value from within the VR SOCET program:  
VrOne: Environment > Edit Configuration > Entity search radius (in ground units)

## 15. Data Edit

As with the insertion applications, VrOne also has numerous edit functions. For example: Edit Line, Edit Symbol, Edit Text, Reverse Line, Join Lines, Square Existing, Trim Lines, Cut Polygon, Delete Layers, and many more. These applications are typically found under the Edit pull down in the VrOne Main Window.

### a) Edit Line

- Edit > Edit Line (**edilin**)
- Edit Line lets the operator move, delete, or insert new points along the selected line, and the line itself can be moved, copied, rotated, mirrored, or closed. Additionally, the graphical attributes can be modified with this routine.



#### b) Edit Symbol

- Edit > Edit Symbol (**edisym**)
- Edit Symbol lets the operator move, copy, delete, rotate, expand, or flip the selected symbol. Additionally, the graphical attributes can be modified with this routine.

#### c) Edit Text

- Edit > Edit Text (**editex**)
- Edit Text lets the operator move, copy, delete, rotate, expand, change justification, or flip the selected text. Additionally, the graphical attributes can be modified with this routine.

#### d) Trim Lines

- Edit > Trim Lines (**trilin**)
- Trim Lines will extend and cut-back one line to another. Options included nodding, extension distance and polygon clearing.

#### e) Break Line

- Edit > Break Line (**brelin**)
- Break Line will break a line into two entities at two user-identified points.

#### f) Reverse Line

- Edit > Reverse Line (**revlin**)
- Reverse Line will reverse the direction of lines. At times the order of the line points must be in a certain direction. This is true when drawing asymmetrically-fonted lines such as tree lines or depression contours. Reverse Line can reverse single lines by identifying individual lines, and it can batch reverse lines of user defined layers and modes.

#### g) Join Lines

- Edit > Join Lines (**joilin**)
- Join Lines will join or match two lines together. The lines to be joined are identified by the user and may reside the same workspace or any open workspace. Lines that are short of each other or overlap each other may be joined. If lines are joined, the second line is added to the first. The line parameters of the first line are used when joining. Lines that are matched are graphically joined but remain in two entities and maintain their graphic parameters. Lines identified in multiple workspaces will be matched regardless of the Join Mode.

#### h) Square Existing

- Edit > Square Exist (**squexi**)
- Square Existing squares existing line(s) in the current workspace or all open workspaces. Lines to square may be identified by pointing at them, or they may be squared by specifying layers in a batch mode. Line segments are rotated about their midpoints to the Square to Azimuth at 0, 90, 180 or 270 degrees and are re-

intersected with the previous and next segments to square a polygon. Line segments that are greater than the Square to Tolerance are not squared (rotated)

## 16. Deleting Objects

### a) Fast Delete

- Edit > Fast Delete (**fasedel**)
- With Fast Delete, the operator is able to delete entities by pointing at them.
- The Search for Entity Type can include lines and/or symbols and/or text.
- There are several procedures within VrOne that will delete entities: Edit Line, Edit Symbol, Edit Text, Global Change and Delete Window. But there are times when entities should be picked one by one for deletion. Fast Delete is a quick way to touch an entity and delete it.

### b) Delete Window

- Edit > Delete Window (**delwin**)
- This function will delete the contents of a user-defined window. Only those entities that fall completely within the window will be deleted. Entities that are turned off will not be considered.

### c) Cut Polygon

- Edit > Cut Polygon (**cutpol**)
- This function will cut data against a user defined polygon. Data can be cut from the inside or outside of the polygon, and the data can be discarded, copied to a file, moved to a file, or have the graphical pointer changed.

## 17. Selecting the Active Workspace

Up to 256 VR files can be open and displayed within VrOne, but only one file is “active” and it is into this file that data will be stored. The Active Workspace (VR file) can be specified with:

- VrOne: Environment > Set Active Workspace. Enter the number of the active workspace (AWS) and press OK.
- Another way to change the Active Workspace is to turn Snap On (**snaon**) and then select an entity in one of the non-active workspaces. The Snap window appears and, by pressing button #7 (Change to Ws x), the user will be able to select the AWS in which the snapped-to object was found.

## 18. Batch Editing

VrOne also has numerous batch edit functions. For example: Batch Attach Line, Batch Join Lines, Batch Node Lines, Batch Offset, Batch Trim, Line Cross, Line Close, Global Change, and many more. These applications are typically found under the Batch pull down in the VrOne Main Window.

### a) Batch Join Lines

- Batch > Batch Join Lines (**batjoi**)

- This batch routine will attempt to join lines within the layers specified. If more than one workspace is open and Workspaces to consider is set to All open then lines between workspaces will be matched. Data layers, line modes, and graphic pointers can also be considered. Care should be taken when setting the Search Distance. Undesirable joins may occur if this parameter is too large. Layers that are turned off will not be considered when searching.

#### b) Batch Trim

- Batch > Batch Trim (**battri**)
- This batch routine will make up to 60 different trimming passes on the specified VrOne workspaces and will extend and cut-back one set of lines to another, change graphics pointers, and will delete or relayer the trimmed segments.

#### c) Batch Node Lines

- Batch > Batch Node Lines (**batnod**)
- This batch routine will make up to 60 different noding passes on the specified VrOne workspaces. Options include the ability to node lines only (which places a common point on each line at the intersection) or node and break lines at the intersection points. Under-shoots and over-shoots will be considered.
- The Z rule for computing the elevation at the intersection of the two lines can be specified. During noding, an elevation for each line is computed at the break point. These elevations are based on the slope of the line segment as determined by the point before and after the break point. The Z Rule determines the action to be taken on these two elevations as follows:
  - Original elevations – The elevations of the break points is not modified
  - Mean node elevations – The elevations are averaged and stored for both node points.
  - Elevation from line 1 – The elevation from the node point on line 1 is used on both lines.
  - Elevation from line 2 – The elevation from the node point on line 2 is used on both lines.

#### d) Batch Filter Lines

- Batch > Batch Filter Lines (**batfil**)
- This batch routine will searches for lines within the specified layers and will reduce the amount of points on those lines with a tube width and maximum distance filter. Layers that are turned off will not be considered when searching.

#### e) Batch Offset

- Batch > Batch Offset (**batoff**)
- This batch routine will searches for lines found within the specified layers and will place up to 10 additional lines that are parallel to the original. Each new line can have a layer width, graphic point, horizontal offset and vertical offset that are different from the source line.

#### e) Line Close

- Batch > Line Close (**linclo**)

- This batch routine will close or will check for closure of lines in user defined layers. Lines that are not closed may be closed by one of the following methods:
  - Move the endpoint onto start point
  - Mean the endpoints
  - Add line segment between the endpoint and the start point
  - Intersect the end segments
  - Report unclosed polygons in drive file only (do not modify line)
- A drive file is always created for unclosed lines even if this application closes them.

## **19. Global Change**

- Batch > Global Change (**glob**)
- This extremely powerful batch routine will make up to 60 passes on the specified VrOne workspaces and will globally change line, symbol and text attribute information. Each pass has Search For and Change To criteria.

## **20. Undo Last**

- File > Undo Last (**undo**)

## 21. Function Keys

The use of Function Keys provides one of the most important aspects of VrOne custom data collection. Taking the time to properly set up function keys before starting a project has the potential to save hundreds of hours of production time.

Function keys reduce the amount of knowledge the mapping professional needs to know about VrOne. They simply choose the feature they want to collect and go. Entering its name or function key number may start a function key. These names or numbers may be keyed in, placed in macros or even placed in other function keys.

For example, if the operator wanted to collect an asphalt road, the Insert Line command would be started, and the various attributes specific to that feature would need to be defined, such as Layer, Mode, Line Width, Line Font, and Pen Code. But VrOne function keys would allow for the pre-defining of this feature, so that the operator would simply enter a numeric code or a descriptive term for the asphalt road, which would automatically assign all of the desired parameters and behavior to Insert Line and start the command.

A more detailed description of VrOne Function Keys can be found at

VrOne: About > Help > Getting Started with VrOne > Function Keys.

The default function key file is `\vr\data\default.fk`, but it is recommended that a custom file with a different name (e.g., `\vr\data\SomeOtherName.fk` or `D:\safe\socet.fk`) be created to prevent the inadvertent overwriting of this file during VrOne upgrading. The Function Key file to be used by VrOne is specified with

VR Configuration: Configuration > General > Function key file

## 22. Touch Pad and Key-in Input

Just as the use of VrOne Function Keys facilitates the collection of specific project-related features by automatically assigning the desired parameters and behavior to one of the Insert commands, incorporating a touch pad input device with a feature extraction system adds even more efficiency to the collection capabilities.

The Keypoint 252 is a touch-sensitive programmable keypad that can be used with VrOne. The 252 programmable keys can have the standard VrOne commands and VrOne Function Keys assigned to individual keys, which allows an operator to press a single key to activate a particular feature to be collected.

The default keypad file is `\vr\data\default.kp`, but it is recommended that a custom file with a different name (e.g., `\vr\data\SomeOtherName.kp` or `D:\safe\socet.kp`) be created to prevent the inadvertent overwriting of this file during VrOne upgrading. The Keypad file to be used by VrOne is specified with:

VR Configuration: Configuration > General > Keypad command file

The syntax of the keypad file (default.kp or socet.kp) is:

**@xxx VrOne\_KeyIn\_Command**

where **xxx** is the Keypad Number defined for a particular key (see “kpvr252\_numbers.doc” for the key numbering reference) and **VrOne\_KeyIn\_Command** is the key-in command, FKey Name or FKey Number that VrOne recognizes for its various applications.

For example: **inslin** (for Insert Line), **instex** (for Insert Text), **rep** (for Replot), **zooa** (for Zoom All), **zoow** (for Zoom window), **exi** (for Exit), **bldg** (for FKey Building).

### **23. Macros**

Macros give the ability to execute a group of VrOne commands as a single word. Macros can execute VrOne commands, function keys and other macros. One common use of macros is to have it set specific snap parameters for a certain situation. Also, with 10,001 layers that are available with VrOne, a macro can also be created to easily turn groups of layers on and off.

### **24. Application Overlay**

Application Overlaying lets the operator place the current command into a “pause” mode while other commands are executed.

Multiple applications may be overlaid and stacked within VrOne which allows the operator to collect data in the order it presents itself instead of feature type by feature type. This unique VrOne feature allows for the collection of data in a flexible and realistic way.

## Appendix A – Pen Table Colors

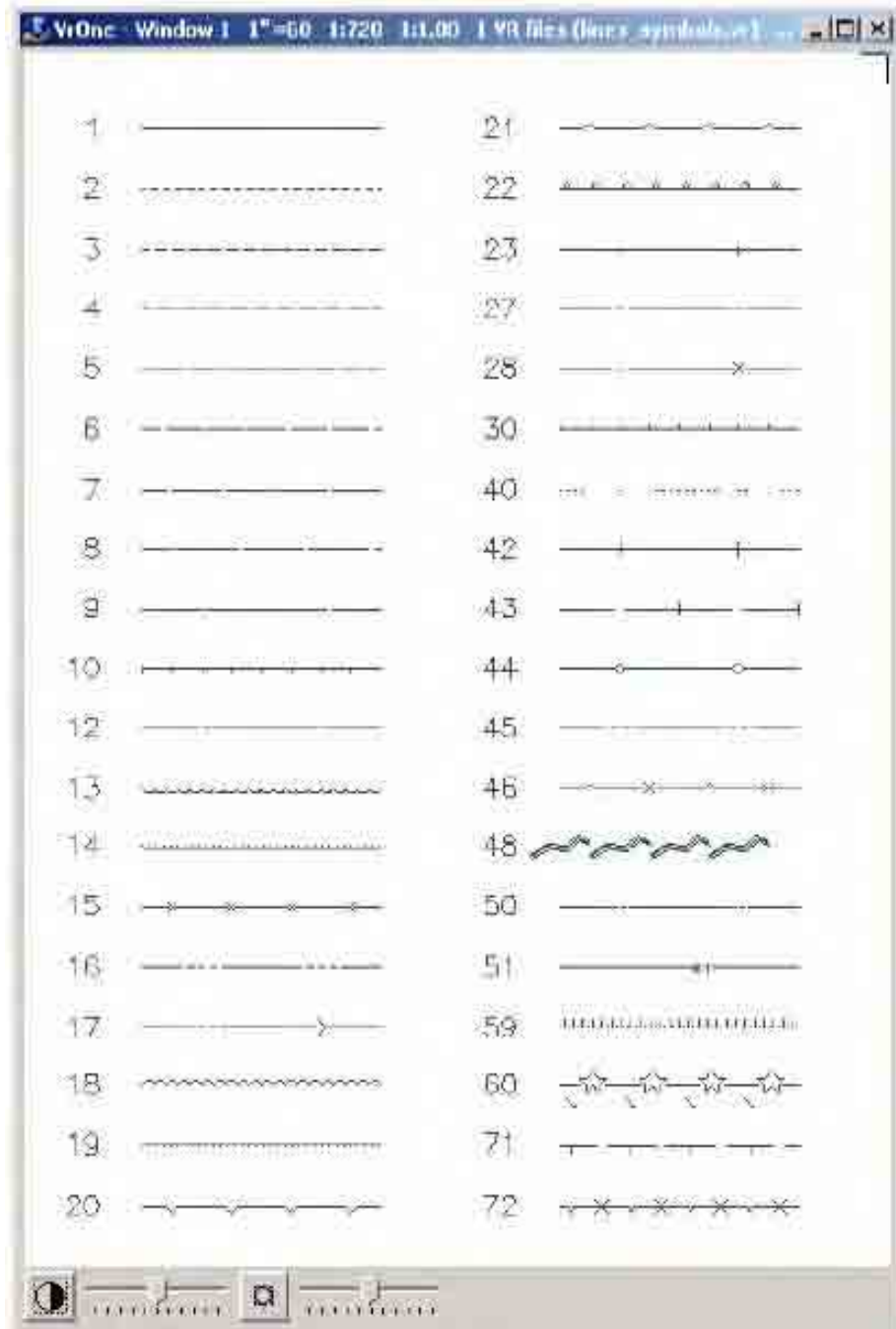
VrOne Pen Table Colors

Filename: \vr\data\defaultscreen.ct

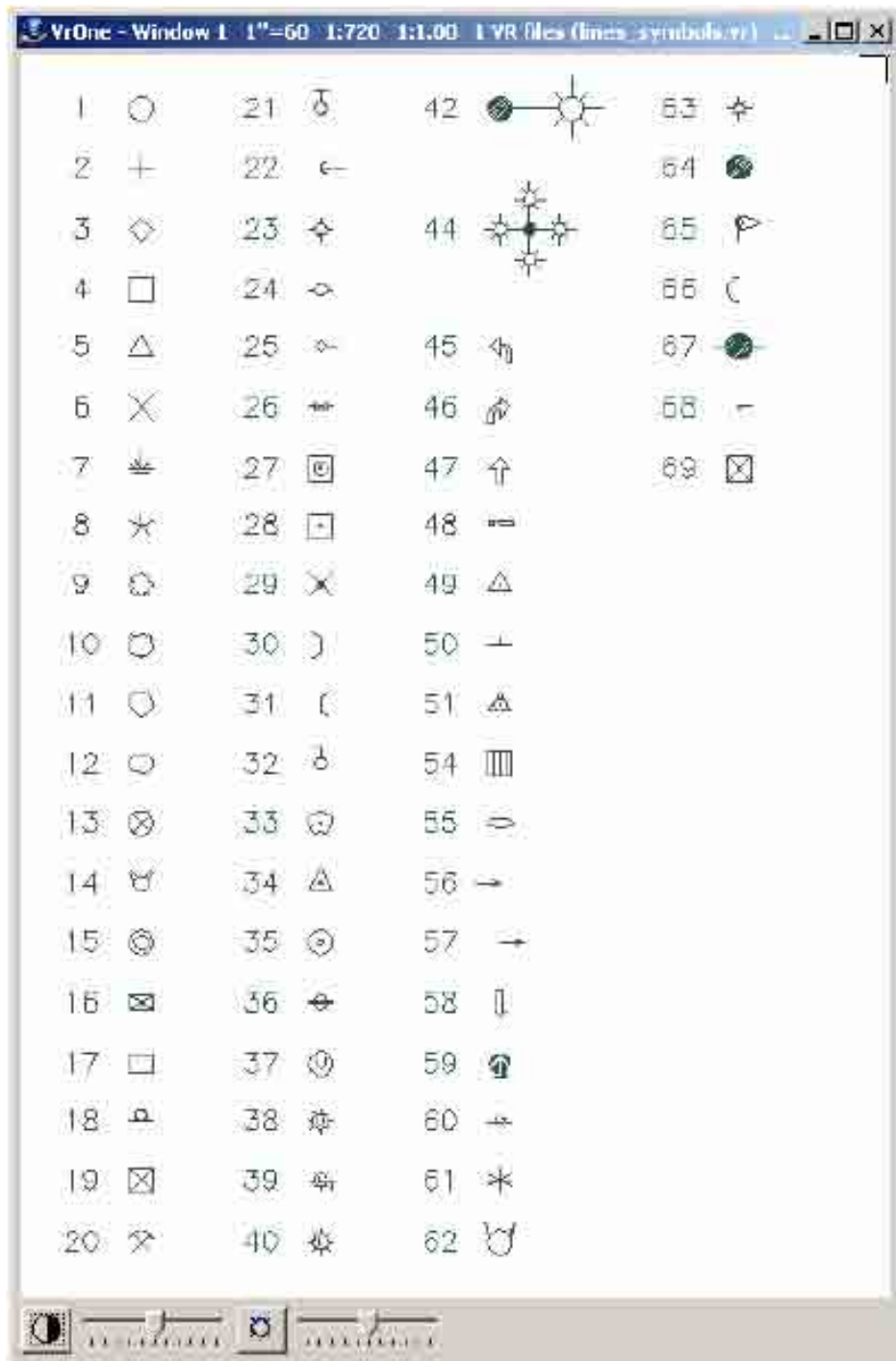
Pen #	RGB	Color Name	Pen #	RGB	Color Name
1	255 255 255	White	36	0 250 154	MediumSpringGreen
2	255 0 0	Red	37	152 251 152	PaleGreen
3	255 255 0	Yellow	38	46 139 87	SeaGreen
4	0 255 0	Green	39	0 255 127	SpringGreen
5	0 255 255	Cyan	40	154 205 50	YellowGreen
6	0 0 255	Blue	41	47 79 79	DarkSlateGray
7	255 0 255	Magenta	42	47 79 79	DarkSlateGray
8	192 192 192	Grey	43	105 105 105	DimGray
9	127 255 212	Aquamarine	44	211 211 211	LightGray
10	102 205 170	MediumAquamarine	45	192 192 192	Grey
11	95 158 160	CadetBlue	46	240 230 140	Khaki
12	100 149 237	ComflowerBlue	47	176 48 96	Maroon
13	72 61 139	DarkSlateBlue	48	255 165 0	Orange
14	173 216 230	LightBlue	49	218 112 214	Orchid
15	176 196 222	LightSteelBlue	50	153 50 204	DarkOrchid
16	0 0 205	MediumBlue	51	186 85 211	MediumOrchid
17	123 104 238	MediumSlateBlue	52	255 192 203	Pink
18	25 25 112	MidnightBlue	53	221 160 221	Plum
19	0 0 128	NavyBlue	54	205 82 92	IndianRed
20	0 0 128	Navy	55	199 21 133	MediumVioletRed
21	135 206 235	SkyBlue	56	255 69 0	OrangeRed
22	106 90 205	SlateBlue	57	208 32 144	VioletRed
23	70 130 180	SteelBlue	58	250 128 114	Salmon
24	255 127 80	Coral	59	160 82 45	Sienna
25	178 34 34	Firebrick	60	210 180 140	Tan
26	165 42 42	Brown	61	216 191 216	Thistle
27	255 215 0	Gold	62	255 255 240	Ivory
28	218 165 32	Goldenrod	63	64 224 208	Turquoise
29	238 221 130	MediumGoldenrod	64	0 206 209	DarkTurquoise
30	0 100 0	DarkGreen	65	72 209 204	MediumTurquoise
31	85 107 47	DarkOliveGreen	66	238 130 238	Violet
32	34 139 34	ForestGreen	67	138 43 226	BlueViolet
33	50 205 50	LimeGreen	68	245 222 179	Wheat
34	34 139 34	MediumForestGreen	69	255 255 255	White
35	60 179 113	MediumSeaGreen	70	173 255 47	GreenYellow

## Appendix B

### Default Line Fonts and Symbols (socet.sym)







## Appendix C – Types of Annotated Symbols

### Spot with Fixed Position Text

The screenshot shows the 'VtOne Function Key Edit' dialog box. The 'Function Keys' list on the left includes 'spot\_fixed', which is selected. The main configuration area is as follows:

Line	Symbol	Text
Layer	521	JustX Left
Font	SR Simplex Font	JustY Lower
Non-graphic	0	Height 0.100
Pen number	1	Width 0.100
Link	0	Rotation 0.000
Construction	Off	Slant 0.000
Feature code		
Text	NULL	

Local args: NSSYM=1, ACTIVE=0, DEC=2, OPSX=0.10, OP5Y=0.1

Global args:

Assoc cmd1:

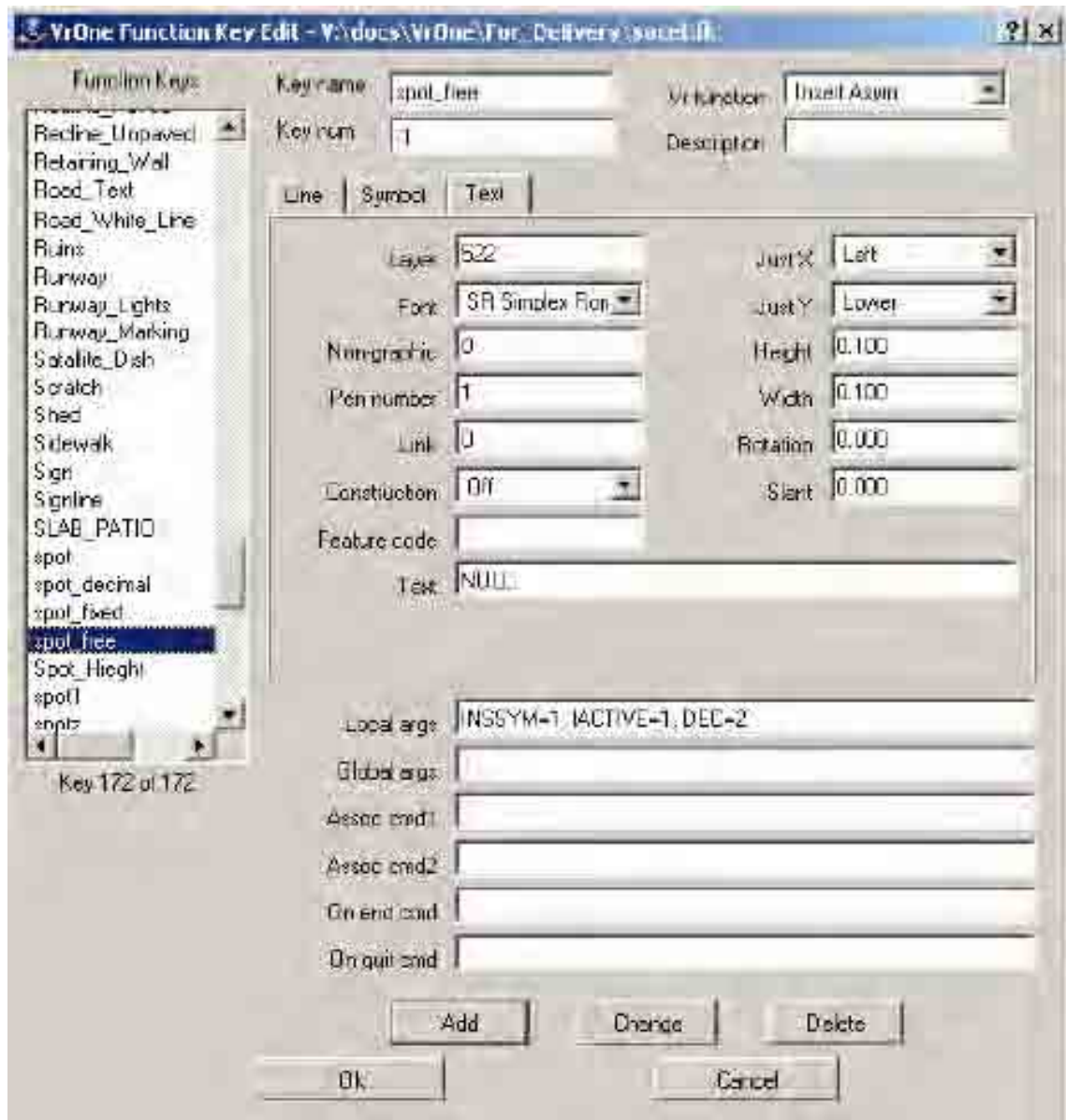
Assoc cmd2:

On end cmd:

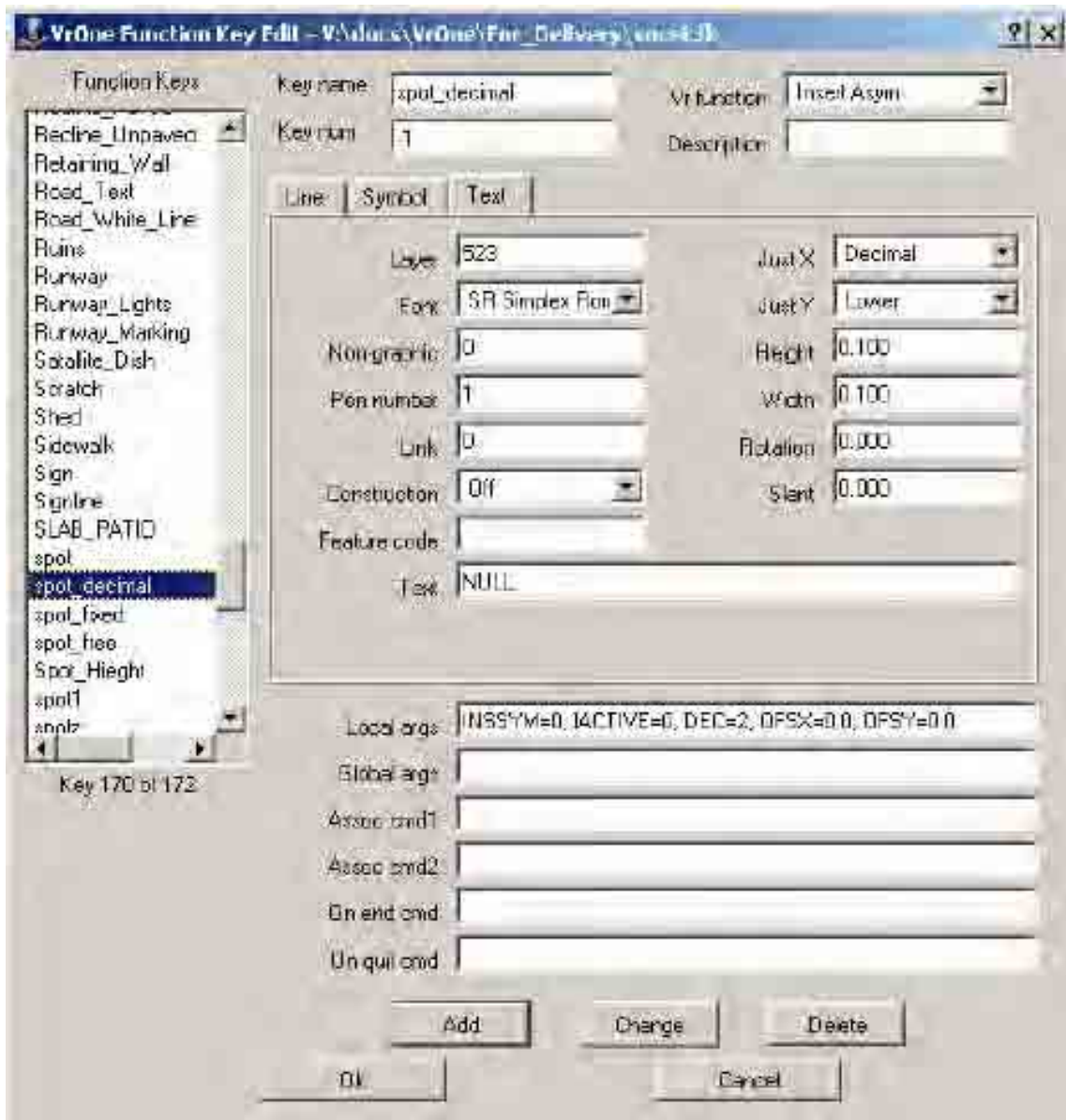
On quit cmd:

Buttons: Add, Change, Delete, Ok, Cancel

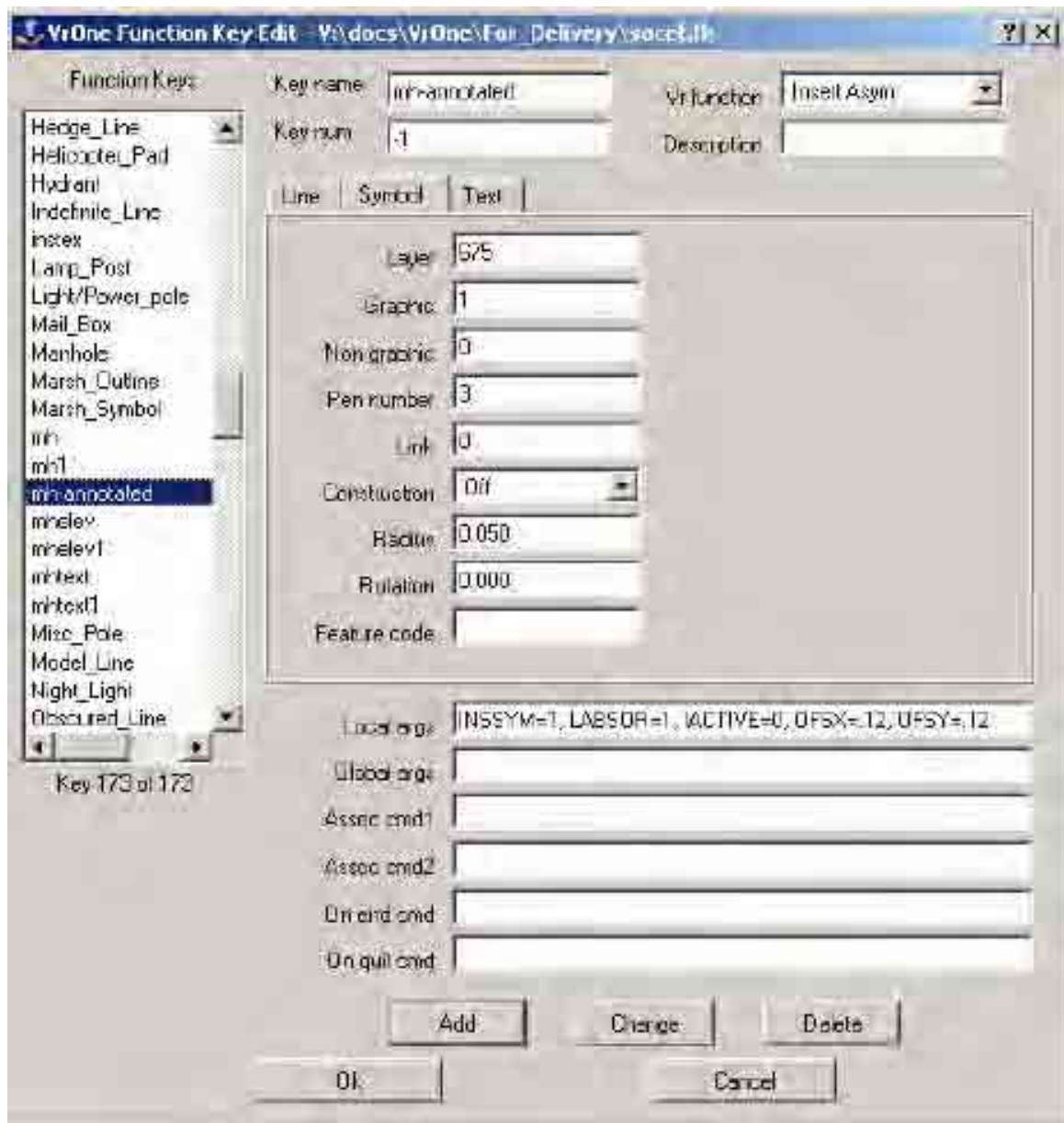
Spot Elevation with Manually Placed Text (freely positioned by the operator)



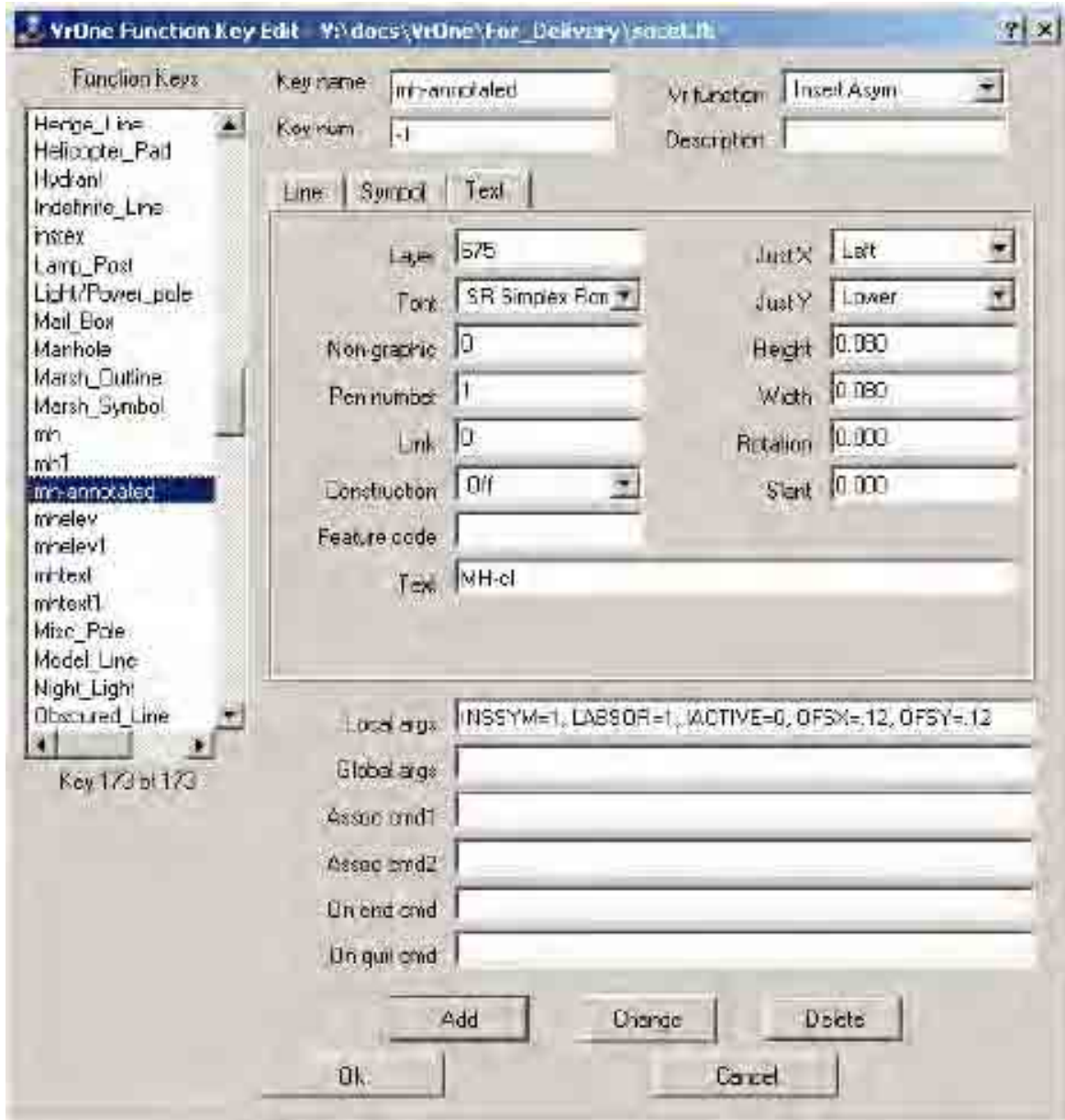
Spot Elevation where the Decimal Point Indicates the Location



Manhole with an "MH" String  
Manhole: Symbol definition



Manhole: Text definition





## Fixed Text String

VrOne Function Key Edit - V:\docs\VrOne\Fun. Delivery\swcst.dlk

Function Keys

Key name: Pond\_Text      Vr function: Inset Text

Key num: 1      Description:

Line	Symbol	Text
Level	635	JustX: Center
Font	SR Simplex Font	JustY: Center
Nongraphic	0	Height: 0.100
Pen number	1	Width: 0.100
Link	0	Rotation: 0.000
Construction	Off	Start: 0.000
Feature code:		
Text:	Pond	

Local args: \_\_\_\_\_

Global args: \_\_\_\_\_

Assoc cmd1: \_\_\_\_\_

Assoc cmd2: \_\_\_\_\_

On end cmd: \_\_\_\_\_

On quit cmd: \_\_\_\_\_

Add      Change      Delete

OK      Cancel

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## Appendix D – Key-In Cross Reference

Insert Line	<b>inslin</b>	Copy Window	<b>copwin</b>	Backup VR File	<b>bacvr</b>
Insert Symbol	<b>inssym</b>	Set DTM	<b>setdtm</b>	Open VR File	<b>opevr</b>
Insert Text	<b>instex</b>	Run DTM	<b>rundtm</b>	Close VR File	<b>clovr</b>
Insert Square	<b>inssqu</b>	Drive Grid	<b>drigri</b>	Replot	<b>rep</b>
Insert Parallel Line	<b>inspar</b>	Z DTM	<b>z dtm</b>	Zoom Left	<b>zool</b>
Insert Line Text	<b>inslte</b>	Label Bear/Distance	<b>labbea</b>	Zoom Center	<b>zooC</b>
Insert File	<b>insfil</b>	Grid Lines	<b>grilin</b>	Zoom Right	<b>zoor</b>
		Tick Lines	<b>iclin</b>	Zoom Previous	<b>zoop</b>
Edit Line	<b>edilin</b>	Inverse	<b>inv</b>	Line Font ON	<b>lfon</b>
Edit Symbol	<b>edisym</b>	Drive To	<b>dri</b>	Line Font OFF	<b>lfoff</b>
Edit Text	<b>editex</b>	Redrive	<b>redri</b>	Spline ON	<b>splon</b>
Trim Line	<b>trilin</b>	Reset Drive	<b>resdri</b>	Spline OFF	<b>sploff</b>
Break Line	<b>brelin</b>	Delete Duplicates	<b>deldup</b>	Line Points ON	<b>lpon</b>
Hack Line	<b>haclin</b>	Batch Filter	<b>batfil</b>	Line Points OFF	<b>lpoff</b>
Point on Line	<b>pol</b>	Batch Trim	<b>battri</b>	Line Elevations ON	<b>leon</b>
Reverse Line	<b>revlin</b>	Batch Offset	<b>batoff</b>	Line Elevations OFF	<b>leoff</b>
Join Lines	<b>joilin</b>	Sheet Grid	<b>shegri</b>	Range XY	<b>ranxy</b>
Insert Flyline	<b>insfly</b>	Plot Control	<b>plocon</b>	Edit VR Header	<b>edivr</b>
		Create Symbol	<b>cresym</b>	UNDO	<b>undo</b>
Interpolate Contours	<b>intcon</b>	Zoom All	<b>zooa</b>	Zoom In 4X	<b>zoo .25</b>
Square Existing	<b>squexi</b>	Zoom In 2X	<b>zoo .5</b>	Zoom Down	<b>zood</b>
Hatch Line	<b>hatlin</b>	Zoom Up	<b>zooU</b>	Zoom Out 4X	<b>zoo 4</b>
Label Point	<b>labpoi</b>	Zoom Out 2X	<b>zoo 2</b>	Pop	<b>pop</b>
Symbol Fill	<b>symfil</b>	Zoom Windows	<b>zooW</b>	Pop ALL	<b>popall</b>
Edit Elevation	<b>ediele</b>	Toggle Grid	<b>toggri</b>	Swap Applications	<b>swa</b>
Fast Delete	<b>fasdel</b>	Set Grid Resolution	<b>setgri</b>	Associate Command 1	<b>ac1</b>
Line Cross	<b>lincro</b>	Toggle Window Shift	<b>togwin</b>	Associate Command 2	<b>ac2</b>
Change Layer	<b>chalay</b>	Set Display Parameters	<b>setpar</b>	Z Source	<b>zsou</b>
Change Graphic Pointer	<b>chagra</b>	Set Display Parameters	<b>setdis</b>	Plot	<b>plo</b>
Change Pen Code	<b>chapen</b>	Set Layer	<b>setlay</b>	Help	<b>help</b>
Global Change	<b>glob</b>	Reset Layer	<b>layres</b>	Global Help	<b>ghelp</b>
Cut Polygon	<b>cutpol</b>	List Layers	<b>lislay</b>	Edit Macros	<b>edimac</b>
Delete Window	<b>delwin</b>	Edit Config Params	<b>edicon</b>	Edit Function Keys	<b>edifun</b>
Move Window	<b>movwin</b>	Pack VR File	<b>pacvr</b>	EXIT	<b>exi</b>