

*Red GPS a Tiempo Real con Precisiones
Centrimétricas para Utilizar en los Sistemas de
Información Geográficos*



Agrim./Ing. Carlos Rodríguez

CoHemis 2006
UPR-Mayagüez

Mayagüez Puerto Rico



Evolución

● Desarrollo Tecnológico

■ Instrumentación

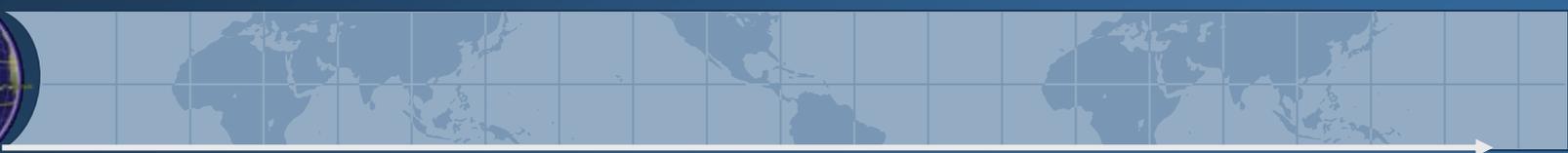
- Distanciómetros
- Total Stations + Cámara + GPS
- Laser Scanners
- GPS
- GPS Reference Stations
- GPS Internet Ready
- PDA
- Tecnología Bluetooth



Mapa de Puerto Rico



Modelo 3D Munich-Alemania



Evolución

● Desarrollo Tecnológico

■ Instrumentación

- Distanciómetros



Survey Chains

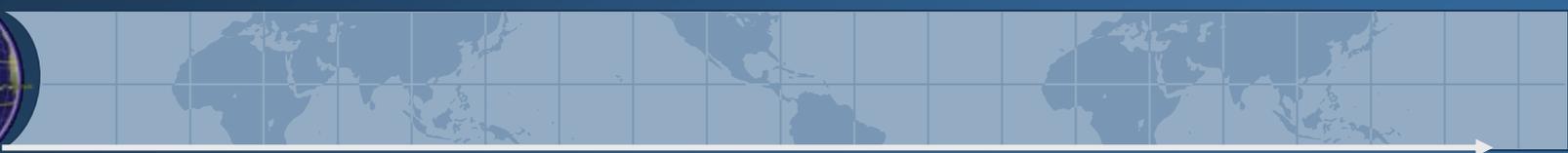


EDM

Laser ranger



Measure tape



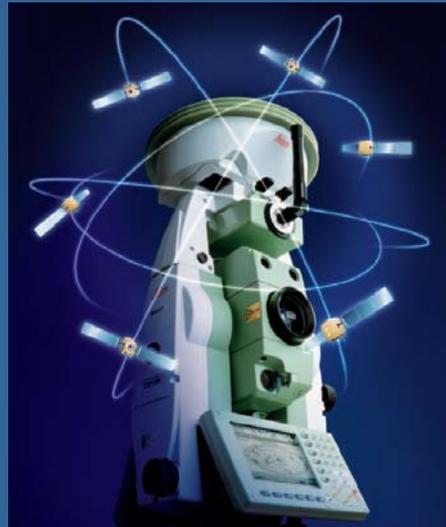
Evolución

● Desarrollo Tecnológico

■ Instrumentación

- Total Stations

Tatal Station+ Robótico+GPS



Tatal Station+Camara



Tatal Station
+Robótico
+Win CE

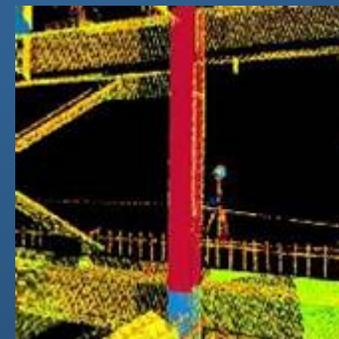
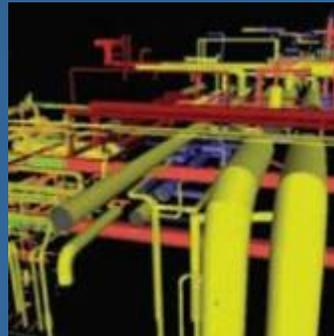




Evolución

● Desarrollo Tecnológico

- Instrumentación
 - Laser Scanners



Modelo 3D

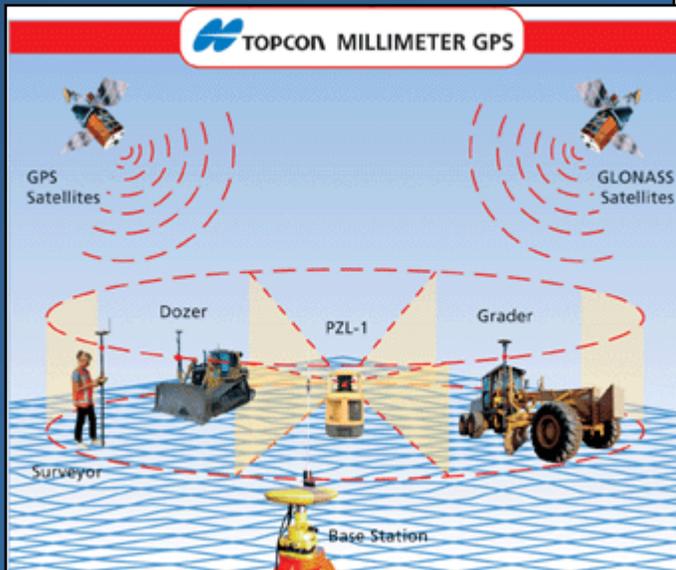


Innovación

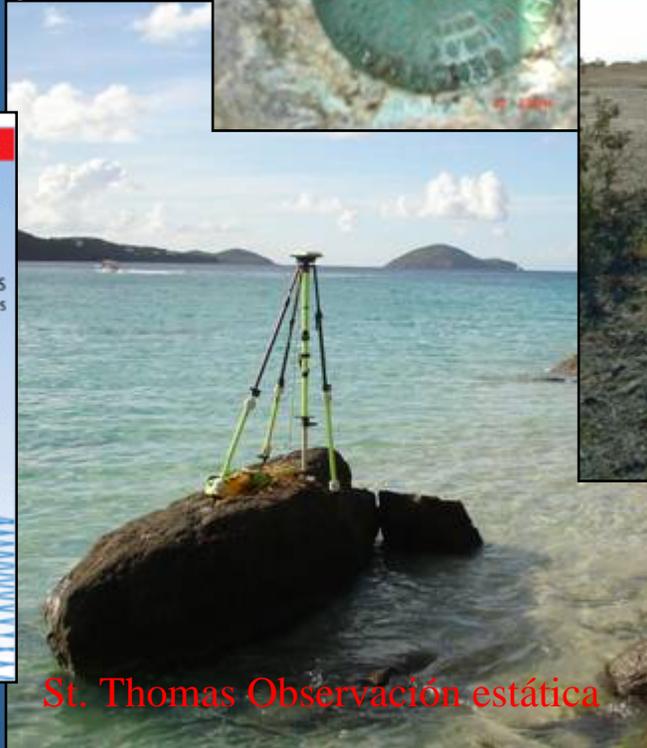
● Desarrollo Tecnológico

■ Instrumentación

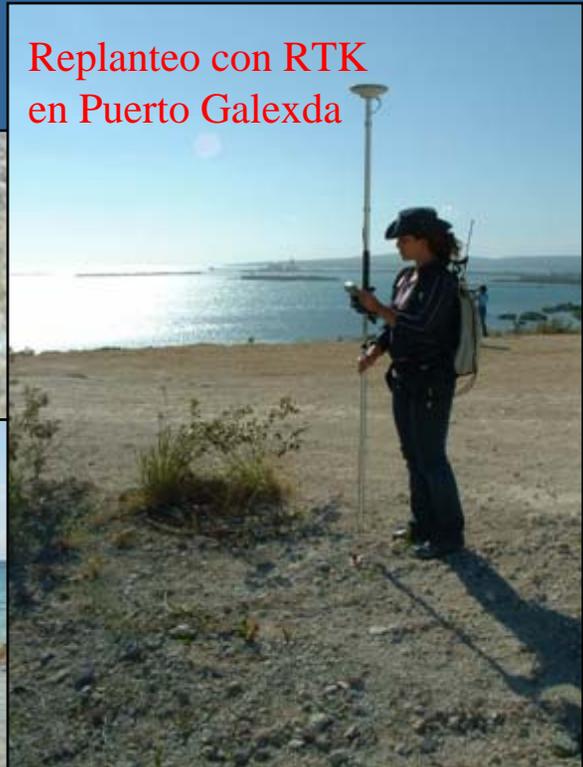
- Agrimensura con GPS
- Estático y "RTK"



Manejo de maquinaria con GPS



St. Thomas Observación estática



Replanteo con RTK en Puerto Galexda



Infraestructura

● Desarrollo Tecnológico

■ Instrumentación

- GPS Reference Stations



Magueyes CORS Site-PRMI

RED CORS del NGS en PR





Concepto

● Desarrollo Tecnológico

■ Instrumentación

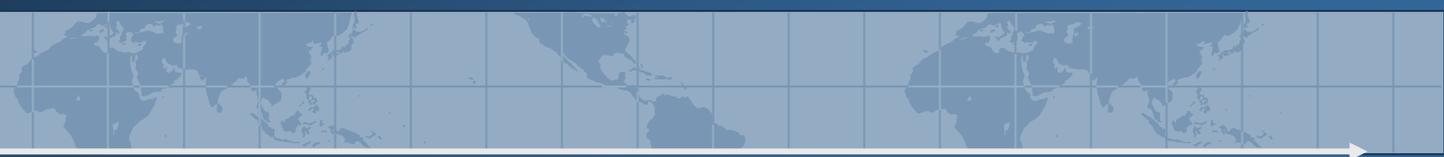
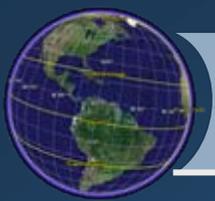
- GPS Internet Ready



Red de GPS a tiempo Real en proceso

Leica Spider Net en Puerto Rico





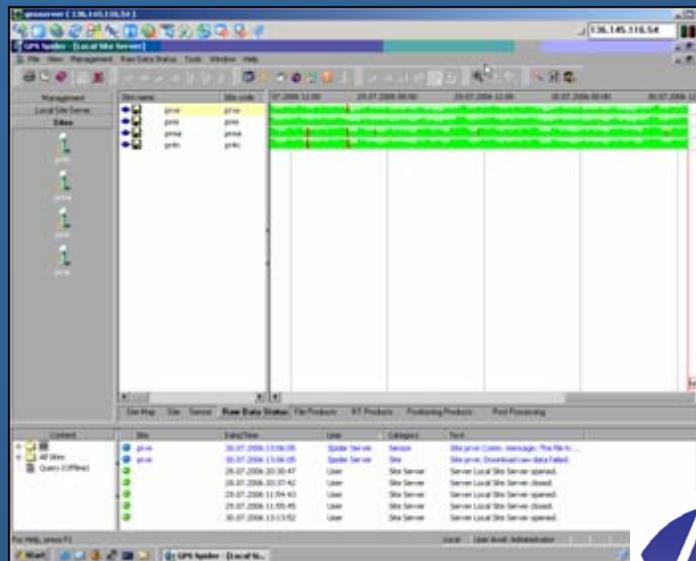
Integración

Red de GPS a tiempo Real en proceso

● Desarrollo Tecnológico

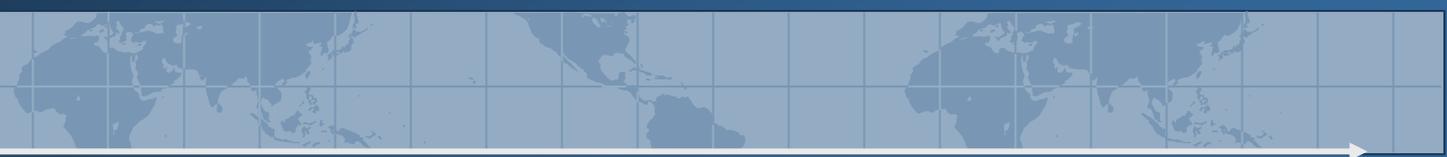
■ Instrumentación

- GPS Internet Ready



Leica Spider Net en Puerto Rico





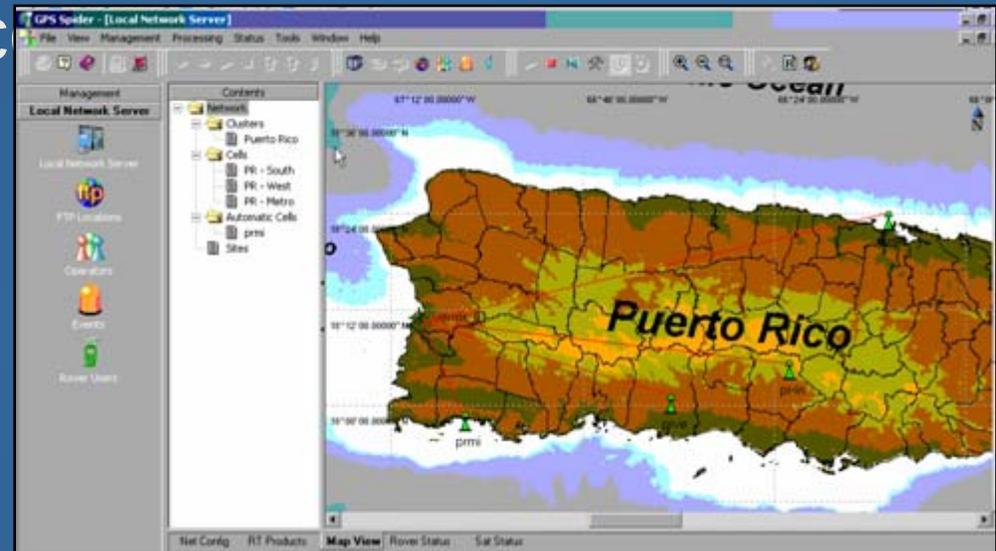
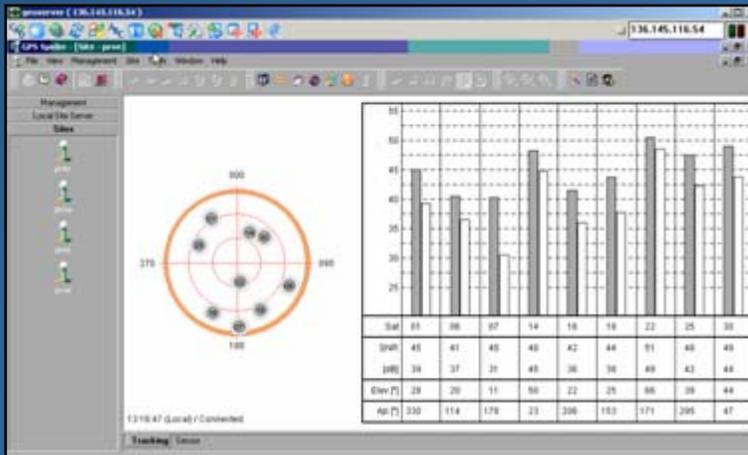
Estabilidad

Red RTK a tiempo Real

● Desarrollo Tecnológico

■ Instrumentación

- GPS Internet Ready



| Name | Connection started | Duration | Sats Rov / Ref | Product | Latency | Ref. Stn. ID | |
|------|--------------------|---------------------|----------------|---------|-------------------|--------------|--------|
| + | vernix_01 | 30.07.2006 13:48:02 | 00:06:19 | 7 / 8 | Puerto Rico I-MAX | 0.64 | prsi-1 |

Localización de “Rovers”

Vista de satélites visibles y sus señales a tiempo real





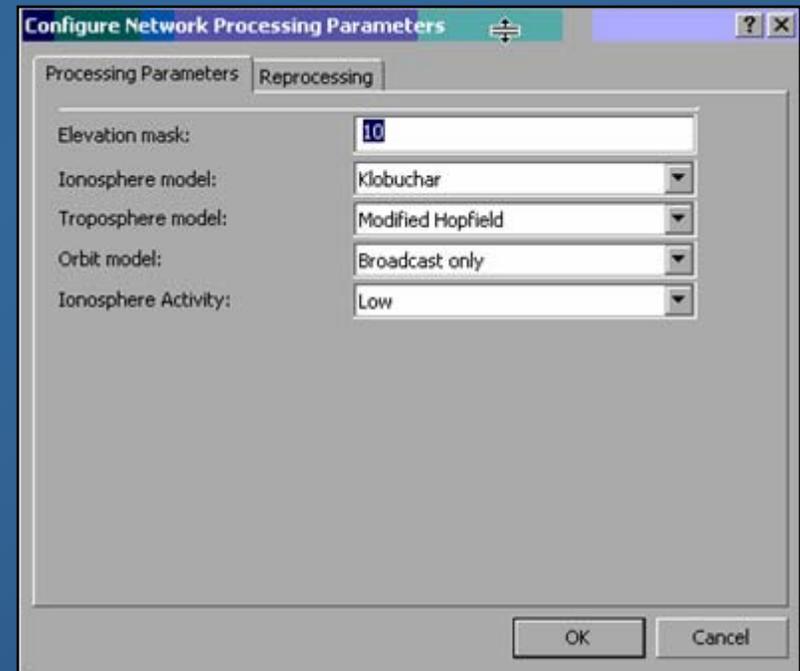
Modelos

● Desarrollo Tecnológico

- Instrumentación
 - GPS Internet Ready

| Contents | Site Name | St... | Fixed/Available | Last update | 01 | 06 | 07 | 14 | 16 | 20 | 22 | 25 | 30 |
|-------------|-----------|-------|-----------------|-------------|----|----|----|----|----|----|----|----|----|
| Network | | | | | | | | | | | | | |
| Clusters | | | | | | | | | | | | | |
| Puerto Rico | prve | prve | 8 / 8 | 14:25:36 | █ | █ | █ | █ | █ | | █ | █ | █ |
| Cells | | | | | | | | | | | | | |
| PR - South | prmi | prmi | 8 / 8 | 14:25:36 | █ | █ | █ | █ | █ | | █ | █ | █ |
| PR - West | prma | prma | 7 / 9 | 14:25:36 | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| PR - Metro | pr4n | pr4n | 8 / 9 | 14:25:36 | █ | █ | █ | █ | █ | █ | █ | █ | █ |

Ambigüedades resueltas y parámetros de Procesos

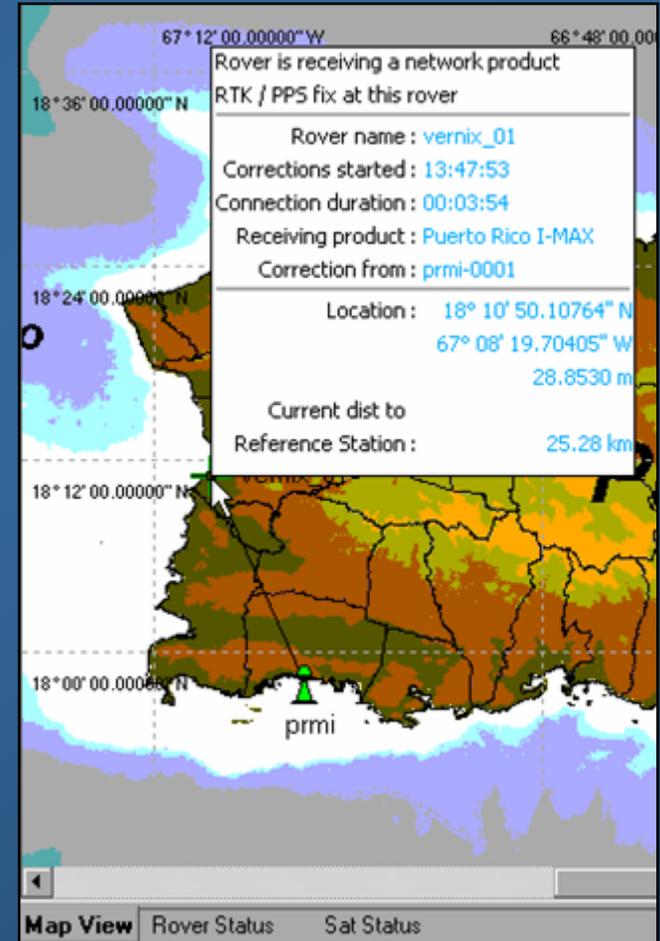
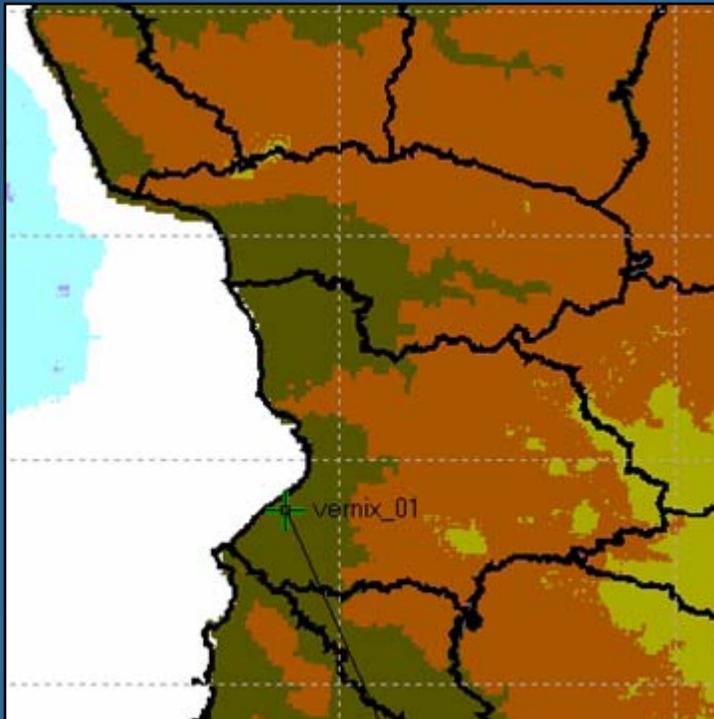




Monitoreo

● Desarrollo Tecnológico

- Instrumentación
 - GPS Internet Ready



Datos a tiempo
real del "Rover"



Red GPS a Tiempo Real

● Desarrollo Tecnológico

■ Instrumentación

- Red GPS para el Caribe



Red GPS para el Caribe en diseño



Red Europea a Tiempo Real

● Desarrollo Tecnológico

■ Instrumentación

- RTK Networks

- | | |
|--------------|------------|
| ➤ Florida | ➤ México |
| ➤ Ohio | ➤ Alemania |
| ➤ California | ➤ Japón |
| ➤ Texas | ➤ China |
| ➤ Michigan | ➤ Suiza |
| ➤ New York | ➤ España |
| ➤ Virginia | ➤ Portugal |

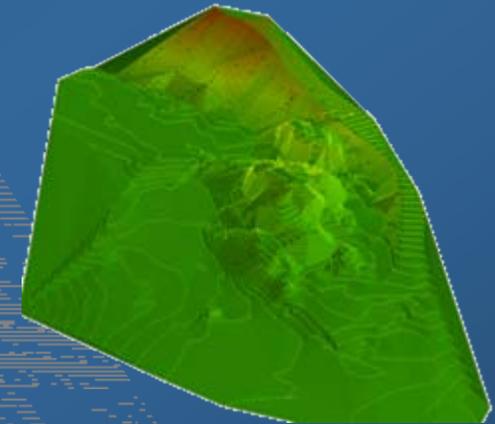
EUREF Permanent Tracking Network



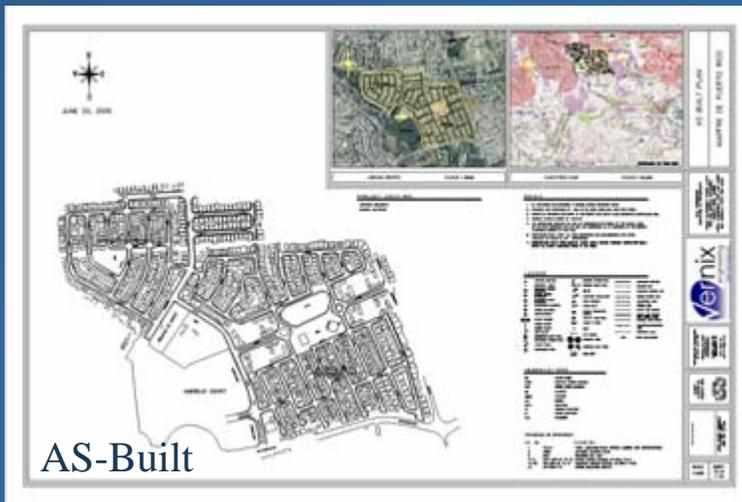


Aplicaciones

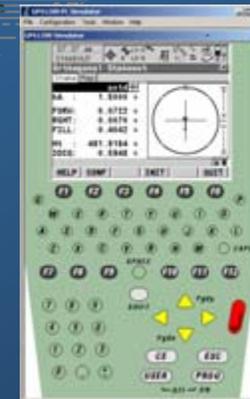
- Trabajos cotidianos
 - Necesidades u Objetivos
 - Topografías
 - As-Built
 - Replanteo
 - Monitoreo
 - Inspección



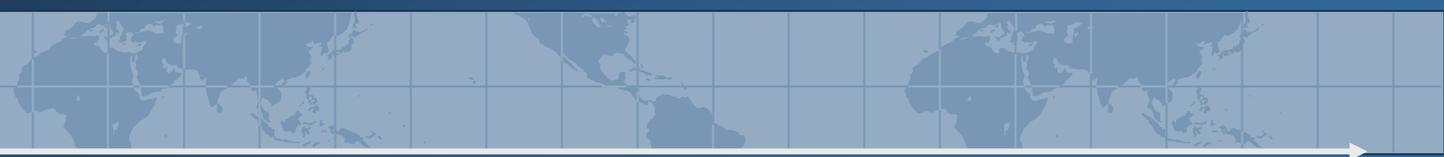
Topografías



AS-Built



Replanteo



Aplicaciones

Manejo de Información

- Manejo de Información 3D
 - Topografías
 - Procesos

Point Group Manager

| Num. | Northing | Eastng | Elevation | Raw D. | Full Des. |
|------|-------------|-------------|-----------|-------------|-------------|
| 1 | 250647.4130 | 120245.7762 | 33.37 | STATION - 3 | STATION - 3 |
| 2 | 250660.3897 | 120244.6017 | 33.24 | STATION - 2 | STATION - 2 |
| 9000 | 250655.7922 | 120210.3039 | 33.04 | TOPO | TOPO |
| 9001 | 250654.4963 | 120216.5183 | 42.90 | TOPO | TOPO |
| 9002 | 250645.9555 | 120217.6646 | 41.18 | TOPO | TOPO |
| 9003 | 250627.6517 | 120215.6948 | 42.41 | TOPO | TOPO |
| 9004 | 250621.7551 | 120224.4185 | 39.92 | TOPO | TOPO |
| 9005 | 250570.4967 | 120232.8013 | 35.77 | TOPO | TOPO |
| 9006 | 250575.7214 | 120230.5420 | 35.75 | TOPO | TOPO |
| 9007 | 250571.5603 | 120229.0858 | 36.29 | TOPO | TOPO |
| 9008 | 250568.1720 | 120230.5403 | 36.38 | TOPO | TOPO |
| 9009 | 250570.2515 | 120240.4736 | 33.84 | TOPO | TOPO |
| 9010 | 250570.8463 | 120238.7546 | 33.89 | TOPO | TOPO |
| 9011 | 250571.2775 | 120233.6424 | 34.19 | TOPO | TOPO |
| 9012 | 250572.1877 | 120234.0526 | 33.81 | TOPO | TOPO |
| 9013 | 250574.8107 | 120231.1047 | 34.58 | TOPO | TOPO |
| 9014 | 250574.5629 | 120232.5624 | 33.78 | TOPO | TOPO |
| 9015 | 250576.0021 | 120237.1680 | 33.44 | TOPO | TOPO |
| 9016 | 250576.3891 | 120243.4780 | 33.45 | TOPO | TOPO |
| 9017 | 250577.2117 | 120249.6667 | 32.89 | TOPO | TOPO |
| 9018 | 250573.2217 | 120252.3848 | 33.10 | TOPO | TOPO |
| 9019 | 250576.4215 | 120254.3036 | 31.69 | TOPO | TOPO |

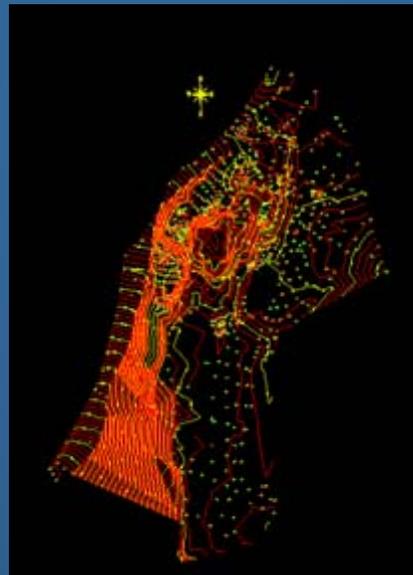
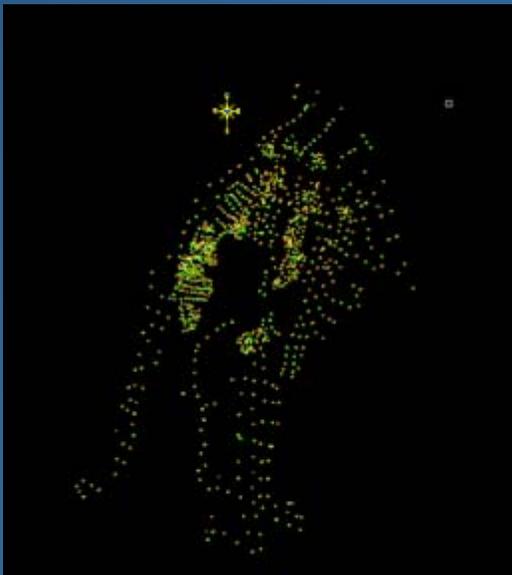
3D Points

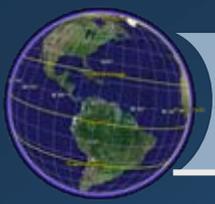
Point List: 1, 2, 9000, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9011, 9012, 9013, 9014, 9015, 9016, 9017, 9018, 9019

Enable Filtering Load Group of Stationing

List All Points Point List Entry

| Station | Northing | Eastng | Elevation | Raw Desc. | Full Desc. |
|---------|-------------|-------------|-----------|-------------|-------------|
| 1 | 250647.4130 | 120245.7762 | 33.37 | STATION - 3 | STATION - 3 |
| 2 | 250660.3897 | 120244.6017 | 33.24 | STATION - 2 | STATION - 2 |
| 3 | 250647.4130 | 120245.7762 | 33.37 | STATION - 3 | STATION - 3 |
| 4 | 250660.3897 | 120244.6017 | 33.24 | STATION - 2 | STATION - 2 |
| 9000 | 250777.6211 | 120217.5209 | 30.38 | TPD | TPD |
| 9001 | 250770.8376 | 120214.1964 | 29.76 | TPD | TPD |
| 9002 | 250763.4440 | 120212.8955 | 29.27 | TPD | TPD |
| 9003 | 250756.3625 | 120211.1212 | 29.67 | TPD | TPD |
| 9004 | 250750.9512 | 120209.0662 | 29.13 | TPD | TPD |
| 9005 | 250743.5246 | 120208.8859 | 29.47 | TPD | TPD |
| 9006 | 250735.4910 | 120207.4375 | 29.76 | TPD | TPD |
| 9007 | 250729.2625 | 120207.7385 | 29.85 | TPD | TPD |
| 9008 | 250720.9193 | 120203.6903 | 29.62 | TPD | TPD |
| 9009 | 250712.9400 | 120200.9717 | 30.28 | TPD | TPD |
| 9010 | 250704.4193 | 120200.7009 | 30.45 | TPD | TPD |
| 9011 | 250696.2640 | 120204.7136 | 30.99 | TPD | TPD |
| 9012 | 250688.0957 | 120203.7540 | 31.61 | TPD | TPD |





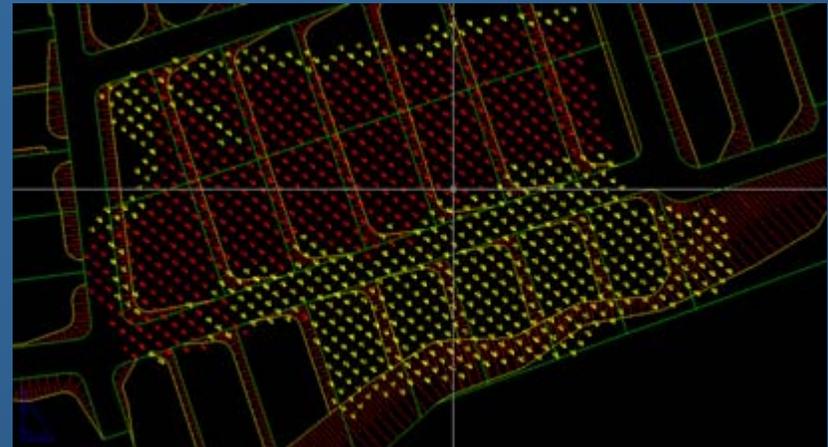
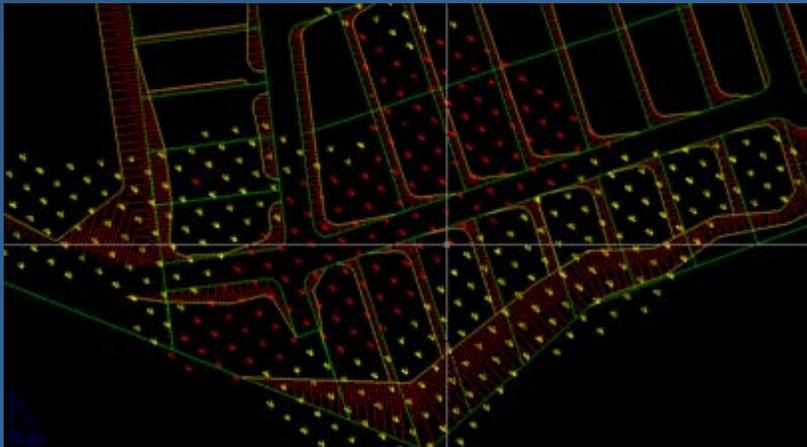
Aplicaciones

- Estudios especializados
 - Topografías
 - Estudio de productividad

CUT & FILL DATA FROM JUNE 30-AUGUST 15, 2006

| DATE | CUT | % DIFF. | FILL | % DIFF. | NET | % DIFF. |
|----------|-------------|---------|-------------|---------|-----------|---------|
| 06/08/15 | 34,199,8754 | NA | 33,489,5649 | NA | 710,31058 | NA |

* NOTE VOLUME DATA ARE UNADJUSTED.



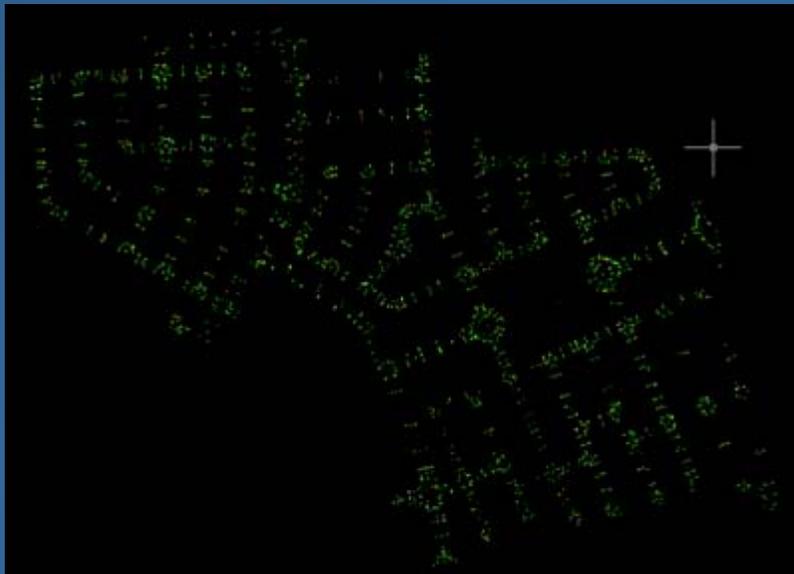


Aplicaciones

- Inventario Sistemas de Drenaje

- As-Built

- ✓ Combinación de datos



Punto con Total Station

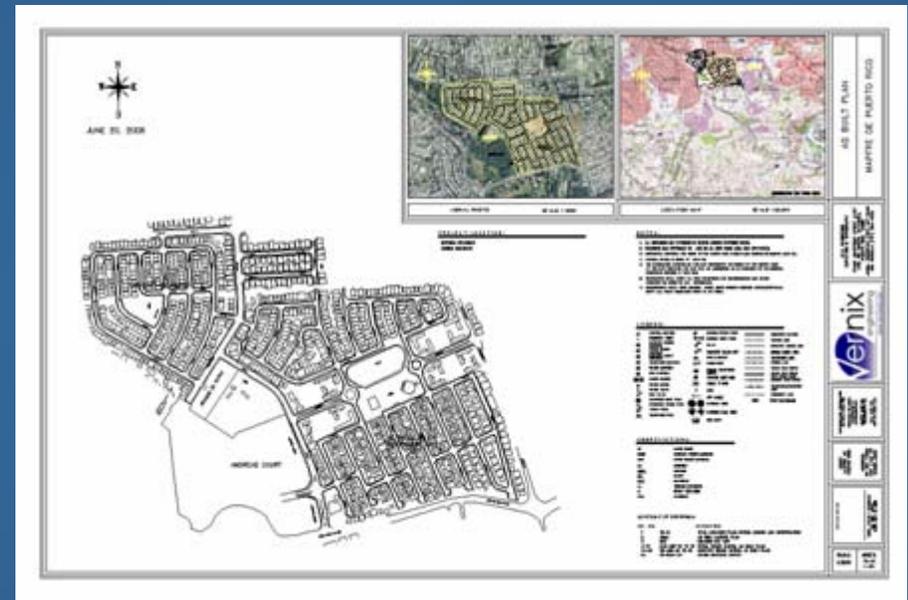
Puntos con GPS
NET 9 KM



Aplicaciones

● Inventario Sistemas de Drenaje

- As-Built – Tiempo
- ✓ Total Station 160 hr.
- ✓ GPS + TPS 32 hr



Plano Final



Aplicaciones

● Monitoreo

■ Replanteo y monitoreo

- Proyectos
- Placas de Asentamiento





Aplicaciones

- Manejo de Maquinaria
 - Posicionamiento en equipo





Aplicaciones

- Control de Calidad

- Inspección

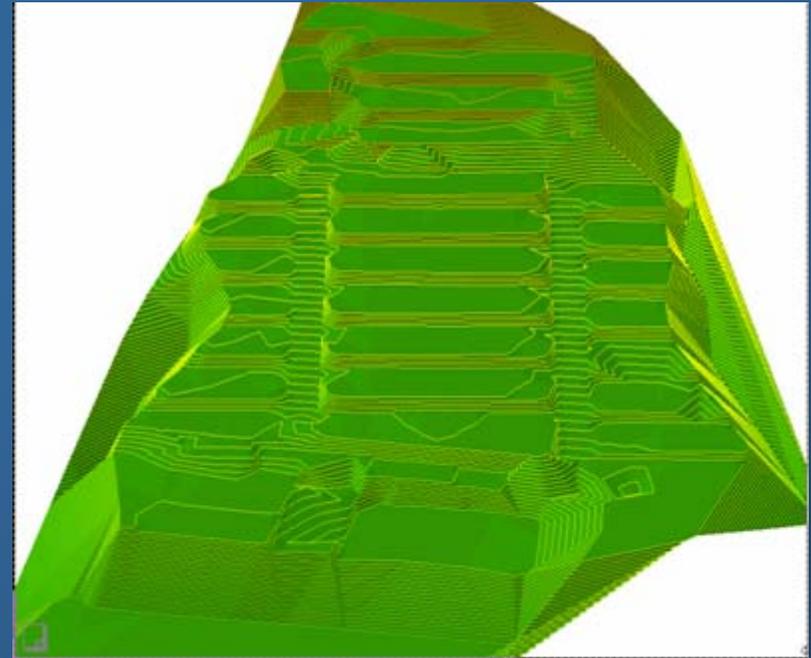




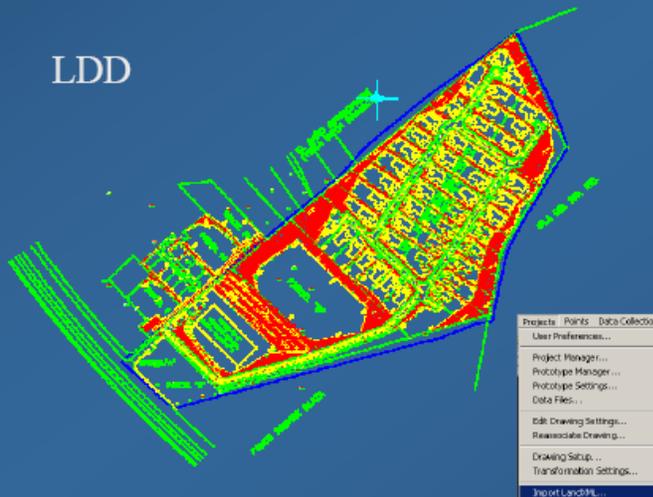
Proyectos con Integración

- Desarrollos
 - Integración
 - ✓ Ingeniería
 - ✓ Agrimensura
 - ✓ GIS
 - ✓ Multimedia

Puerto Galexia 3D



LDD





Integración

- Mapas bases
 - Integración
 - ✓ Ingeniería
 - ✓ Agrimensura
 - ✓ GIS
 - ✓ Multimedia



Identify Results

Layers: < Topmost layer >

PRSV Stations

| Field | Value |
|-------------|----------------|
| OID | 12 |
| STATION | MPR-Station |
| N_UTM_83 | 2014605.042 |
| E_UTM_83 | 696720.308 |
| N_UTM_27 | 2014953.657 |
| E_UTM_27 | 696465.142 |
| N_SAD63 | 242021.386 |
| E_NAD83 | 125275.053 |
| N_PRODAT | 42236.560 |
| E_PRODAT | 77635.257 |
| LAT_WGS84 | 18 12 42.09646 |
| LONG_WGS84 | 87 08 23.17868 |
| LAT_ITRF00 | N/A |
| LONG_ITRF00 | N/A |
| GPS_ELE | 22.409 |
| Shape | Point |



Mapa base GIS RSPR

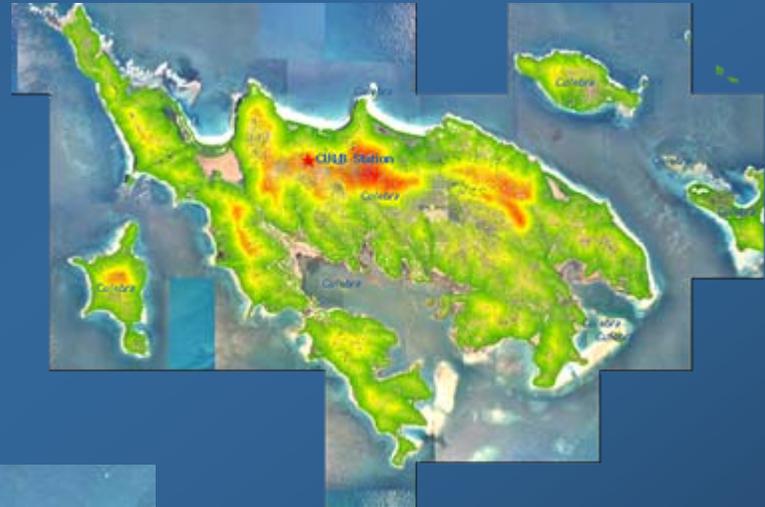


Integración

- Modelos de elevaciones

- Integración

- ✓ Ingeniería
 - ✓ Agrimensura
 - ✓ GIS
 - ✓ Multimedia



Topo Culebra



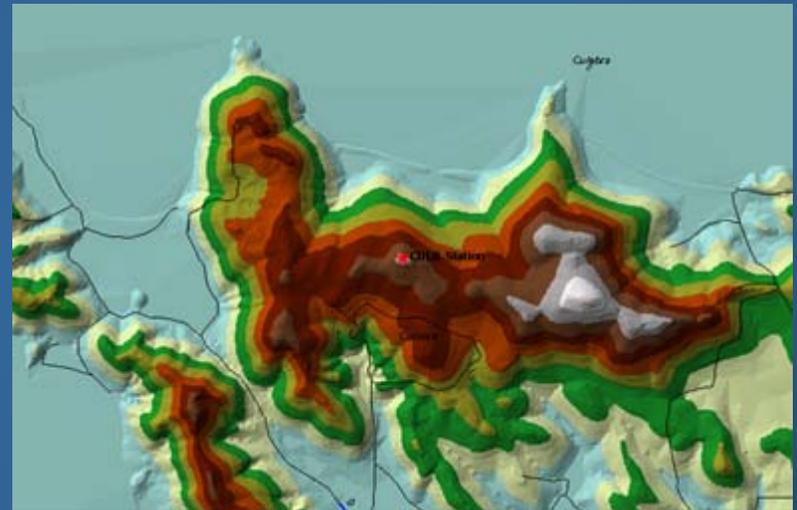


Integración

- Modelos de Terreno

- Integración

- ✓ Ingeniería
 - ✓ Agrimensura
 - ✓ GIS
 - ✓ Multimedia



Modelo 3D



Base de datos GPS



Integración

● Información Sísmica

■ Integración

- ✓ Ingeniería
- ✓ Agrimensura
- ✓ GIS
- ✓ Multimedia



Sismos registrados 1986-2006

Base de Tsunami Mayagüez



Integración

Mapa de Evacuación por Tsunami

- Mapas de desalojo

- Integración

- ✓ Ingeniería
 - ✓ Agrimensura
 - ✓ GIS
 - ✓ Multimedia



Modelo Tsunami 1918



Nuestro Objetivo

Que el gobierno de Puerto Rico adopte nuestro proyecto como uno de enriquecimiento tecnológico para el desarrollo de nuestro país. Proveyendo el servicio gratuitamente a toda la comunidad donde el posicionamiento global es vital...



Muchas gracias por su atención . . .

