



**Centro de Transferencia de
Tecnología en Transportación
de Puerto Rico**

Proyecciones Cartográficas y Sistemas de Coordenadas

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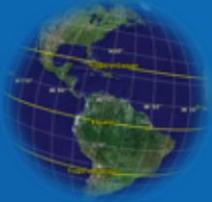
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Temas

- Introducción
- Agrimensura y las Ciencias Geodésicas
 - Geodésia
 - Fotogrametría
 - Percepcion Remota
 - Cartografía
- Proyecciones Cartografías
 - De Coordenadas Esfericas a Coordenadas Planas

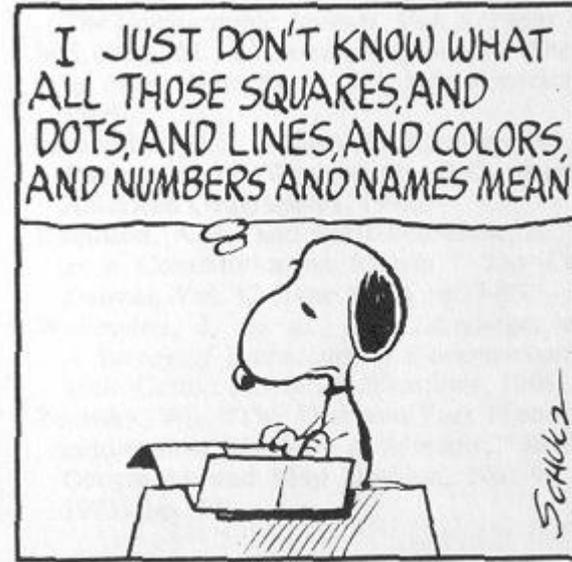
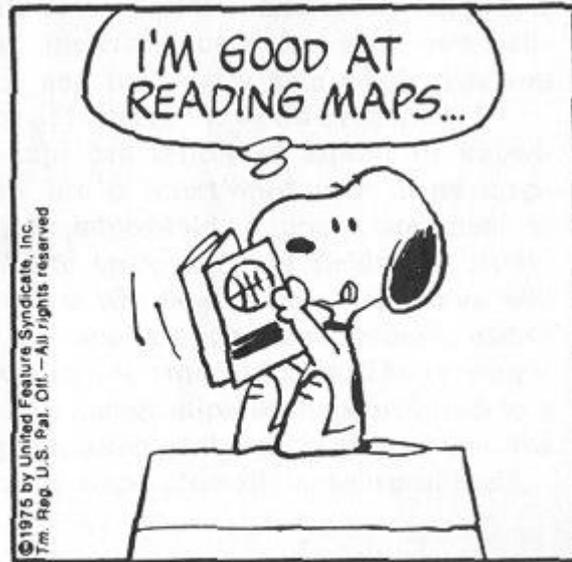
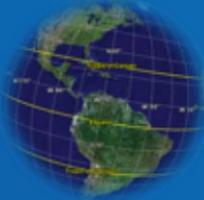


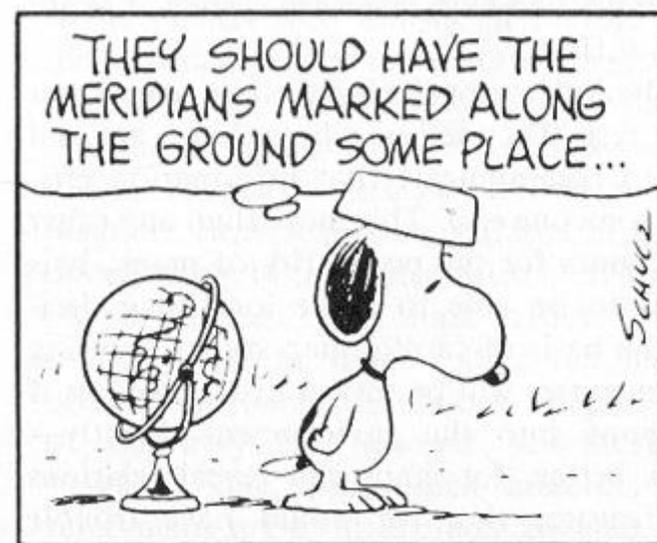
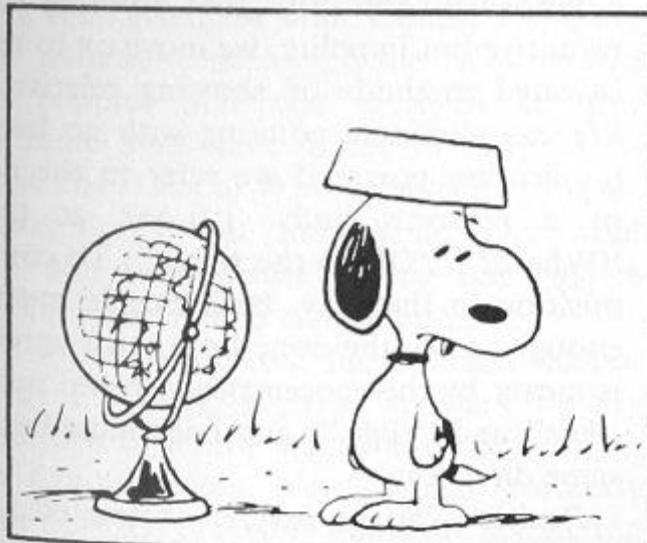
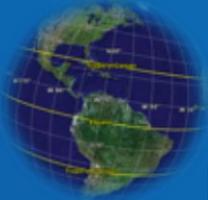


Temas

- Sistemas de Coordenadas Planas Estatales para Puerto Rico e Islas Virgenes
- De Coordenadas Asumidas a Coordenadas Planas Estatales para Puerto Rico e Islas Virgenes
- ¿Que son las Coordenadas UTM (Universal Transverso Mercator) y sus zonas?
- Las Coordenadas, los GPS (Global Positioning System) y los GIS (Geographic Information System)
- El National Geodetic Survey, su web site y sus Geodetic Tools



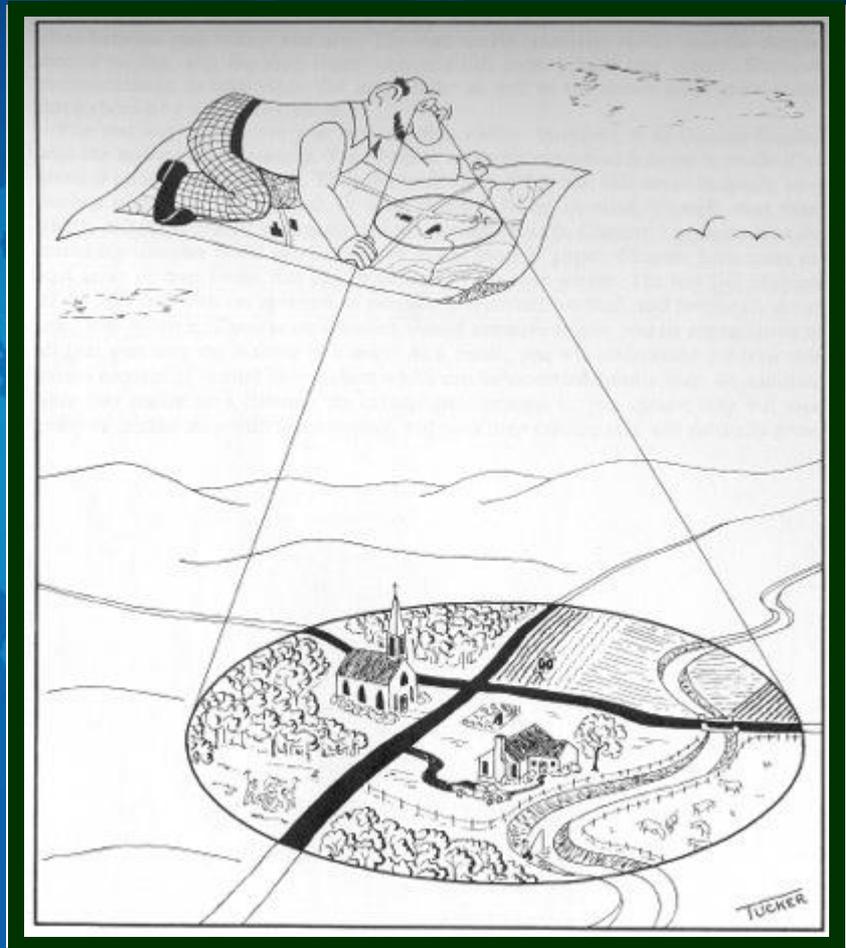




AGRIMENSURA:

obtenemos ángulos y distancias para luego
calcular las coordenadas

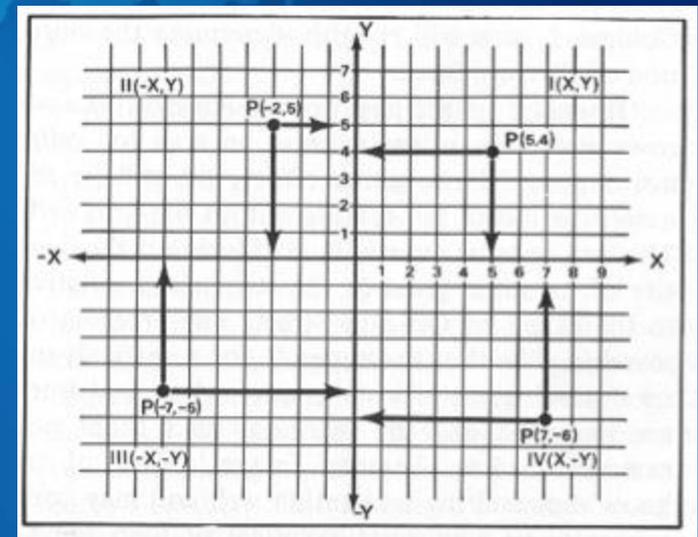
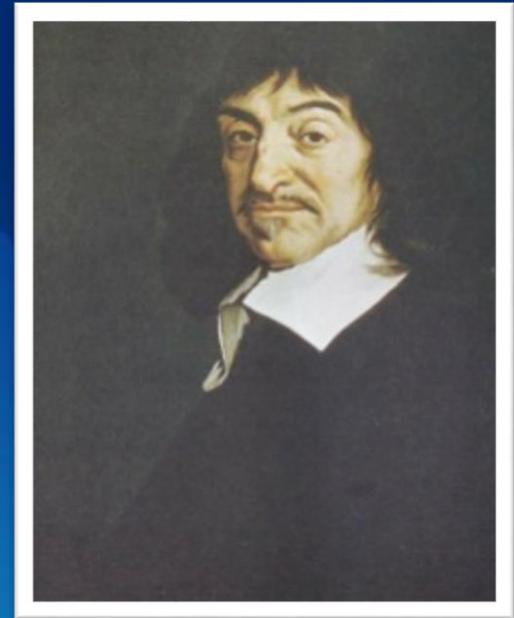
- Se define como el arte, ciencia y tecnología de determinar la posición de un punto en, sobre o bajo la superficie de la tierra, o establecer la posición de dichos puntos. Envuelve todo lo que tenga que ver con nuestro ambiente pues TODO tiene una definición en el espacio que habitamos, y de eso es de lo que se trata el NEGOCIO de la AGRIMENSURA, de la localización. En agrimensura consideramos como un plano la superficie de la Tierra por eso la extensión del área es limitada

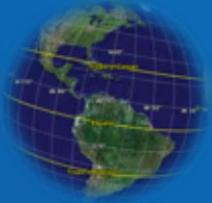


Sistemas de coordenadas planas

El matemático francés **René Descartes**, en el siglo XVII ideó el sistema de coordenadas rectangulares, también conocido como plano Cartesiano. Este sistema usa un par ordenado de coordenadas para localizar puntos. Ese par ordenado de coordenadas se denominan la coordenada-X y la coordenada-Y.

En la ilustración en el primer cuadrante el punto P tiene unas coordenadas (5,4). La distancia horizontal desde el eje de Y a P, se conoce como la **Abcisa**. La distancia vertical desde el eje de X a P, se conoce como la **Ordenada**. En este sistema de coordenadas cartesianas existe cuatro cuadrantes, rotulados en contra de las manecillas del reloj del 1 al 4. En Agrimensura se identifican en dirección contraria y los ángulos se miden desde el eje de Y a favor de las manecillas del reloj.





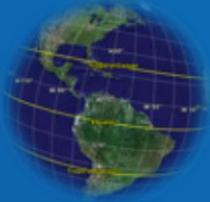
COORDENADAS

Por definición son cantidades lineales o angulares, o ambas, que designa la posición de un punto relativo a un marco de referencia.

Se dividen en agrimensura generalmente en dos: (1) polares y (2) rectangulares.

Se subdividen en tres clases: coordenadas; (1) planas, (2) esfericas y (3) Espaciales.



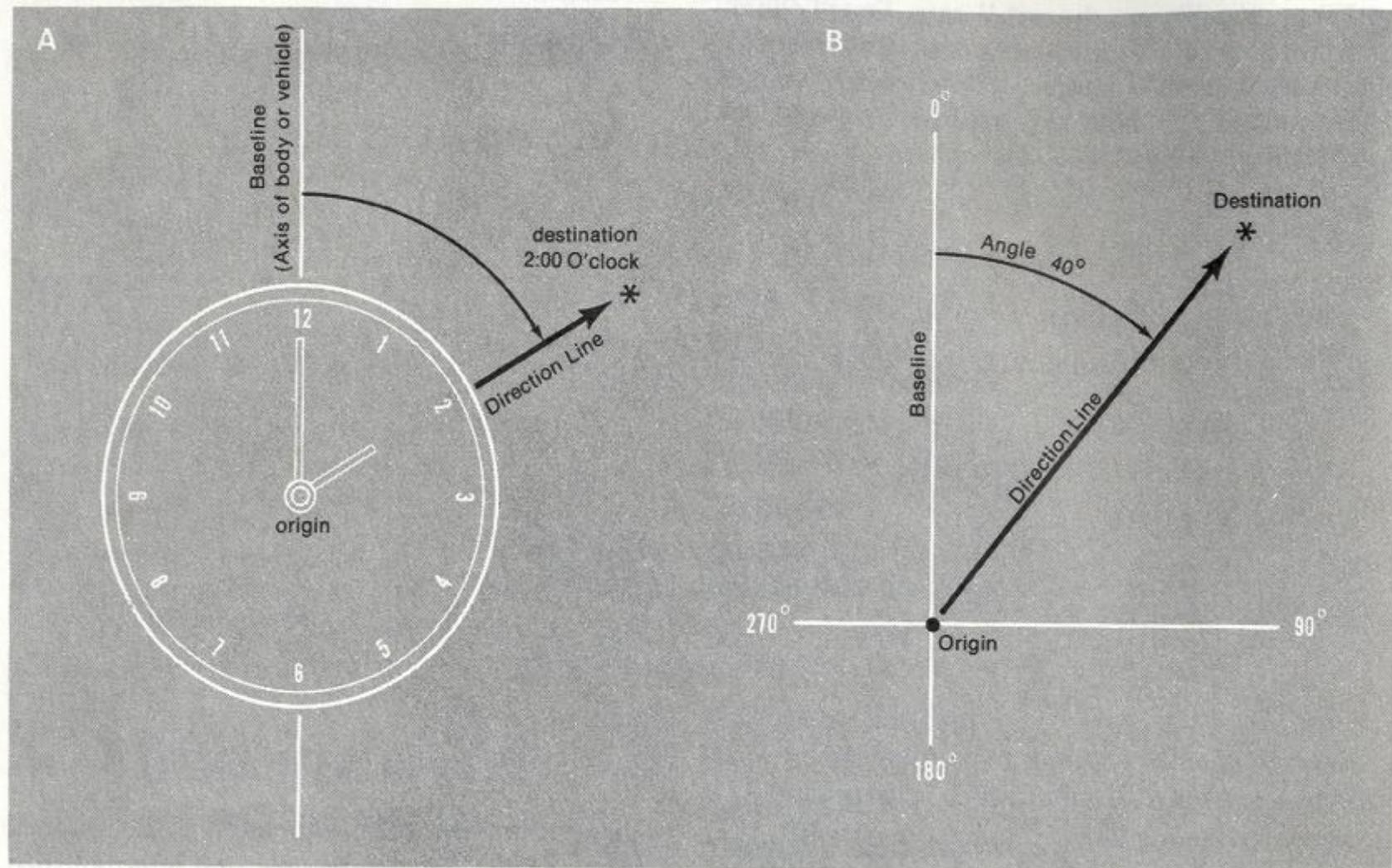


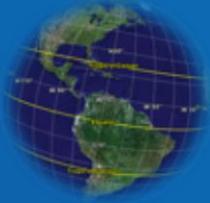
DISTANCIA – Teorema de Pitagoras

- Entre dos puntos con coordenadas conocidas tenemos que la distancia D_{1-2} es igual a la raíz cuadrada del cuadrado de las diferencias de las Y mas el cuadrado de las diferencias de las X.
- Es decir:

$$D_{1-2} = \left((Y_2 - Y_1)^2 + (X_2 - X_1)^2 \right)^{1/2}$$





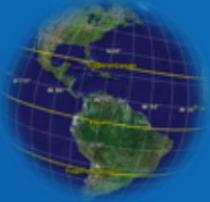


ANGULOS/DIRECCIONES

- Para rumbos y acimuts tenemos que la tangente del rumbo o acimut es igual a las diferencias de las X dividido por la diferencia de la Y.
- Es decir:

$$\tan B = \frac{X_2 - X_1}{Y_2 - Y_1}$$





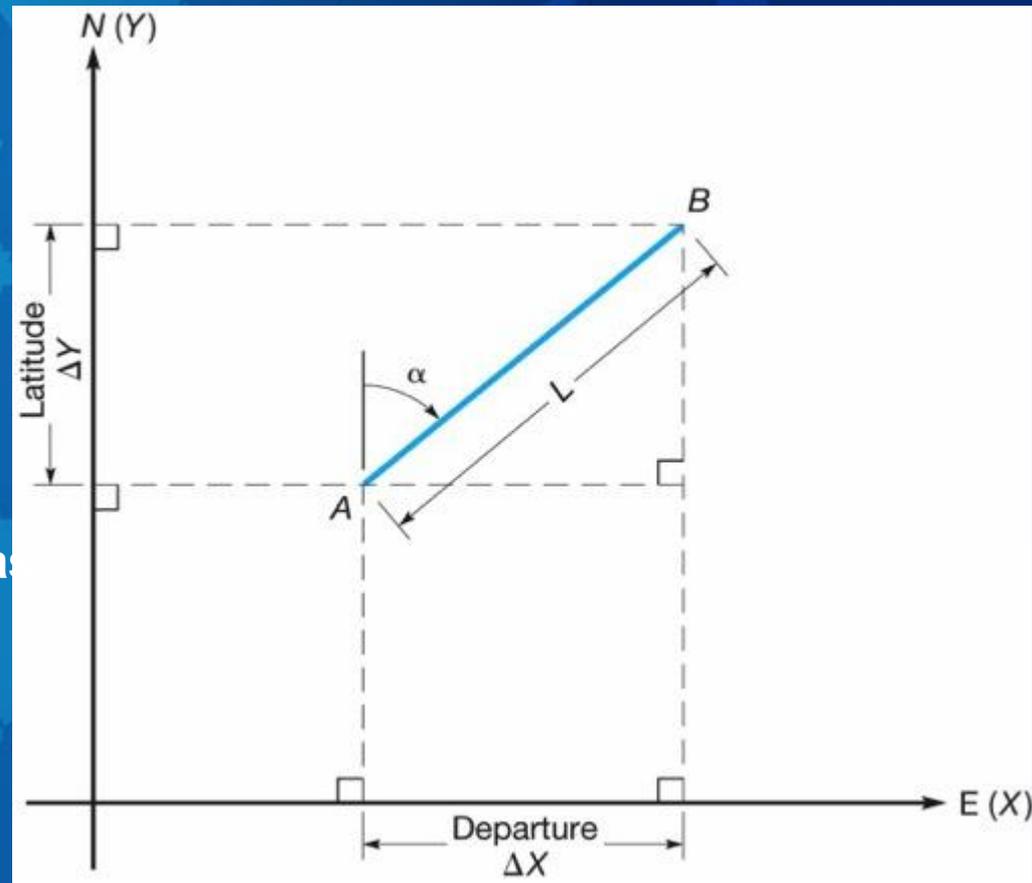
Componentes en X & Y de la linea AB,
cuya longitud es igual a L y un angulo α

“Latitude” = $L \sin \alpha$

Si tenemos las coordenadas
del punto A, podemos
calcular las coordenadas
del punto B, asi:

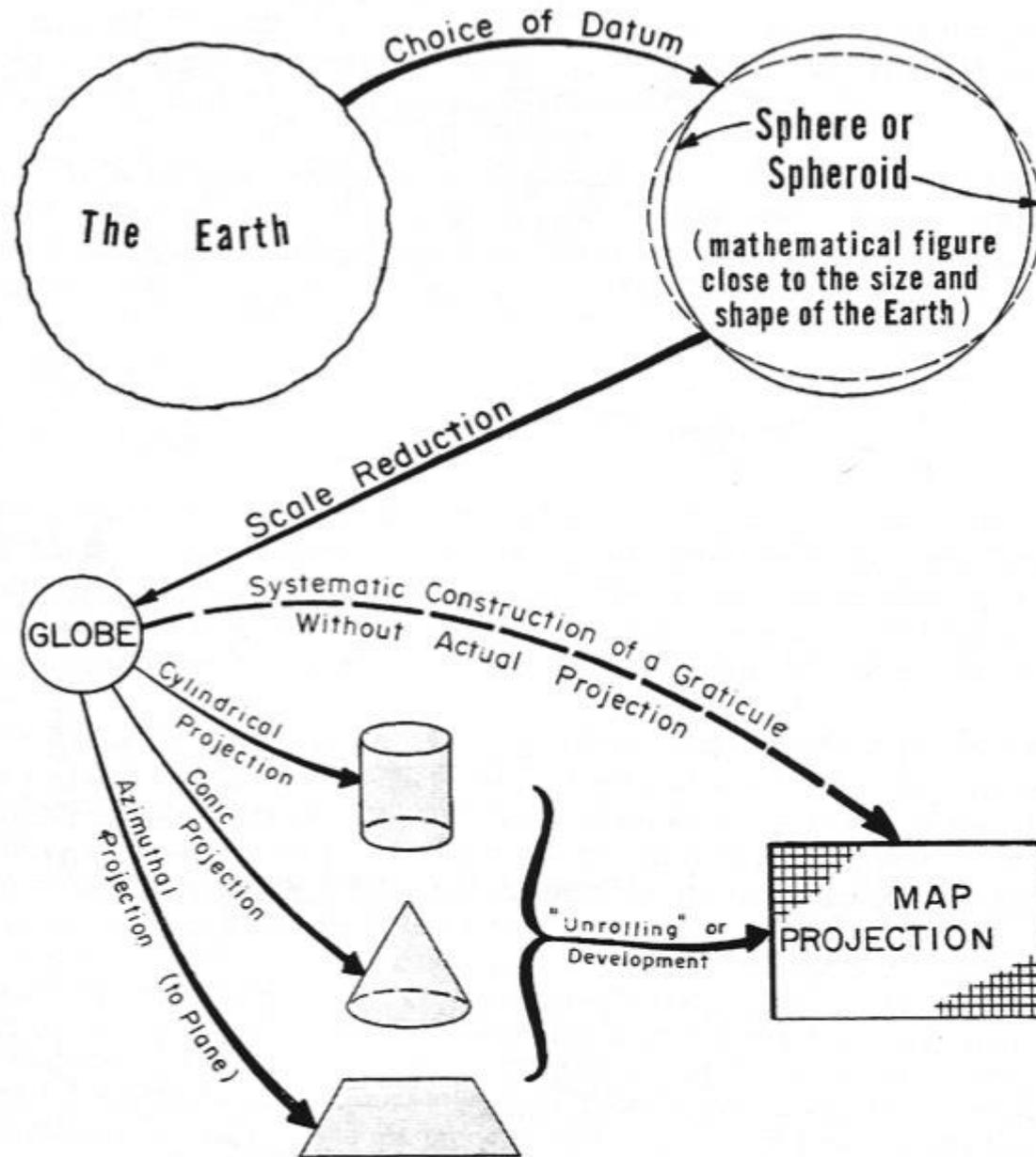
$$X_B = \Delta X + X_A$$

$$Y_B = \Delta Y + Y_A$$



“Departure” = $L \cos \alpha$





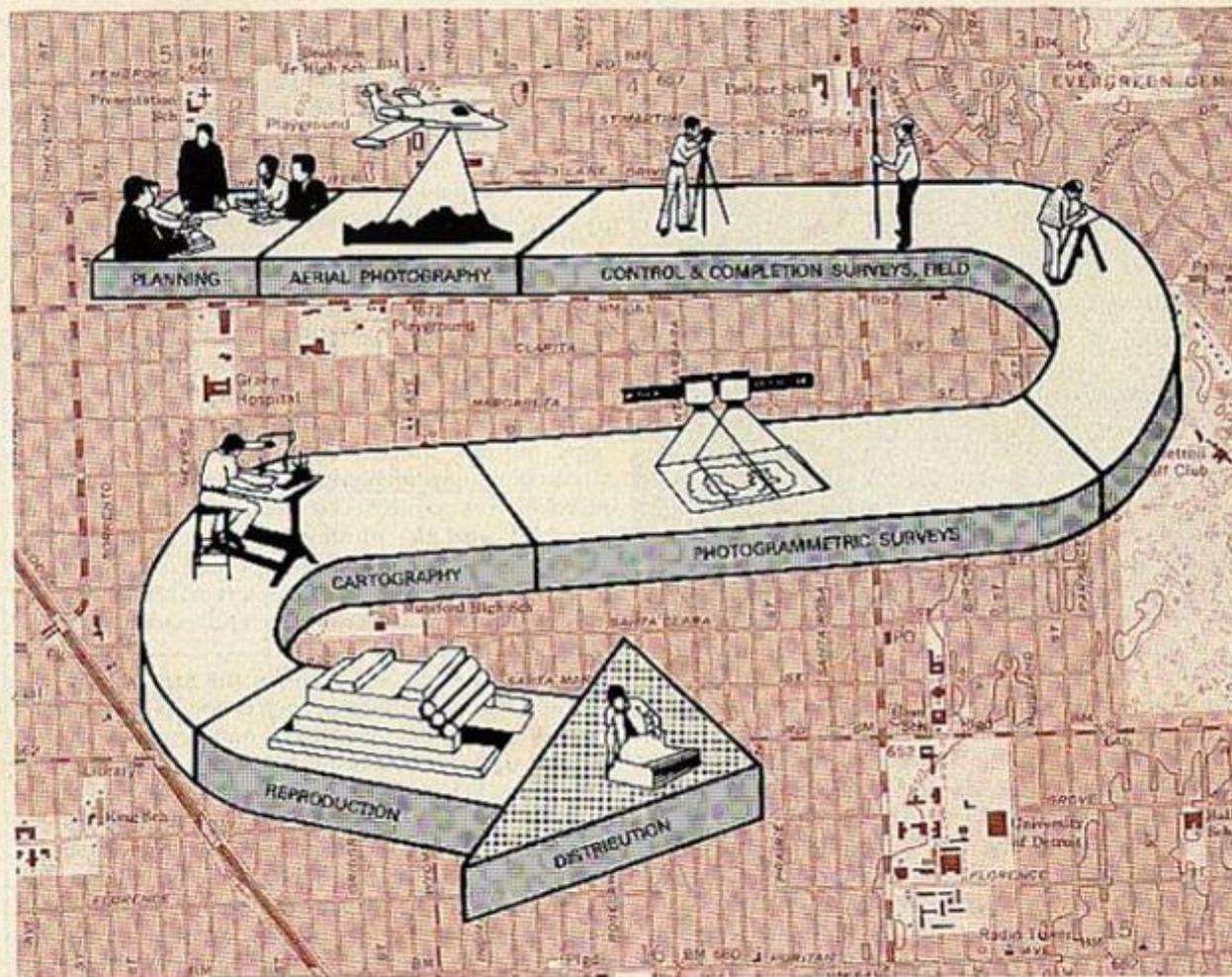
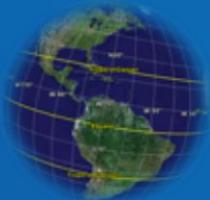


FIGURE 19. Sequence of standard topographic mapping operations.



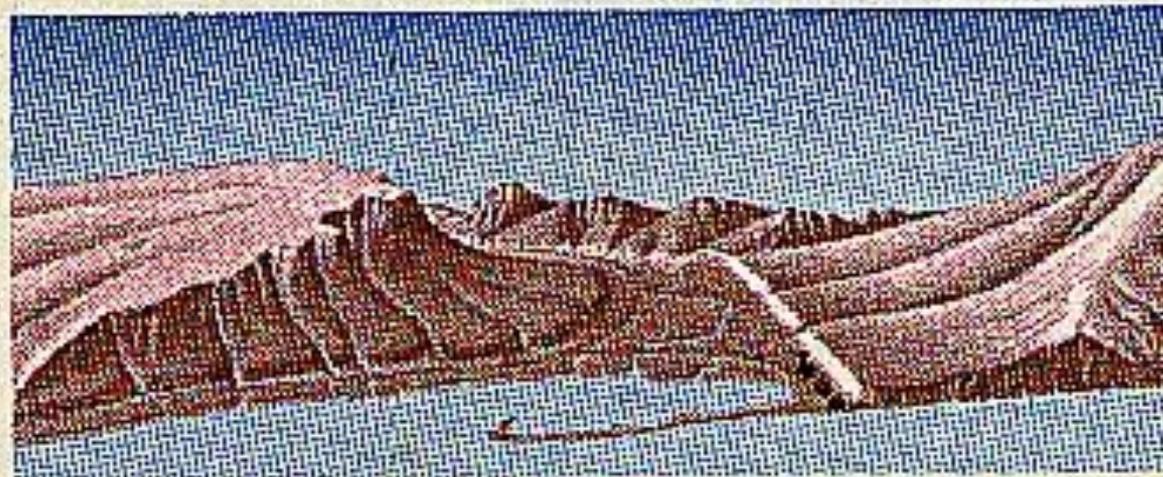
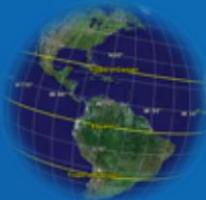
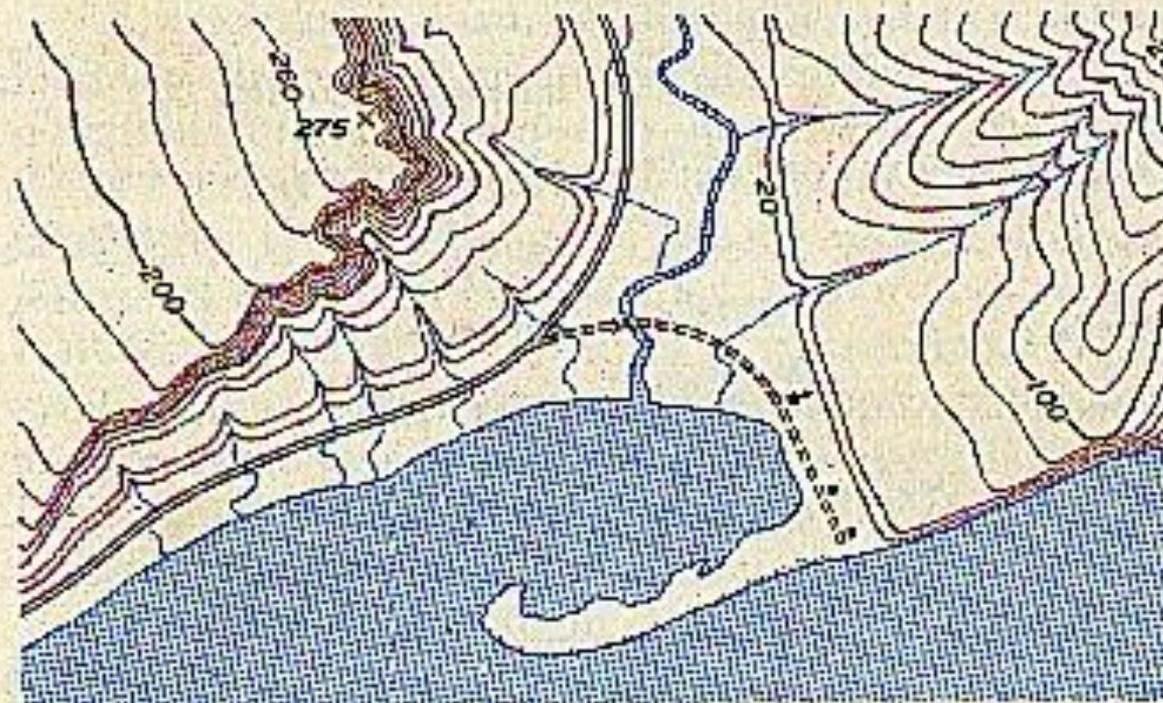
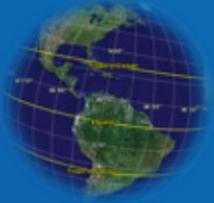


FIGURE 22. Ground configuration (*above*) shown by contours (*below*).



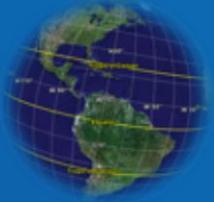




Diferencias Geométricas entre Fotografías y Mapas

- Tiene Distorsión
- Proyección Central
- Cambio en escala por:
 - Relieve
 - Inclinación
- No tienen datos sobre Elevación
- Distorsión de la imagen por:
 - Relieve
 - Inclinación
- No Tiene Distorsión
- Proyección Ortogonal
- Escala Uniforme
- Tienen datos sobre Elevación
- No tienen distorsión de la imagen





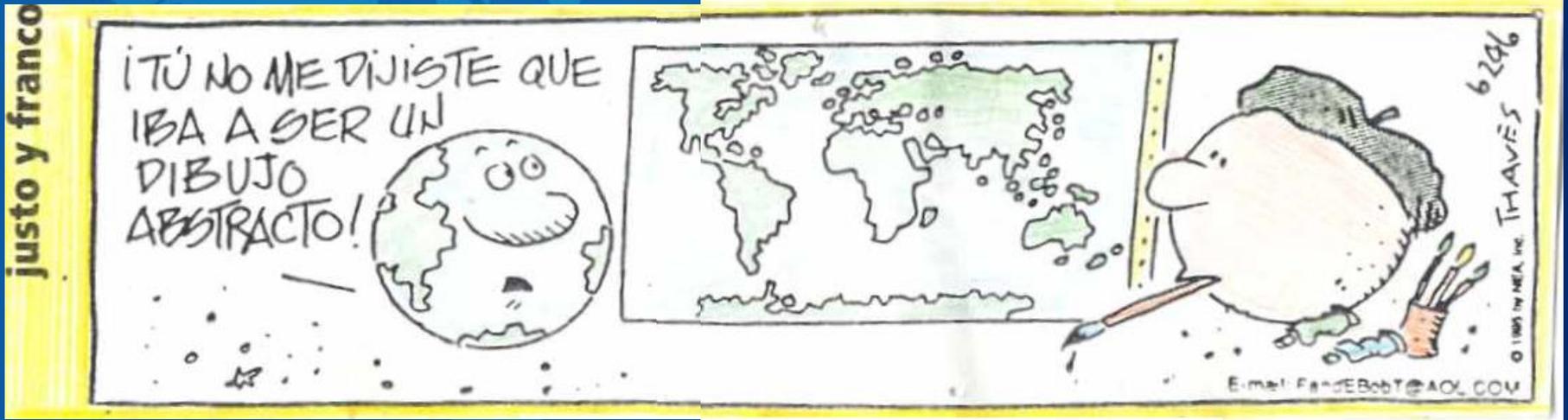
Diferencias Geométricas entre Fotografías y Mapas

- No tienen cuadrícula, pues:
 - No están orientadas al Norte
 - No tienen escala constante
- Orientación Arbitraria en el espacio
- Efecto de Curvatura
- Refracción atmosférica
- Tienen cuadrícula
- Orientación ortogonal fija
- No se tiene el efecto de curvatura
- No se tiene el efecto de la refracción atmosférica



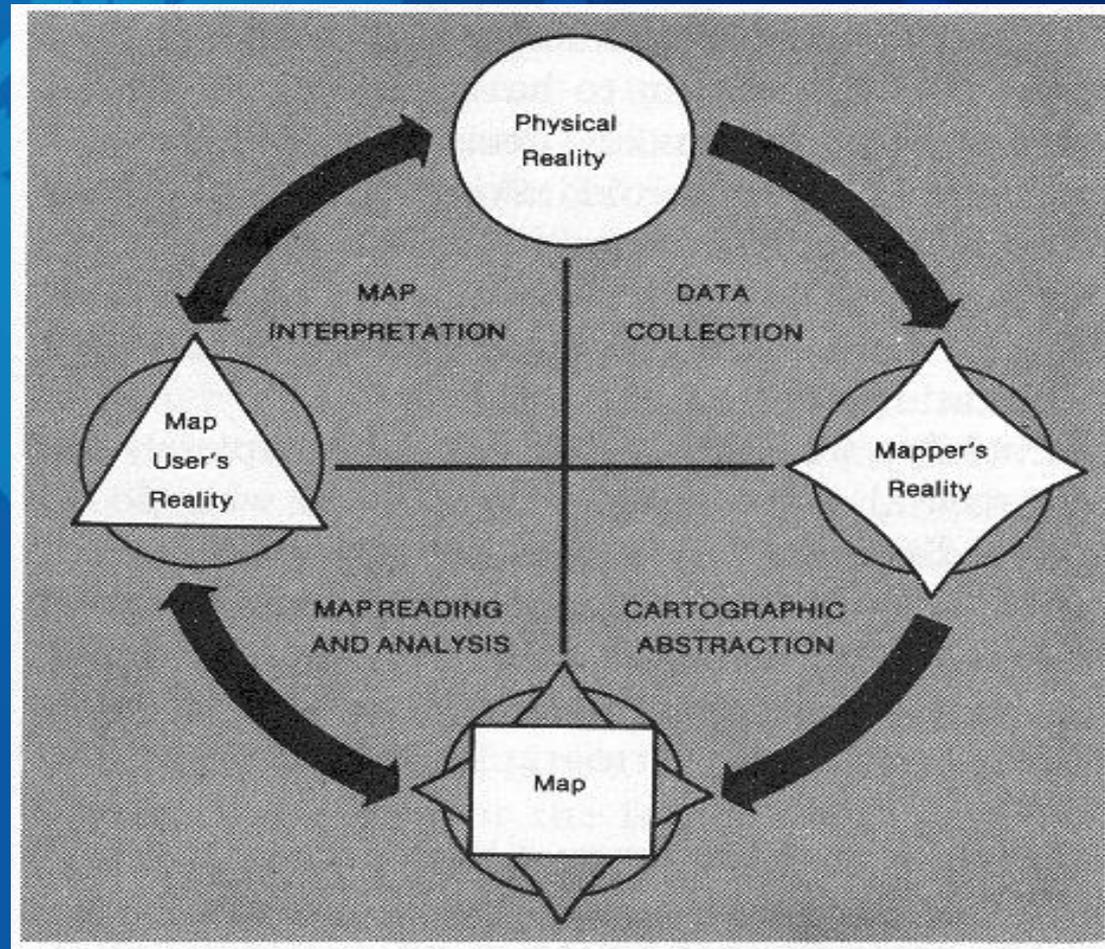


PROYECCIONES CARTOGRÁFICAS



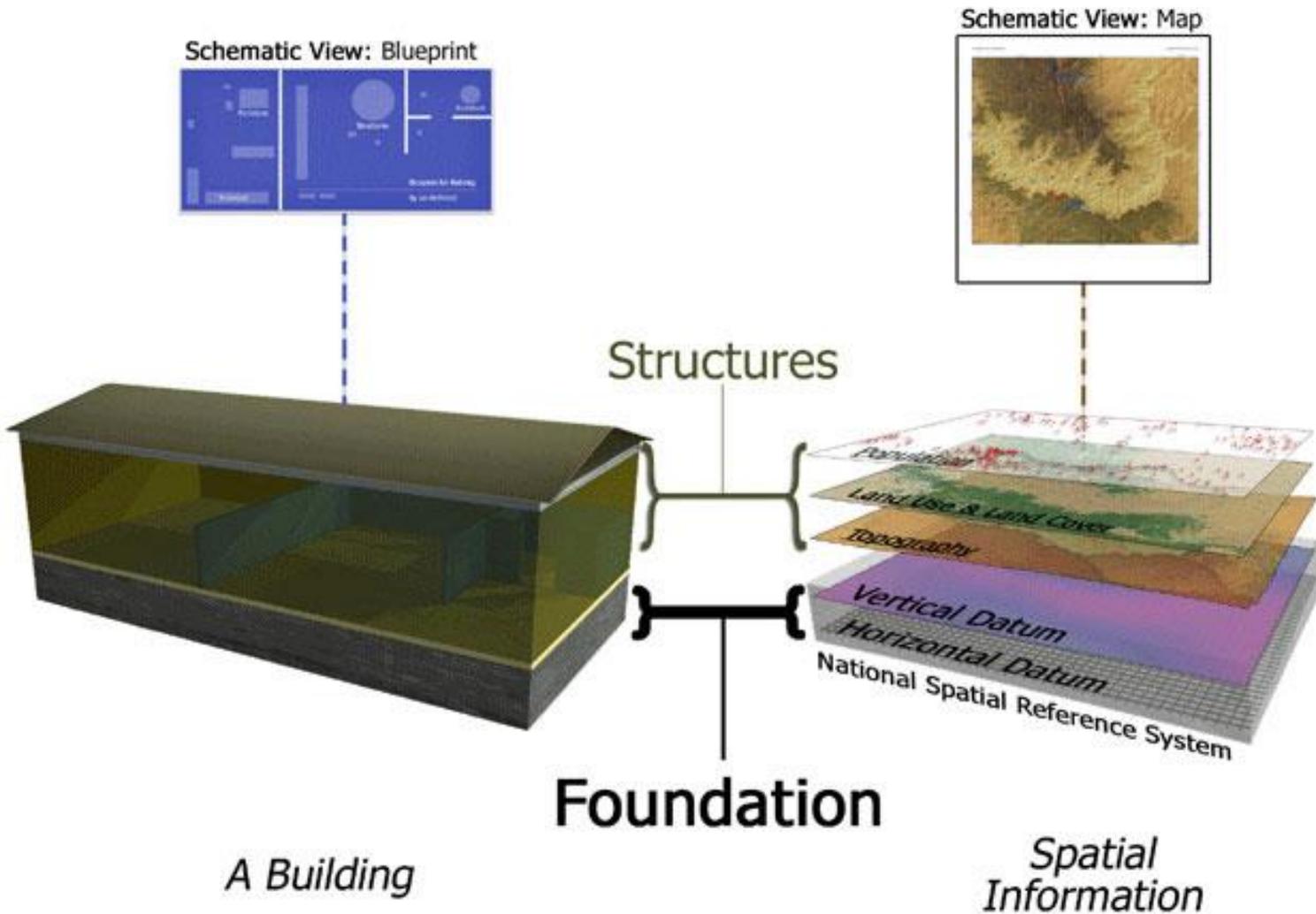


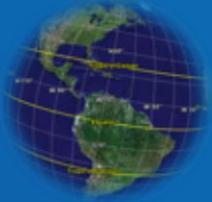
PROYECCIONES CARTOGRÁFICAS





Estructura VS. Datos Geo-Espaciales





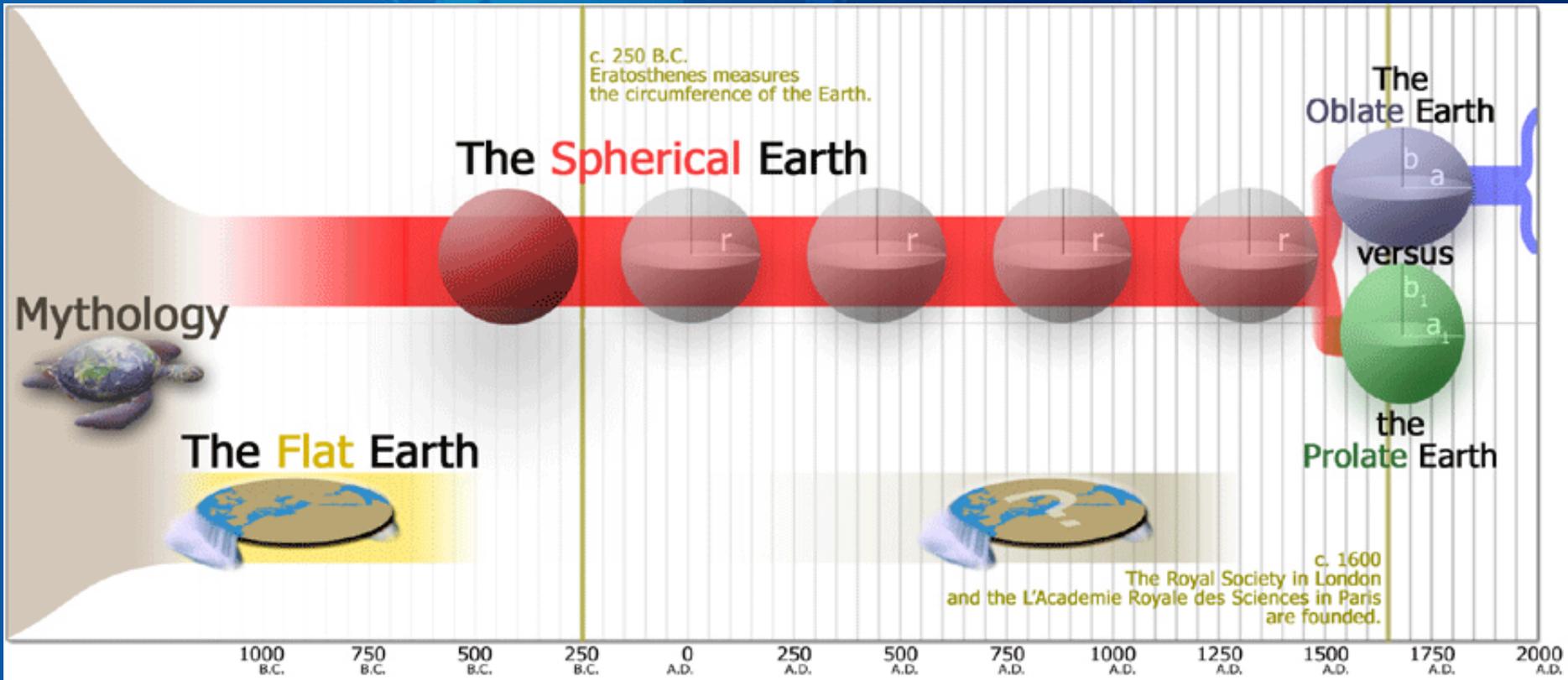
Geodesia

- Se define como la rama de la matemática aplicada que tiene que ver con el estudio de la forma y tamaño de la Tierra al igual que su campo gravitacional.
- Es una de las Geo-Ciencias o Ciencias Terrestres, junto con: Geografía, Geología, Geofísica y Geomorfología





Evolución de la forma de la Tierra





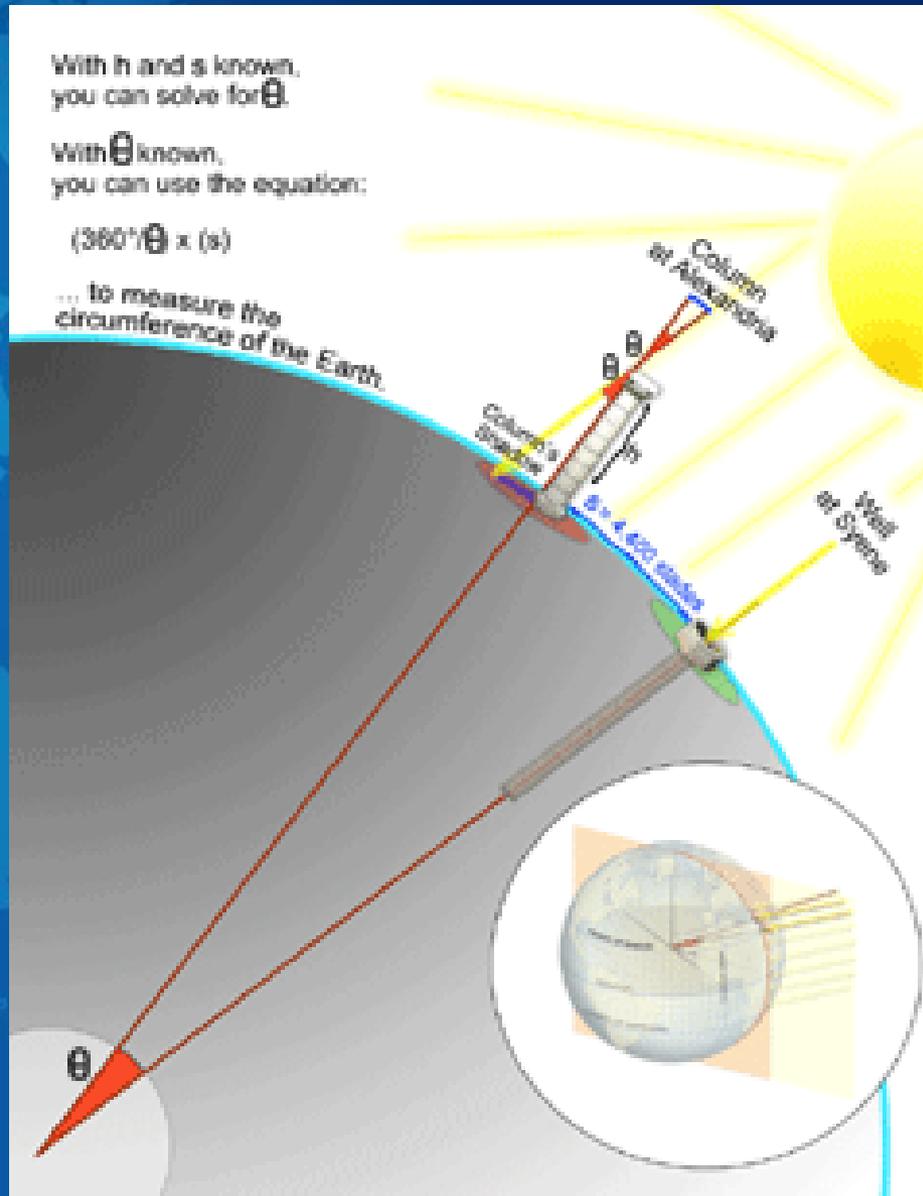
Eratosthenes: Padre de la Geodesia

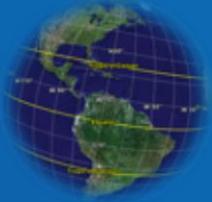
With h and s known,
you can solve for θ .

With θ known,
you can use the equation:

$$(360^\circ/\theta) \times (s)$$

... to measure the
circumference of the Earth.





DATUMS

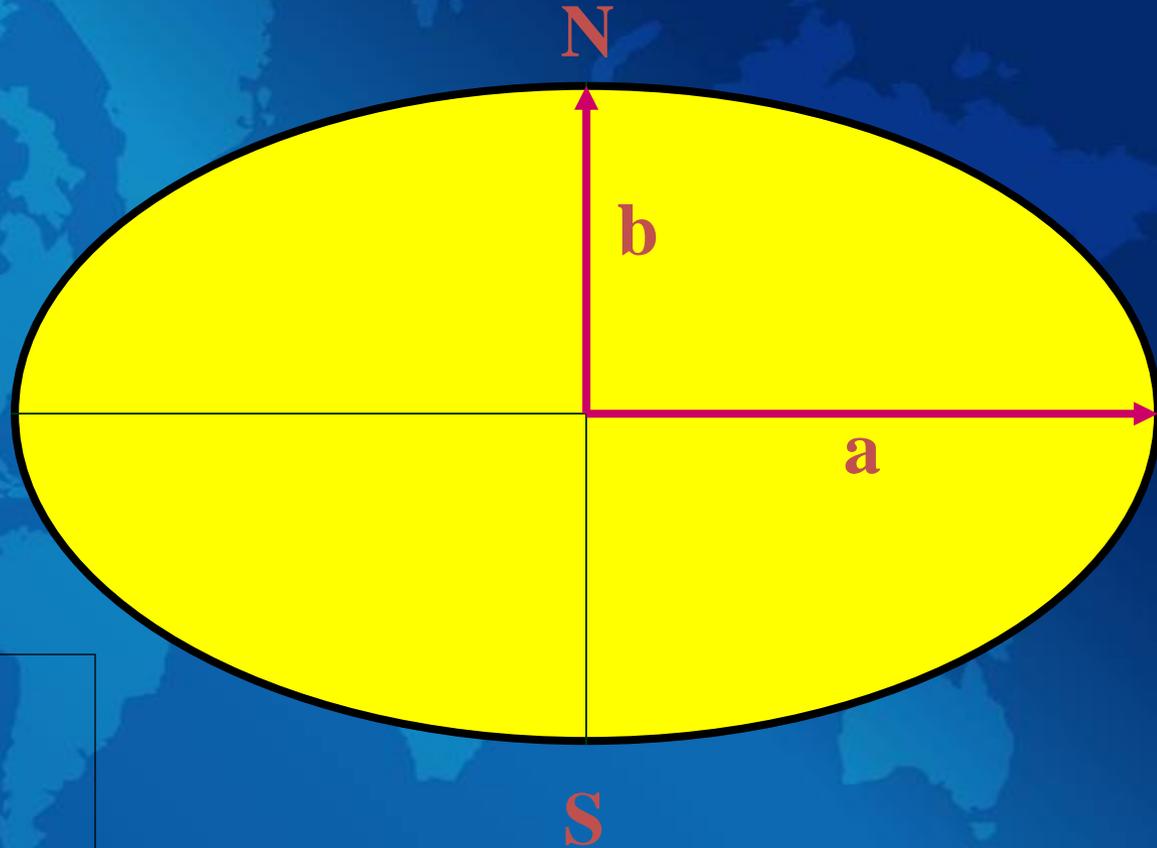
- Un DATUM es un conjunto de parámetros que definen un sistema de coordenadas y un conjunto de puntos de control cuya relación geométrica es conocida ya sea por medidas o cálculos
- Dewhurst, 1990.
- Todos los DATUMS se fundamentan en un elipsoide, el cual aproxima la forma de la Tierra.





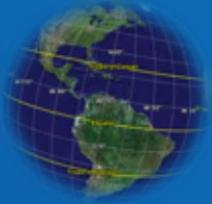
THE ELLIPSOID

A MATHEMATICAL MODEL OF THE EARTH



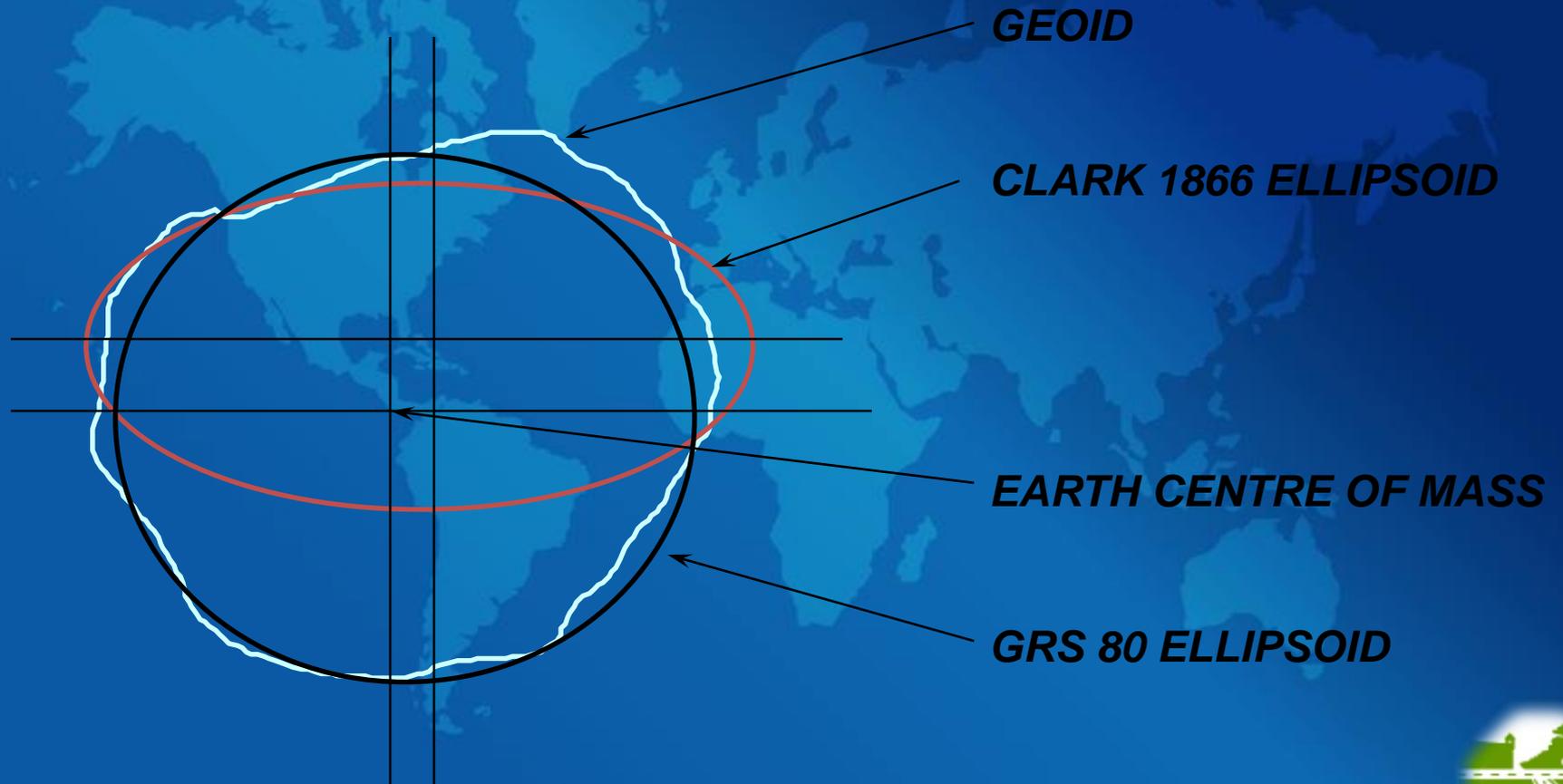
a = Semi major axis
 b = Semi minor axis
 $f = \frac{a-b}{a}$ = Flattening





NORTH AMERICAN DATUM

THE GEOID AND TWO ELLIPSOIDS

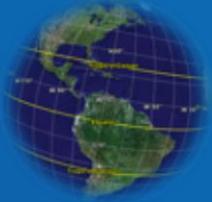




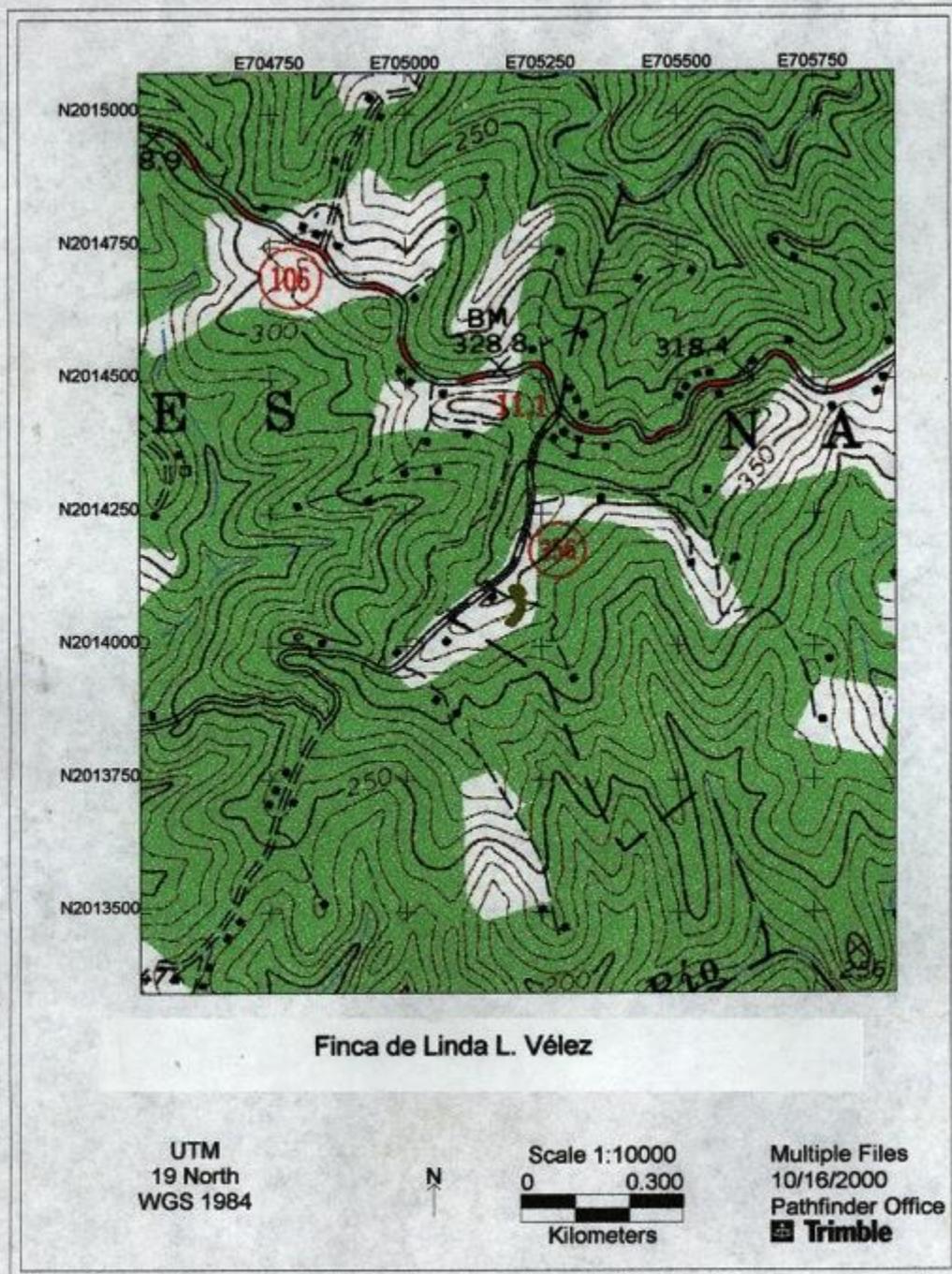
Datum Horizontales y sus Elipsoides

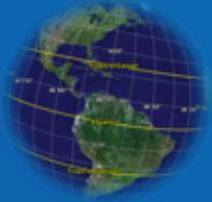
- PR Datum Clarke 1866
- NAD27 Clarke 1866
- NAD83 GRS80
- WGS84 WGS84





Mezcla de Datums: Mapa en PR Datum y Datos en WGS84

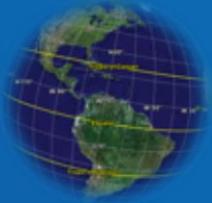




Geoide

- nosotros habitamos un planeta cuya forma es única y puede ser descrita por el término geoide. Esta palabra procede del griego “geoeides” que quiere decir “perteneciente a la tierra” (GE de tierra y EIDOS de forma).
- El geoide es la forma que tiene la superficie de la tierra allí donde el nivel del mar es uniforme y siempre es perpendicular a la dirección de la gravedad.





EL GEOIDE

¿QUE ES ?

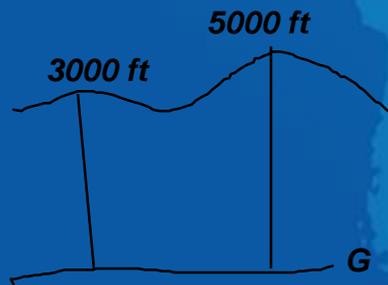
TEORICAMENTE:



UNA SUPERFICIE A NIVEL EN ESPECIFICO DEL CAMPO GRAVITACIONAL

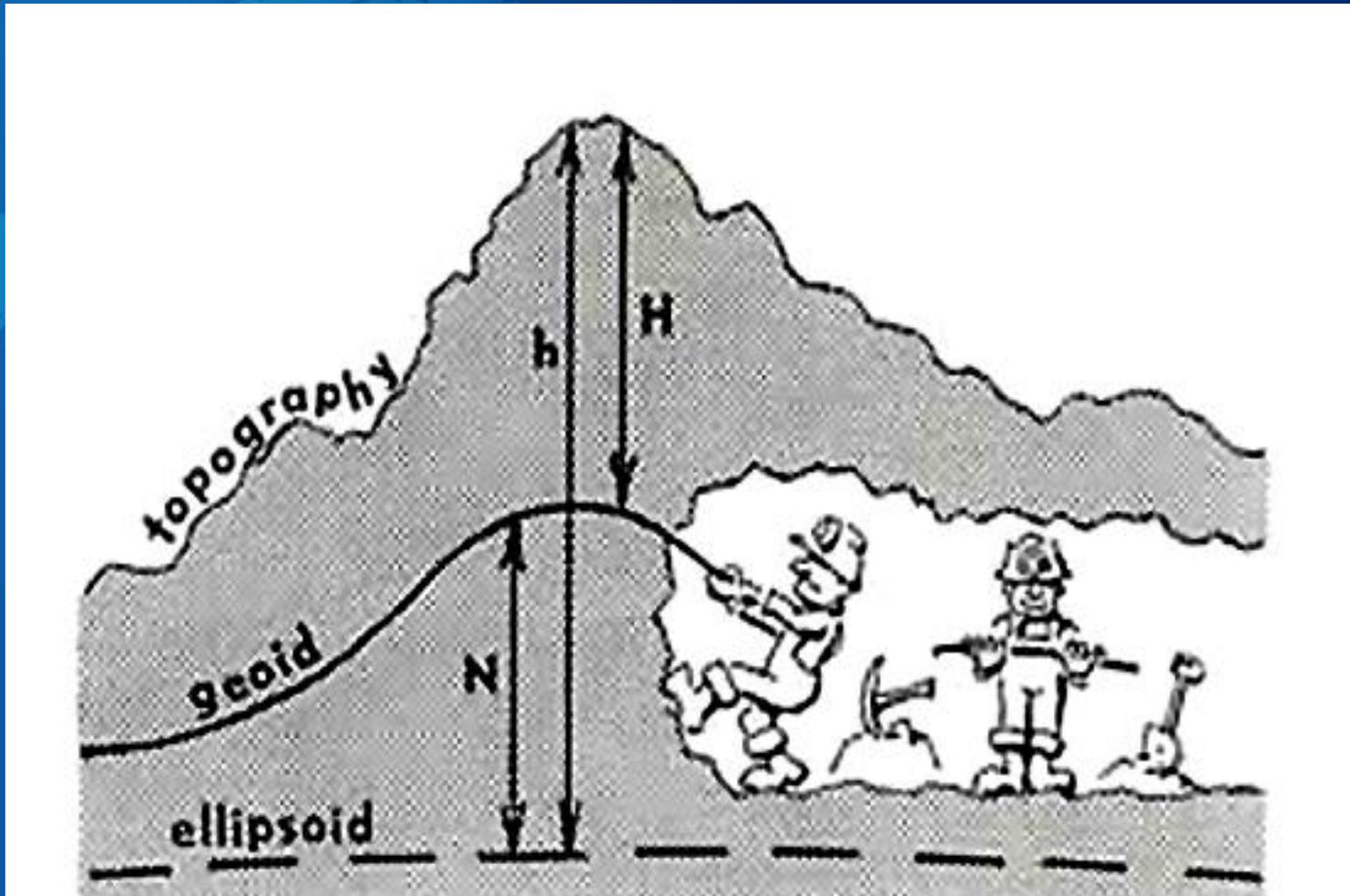
EN LA PRACTICA:

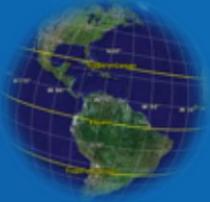
- **REFERENCIA CERO PARA ELEVACIONES Y PROFUNDIDAD**
- **“MEAN SEA LEVEL” CONTINUO EN LOS CONTINENTES**
- **LA SURPERFICIE PERPENDICULAR A LA DIRECCION DE LA GRAVEDAD**



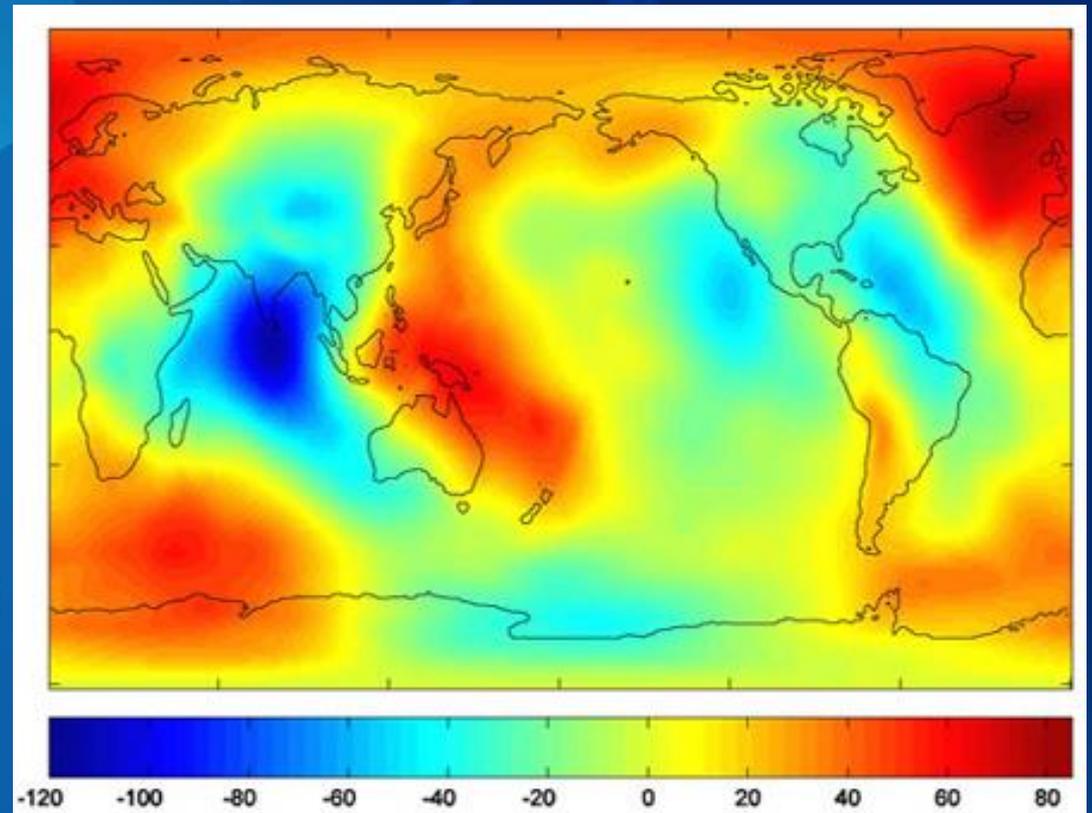
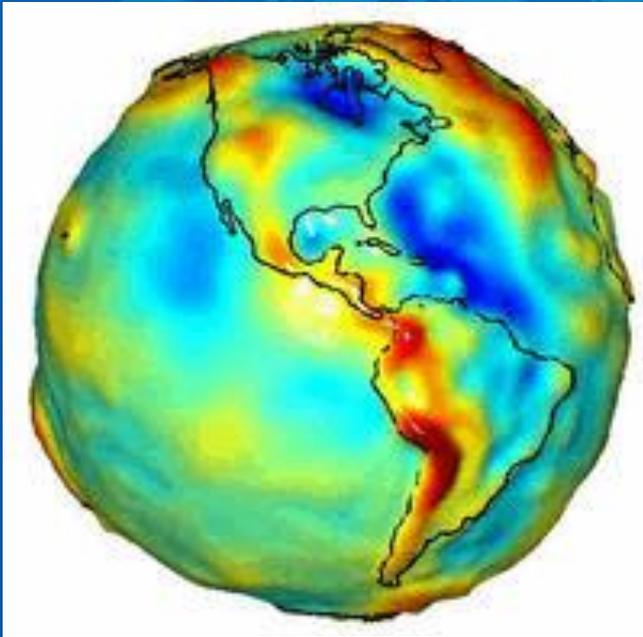


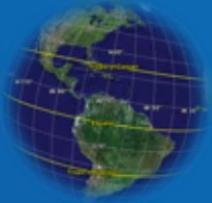
En busca del Geoide...





Gravity Recovery And Climate Experiment (GRACE)





DATUM

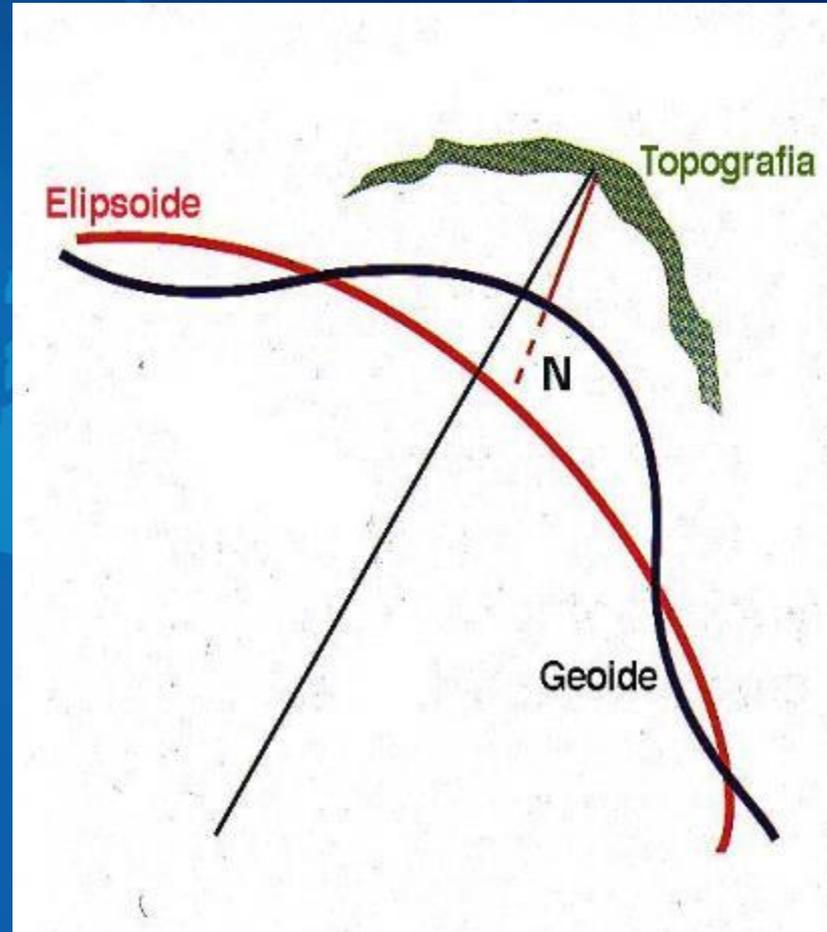
- “North American Datum del 1983”
 - se uso el elipsoide denominado “Geodetic Reference System del 1980” (conocido por sus siglas GRS80)
 - origen del “North American Datum del 1983” (conocido por sus siglas de NAD83) es el centro de masa de la tierra
 - Se esperaba concluir en 1983 por eso se llamo NAD83
 - Luego de publicarse se le han hecho varias revisiones, las cuales se indican en parentesis, ejemplo NAD83(2007)
 - La revision a realizacion mas reciente es NAD83(2011)Epoch 2010.00

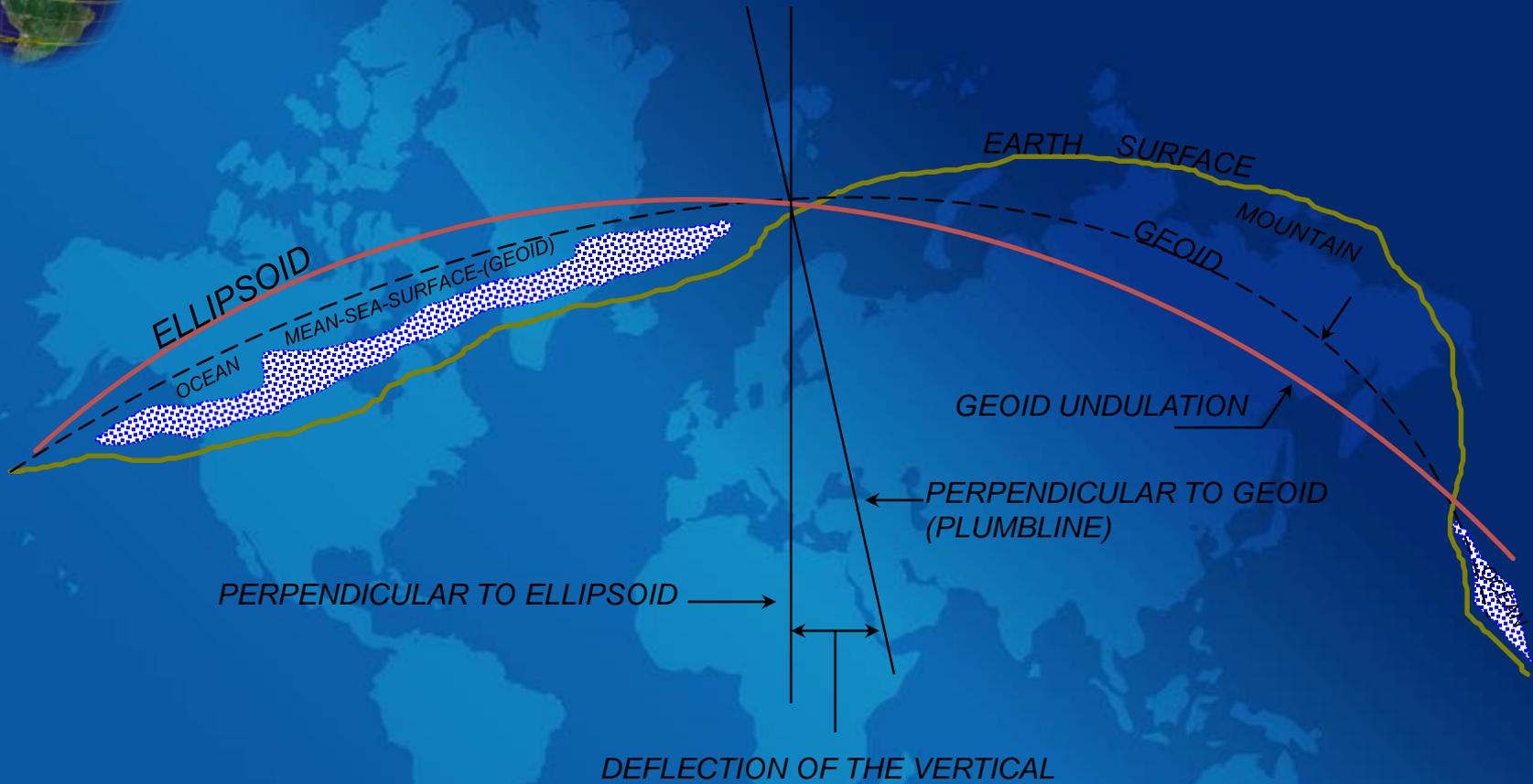
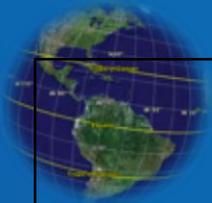




Tres Superficies Una Realidad

- **Topografía** - superficie de nuestro planeta donde nosotros hacemos las observaciones
- **Elipsoide** - superficie matemática que usamos para describir la tierra
- **Geoide**- superficie física que denota el potencial de gravedad de nuestro planeta



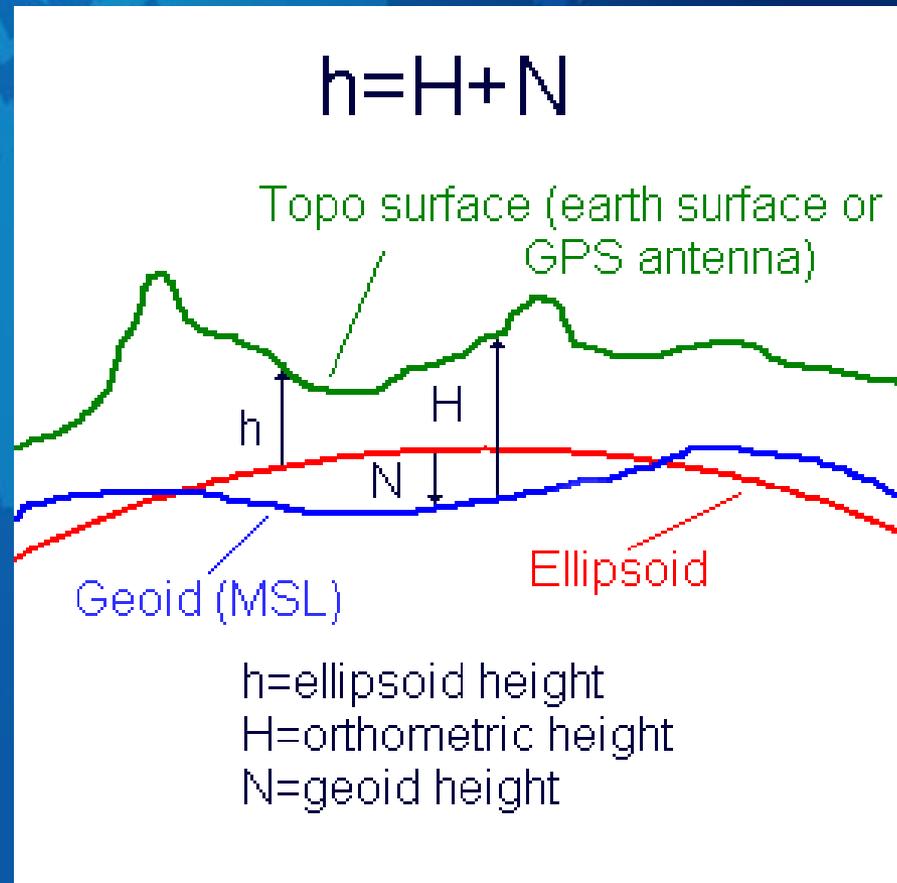


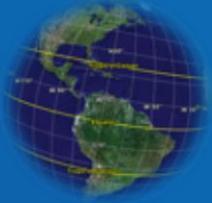
GEOID - ELLIPSOID RELATIONSHIP



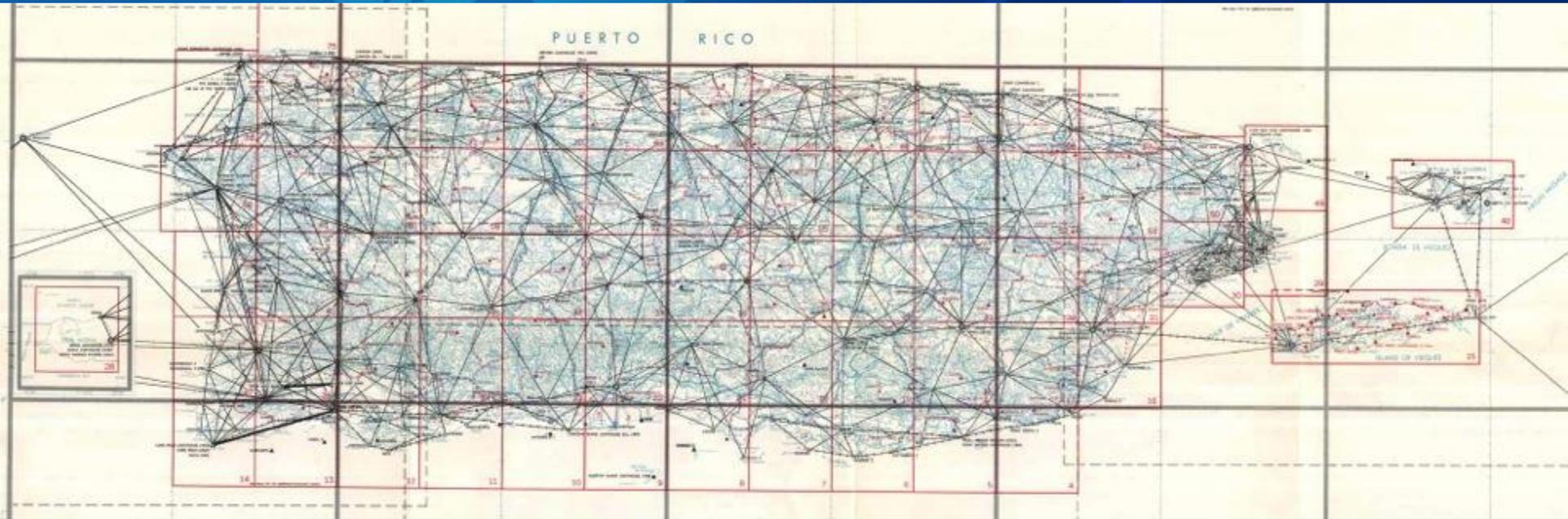


Relación de elevaciones y las Tres superficies



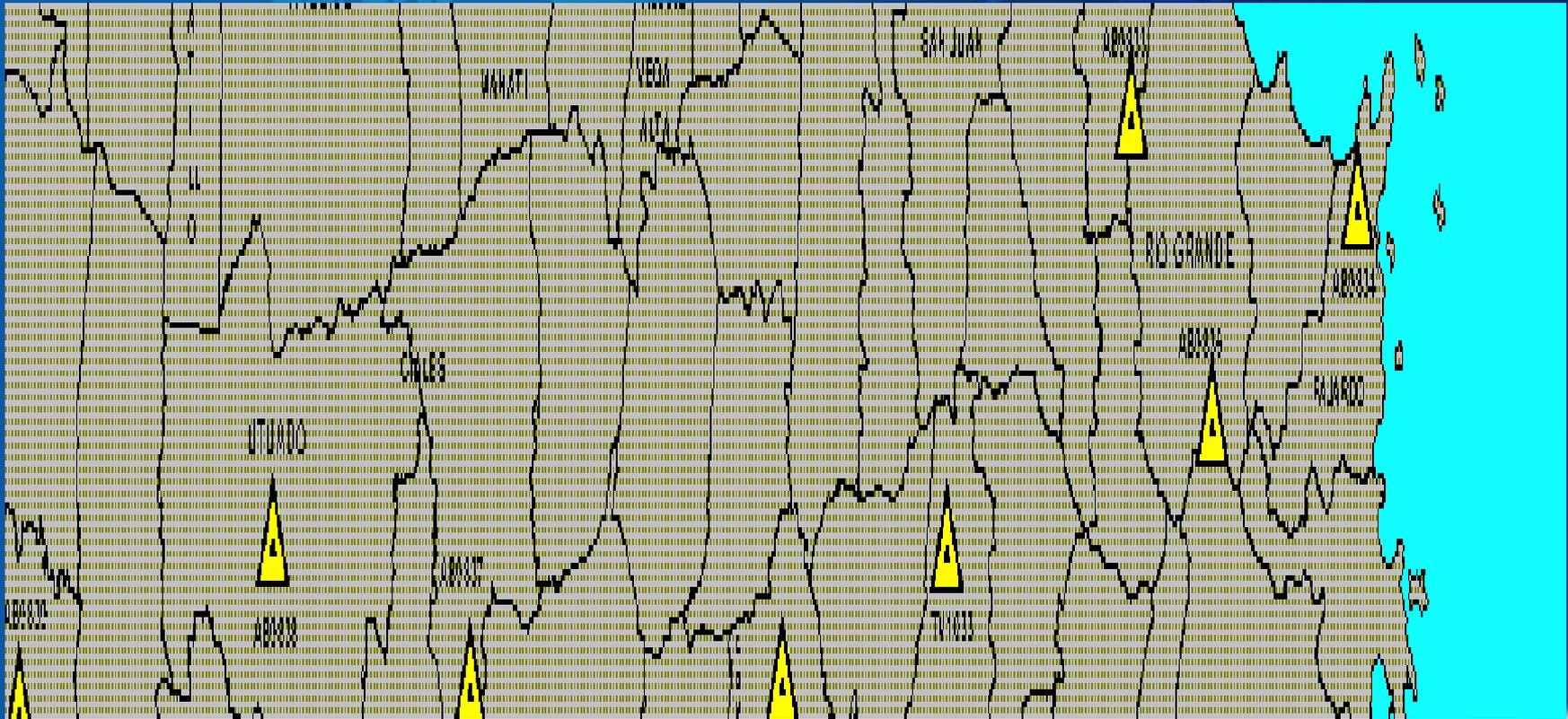


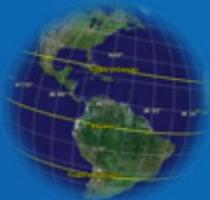
Red de Triangulación



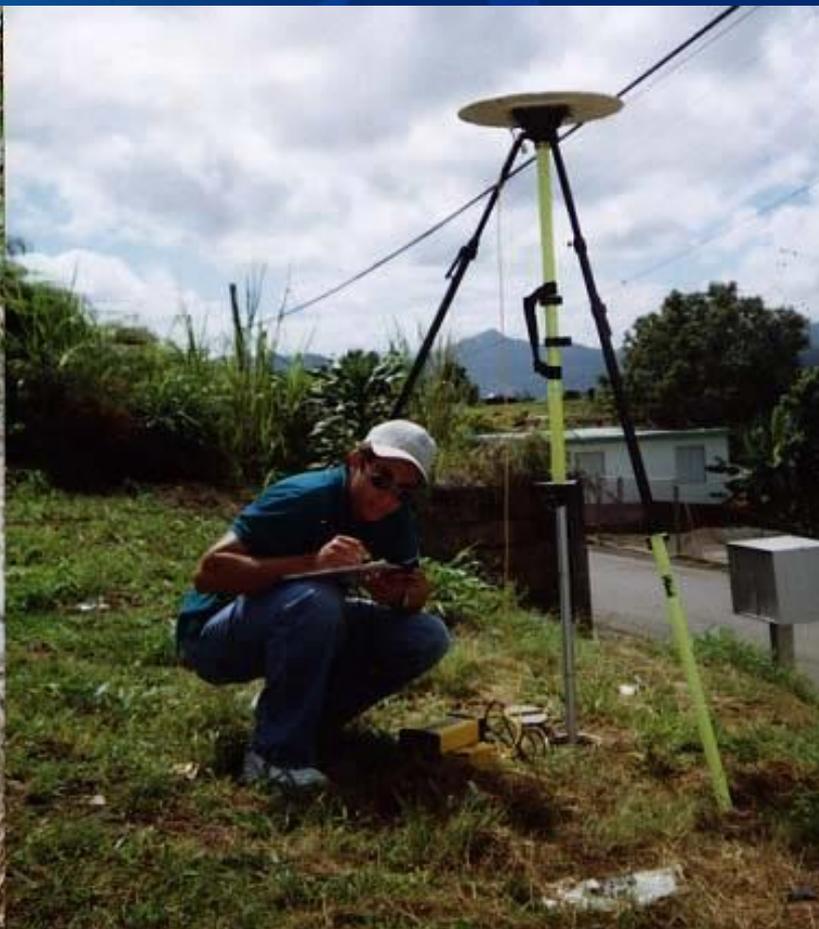


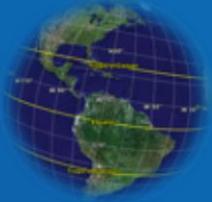
Red de Control establecida en 1995 por el CRIM





Las Marias 2 – Control Geodésico establecido en 1995

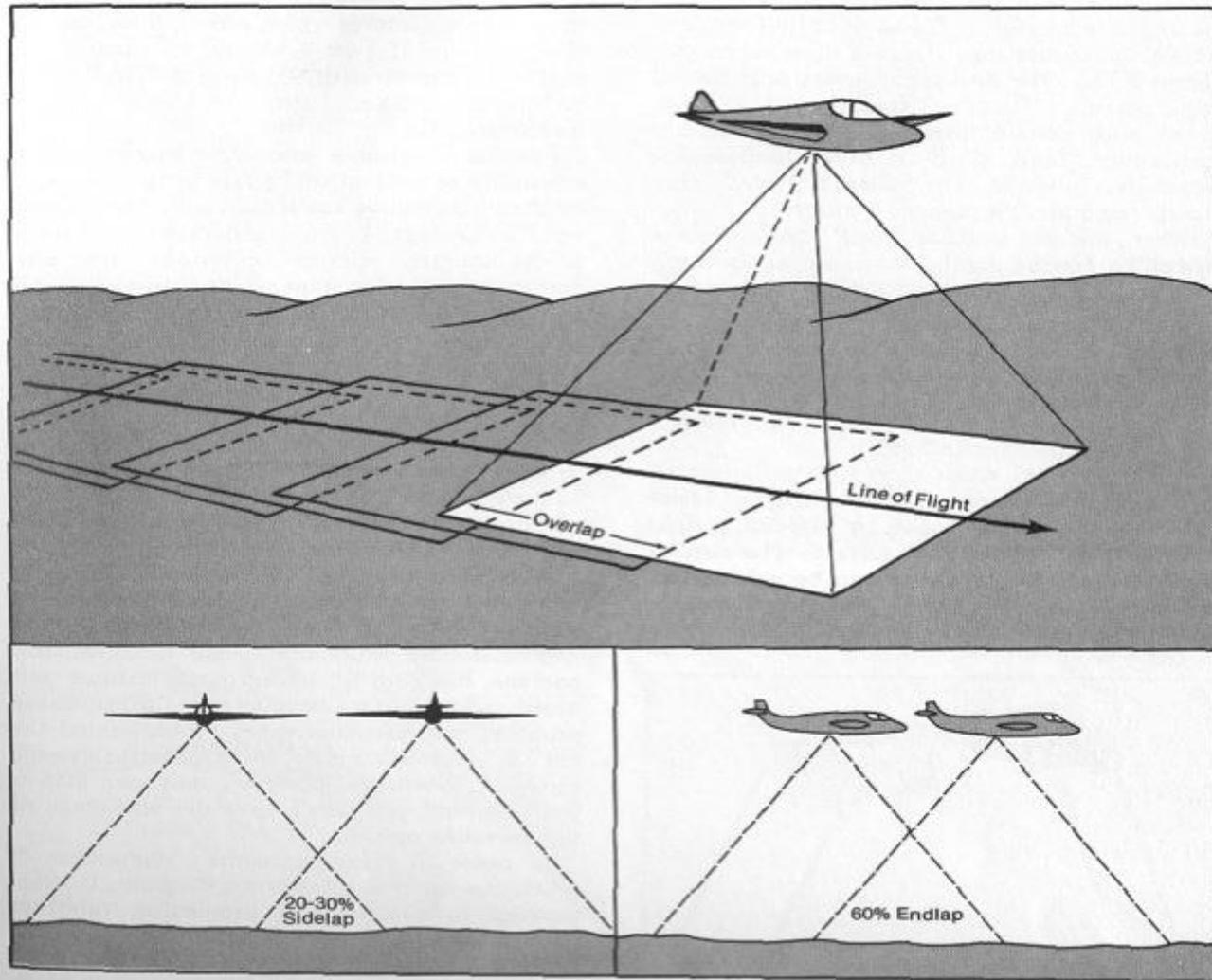
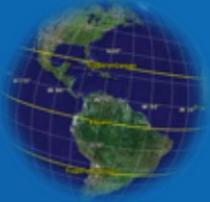


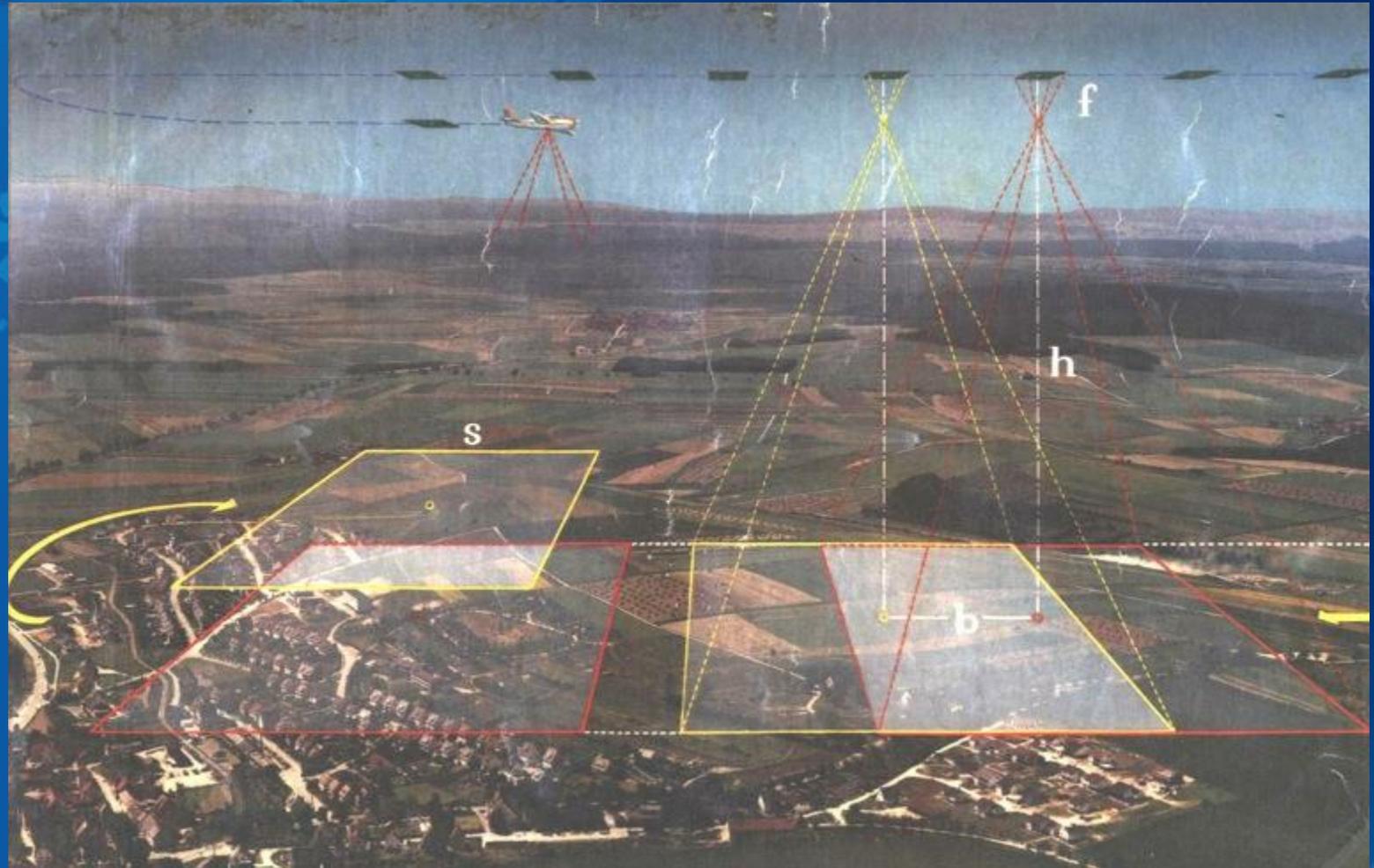


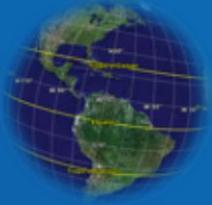
Fotogrametría

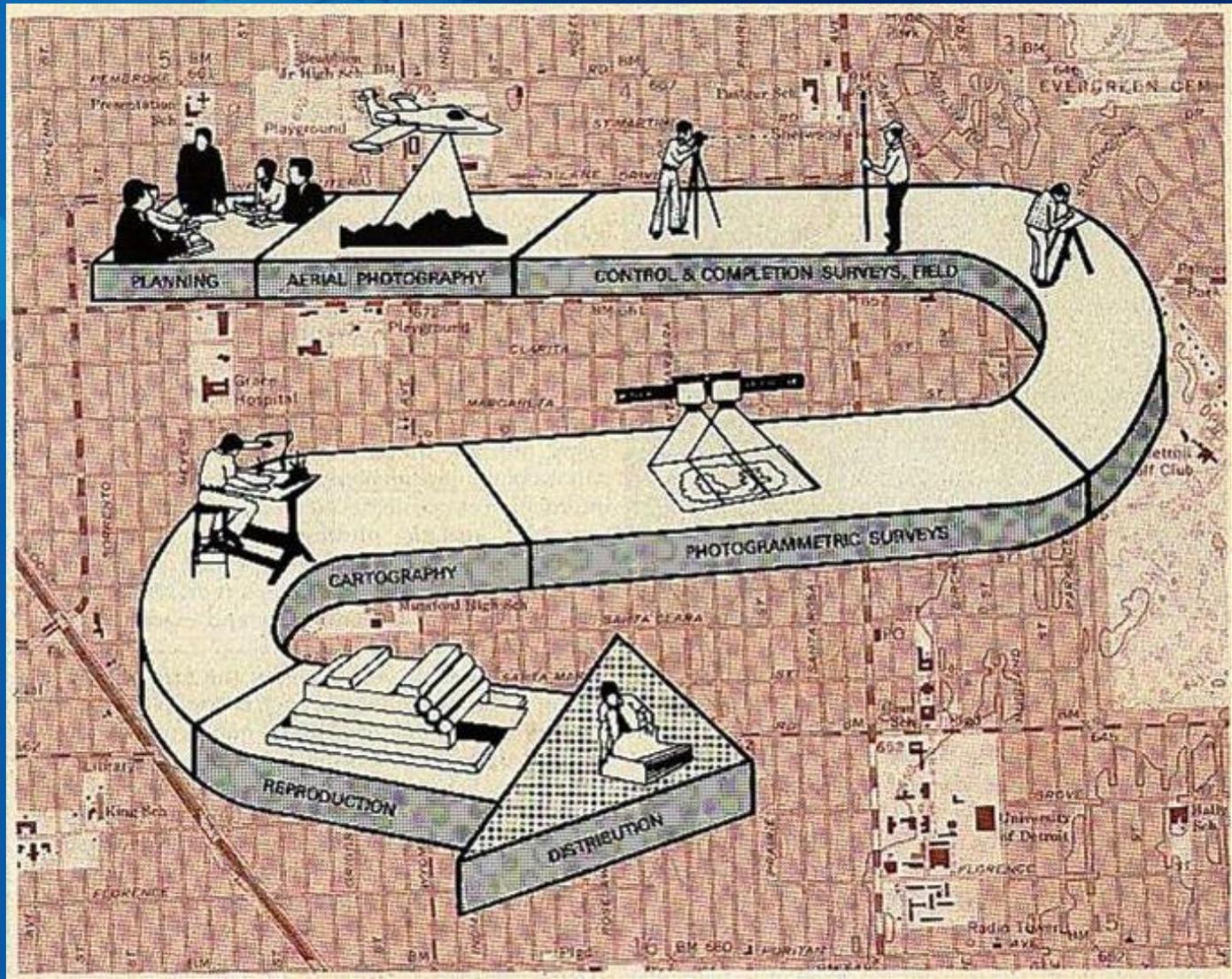
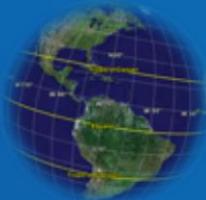
- Definición:
 - Ciencia, Arte y Tecnología de obtener información cuantitativa de un lugar usando fotografías aéreas.
 - Su aplicación más común en la obtención de datos para hacer mapas topográficos
 - Se usan cámaras especiales y los vuelos se planifican para obtener las fotografías a una escala en particular.

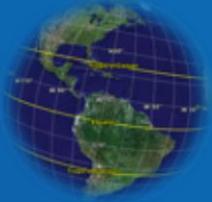








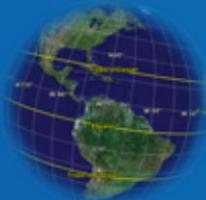


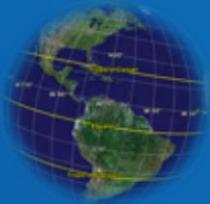


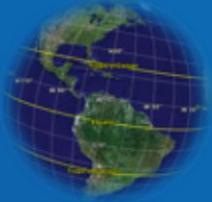
Percepción Remota

- Definición:
 - Ciencia, Arte y Tecnología de obtener información cuantitativa y cualitativa de un objeto bajo estudio sin estar en contacto físico con el mismo.
- Cuando se usan fotografías se denomina como Fotointerpretación, siendo esto la forma clásica de la Percepción Remota.





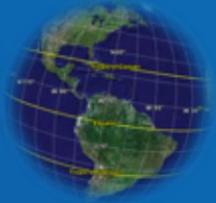




Cartografía

- Definición:
 - Ciencia, Arte y Tecnología de hacer mapas junto con su estudio como documento científico y trabajo de arte. Los mapas son una representación de la tierra o parte de ella a **escala**.
 - La escala es la relación entre el tamaño real del área y la porción reducida que aparece en el mapa. Son productos cartográficos, los planos, secciones transversales, modelos en tercera dimensión, entre otros.





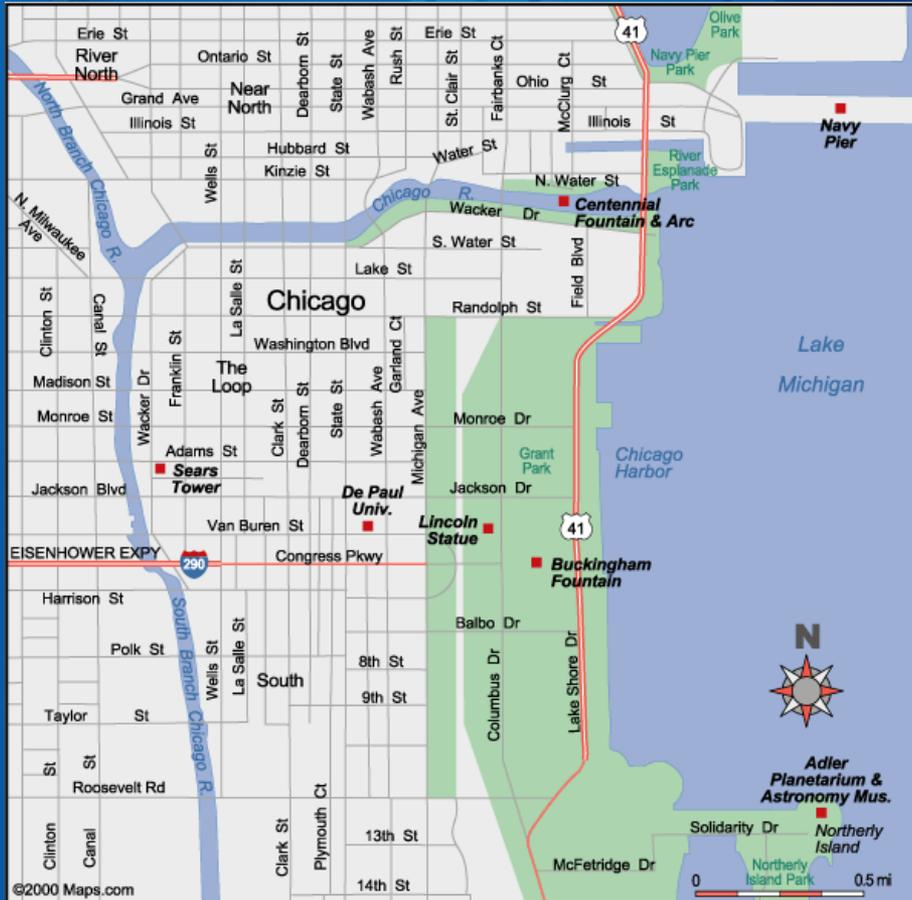
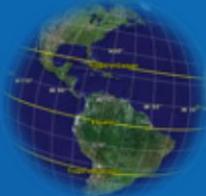
Escala

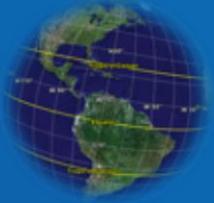
Escala como fracción representativa:

Una razón, tal como 1:1,000,000. Si se asume que el mapa está en centímetros, significa que un centímetro en el mapa es igual a un millón de centímetros en la Tierra.

Esta escala se podría también escribir como fracción proporcional ($1/1,000,000$).



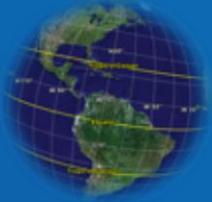




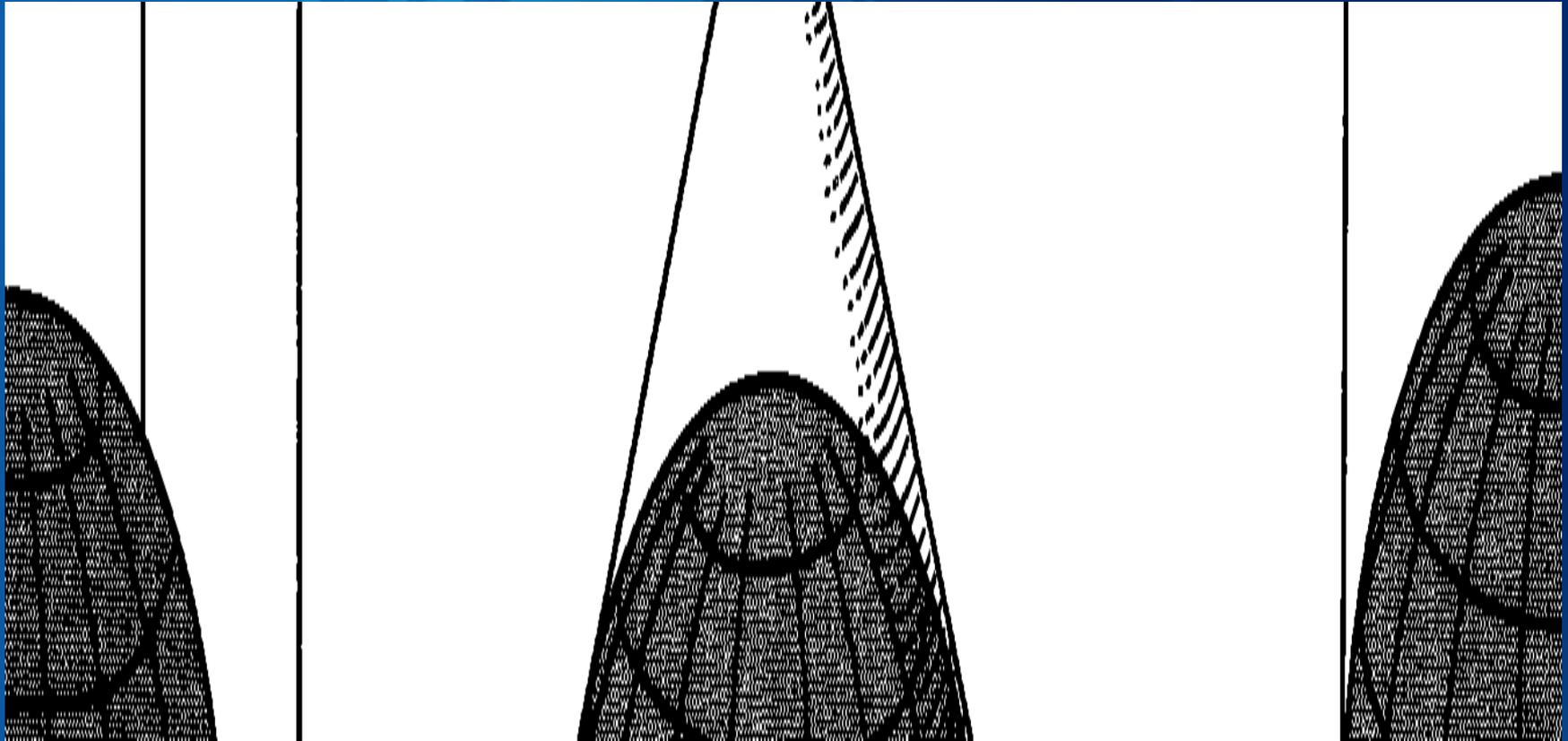
Superficies Desarrollables

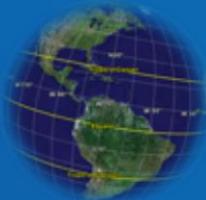
- son superficies que se desarrollan en un plano, fundamentales para las Proyecciones Cartograficas. Ellas son:
 - el cono
 - el cilindro y
 - por supuesto el plano





Proyecciones cartográficas





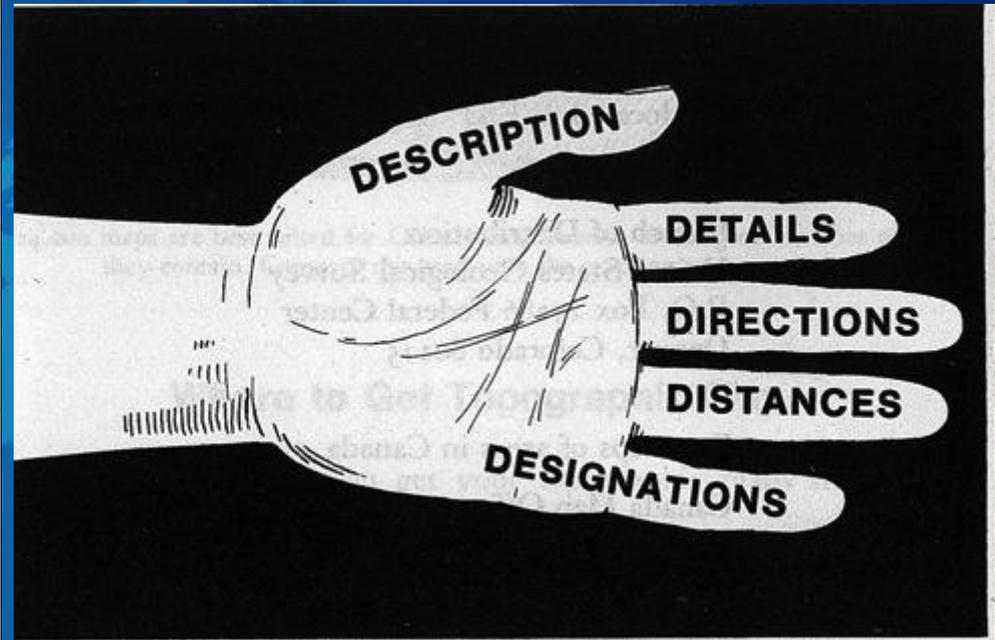
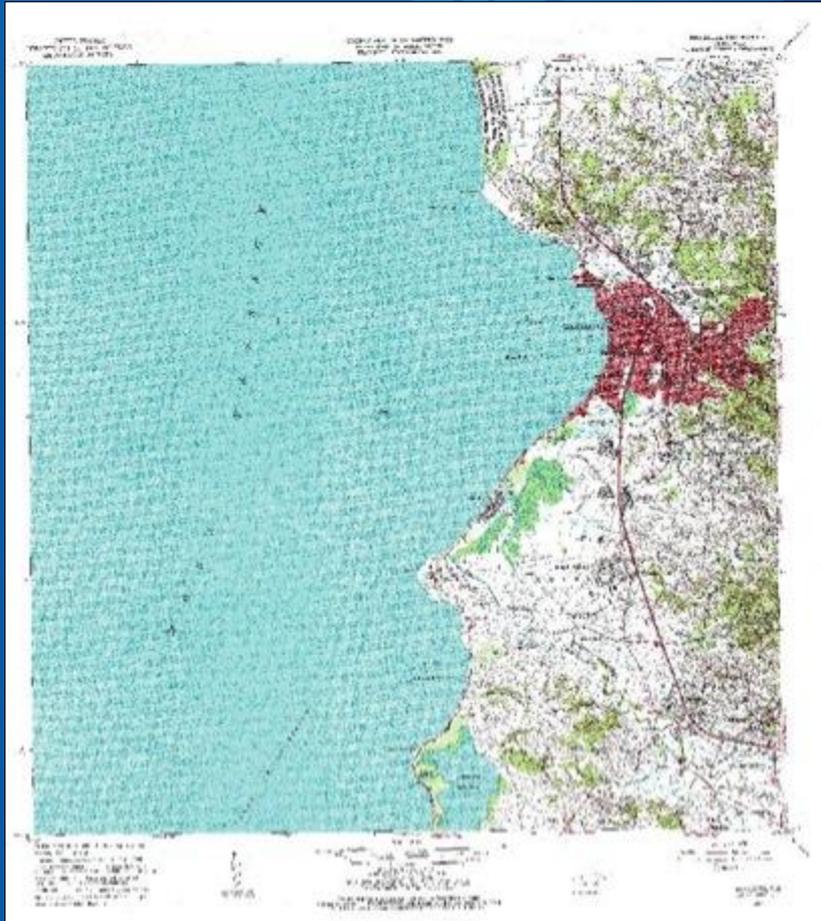
Clasificación de Proyecciones Cartográficas

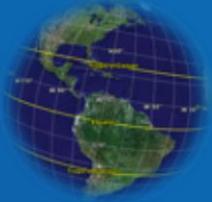
CLASES	V A R I E D A D E S		
	<i>CONSIDERACIONES EXTRINSECAS</i>		
NATURALEZA	PLANA / AZIMUTAL	CONICA	CILINDRICA
COINCIDENCIA	TANGENTE	SECANTE	POLISUPERFICIAL
POSICION	NORMAL	TRANSVERSAL	OBLICUA
	<i>CONSIDERACIONES INTRINSECAS</i>		
PROPIEDAD	EQUIDISTANTE	EQUIVALENTE	CONFORME
GENERACION	GEOMETRICA	SEMI-GEOMETRICA	MATEMATICA





Mapas Topográficos del USGS

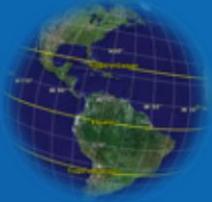




Mapas Topográficos del USGS

- Mejor conocidos como los cuadrángulos del USGS, cubren 7.5 minutos de latitud por 7.5 minutos de longitud, así que son de la serie de 7.5 minutos
- Escala 1:20,000
- 67 cuadrángulos cubren toda la **Isla**
- Muestran todos dos sistemas de coordenadas y los foto revisados muestra otro más.

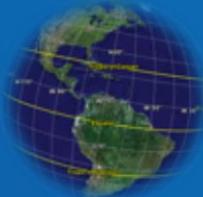




Mapas Topográficos del USGS

- Sistemas de Coordenadas en los Cuadrángulos
 - Sistema de Coordenadas Geográficas o Geodésicas, Latitud y Longitud
 - Sistema de Coordenadas Planas Estatales para Puerto Rico se uso la Proyección Cartográfica Conforme Cónica con Dos Paralelos "Standard" Lambert referida a el Puerto Rico Datum
 - Sistema Universal Transverso Mercator conocido por sus siglas UTM





Esquina Inferior Izquierda Cuadrangulo de Adjuntas

Distinga los dos sistemas de coordenadas en el Puerto Rico Datum:

(1) Latitud (ϕ) y Longitud (λ)

(2) X,Y del Sistema de Coordenadas Planas para Puerto Rico – Sistema Lambert

18°07'30"

66°45'

120 000 METERS

(YAUACO)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

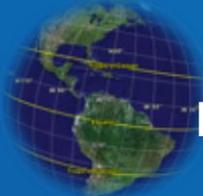
Topography by photogrammetric methods from aerial photographs taken 1941. Field checked 1943. Revised 1960

Polyconic projection. Puerto Rican datum, 1940 adjustment
2000-meter grid based on Puerto Rico coordinate system

Barrio and municipality boundaries by the Puerto Rican
Planning Board

Kilometric reference distances are shown in red



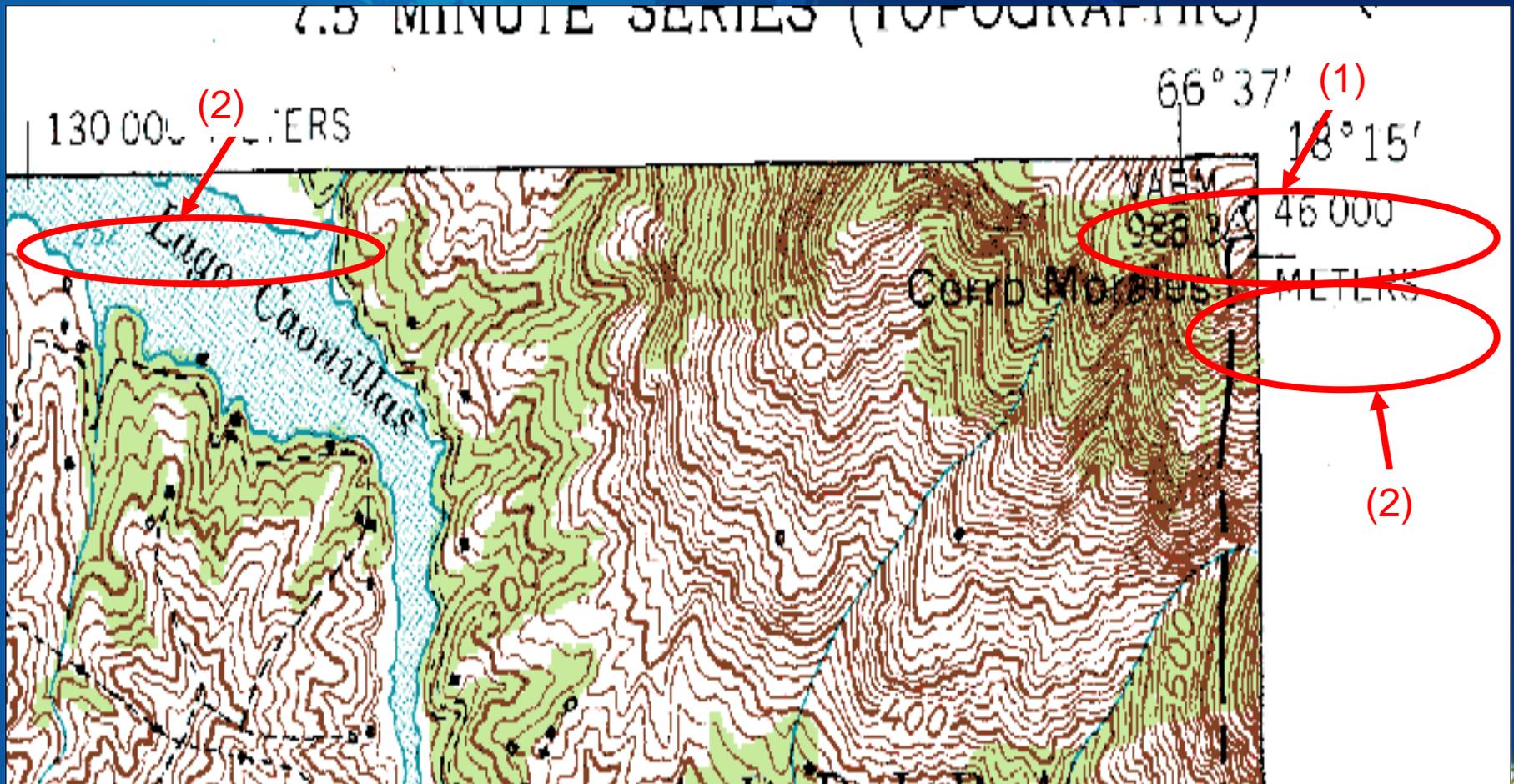


Esquina Superior Derecha Cuadrangulo de Adjuntas

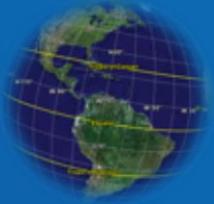
Distinga los dos sistemas de coordenadas en el Puerto Rico Datum:

(1) Latitud (ϕ) y Longitud (λ)

(2) X,Y del Sistema de Coordenadas Planas para Puerto Rico – Sistema Lambert



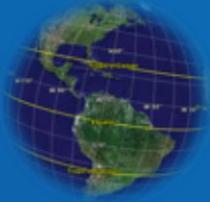




Posiciones

- Horizontal φ, λ o X, Y
- Vertical $\varphi, \lambda, \underline{h}$ o X, Y, \underline{Z}
- Temporal Δt





Sistema de Coordenadas

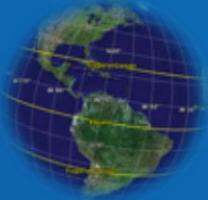
Planas Estatales (SPCS por sus siglas en ingles)

- El gobierno federal desarrollo el sistema de coordenadas planas estatales para cada estado y sus territorios.
- En el caso en particular de Puerto Rico e Islas Virgenes se usa la proyección conforme cónica Lambert con dos paralelos standard, teniendo los siguientes parametros para el NAD 83:

$$\phi_N = 18^\circ - 26' \text{ N}; \phi_S = 18^\circ - 02' \text{ N}; \phi_0 = 17^\circ - 50' \text{ N};$$

$$\lambda_0 = 66^\circ - 26' \text{ W}; N_b = 200,000.0\text{m}; E_0 = 200,000.0 \text{ m}$$





Sistema de Coordenadas Planas Estatales

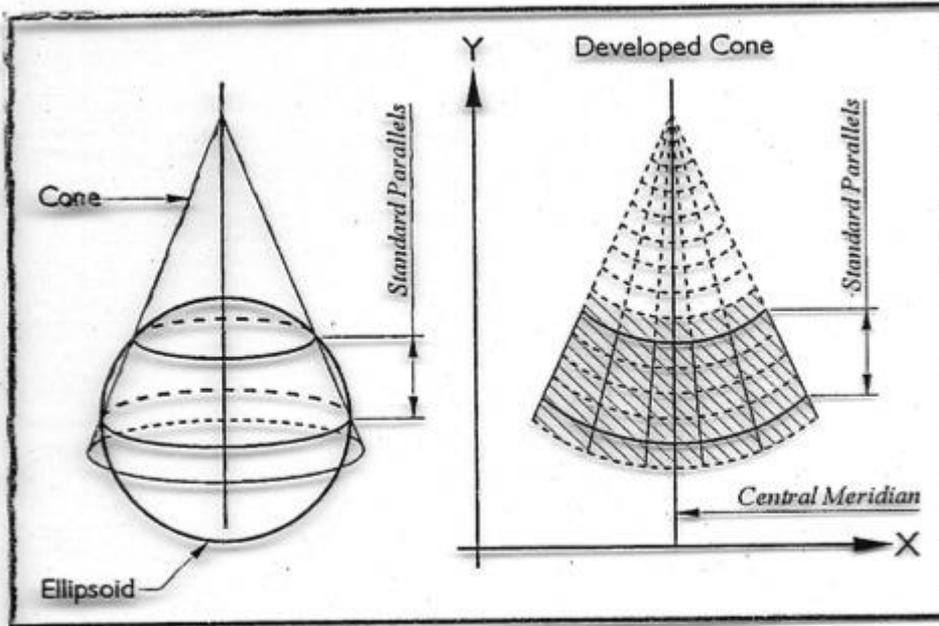


Figure 5.7. Lambert Conic Projection.

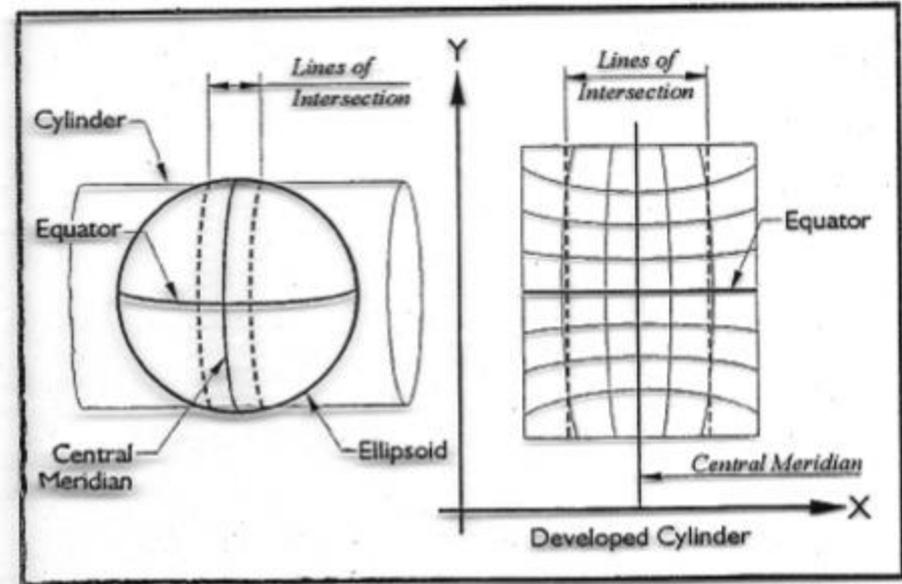
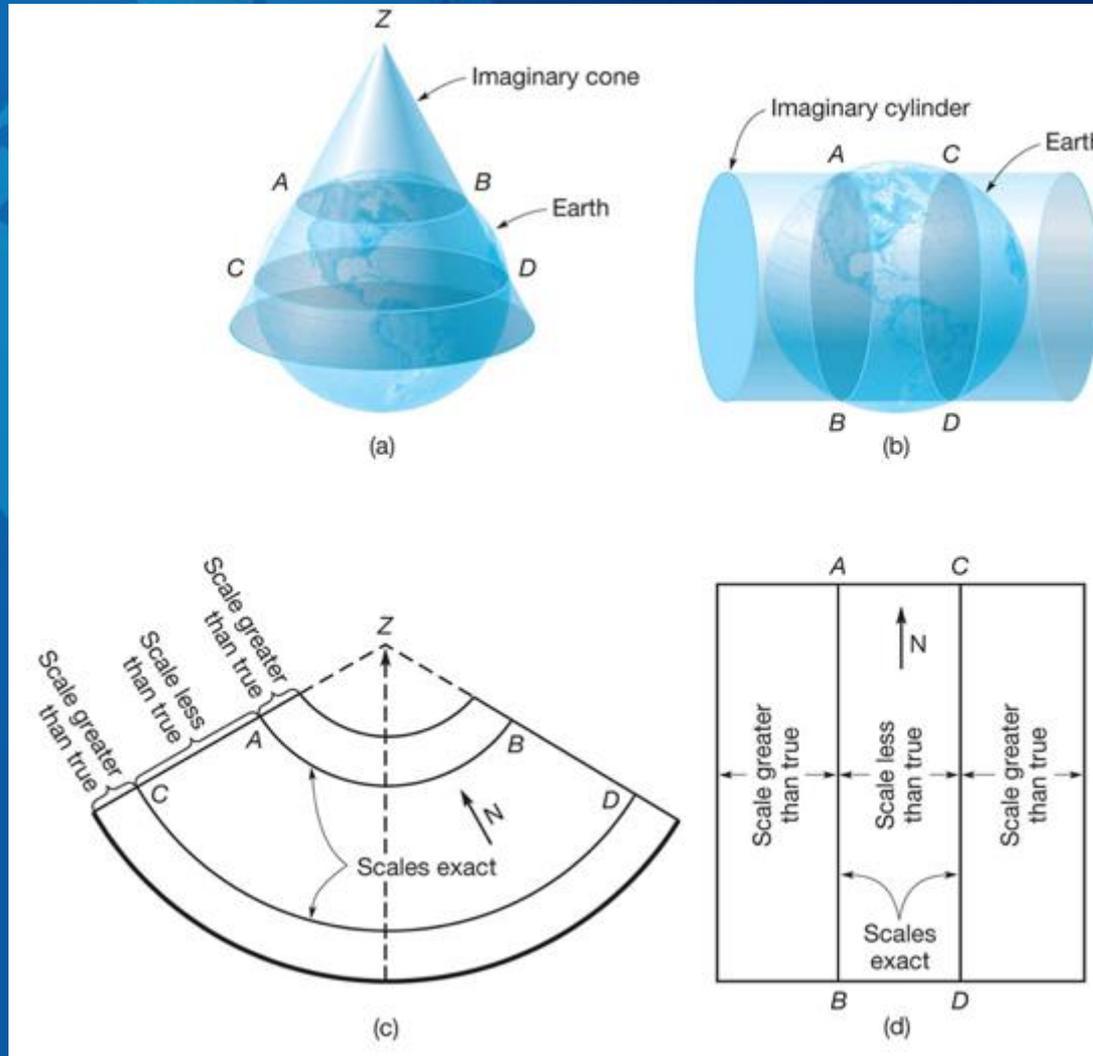


Figure 5.8. Transverse Mercator Projection.

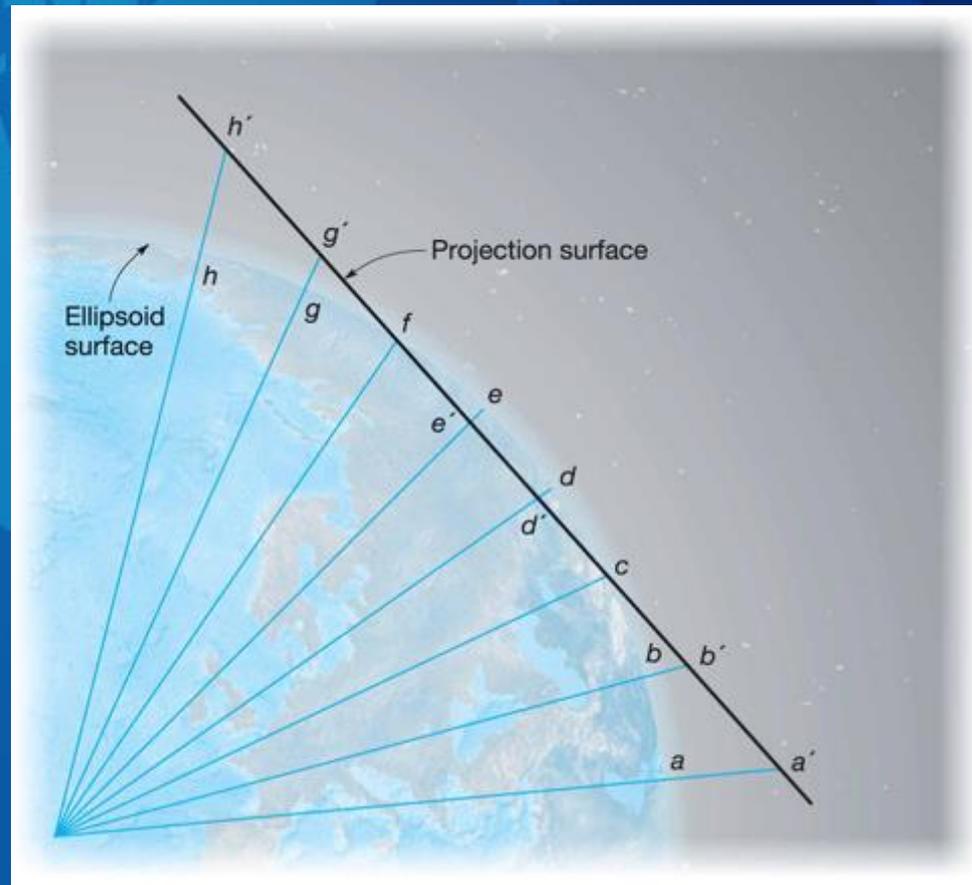


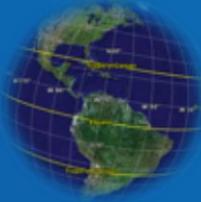


Cono y Cilindro en SPCS con zonas de 158 millas

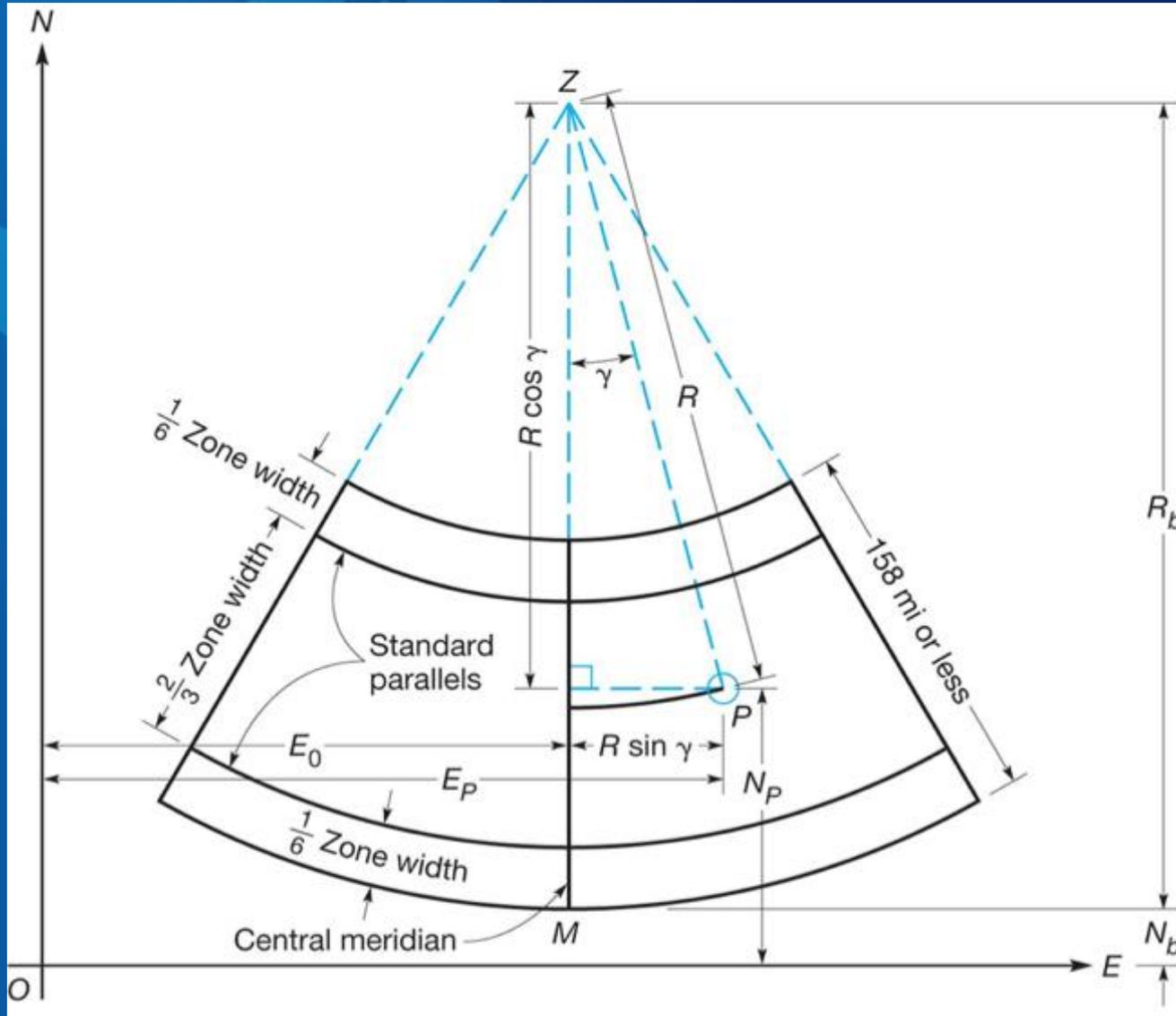


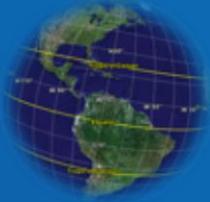
Conforme Conica Lambert con Dos Paralelos Standard



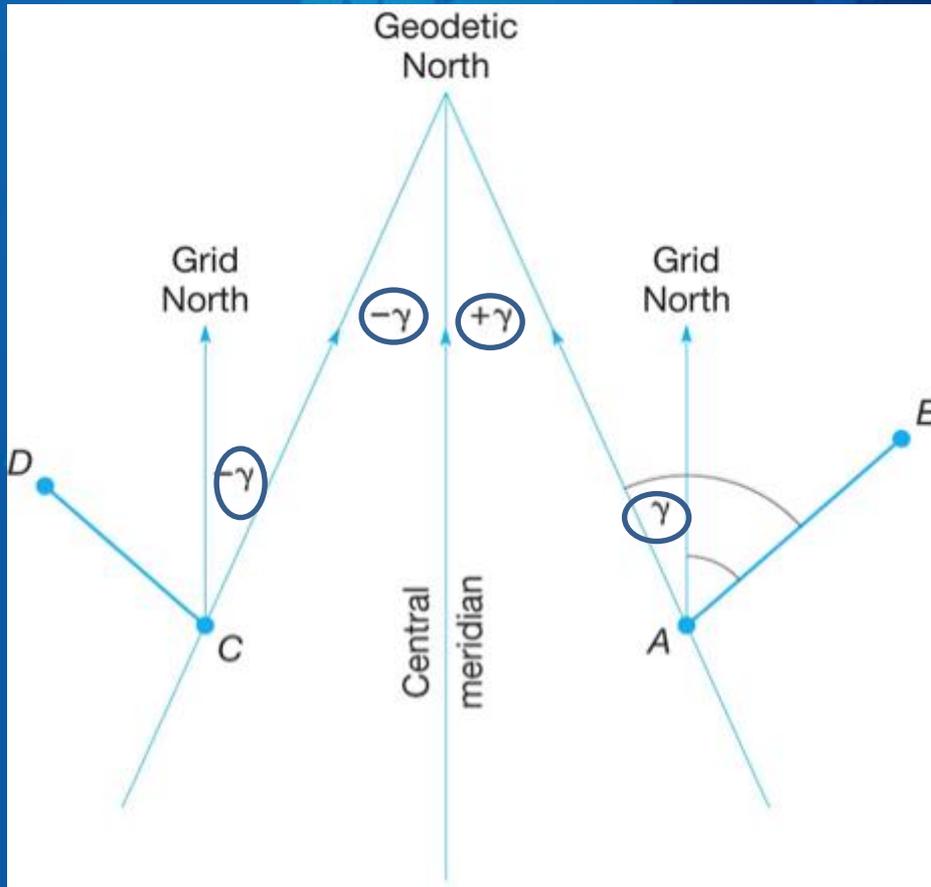


Conica Lambert



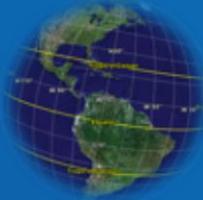


Nortes – Geodesico;Cuadricula



Angulo de convergencia de los meridianos γ

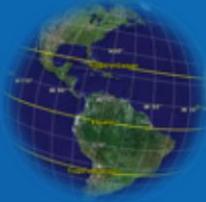




Sistema de Coordenadas Planas Estatales

Lambert system		Transverse mercator system		Both
Arkansas	North Dakota	Alabama	Mississippi	Alaska
California	Ohio	Arizona	Missouri	Florida
Colorado	Oklahoma	Delaware	Nevada	New York
Connecticut	Oregon	Georgia	New Hampshire	
Iowa	Pennsylvania	Hawaii	New Jersey	
Kansas	South Carolina	Idaho	New Mexico	
Kentucky	South Dakota	Illinois	Rhode Island	
Louisiana	Tennessee	Indiana	Vermont	
Maryland	Texas	Maine	Wyoming	
Massachusetts	Utah			
Michigan	Virginia			
Minnesota	Washington			
Montana	West Virginia			
Nebraska	Wisconsin			
North Carolina				





Sistema de Coordenadas Planas Estatales

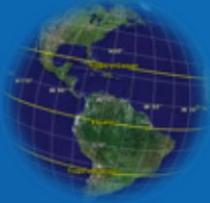
$$X = f(\varphi, \lambda) \quad Y = f(\varphi, \lambda)$$

DESIGNATION - VÉLEZ
PID - DE5545
COUNTRY - PUERTO RICO

NAD 83(2002)- 18 26 41.28060(N) 067 08 48.93357(W) ADJUSTED

	North	East	Units	Scale	Converg.
SPC PRVI -	267,825.241	124,618.857	MT	1.00000071	-0 13 23.8
UTM 19 -	2,040,399.173	695,701.034	MT	1.00007349	+0 35 11.3





Lambert Conforme Conica

Ecuaciones:

$$W(\varphi) = (1 - e^2 \sin^2 \varphi)^{1/2}$$

$$M(\varphi) = (\cos \varphi) / W(\varphi)$$

$$T(\varphi) = [((1 - \sin \varphi) / (1 + \sin \varphi)) ((1 + e \sin \varphi) / (1 - e \sin \varphi)^e)]^{1/2}$$

$$w_1 = W(\varphi_s)$$

$$w_2 = W(\varphi_N)$$

$$m_1 = M(\varphi_s)$$

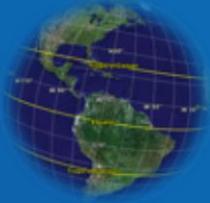
$$m_2 = M(\varphi_N)$$

$$t_0 = T(\varphi_0)$$

$$t_1 = T(\varphi_s)$$

$$t_2 = T(\varphi_N)$$





Lambert Conforme Conica

Continuacion de Ecuaciones:

$$n = \sin \varphi_0 = [(\ln(m_1) - \ln(m_2))/(\ln(t_1) - \ln(t_2))]$$

$$F = m_1/(n \cdot t_1^n)$$

$$R_b = aF t_2^n$$

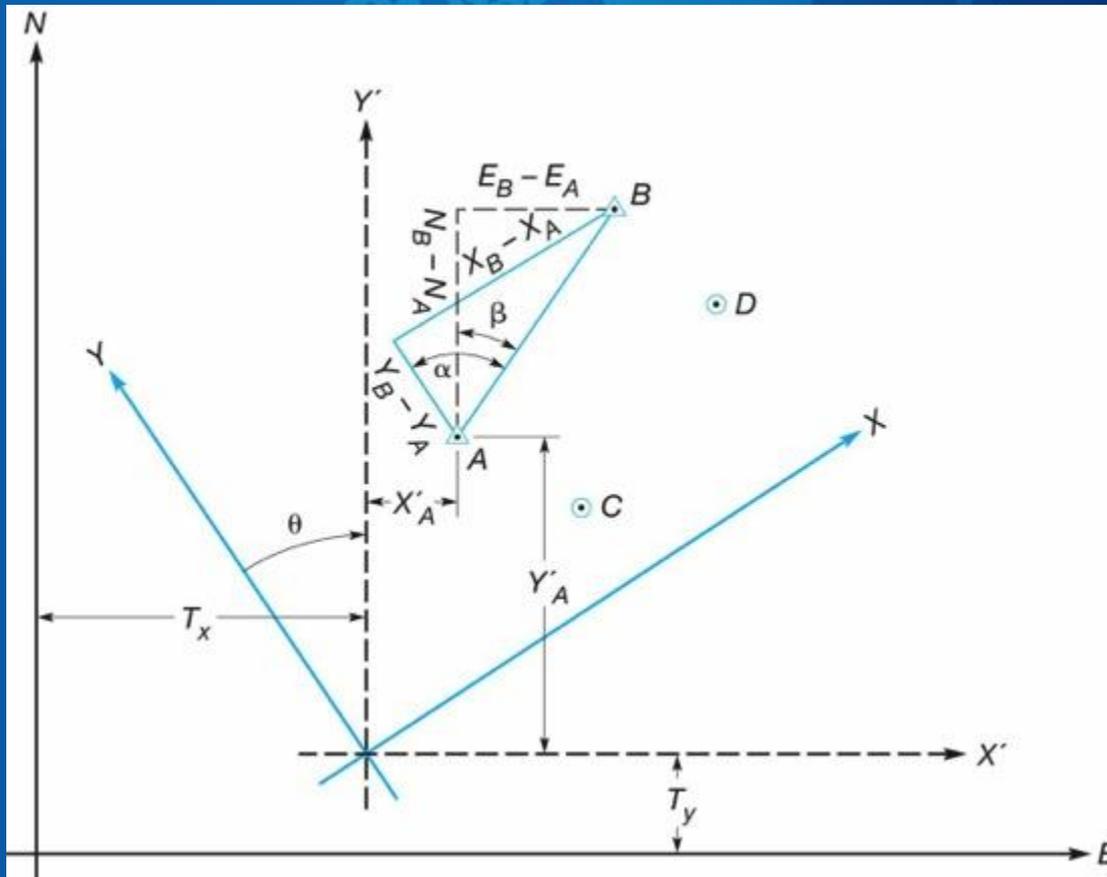
COORDENADAS DE UN PUNTO P

$$E_p = R \sin \gamma + E_0$$

$$N_p = R_b - R \cos \gamma + N_b$$



Transformacion de Coordenadas



TRASLACION
ROTACION
ESCALA

Transformación de Coordenadas

- El procedimiento para transformar unas coordenadas consiste de tres partes:
 - Escala
 - Rotación
 - Traslación
- Se tiene un listado de coordenadas planas y se conocen las coordenadas planas del sistema al que se transformará en dos o más puntos.

Transformación de Coordenadas

- Frecuentemente se transforman coordenadas de sistemas arbitrarios a sistemas estatales o globales, por lo general con la observación de GPS/RTK en dos de los controles (puntos).
- Al completar las observaciones de GPS/RTK se obtienen coordenadas del sistema plano o coordenadas geodésicas.
- De obtener coordenadas geodésicas existen utilidades del NGS para la transformación de estas a sistemas planas estatales.

Transformación de Coordenadas

- El procedimiento discutido a continuación considera que se conocen las coordenadas en dos de los controles (o puntos) en el sistema al que se transformará.
- De conocer las coordenadas en más de dos controles puedes completar el procedimiento con dos de los puntos y utilizar los demás para cotejar y comparar los resultados obtenidos de la transformación.

Transformación de Coordenadas

- De desear utilizar más de dos puntos para establecer la solución de la transformación, deberá completar un procedimiento de mínimos cuadrados.
- Esto pudiera ser recomendable en proyectos de grandes extensiones, donde el cambio en escala en distintas localizaciones del proyecto y los efectos de curvatura deben ser considerados.

Transformación de Coordenadas

- Procedimiento:

Para diferenciar ambos sistemas de coordenadas, se identificarán:

$\underline{X}, \underline{Y} \rightarrow$ sistema de original

$\underline{E}, \underline{N} \rightarrow$ sistema al que se transformará.

de tener algún subscrito éste identificará el punto.

Transformación de Coordenadas

- Aplicación de escala

$$E = SX$$

$$N = SY$$

- Aplicación de traslación

$$E = X + \Delta E$$

$$N = Y + \Delta N$$

- Aplicación de escala, traslación y rotación

$$E = (S \cos \Theta) X - (S \sin \Theta) Y + \Delta E$$

$$N = (S \sin \Theta) X + (S \cos \Theta) Y + \Delta N$$

Transformación de Coordenadas

- Luego de considerado los efectos de escala, rotación y traslación, obtenemos las siguientes ecuaciones para la obtención de E y N:

$$(S \cos \Theta) X - (S \sin \Theta) Y + \Delta E = E$$

$$(S \cos \Theta) Y + (S \sin \Theta) X + \Delta N = N$$

Transformación de Coordenadas

- Con el objetivo de simplificar las pasadas ecuaciones, se reescribirán considerando:

$$a = S \cos \Theta$$

$$c = \Delta E$$

$$b = S \sin \Theta$$

$$d = \Delta N$$

$$a X - b Y + c = E$$

$$a Y + b X + d = N$$

Transformación de Coordenadas

- Para continuar se utilizará un listado de coordenadas que contiene los controles 1 y 2, de los cuales se obtuvieron coordenadas planas estatales mediante el uso de GPS.
- Al tener datos de dos de los puntos, obtendríamos cuatro ecuaciones con cuatro desconocidas (a, b, c, d):

$$a X_1 - b Y_1 + c = E_1$$

$$a Y_1 + b X_1 + d = N_1$$

$$a X_2 - b Y_2 + c = E_2$$

$$a Y_2 + b X_2 + d = N_2$$

Transformación de Coordenadas

- Reescribiremos el sistema de ecuaciones de forma matricial para su solución.

$$a X_1 - b Y_1 + c = E_1$$

$$a Y_1 + b X_1 + d = N_1$$

$$a X_2 - b Y_2 + c = E_2$$

$$a Y_2 + b X_2 + d = N_2$$


$$\begin{bmatrix} X_1 & -Y_1 & 1 & 0 \\ Y_1 & X_1 & 0 & 1 \\ X_2 & -Y_2 & 1 & 0 \\ Y_2 & X_2 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} E_1 \\ N_1 \\ E_2 \\ N_2 \end{bmatrix}$$

Transformación de Coordenadas

- Recordando que:

$$\begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} X_1 & -Y_1 & 1 & 0 \\ Y_1 & X_1 & 0 & 1 \\ X_2 & -Y_2 & 1 & 0 \\ Y_2 & X_2 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} E_1 \\ N_1 \\ E_2 \\ N_2 \end{bmatrix}$$

podemos así obtener los valores de las variables a, b, c y d.

Transformación de Coordenadas

- Considerando los siguientes, obtenemos como resultado de las variables a, b, c y d:

Punto	X	Y	E	N
1	1000.000	1000.00	133880.807	241647.576
2	1032.454	1018.109	133910.982	241625.858

- $a = 0.424274607$
- $b = -0.905934788$
- $c = 132550.5976$
- $d = 242129.2362$

Transformación de Coordenadas

- Translación

$$\Delta E = c = 132550.5976$$

$$\Delta N = d = 242129.2362$$

- Rotación

$$\theta = \tan^{-1}\left(\frac{b}{a}\right)$$

$$\theta = \tan^{-1}\left(\frac{-0.905934788}{0.424274607}\right) = -1.132805821 \text{ rad} = -64.90499255^\circ$$

- Escala

$$S = \frac{a}{\cos \theta}$$

$$S = \frac{0.424274607}{\cos(-1.132805821)} = 1.000363325$$

Transformación de Coordenadas

- Unidades
 - Al momento de efectuar la transformación, las coordenadas originales pueden encontrarse en cualquier sistema de unidades.
 - En caso que el sistema de coordenadas al cual se transformará sea distinto, éste se armonizará incluyendo la conversión en la escala.
 - Las coordenadas resultantes contendrán las unidades utilizadas por el sistema de coordenadas al cual se transformó.

Transformación de Coordenadas

- Escala
 - La escala incluirá el factor para el cambio de unidades entre sistemas en caso de ser unidades distintas.
 - Incluirá el factor de escala combinado perteneciente a la proyección utilizada de las coordenadas transformadas.
 - En caso de que las coordenada originales y las que se transformarán tengan las misma unidades, el factor escala debe ser similar al que obtendría del reporte de las observaciones de GPS en la localización.

Transformación de Coordenadas

- Escala
 - Al computar la escala en la transformación se está utilizando la distancia entre los puntos observados con GPS. Por tal razón al utilizar resultados de la observación de GPS erróneos o de pobre calidad, no solo se está localizando (trasladando y rotando) incorrectamente, sino que también se están modificando todas las dimensiones (escala) erróneamente.

Transformación de Coordenadas



- Escala
 - Recordemos que al transformar las coordenadas a un sistema que proviene de una proyección, estas coordenadas son propias de la proyección y las dimensiones y áreas entre estas son en la proyección.

A world map is visible in the background, rendered in a lighter shade of blue against the darker blue gradient of the slide. The map shows the outlines of continents and oceans.

DEMOSTRAR EL USO DE TRANSCOORD



Project information		Coordinate System	
Name:	C:\Users\Linda L. Velez\Documents\Trimble Business Center\Gas_Hernandez_Naranjales.vce	Name:	US State Plane 1983
Size:	101 KB	Datum:	NAD 1983 (Conus)
Modified:	8/17/2010 11:31:18 PM	Zone:	Puerto Rico/Virgin Is 5200
Reference number:		Geoid:	GEOID03 (Puerto Rico)
Description:		Vertical datum:	

Point List

ID	Northing (Meter)	Easting (Meter)	Elevation (Meter)	Feature Code
1	241625.858	133910.982	325.270	
2	241647.576	133880.807	328.164	

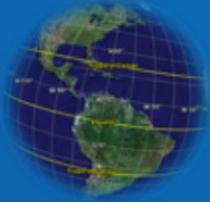
8/20/2010 9:51:16 PM	C:\Users\Linda L. Velez\Documents\Trimble Business Center\Gas_Hernandez_Naranjales.vce	Trimble Business Center
----------------------	--	-------------------------



Universal Transversa Mercator

- Para el sistema Universal Transversa Mercator, mejor conocido por sus siglas en ingles UTM, el globo esta dividido en 60 zonas.
 - Se asume que el esferoide del DATUM es una esfera
- Cada zona se extiende seis grados de longitud, con un solape de 30 minutos con las zonas adyacentes.
- Cada zona tiene su propio meridiano central del cual se extiende 3 grados al este y 3 grados al oeste

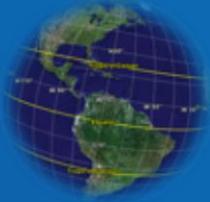




Universal Transversa Mercator

- Las coordenadas de este sistemas están en metros.
- El origen de cada zona es en el ecuador y en su meridiano central.
- El valor dado al meridiano central es un "falso este" igual a 500,000 metros.





Universal Transversa Mercator

- La cuadrícula del sistema UTM se extiende alrededor del globo desde la latitud 80° N a la 80° S.
- Cada zona en el Ecuador tiene dos falsos nortes 0 metros para la mitad norte y 10,000,000 metros en la mitad sur.
 - Lo cual significa que cada localización en el Ecuador tiene dos conjuntos de coordenadas UTM





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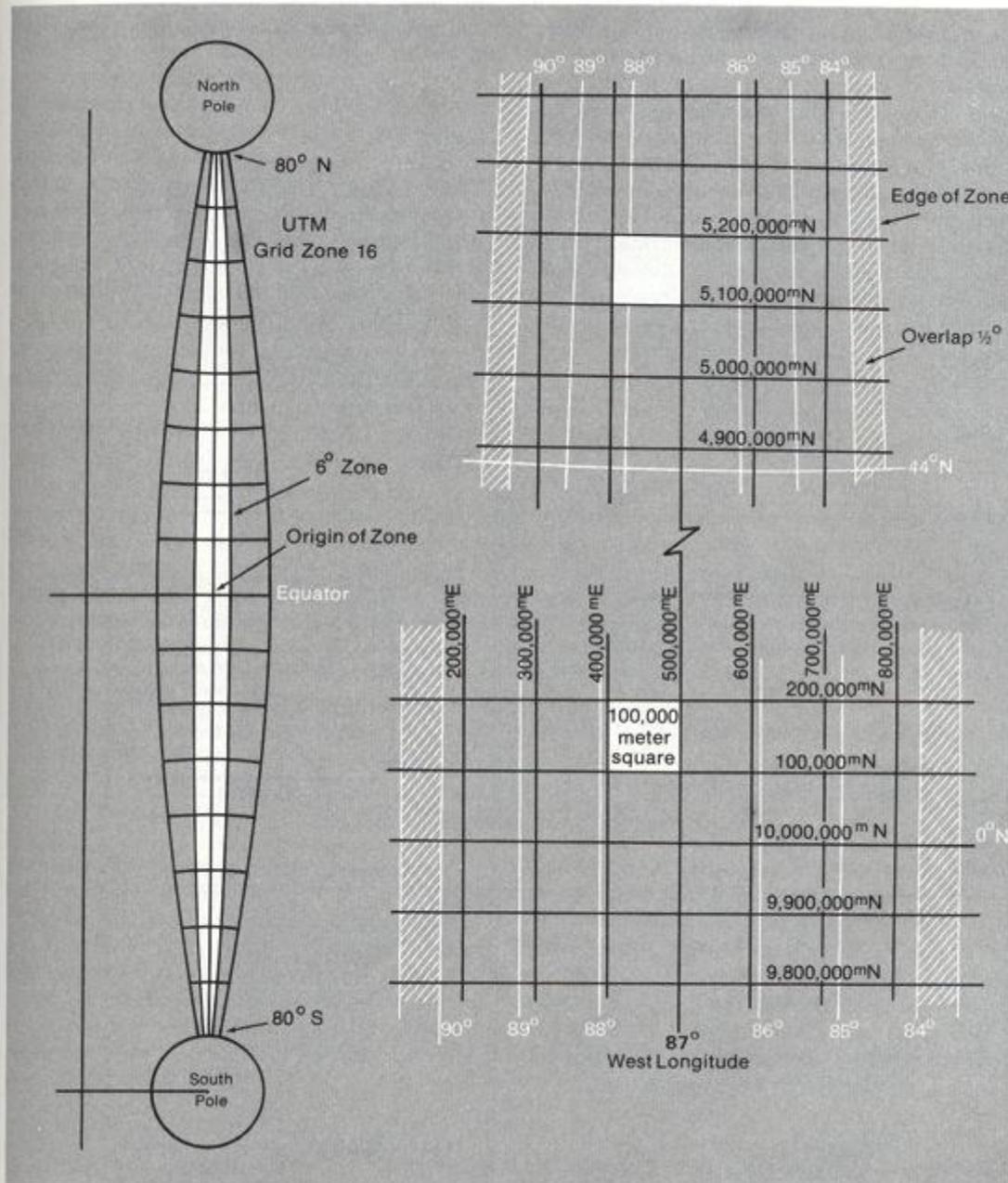
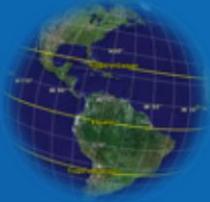


Figure 3.8 Universal Transverse Mercator coordinates in selected portions of zone 16.

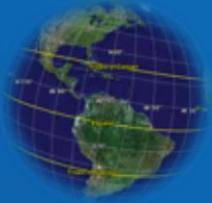




Universal Transverse Mercator

- Las zonas se designan con números desde el 1 al 60.
 - Desde 180° W hacia 0° termina 180° E.
- Las zonas se calculan, basado en la longitud:
 - para las longitudes al oeste del meridiano de Greenwich
 - restando 180° menos la longitud y se divide entre seis.
 - para las longitudes al este del meridiano de Greenwich;
 - sumando 180° a la longitud y se divide entre seis.
- El resultado se toma el entero **mayor** sino da un entero.





60 Zonas de Sistema UTM



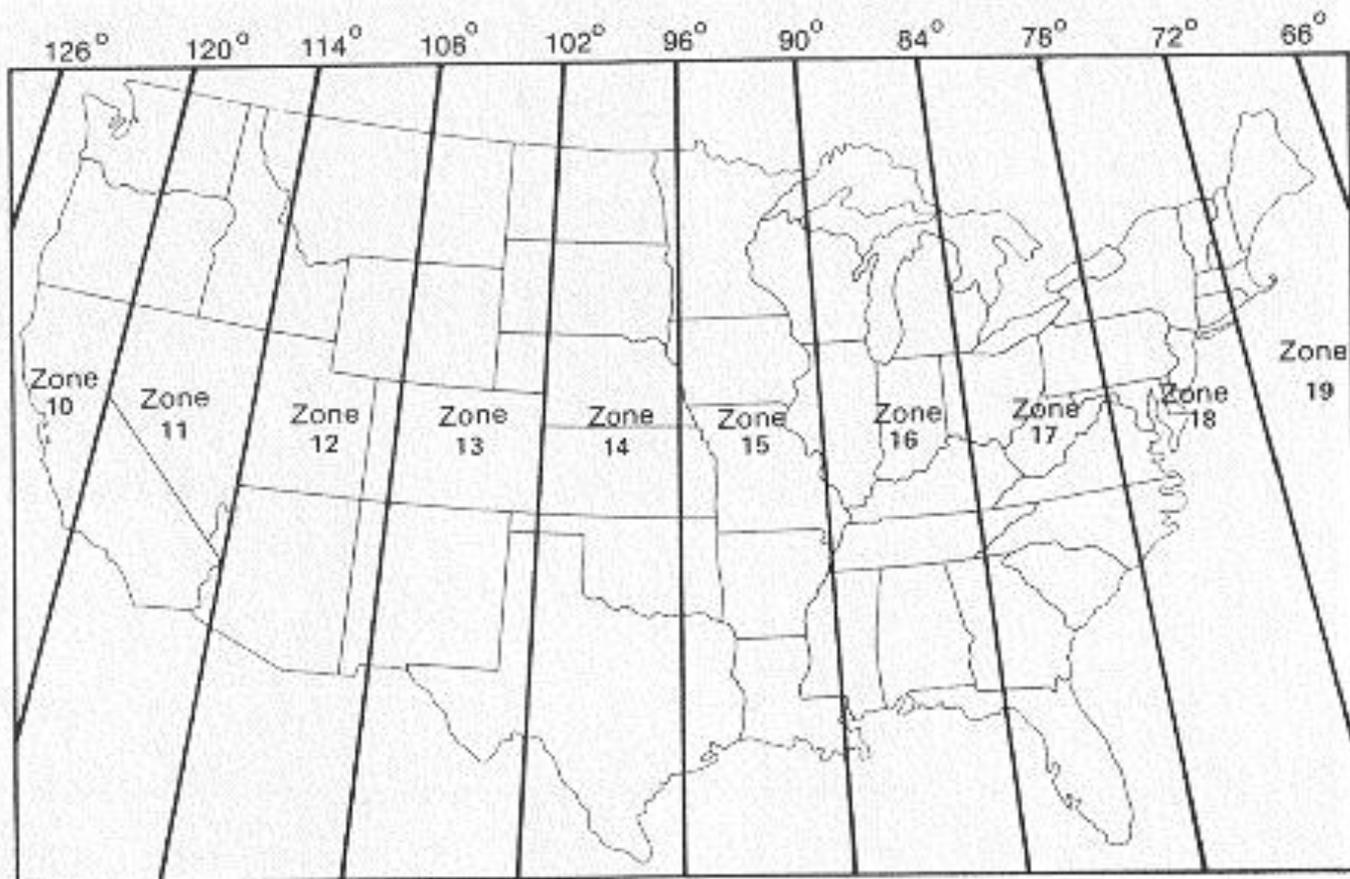
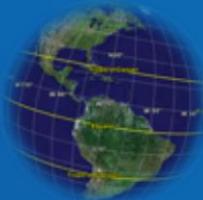
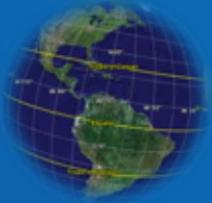


Figure 3.7 Zones of the Universal Transverse Mercator Grid in the United States.

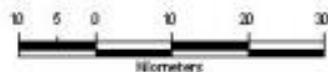




Datum Verticales

- Los Datums Verticales son locales
 - Puerto Rico Vertical Datum 2002 (PRVD02)
 - Se usa en PR en el epoch del 1983-2001 de datos del mareógrafo de La Puntilla
 - El cero esta en las Oficinas de la Guardia Costanera en La Puntilla en el Viejo San Juan
 - Se corrió una nivelación en Mayo del 2002 desde La Puntilla hasta Aguadilla bajo el auspicio del National Geodetic Survey (NGS) ya estan publicados
 - Dos contratistas corrieron varias lineas y se estan procesando



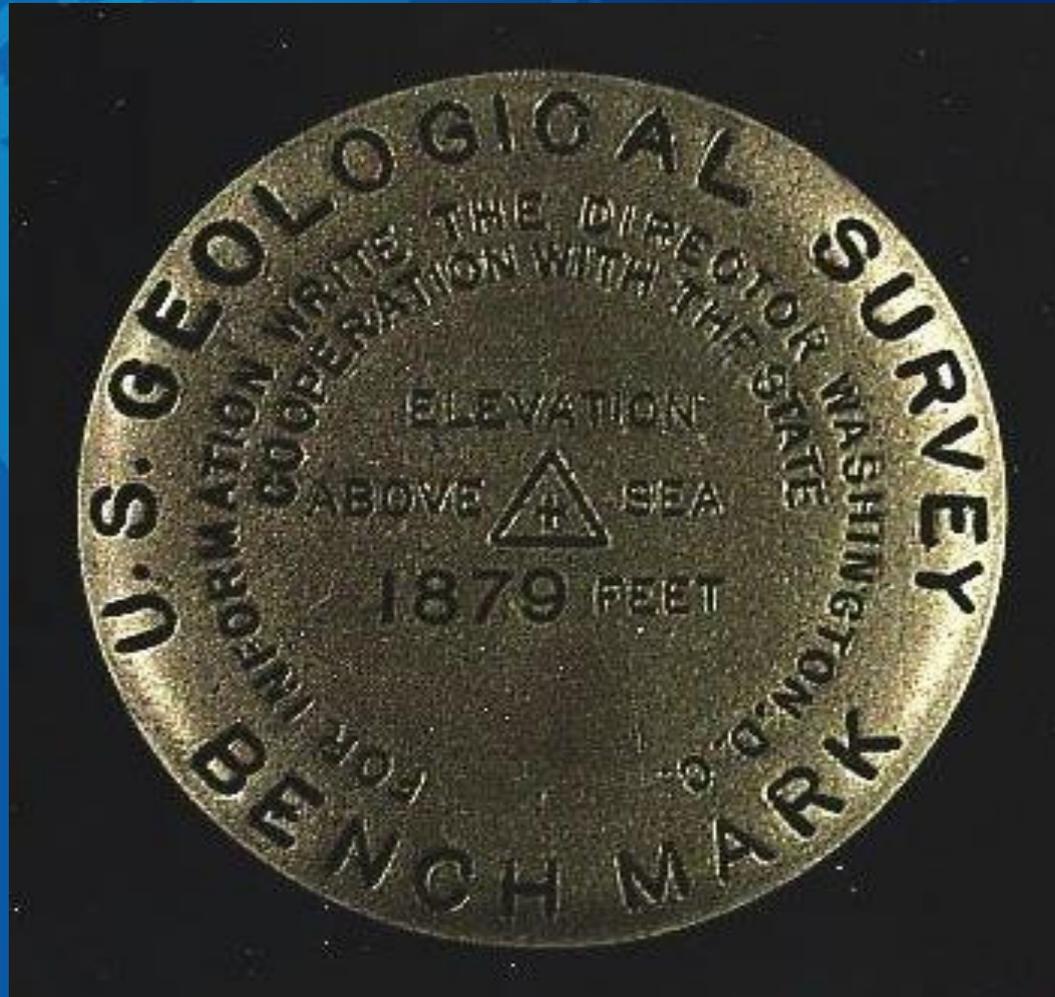


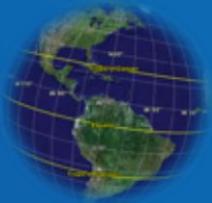
**NOAA's National Geodetic Survey
Puerto Rico Geodetic Framework Project
PRVD02**

-  Planned Level Lines
 -  PRVD02 - Completed Vertical Datum
 -  Field Work Completed / In-Progress
- April 2010



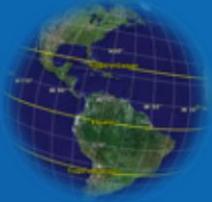
Controles Verticales del USGS





Vélez 2002





Vélez 2002

PID - DE5545

- HORZ ORDER - B
- NAD 83(2002)-
 - $\phi=18^{\circ} 26' 41.28060''$ N $\lambda=67^{\circ} 08' 48.93357''$ W
 - SPC PRVI – N=267,825.241m E=124,618.857m
 - UTM 19 – N=2,040,399.173m E=695,701.034m
- NAD 83(2011) Epoch 2010.00-
 - $\phi=18^{\circ} 26' 41.28162''$ N $\lambda=67^{\circ} 08' 48.92893''$ W
 - SPC PRVI – N=267,825.272m E=124,618.993m
 - UTM 19 – N=2,040,399.206m E=695,701.169m
- VERT ORDER - FIRST CLASS II
- PRVD02 - 134.320meters 440.68feet



DE5545 *****

DE5545 DESIGNATION - VELEZ

DE5545 PID - DE5545

DE5545 STATE/COUNTY- PR/AGUADILLA

DE5545 COUNTRY - US

DE5545 USGS QUAD -

DE5545

DE5545 *CURRENT SURVEY CONTROL

DE5545

DE5545* NAD 83(2011) POSITION- 18 26 41.28162(N) 067 08 48.92892(W) ADJUSTED

DE5545* NAD 83(2011) ELLIP HT- 90.419 (meters) (06/27/12) ADJUSTED

DE5545* NAD 83(2011) EPOCH - 2010.00

DE5545* **PRVD02** ORTHO HEIGHT - 134.320 (meters) 440.68 (feet) ADJUSTED

DE5545

DE5545 NAD 83(2011) X - 2,350,644.204 (meters) COMP

DE5545 NAD 83(2011) Y - -5,577,493.121 (meters) COMP

DE5545 NAD 83(2011) Z - 2,005,175.805 (meters) COMP

DE5545 LAPLACE CORR - 3.90 (seconds) DEFLEC12A

DE5545 **GEOID HEIGHT - -43.90 (meters)** GEOID12A

DE5545 VERT ORDER - FIRST CLASS II

DE5545

DE5545 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)

DE5545 Type Horiz Ellip Dist(km)

DE5545 -----

DE5545 NETWORK 1.10 1.65

DE5545 -----

DE5545 MEDIAN LOCAL ACCURACY AND DIST (002 points) 1.02 0.82 65.27

DE5545 -----

DE5545 NOTE: Click [here](#) for information on individual local accuracy

DE5545 values and other accuracy information.

DE5545

DE5545

DE5545.The horizontal coordinates were established by GPS observations

DE5545.and adjusted by the National Geodetic Survey in June 2012.

DE5545

DE5545.NAD 83(2011) refers to NAD 83 coordinates where the reference

DE5545.frame has been affixed to the stable North American tectonic plate. See

DE5545.[NA2011](#) for more information. for more information.

DE5545

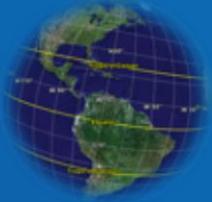
$$H = h - N$$

$$134.52 = 90.419 - (-43.90)$$

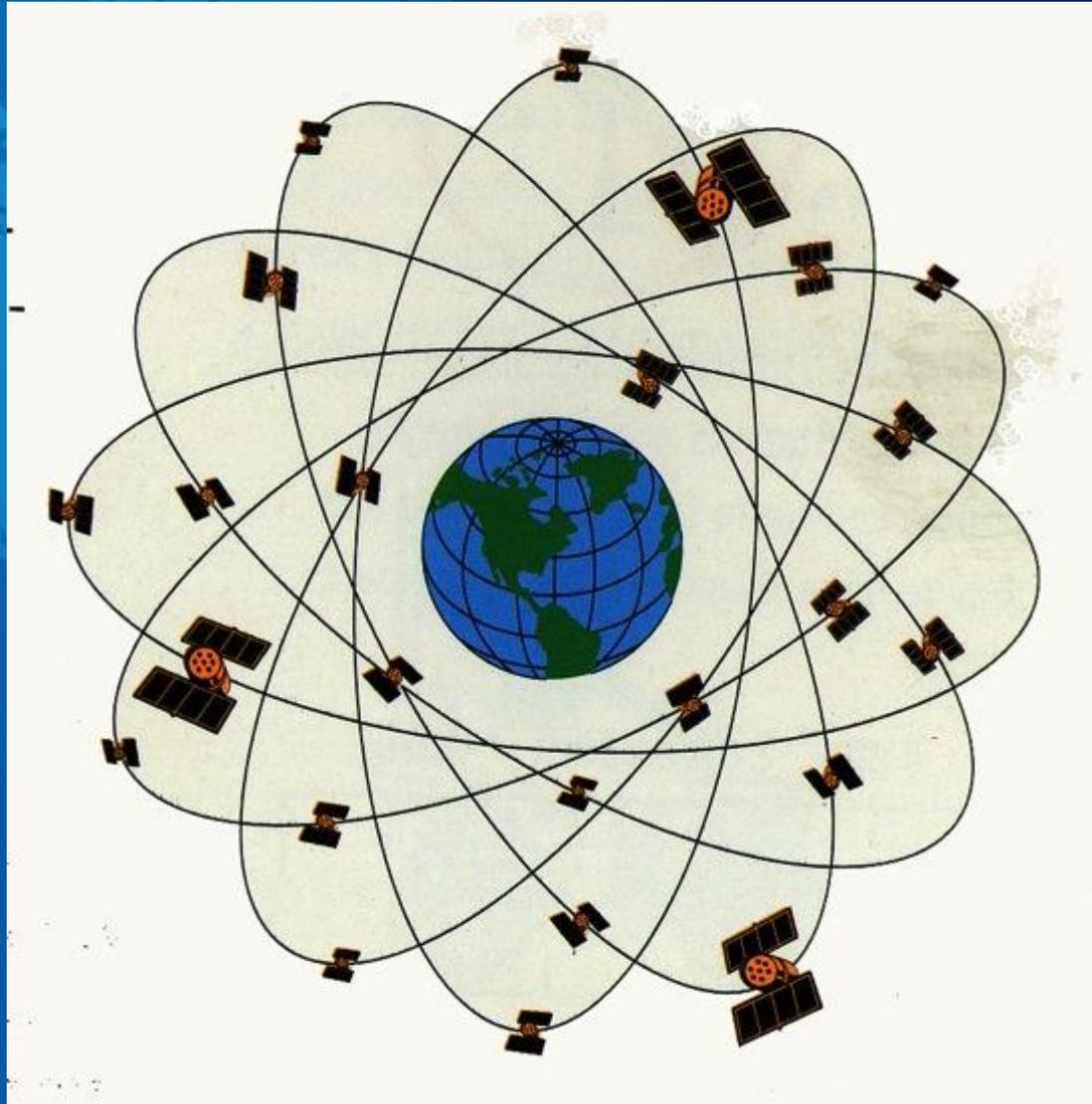
$$134.32 \neq 134.319$$

$$\text{NAD 83 (2011) Epoch 2010.00} = 90.419$$





Sistemas de Posicionamiento Global GPS



Civil GPS Use

Power Grid
Interfaces

Satellite Ops --
Ephemeris,
Timing

Personal Navigation

Surveying &
Mapping

Trucking &
Shipping

Communications --
Network
Synchronization
and Timing

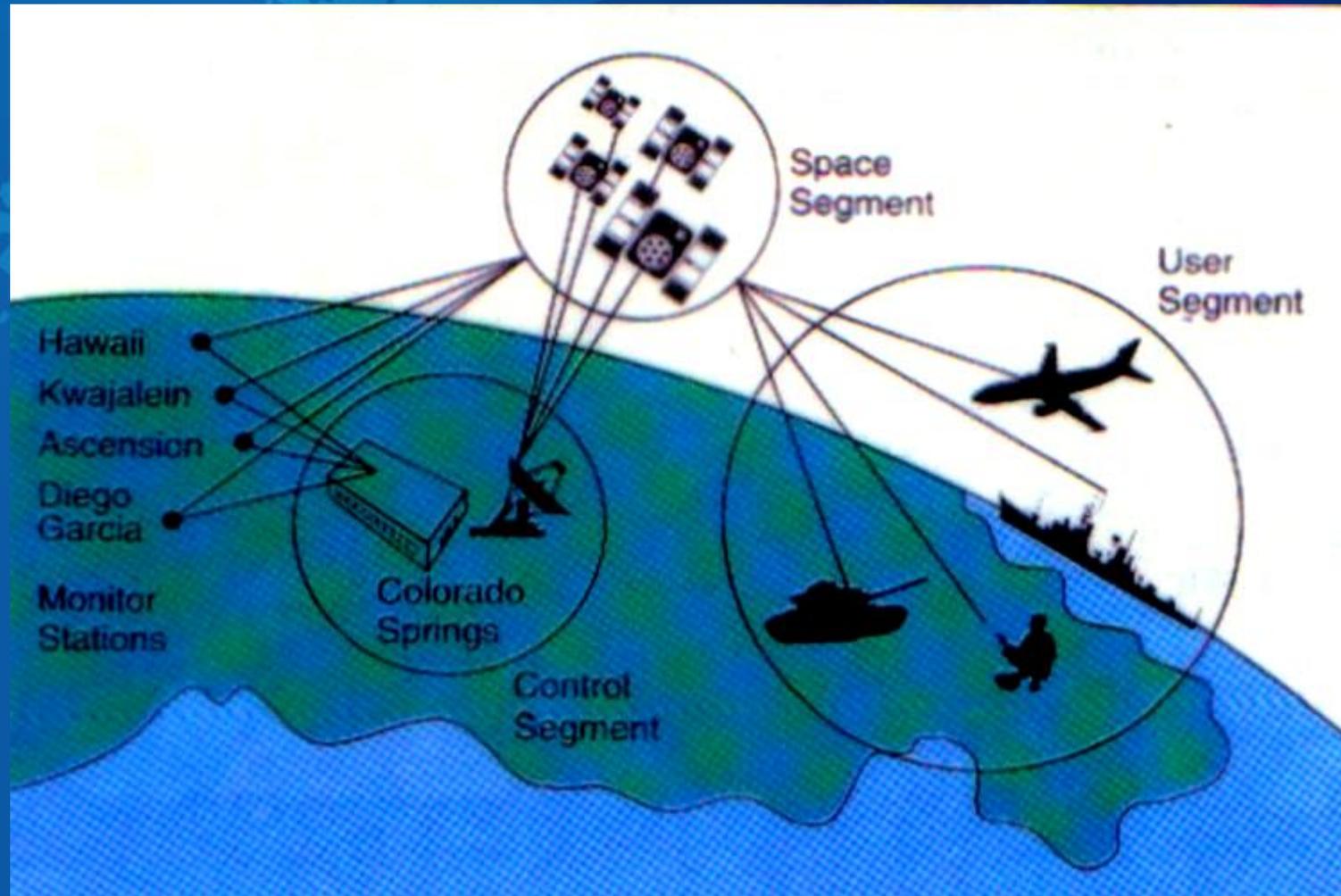
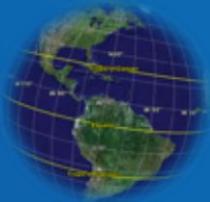
Aviation

Recreation

Railroads

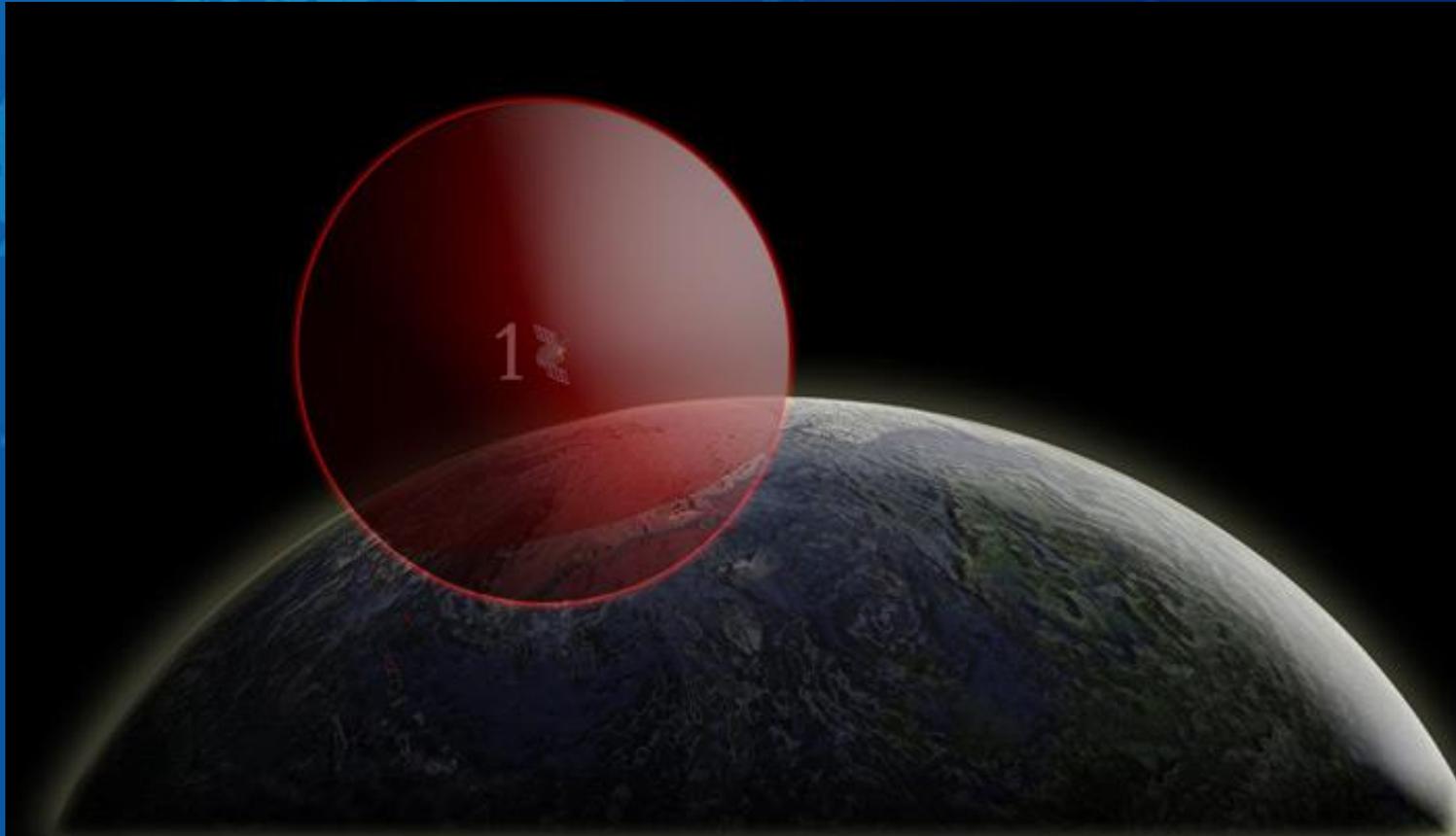
Fishing &
Boating

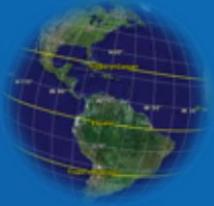
Off shore
Drilling





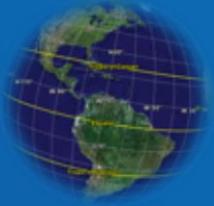
Un Satelite





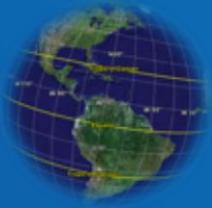
Dos Satelites





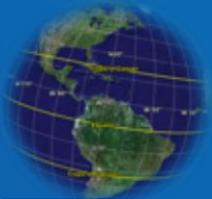
Tres Satelites





Cuatro Satelites

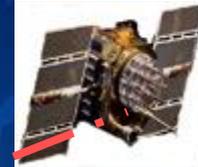




X_{23}
 Y_{23}
 Z_{23}



X_{19}
 Y_{19}
 Z_{19}



X_{14}
 Y_{14}
 Z_{14}



X_{21}
 Y_{21}
 Z_{21}

d_{23}

d_{19}

d_{14}

d_{21}

Measured: x y z



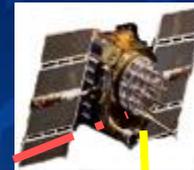
Non-Differential GPS (Autonomous or Stand-alone)





X_{23}
 Y_{23}
 Z_{23}

X_{19}
 Y_{19}
 Z_{19}



X_{14}
 Y_{14}
 Z_{14}



X_{21}
 Y_{21}
 Z_{21}



Measured: $x y z$
Delta: $x y z$

True: $x y z$

← Corrections applied
after survey

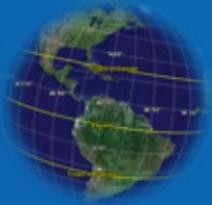


True: $x y z$
Measured: $x y z$

Delta: $x y z$

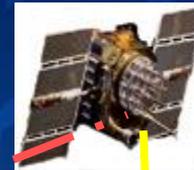
Differential GPS





X_{23}
 Y_{23}
 Z_{23}

X_{19}
 Y_{19}
 Z_{19}



X_{14}
 Y_{14}
 Z_{14}



X_{21}
 Y_{21}
 Z_{21}



Measured: $x y z$

Delta: $x y z$

True: $x y z$

← Corrections applied during the survey



True: $x y z$
Measured: $x y z$

Delta: $x y z$

Real-Time Differential GPS





Con Datos Geo-Espaciales

- Se establecen monumentos con coordenadas para la posteridad como el caso de la ubicación del Arbol de la finca donde nacio el Presidente Abraham Lincoln en Kentucky



Locating The Lincoln Boundary Oak For Posterity

by Vic McCauley and Frank Fowler

Beginning at a large white oak 13 poles above the Sinking Spring or Rock Spring, running thence N 9 1/2 E, 310 poles to" This was the beginning of the description of a tract of land of Thomas Lincoln, father of Abraham Lincoln.

Abraham Lincoln, 16th President of the United States, was, to use his words, born "in the most humble walks of life," on February 12, 1809, in a log cabin about three miles south of Hodgson's Mill on what was known as the Sinking Spring Farm in Hardin (now Larue) County, Kentucky. Until he was seven, the family lived in a picturesque spot on Knob Creek about eight miles from his birthplace. Throughout his life, Lincoln fondly recalled memories of his Kentucky home, including the "boundary oak" that stood less

than 150 yards from the cabin where he was born, and which his father pointed out as marking the boundary of his land. Legend has it that a boundary dispute

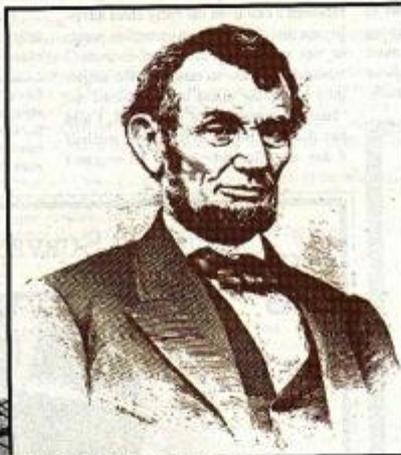
was at least part of the reason for the family's migration to Indiana.

The exact location of the oak was recorded about 20 years later when, on December 4, 1837, Hardin County Deputy Surveyor John Duncan began a survey (to settle a controversy) at a large "White Oak, thirteen poles above the Sinking or Rock Spring." Hence the oak tree that helped mark Abraham's birthplace was put on record in an official survey—the first known documentation of the "Boundary Oak."

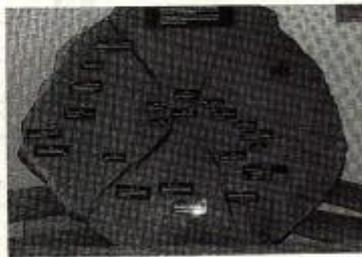
President William Howard Taft dedicated the Lincoln birthplace site as a national memorial in 1911. By that time, however, the Lincoln cabin had already been disassembled and moved around the country for display. Many rumors still exist concerning the authenticity of the cabin, but the Boundary Oak remained, undaunted amidst the turmoil. In 1933, the National Park Service



The Boundary Oak Stump.



The entrance to the Abraham Lincoln Birthplace, National Historical Site, near Hodgenville, Kentucky.



Cross-section of the Boundary Oak on display at the site.



The "Sinking or Rock Spring."



An informational plaque.



Survey disk.

took over management of the site, which it still maintains. Each year, nearly 250,000 visitors pay homage to Lincoln at the park.

The Boundary Oak stood as a living link to Lincoln until its death in 1976 at an estimated age of 195. At the time of its death, it was nearly six feet in diameter, stood 90 feet tall and spread its crown 115 feet across. Its remains were placed in storage in 1986, but brought out in 1990 because of continued decline in the condition of its wood. A cross section from its trunk remains on display at the site.

The tree's stump still marks the original location, but Park Manager Carolyn Link, concerned about advancing decay, decided she wanted to somehow preserve the tree's exact location. Researching park records, she discovered that a local surveyor, Ed Pence, had monumented the park boundary in 1970, and had used the

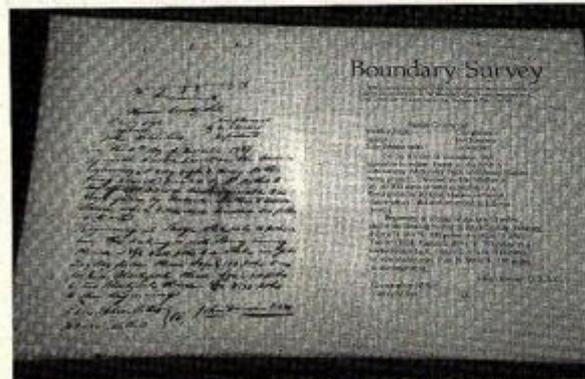
Boundary Oak to establish one of the lines. Link contacted him and explained the problem.

Pence, a member of The Kentucky Association of Professional Surveyors (KAPS), contacted Frank Fowler, who is chairman of the association's local Falls of the Ohio Chapter. Fowler, who is with the U.S. Army Corps of Engineers' Louisville District, said he would be happy to help organize the project. A GPS surveyor with the Corps, Fowler obtained authorization to use the Corps' receivers. Beginning last October, Fowler and Bobby Lambert, another Corps member, started the GPS survey while Pence, Jim Krauth, Steve Hibbs, Vic McCauley and Ray Leigh began solar observations and traversing to the stump. Once the exact position (NAD 83) of the stump was determined, Fowler contacted Bernsten International, Inc., which donated

the disk used to monument the stump. The official dedication took place on February 12 as part of Kentucky's bicentennial celebration and the KAPS 25th Anniversary, and as a tribute to the 133rd anniversary of President Lincoln's birth. Participating dignitaries included Charles Tapley, NSPS past president; David Atwell, NSPS Area 3 director; Al Matherly, NSPS governor from Kentucky; John Harper, member of the Kentucky House of Representatives; Jim Rincy, KAPS president; Vic McCauley, KAPS president-elect; Peggy Fortney, chair of the Falls of the Ohio Chapter, and Carolyn Link and Gary Talley of the National Park Service.

The purpose of the survey was to perpetuate the exact location of the Boundary Oak, which might otherwise have been lost due to rotting of the stump. Since it is tied to the National Network of Geodetic Control, the position of the oak will always be known, regardless of what happens to the area. The surveyors who participated in the project felt that they were contributing to the preservation of an important national monument. Just as it did when it was young and strong, the Boundary Oak will provide future generations with a concrete link to the birthplace of one of our nation's most treasured figures. **PS**

Vic McCauley is a registered surveyor employed with H.E. Rudy Engineers of Louisville, Kentucky, and is 1992 president of the Kentucky Association of Professional Surveyors. Frank Fowler is a registered surveyor employed with the Louisville District Army Corps of Engineers, is past chairman of the Falls of the Ohio chapter of KAPS, and is on the Board of Directors of the Kentucky Association of Professional Surveyors.



The 1837 Boundary Survey performed by John Duncan, Deputy Surveyor, Hardin County, Kentucky.



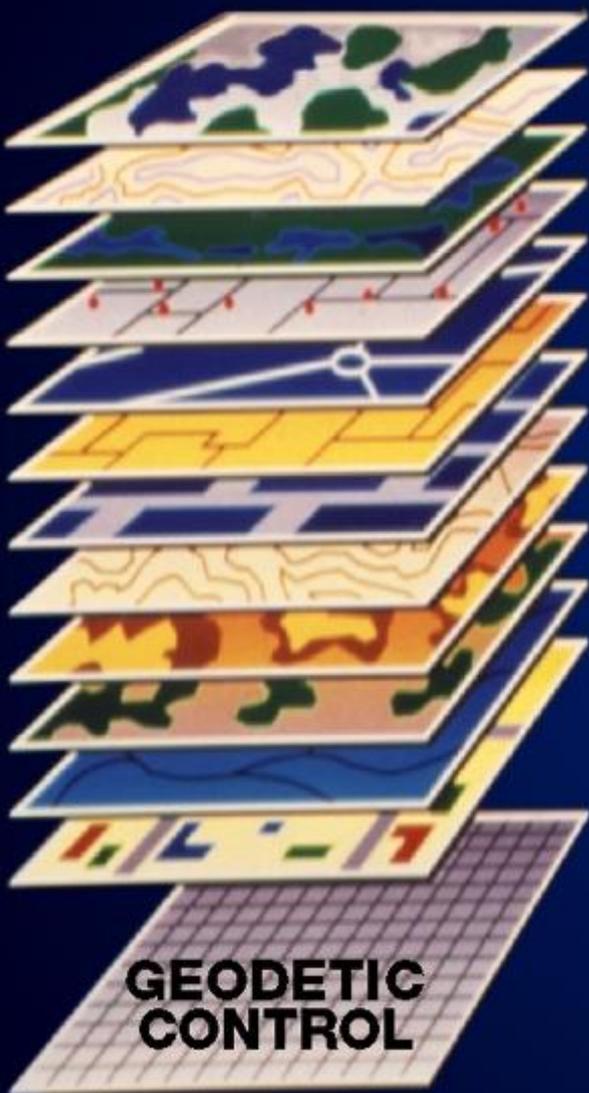
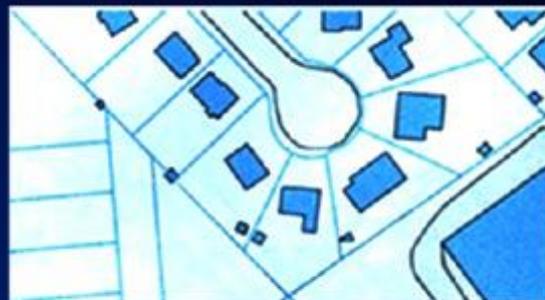
Sistema de Informacion Geografica

- Los Sistema de Informacion Geografica mejor conocidos por sus siglas en ingles GIS (Geographic Information Systems) es una herramienta que hace uso de la capacidad de manejar datos espaciales a una gran velocidad que tienen las computadoras.
- Los terminos LIS (Land Information Systems) y AM/FM (Automated Mapping/Facilities Management) son terminos similares.
- Los sistemas incluyen las personas, los datos, al igual que los programas de computadoras y las mismas computadoras, es decir el “hardware” y “software”.



Geographic Information Systems (GIS)

Wards and Precincts
Demographics
Structures
Water Utilities
Sewerage
Electrical Utilities
Roads
Boundaries
Land Use
Hydrology
Soils
Topography



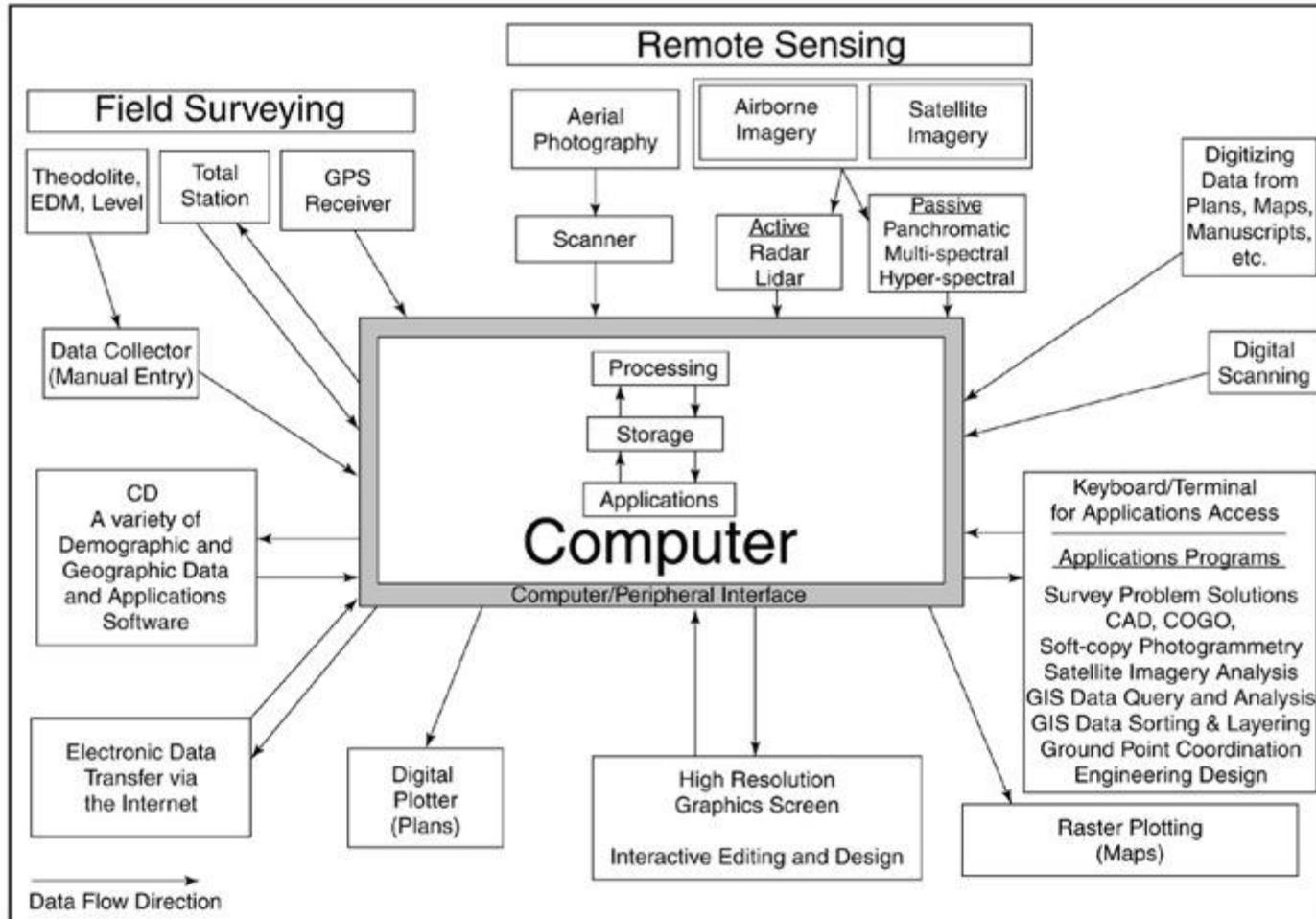
**GEODETTIC
CONTROL**

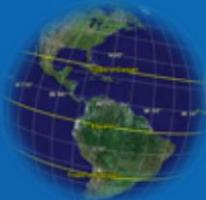


Matriz del GIS de Puerto Rico

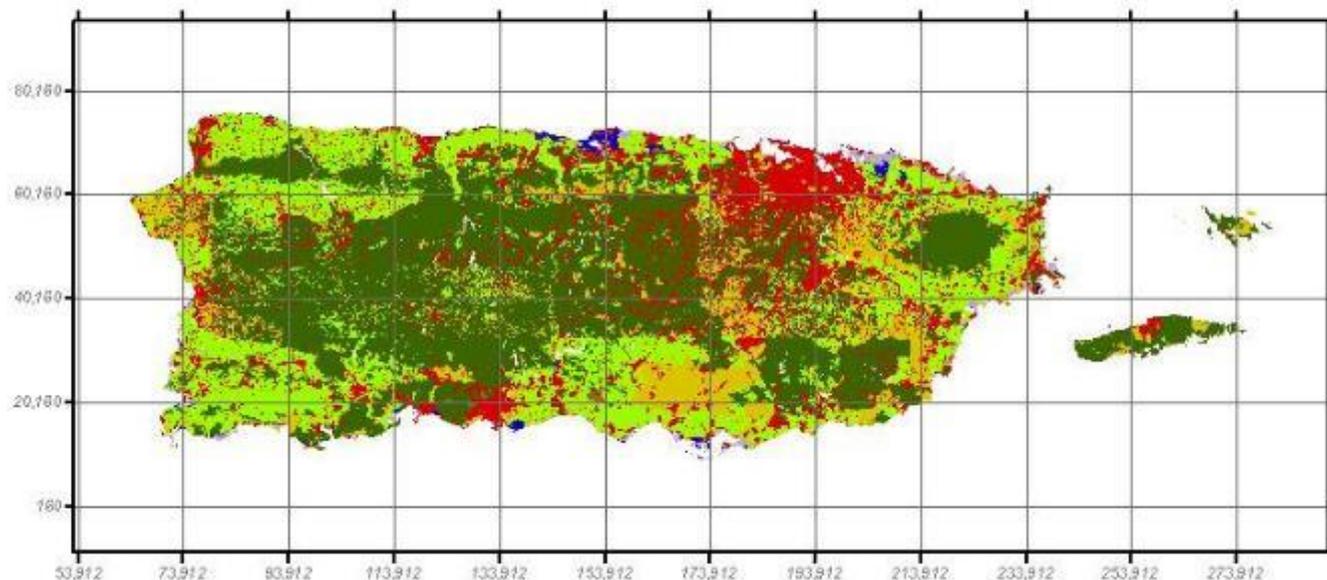
	Communications Base Maps	Crime Statistics	Economic Demographics	Electrical	Environmental	Government (Financial)	Hazardous Buildings	Hazards	Immigration	Hydrology	Import/Export Data	Land parcels	Land Use Data	Nature	Ownership/Occupancy	Permits	Private	Rac.	Rec.	Social Services	Sewer	Streets	Topographic	Transportation	Water	Zoning	
Planning Board
AEP (Public Building Authority)
ARPE
Civil Defense
Department of Agriculture
Economic Development Administration
Federal Department of Commerce
General Services Administration
Government Development Bank
Municipalities
National Guard
P.R. Aqueduct & Sewer Authority
P.R. Communications Authority
P.R. Department of Commerce
P.R. Department of Natural Resources
P.R. Department of Transportation & P.W.
P.R. Electrical Power Authority
P.R. Industrial Development Company
P.R. Department of Public Health
P.R. Telephone Company
Environmental Quality Board
Social Services
State Police Department
Tourism Board
Treasury Department
University of Puerto Rico







1999 Puerto Rico Land Use & Land Cover



Legend

- Urban
- Agriculture / Forest
- Forest Land Closed
- Forest Land Open
- Forested Wetland
- Non-Forested Wetland
- Commercial
- Coastal Wetlands
- Water

Puerto Rico State Plane Coordinate System
 Puerto Rico, Latin America
 NAD83



Sponsored by: Puerto Rico, National Oceanic and Atmospheric Administration

Puerto Rico

0 5 10 20 30 40 Miles

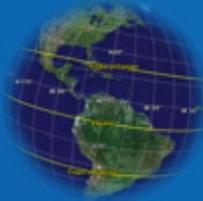


©2001 Puerto Rico Land Use & Land Cover Maps Series



Produced by: Surveying and Topography Laboratory
 Department of Civil and Environmental Engineering and
 Urban and Environmental Planning
 University of Puerto Rico
 Mayagüez, Puerto Rico





NGS Web Page

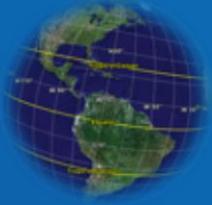
<http://www.ngs.noaa.gov>

The screenshot shows the National Geodetic Survey (NGS) website homepage. At the top left is the NOAA logo. The main header reads "National Geodetic Survey" with the tagline "Positioning America for the Future". Below the header is a navigation menu with links: "NGS Home", "About NGS", "Data & Imagery", "Tools", "Surveys", and "Science & Education". A search bar is located to the right of the menu. Below the menu is an "Announcements" section with a link to "NGS Releases Kindle-friendly Document of its Popular Bench Mark Reset Procedures". The main content area is divided into several sections: "Notices" (dated February 27, 2013) with links to "NGS Announces Release of Geodetic Data from Geoid Slope Validation Survey 2011 (GSVS11)", "NGS Releases Updated Ten-Year Strategic Plan 2013-2023", "NGS Announces Joint Beta Release of GEOCON and GEOCON11", "NGS updates 'Bluebooking' process for GPS projects", "DEFLEC12A and USDOV2012 Models Released", and "GEOID12A Model Released"; "Most Popular" with links to "Contact Us", "CORS", "Survey Mark Datasheets", "Geodetic Tool Kit", "NAD 83(2011) epoch 2010.00", "OPUS", "LOCUS", "Publications", "Geodetic Advisors", "Storm Imagery", and "UFCORS"; and "In The News" with a link to "02/21/2013 - NGS and Other NOS Offices Present Roundtable Discussion on New Hampshire Coastal Management Issues". On the right side, there are two promotional boxes: "Looking for Bench Marks?" and "NRC Highlights Importance of NGS Products...". At the bottom right, there is a logo for "Federal Geodetic Control".

Datasheets

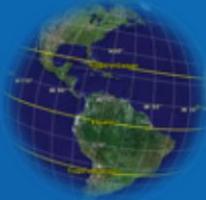
Geodetic
Tool Kit





**¿Qué es
y
como busca en
National Spatial Reference
System (NSRS)?**





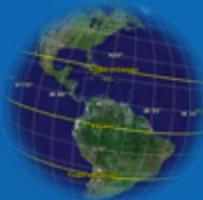
NGS DataSheet

¿Como acezarlos?

<http://www.ngs.noaa.gov>

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NGS DataSheet

NGS DATASHEET DATASHEET PAGE - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/ds/dsheet.cgi

Favorites: NGS DATASHEET DATASHEET PAGE

NGS DATASHEET PAGE 

This page is maintained by [NGS Software Requests](#) updated:01/06/09 09:51:53

Part of the [mission](#) of the [National Geodetic Survey](#), is to provide the public with survey control information, such as *Latitude, Longitude, Height and Gravity Data*. This is done for [publishable](#) stations in the form of DATASHEETS.

Click [here](#) to see what a DATASHEET looks like.
(or check out the [Tell me more...](#) link below)

Last change to datasheet format was made on [10/01/07](#)

Click [here](#) for information about the similarities and differences between NAD83(NSRS2007) and NAD 83(CORS96)

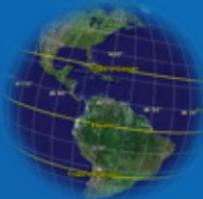
Retrieval Links	Info Links
DATASHEETS	Tell me more about DATASHEETS
ShapeFiles	Tell me more about ShapeFiles
SDTS	Tell me more about SDTS
TIDAL BENCH MARK	Tell me more about TIDAL BENCH MARKS
ARCHIVED DATASHEETS <small>SouthEast posted 10/10/06</small> <small>SouthEast posted 10/10/06</small> <small>2006 SouthCentral posted 10/10/06</small> <small>2006 SouthCentral posted 10/10/06</small> <small>2006 West (except for AZ) posted 10/06/06</small> <small>2006 West (AZ only) posted 10/19/06</small>	Tell me more about ARCHIVED DATASHEETS
ARCHIVED ShapeFiles by STATE	Tell me more about ARCHIVED ShapeFiles
CD_ROM	Tell me more about CD_ROM
SUBMIT RECOVERY	Tell me more about Submitting Recovery

For more information, contact NGS Information Services:
by e-mail: [ngs@noaa.gov](#)
or call: (301) 713-0262, Monday-Friday, 7:00 AM - 4:00 PM eastern time.

Done Internet 100%

1





NGS DataSheet

2

NGS DATASHEET RETRIEVAL PAGE Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/ngsdatasheet.pl

NGS DATASHEET RETRIEVAL PAGE

NGS DATASHEET RETRIEVAL PAGE 

This page is maintained by [NGS Software Requests](#) updated:01/06/09:09:51:53

[Tell me more about DATASHEET](#)

Retrieval Methods

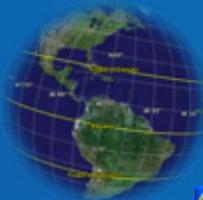
- [PIDs](#) - Permanent Identifiers
- [CORS SiteID](#) - CORS Site IDs
- [Radial Search](#) - provide center coordinates and radius in Miles
- [Rectangular Search](#) - provide min/max coordinates
- [Station Name](#)
- [Project Identifier](#)
- [USGS Quads](#)
- **COUNTY**
- [County Data](#)
- [Map Search](#) - interactive MAP retrieval.

Determine if a control point [is publishable](#)

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NGS DataSheet

NGS DATASHEET COUNTY FORM - Windows Internet Explorer provided by Yahoo!

https://www.ngs.noaa.gov/cgi-bin/ids_county.pl

NGS DATASHEET COUNTY FORM

datasheet >BY COUNTY

This page is maintained by [NGS Software Requests](#) updated:01/06/09:09:51:56

Data Sheets can be retrieved by County.

Select a State to get a County listing...

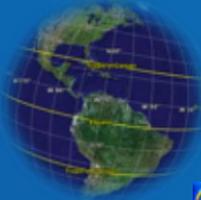
3 Pick a State:

- OREGON
- PENNSYLVANIA
- PUERTO RICO**
- VERMONT
- SOUTH CAROLINA
- SOUTH DAKOTA

4

Internet 100%





NGS DataSheet

NGS DATASHEET COUNTY CHOICE Windows Internet Explorer provided by Yahoo!

https://www.ngs.noaa.gov/cgi-bin/ids_county.pl

NGS DATASHEET COUNTY CHOICE

datasheet -> BY COUNTY

This page is maintained by [NGS Software Requests](#) updated:01/06/09 09:51:56

Select a County to get a list of Stations...

Pick a County

5

- |PR|065|HAILLO
- |PR|066|BOONVILLE
- 6 |PR|065|TUMACACI
- |PR|071|ISABELLA
- |PR|073|JAYUYA
- |PR|075|JUANA DIAZ
- |PR|077|JUNCOS
- |PR|079|LAJAS
- |PR|081|LARES
- |PR|083|LAS MARIAS

Data Type Desired:

- Any Horiz. and/or Vert. Control
- GFS Sites Only
- Any Horizontal Control

Stability Desired:

- Any Stability
- Stability A only
- Stability B or better

Output in East Longitude.

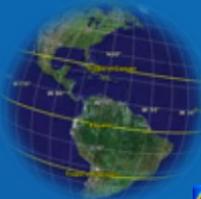
[Include suspect heights](#) in subsidence areas

[Remove Node](#)

6

GetMarks





NGS DataSheet

Windows Internet Explorer provided by Yahoo!

https://www.ngs.noaa.gov/cgi-bin/ids_county.pl

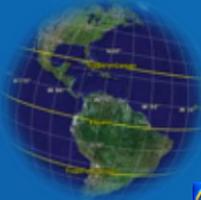
Favorites DATASHEETS

The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.
DATABASE = , PROGRAM = datasheet, VERSION = 7.65
1 National Geodetic Survey, Retrieval Date = MARCH 22, 2009

IV0913 *****
IV0913 DESIGNATION - FRIO USGS 1934
IV0913 FID - IV0913
IV0913 STATE/COUNTY- PR/HUNGARO
IV0913 USGS QUAD -
IV0913
IV0913 *CURRENT SURVEY CONTROL
IV0913
IV0913
IV0913 * NAD 83 (1997) - 18 18 23.86403 (N) 065 52 10.79346 (W) ADJUSTED
IV0913 * LOCAL TIDAL - 579.8 (meters) 1902. (feet) VERT ANG
IV0913
IV0913 LAPLACE CORR- 0.06 (seconds) DEFLECS9
IV0913 GEOID HEIGHT- -40.91 (meters) GEOID03
IV0913 HORIZ ORDER - THIRD
IV0913
IV0913 The horizontal coordinates were established by classical geodetic methods
IV0913 and adjusted by the National Geodetic Survey in May 1997.
IV0913
IV0913 The orthometric height was determined by vertical angle observations.
IV0913
IV0913 The Laplace correction was computed from DEFLECS99 derived deflections.
IV0913
IV0913 The geoid height was determined by GEOID03.
IV0913
IV0913
IV0913: North East Units Scale Factor Converg.
IV0913:SPC PRVI - 282,476.700 289,590.870 NT 0.99999478 +0 10 34.9
IV0913:UM 20 - 2,026,497.987 196,636.634 NT 1.00078791 -0 54 07.4
IV0913
IV0913: Elev Factor x Scale Factor = Combined Scale Factor
IV0913:SPC PRVI - 0.99991520 x 0.99999478 = 0.99991065
IV0913:UM 20 - 0.99991520 x 1.00078791 = 1.00065314
IV0913
IV0913: Primary Azimuth Mark Grid Az
IV0913:SPC PRVI - CENTRAL PROGRESSO USGS 308 53 58.0
IV0913:UM 20 - CENTRAL PROGRESSO USGS 309 58 40.3
IV0913
IV0913-----|
IV0913| FID Reference Object Distance Coord. Az
IV0913|-----|
IV0913| IV0934 CENTRAL PROGRESSO USGS APPROX. 12.7 KM 3090432.9
IV0913| IV0920 LA PALMA USGS 1999 APPROX. 8.2 KM 3303032.4
IV0913| IV0928 CANOVANAS CHURCH APPROX. 8.7 KM 3374906.3
IV0913|-----|
IV0913
IV0913
IV0913 SUPERSEDED SURVEY CONTROL





NGS DataSheet

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http://www.ngs.noaa.gov/cgi-bin/ds_county.prl

Yahoo!

DATASHEETS

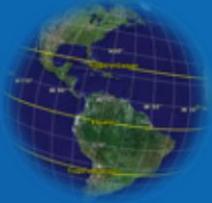
TV0913'SIGNAL--A QUADRIPOD WITH BLACK CROSS TARGETS.
TV0913'
TV0913'TO REACH FROM KILOMETER 7 H 6 OF THE CANOVANAS-HATO PUERCO ROAD,
TV0913'FOLLOW E A CART ROAD THROUGH FARM OF TOMAS SACHEZ, PASS CANOVANAS
TV0913'RIVER AND FOLLOW ROAD UPHILL THROUGH PEDRO FUSTEV FARM. PASS
TV0913'FIRST RIDGE, AND ON SECOND IS THE STATION.
TV0913
TV0913
TV0913 STATION RECOVERY (1940)
TV0913
TV0913'RECOVERY NOTE BY US GEOLOGICAL SURVEY 1940
TV0913'STATION AND R.M.S RECOVERED. NEW DESCRIPTION FOLLOWS--
TV0913'
TV0913'ABOUT 6 KMS. SE OF CANOVANAS ON A HIGH GRASS AND BRUSH COVERED
TV0913'HILL. ABOUT 3/4 KM. NE OF THE PENIER SCHOOL. ON PROPERTY OF
TV0913'NICASIO BENTANCOURT. THE HILL IS BROAD TOPPED. AND THERE ARE NO
TV0913'PROMINENT FEATURES NEARBY TO WHICH TO REFER THE STATION. BUT IT
TV0913'IS ON THE HIGHEST PART. IT IS A STANDARD TABLET STAMPED FRIO 1934
TV0913'SET IN A ROCK, FLUSH WITH GROUND AND SURROUNDED BY BUSHES.
TV0913'
TV0913'R. M. NO. 1 IS A CROSS WITH A HOLE DRILLED IN ITS MIDDLE, IN A
TV0913'ROCK, FLUSH WITH GROUND, 2.42M FROM STATION IN AZIMUTH 348 DEG
TV0913'20 MIN.
TV0913'
TV0913'R. M. NO. 2 IS A CROSS WITH A HOLE DRILLED IN ITS MIDDLE, IN A
TV0913'ROCK, FLUSH WITH GROUND, 3.06M FROM STATION IN AZIMUTH 73 DEG
TV0913'00 MIN.
TV0913'
TV0913'TO REACH FROM CANOVANAS (PLAZA). GO S ON ROAD TO HATA PUERCA
TV0913'(BEING EXTENDED TO JUNCOA), 5.3 MILES TO STORE OF PEDRO FUSTEV ON
TV0913'LEFT. LEAVE CAR. TAKE TRAIL DOWN TO AND ACROSS RIVER, CONTINUING
TV0913'UP E SIDE OF RIVER ABOUT 400 FT. HERE TAKE LEFT FORK UP TO GROUP
TV0913'OF YELLOW HOUSES AND CASUALIDAD SCHOOL, ABOUT 0.2 MILE. TAKE
TV0913'CART ROAD SOUTHWARD ALONG W SIDE OF FENCE. AND AT FORKS, ABOUT
TV0913'1000 FT. FARTHER, TAKE LEFT UP HILL. FOLLOW THIS MAIN TRAIL
TV0913'UP HILL TO SADDLE (ABOUT 1-1/4 KM.). AND PASS LARGE TIN HOUSE
TV0913'AND BARN ON LEFT. CONTINUE ON UP TRAIL TO PENJER SCHOOL (NO.
TV0913'517), FROM WHERE THE STATION HILL IS PROMINENT TO THE LEFT.
TV0913'CONTINUE ON TRAIL, BEARING LEFT ON SADDLE, THROUGH GATE AND
TV0913'UP TO TOP.
TV0913
TV0913 STATION RECOVERY (1963)
TV0913
TV0913
TV0913'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1963 (CFO)
TV0913'THE STATION DISK IN A BURIED BOULDER SET ABOUT FLUSH WITH THE
TV0913'GROUND, WAS RECOVERED AND FOUND TO BE IN GOOD CONDITION. IT IS
TV0913'LOCATED IN A FIELD AREA.
TV0913'
TV0913'THE TWO REFERENCE MARKS HAVE BEEN DESTROYED, EVIDENCE OF ONE WAS
TV0913'FOUND NEAR THE STATION.

*** retrieval complete.
Elapsed Time = 00:00:00

Done

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Ejercicio con el Punto Frio USGS 1934

- Con ecuaciones
 - DATASHEET
 - CONSTANTES
 - EN UN DATUM NAD27
 - GEODESICAS A SPC
 - SPC A GEODESICAS
 - EN UN DATUM NAD83
 - GEODESICAS A SPC
 - SPC A GEODESICAS





NGS Data Sheet Station FRIO USGS 1934 (TV0913)

TV0913 DESIGNATION - FRIO USGS 1934

TV0913 PID - TV0913

TV0913 COUNTRY - PUERTO RICO

TV0913 USGS QUAD -

TV0913

TV0913 *CURRENT SURVEY CONTROL

TV0913

TV0913* NAD 83(1993)- 18 18 23.86483(N) 065 52 10.79346(W) ADJUSTED

TV0913* LOCAL TIDAL - 579.8 (meters) 1902. (feet) VERT ANG

TV0913

TV0913 LAPLACE CORR- 0.06 (seconds) DEFLEC99

TV0913 GEOID HEIGHT- -42.78 (meters) GEOID99

TV0913

TV0913 HORZ ORDER - THIRD

TV0913

TV0913.The horizontal coordinates were established by classical geodetic methods

TV0913.and adjusted by the National Geodetic Survey in May 1997.

TV0913

TV0913.The orthometric height was determined by vertical angle observations.

TV0913

TV0913.The Laplace correction was computed from DEFLEC99 derived deflections.

TV0913

TV0913.The geoid height was determined by GEOID99.

TV0913

TV0913; North East Units Scale Converg.

TV0913;SPC PRVI - 252,476.700 259,590.870 MT 0.99999476 +0 10 34.9

TV0913;UTM 20 - 2,026,497.987 196,636.634 MT 1.00073791 -0 54 07.4

TV0913

TV0913: Primary Azimuth Mark Grid Az

TV0913:SPC PRVI - LA PALMA USGS 1939 330 19 57.5

TV0913:UTM 20 - LA PALMA USGS 1939 331 24 39.8

TV0913

TV0913|-----|

TV0913| PID Reference Object Distance Geod. Az |

TV0913| | | | dddmmss.s |

TV0913| TV0934 CENTRAL PROGRESSO USGS APPROX.12.7 KM 3090432.9 |

TV0913| TV0920 LA PALMA USGS 1939 APPROX. 8.2 KM 3303032.4 |

TV0913| TV0928 CANOVANAS CHURCH APPROX. 8.7 KM 3374906.3 |

TV0913|-----|





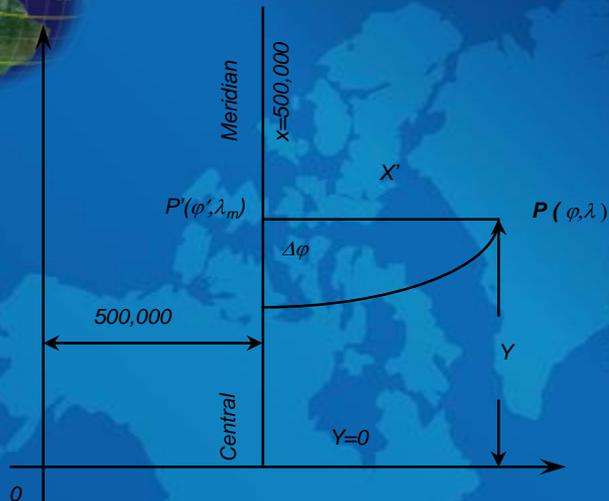
CONSTANTS FOR PUERTO RICO AND VIRGIN ISLAND

(INCLUDING ST. CROIX)

	<u>NAD27</u>	<u>NAD83</u>
LATITUD OF ORIGIN	17° 15'	SAME
CENTRAL MERIDIAN	66° 26'	SAME
STANDARD PARALLEL 1	18° 02'	SAME
STANDARD PARALLEL 2	18° 26'	SAME
FALSE EASTING	500,000.00 ft.	200,000.000 m
FALSE NORTHING	0.00 ft..	200,000.000 m
$l = \sin \theta$	0.3128882281	0.312888187729
R_b	63,687,479.44 fts.	19,411,706.1974 m



CONVERSION OF GEODETIC TO STATE PLANE 27 NAD 27



STATION: FRIO 1934 (USGS) P.R.
PID = TV1353; ORDER 3 HORIZONTAL

LATITUDE: $N18^{\circ}-18'-30.947'' = 18.3085963889^{\circ}$
LONGITUDE: $W 65^{\circ}-52'-12.191'' = 65.8700530556^{\circ}$

ZONE: PUERTO RICO & V.I.

Y = ? X = ?

EQUATIONS: $Y = R_b - R \cos \theta$ $X = X_0 + R \sin \theta$

CONSTANTS: $R_b = 63,687,479.44$ ft. $C = 500,000$ ft.
 $I = 0.3128882281 = \sin \theta$
 $CM = 66^{\circ}-26'-00.00''$

SOLUTION: FIRST : Obtain the value of R by interpolation from Table I. (EXHIBIT I)

$$\begin{aligned} R \text{ for } 18^{\circ}-18' &= 63,518,029.29 \text{ ft.} \\ 100.86517 \text{ ft.} \times 30.947'' &= \underline{-3,121.47 \text{ ft.}} \\ R \text{ for } 18^{\circ}-18'-30.947'' &= 63,514,907.82 \text{ ft.} \end{aligned}$$

SECOND: Obtain the value of θ from Table II by interpolation. (EXHIBIT II)

$$\begin{aligned} 1^{\circ} \text{ of Longitude} &= 0.31288823^{\circ} \text{ of } \theta \\ \theta \text{ for } 65^{\circ}-52'-12.191'' &= 0^{\circ}-10'-38.291985'' \\ 0.31288823^{\circ} \times 12.91'' &= \underline{-3.814420''} \\ \theta \text{ for } 65^{\circ}-52'-12.191'' &= 0^{\circ}-10'-34.477565'' \end{aligned}$$

COMPUTE SP COORD. FROM EQUATIONS:

$$\begin{aligned} R_b &= 63,687,479.44 \text{ ft.} \\ R \cos \theta &= -\underline{63,514,607.3317 \text{ ft.}} \end{aligned}$$

$$\begin{aligned} X_0 &= 500,000.00 \text{ ft.} \\ R \sin \theta &= -\underline{195,373.7103 \text{ ft.}} \end{aligned}$$

$$Y = 172,872.1083 \text{ ft.}$$

$$X = 695,373.7103 \text{ ft.}$$





CONVERSION OF STATE PLANE 27 TO GEODETIC NAD 27

STATION: FRIO 1934 (USGS) P.R.
PID = TV1353; ORDER 3 HORIZONTAL

$X = 695,373.71$ ft.
 $Y = 172,872.11$ ft.

ZONE: PUERTO RICO & V.I.

LATITUDE = ϕ = ? LONGITUDE = λ = ?

EQUATIONS: $Y = R_b - R \cos \theta$ $X = X_0 + R \sin \theta$
 $\tan \theta = X' / R_b - Y \Rightarrow X - X_0 / R_b - Y$
 $\theta = I \Delta\lambda$ $\Delta\lambda = \lambda_{cm} - \lambda$

CONSTANTS: $R_b = 63,687,479.44$ ft. $C = 500,000$ ft.
 $CM = 66^\circ-26'-00.00''$

$I = 0.3128882281 = \sin \theta$

SOLUTION: FIRST: Obtain the value of " θ "

$X = 695,373.71$ ft.	$R_b = 63,687,479.44$ ft.	$\tan \theta = 195,373.71$ ft. / $63,514,607.33$ ft.
$X_0 = -500,000.00$ ft.	$Y = -172,872.11$ ft.	$\tan \theta = 0.003076044$
$X' = 195,373.71$ ft.	$R_b - Y = 63,514,607.33$ ft.	$\theta = 0.1762437678^\circ \Rightarrow 0^\circ-33'-47.808997''$
		$\theta = 634.477564''$

SECOND: Obtain the value of $\Delta\lambda$ and λ
 $\Delta\lambda = \theta / I \Rightarrow 634.477564'' / 0.3128882281''$
 $\Delta\lambda = 2,027.808997'' \Rightarrow 0^\circ-33'-47.808997''$

$$\lambda = \lambda_{cm} - \Delta\lambda \Rightarrow 66^\circ-26'-00.000000''$$

$$\quad \quad \quad - 0^\circ-33'-47.808997''$$

$$\lambda = 65^\circ-52'-12.191003''$$

THIRD: Obtain R and ϕ

$$R = R_b - Y / \cos \theta$$

$$= 63,514,607.33 \text{ ft.} / \cos(0^\circ-10'-34.4776'')$$

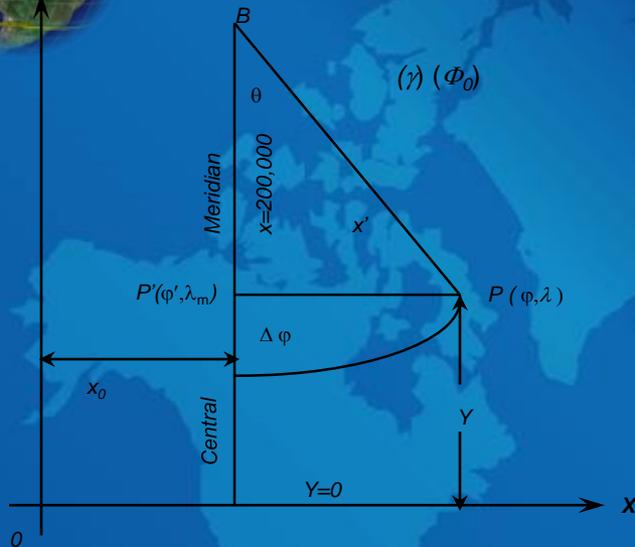
$$R = 36,514,907.8183 \text{ ft.}$$

Finally, the Latitude is obtained from the value of R by interpolating in Table I (EXHIBIT I)

R for $18^\circ-18'$	$= 63,518,029.29$ ft.	number of seconds	$= 3,121.47$ ft. / 100.86517 ft. / $^\circ$
R of point	$= -63,514,907.82$ ft.		$= 30.94697''$
difference for sec.	$= 3,121.47$ ft.	$\phi = 18^\circ-18'-30.94697''$	



CONVERSION OF GEODETIC TO STATE PLANE 83 NAD 83



STATION: FRIO 1934 (USGS) P.R.
PID = TV1353; ORDER 3 HORIZONTAL

LATITUDE: $\phi = N18^{\circ}-18'-23.86483'' = 18.3066291194^{\circ}$
LONGITUDE: $\lambda = W 65^{\circ}-52'-10.79346'' = 65.86966485^{\circ}$

ZONE: PUERTO RICO & V.I.

NORTHING = Y = ?

EASTING = X = ?

EQUATIONS: $N = R_b - R \cos(\gamma) + N_b$ $E = R \sin(\gamma) + E_0$
 $\gamma = (\lambda_{cm} - \lambda) \sin(\Phi_0)$

CONSTANTS: $R_b = 19,411,706.1974 \text{ m}$ $E_0 = 200,000.0000 \text{ m}$
 $N_b = 200,000.0000 \text{ m}$

$I = 0.312888187729 = \sin(\Phi_0)$
 $\lambda_{cm} = CM = 66^{\circ}-26'-00.00'' = 66.4333333333^{\circ}$

SOLUTION: first: By equation $\gamma = (\lambda_{cm} - \lambda) \sin(\Phi_0)$

$$\gamma = (66.4333333333^{\circ} - 65.86966485^{\circ}) 0.312888187729$$

$$= 0.17636521022^{\circ} = 0^{\circ}-10'-34.9147568''$$

From Table (EXHIBIT III) Calculate R

$$R \text{ for } 18^{\circ}-18' = 19,360,054.945 \text{ m}$$

$$30.74538 \times 23.86483 = \underline{\quad - 733.733266985 \text{ m} \quad}$$

$$R \text{ for } 18^{\circ}-18'-23.86483'' = 19,359,321.2117 \text{ m}$$

$$E = 19,359,321.2117 \text{ m} \sin(0.17636521022^{\circ}) + 200,000.0000 \text{ m}$$

$$E = 259,590.8704 \text{ m}$$

$$N = 19,411,706.1974 \text{ m} - 19,359,321.2117 \text{ m} \cos(0.17636521022^{\circ}) + 200,000.0000 \text{ m}$$

$$N = 252,476.7007 \text{ m}$$





CONVERSION OF STATE PLANE 83 TO GEODETIC NAD 83

STATION: FRIO 1934 (USGS) P.R.
PID = TV1353; ORDER 3 HORIZONTAL

NORTHING = Y = 252,476.700 m
EASTING = X = 259,590.870 m

ZONE: PUERTO RICO & V.I.

LATITUDE = ϕ = ? LONGITUDE = λ = ?

EQUATIONS: $N = R_b - R \cos(\gamma) + N_b$ $E = R \sin(\gamma) + E_0$
 $\gamma = (\lambda_{cm} - \lambda) \sin(\phi_0)$
 $\tan(\gamma) = (E - E_0) / R_b - (N - N_b)$
 $R = (R_b - (N - N_b)) / \cos(\gamma)$
 $\lambda = \lambda_{cm} - \gamma / I$

CONSTANTS: $R_b = 19,411,706.1974 \text{ m}$ $E_0 = 2,000,000.0000 \text{ m}$
 $N_b = 200,000.0000 \text{ m}$
 $I = 0.312888187729 = \sin(\phi_0)$
 $\lambda_{cm} = CM = 66^\circ-26'-00.00'' = 66.4333333333^\circ$

SOLUTION: FIRST: λ is calculated from equations.

$$\tan(\gamma) = 259,590.870 \text{ m} - 2,000,000.0000 \text{ m} / 19,411,706.1974 \text{ m} - (252,476.700 \text{ m} - 200,000.0000 \text{ m})$$

$$= 0.00307816331$$

$$\gamma = 0.17636520929^\circ = 0^\circ-10'-34.9147535''$$

SECOND: calculate R from equation.

$$R = 19,411,706.1974 \text{ m} - (252,476.700 \text{ m} - 200,000.0000 \text{ m}) / \cos(0.17636520929^\circ)$$

$$= 19,359,321.2124 \text{ m}$$

$$\lambda = 66.4333333333^\circ - 0.17636520929^\circ / 0.312888187729$$

$$= 65.8696648530^\circ$$

$$\lambda = 65^\circ-52'-10.793471''$$

THIRD: ϕ is obtained from Table (EXHIBIT III) Interpolating.

$$R \text{ for } 18^\circ-18' = 19,360,054.945 \text{ m}$$

$$R \text{ for } \phi = -19,359,321.2124 \text{ m}$$

$$\text{Difference} = \frac{733.7326 \text{ m}}{30.74538''/\text{m}}$$

$$= 23.864808''$$

$$\phi = 18^\circ-18'-23.864808''$$





Lambert Conformal Conic Projection Tables (Exhibit I)

Puerto Rico and Virgin Islands (except St. Croix)

Table I

Lat.	R (feet)	y' (y value on central meridian) (feet)	Tabular difference for 1 sec. of lat. (feet)	Scale in units of 7th place of logs	Scale expressed as a ratio
17° 50'	63,667,479.44	0	100.86250	+78.9	1.00001617
51	63,681,427.69	6,051.75	100.86233	+70.3	1.00001619
52	63,675,375.95	12,103.49	100.86250	+62.1	1.00001430
53	63,669,324.20	18,155.24	100.86233	+54.3	1.00001250
54	63,663,272.46	24,206.98	100.86250	+46.8	1.00001078
55	63,657,220.71	30,258.73	100.86233	+39.7	1.00000914
17 56	63,651,168.97	36,310.47	100.86250	+32.9	1.00000758
57	63,645,117.22	42,362.22	100.86250	+26.5	1.00000610
58	63,639,065.47	48,413.97	100.86250	+20.5	1.00000472
59	63,633,013.72	54,465.72	100.86250	+14.8	1.00000341
18 00	63,626,961.97	60,517.47	100.86267	+ 9.5	1.00000219
18 01	63,620,910.21	66,569.23	100.86267	+ 4.6	1.00000106
02	63,614,858.45	72,620.99	100.86283	0.0	1.00000000
03	63,608,806.68	78,672.76	100.86283	- 4.2	0.99999903
04	63,602,754.91	84,724.53	100.86300	- 8.0	0.99999816
05	63,596,703.13	90,776.31	100.86300	-11.5	0.99999735
18 06	63,590,651.35	96,828.09	100.86317	-14.6	0.99999664
07	63,584,599.56	102,879.88	100.86333	-17.3	0.99999602
08	63,578,547.76	108,931.68	100.86350	-19.7	0.99999546
09	63,572,495.95	114,983.49	100.86350	-21.7	0.99999500
10	63,566,444.14	121,035.30	100.86367	-23.4	0.99999462
18 11	63,560,392.32	127,087.12	100.86383	-25.7	0.99999431
12	63,554,340.49	133,138.95	100.86400	-25.6	0.99999411
13	63,548,288.65	139,190.79	100.86417	-26.1	0.99999399
14	63,542,236.80	145,242.64	100.86433	-26.3	0.99999394
15	63,536,184.94	151,294.50	100.86450	-26.1	0.99999399
18 16	63,530,133.07	157,346.37	100.86467	-25.6	0.99999411
17	63,524,081.19	163,398.25	100.86500	-24.7	0.99999431
18	63,518,029.29	169,450.15	100.86517	-23.4	0.99999462
19	63,511,977.38	175,502.06	100.86533	-21.7	0.99999500
20	63,505,925.46	181,553.98	100.86550	-19.7	0.99999546
18 21	63,499,873.53	187,605.91	100.86583	-17.3	0.99999602
22	63,493,821.58	193,657.86	100.86600	-14.6	0.99999664
23	63,487,769.62	199,709.82	100.86633	-11.5	0.99999735
24	63,481,717.64	205,761.80	100.86667	- 8.0	0.99999816
25	63,475,665.64	211,813.80	100.86683	- 4.2	0.99999903

Puerto Rico and Virgin Islands (except St. Croix)

Table I (Concluded)

Lat.	R (feet)	y' (y value on central meridian) (feet)	Tabular difference for 1 sec. of lat. (feet)	Scale in units of 7th place of logs	Scale expressed as a ratio
18° 26'	63,469,613.63	217,865.81	100.86717	0.0	1.00000000
27	63,463,561.60	223,917.84	100.86733	+ 4.6	1.00000106
28	63,457,509.56	229,969.68	100.86767	+ 9.5	1.00000219
29	63,451,457.50	236,021.94	100.86817	+14.3	1.00000341
30	63,445,405.41	242,074.03	100.86833	+20.5	1.00000471
18 31	63,439,353.31	248,126.13	100.86867	+26.5	1.00000610
32	63,433,301.19	254,178.25	100.86883	+32.9	1.00000758
33	63,427,249.06	260,230.38	100.86933	+39.6	1.00000912
34	63,421,196.90	266,282.54	100.86967	+46.7	1.00001075
35	63,415,144.72	272,334.72	100.87000	+54.2	1.00001248
18 36	63,409,092.52	278,386.92	100.87050	+62.1	1.00001430
37	63,403,040.29	284,439.15	100.87083	+70.3	1.00001619
38	63,396,988.04	290,491.40	100.87117	+78.9	1.00001817
39	63,390,935.77	296,543.67	100.87150	+87.8	1.00002022
40	63,384,883.48	302,595.96		+97.1	1.00002216

St. Croix Island

Table I

Lat.	R (feet)	y' (y value on central meridian) (feet)	Tabular difference for 1 sec. of lat. (feet)	Scale in units of 7th place of logs	Scale expressed as a ratio
17° 35'	63,778,256.14	9,223.30	100.86383	+251.2	1.00005873
36	63,772,204.31	15,275.13	100.86367	+237.1	1.00005460
37	63,766,152.49	21,326.95	100.86350	+223.4	1.00005145
38	63,760,100.68	27,378.76	100.86333	+210.1	1.00004839
39	63,754,048.88	33,430.56	100.86317	+197.2	1.00004541
40	63,747,997.09	39,482.35	100.86317	+184.6	1.00004251
17 41	63,741,945.30	45,534.14	100.86300	+172.4	1.00003970
42	63,735,893.52	51,585.92	100.86300	+160.5	1.00003697
43	63,729,841.74	57,637.70	100.86283	+149.0	1.00003432
44	63,723,789.97	63,689.47	100.86283	+137.9	1.00003176
45	63,717,738.20	69,741.24	100.86267	+127.2	1.00002928
17 46	63,711,686.44	75,793.00	100.86250	+116.3	1.00002689
47	63,705,634.69	81,844.75	100.86267	+106.8	1.00002458
48	63,699,582.93	87,896.51	100.86250	+ 97.1	1.00002235
49	63,693,531.18	93,948.26	100.86233	+ 87.8	1.00002021
50	63,687,479.44	100,000.00		+ 78.9	1.00001817



Lambert Conformal Conic Projection Tables

(Exhibit II)

Puerto Rico and Virgin Islands, including St. Croix

Table II

1" of Long. = 0.31288823 of θ

Long.	θ	Long.	θ	Long.	θ
64°01'	+0°45'22"127585	64°36'	+0°34'25"062306	65°11'	+0°23'27"997027
02	+0 45 03.354291	37	+0 34 06.289012	12	+0 23 09.223733
03	+0 44 44.580998	38	+0 33 47.515719	13	+0 22 50.450439
04	+0 44 25.807704	39	+0 33 28.742425	14	+0 22 31.677146
05	+0 44 07.034410	40	+0 33 09.969131	15	+0 22 12.903852
64 06	+0 43 48.261117	64 41	+0 32 51.195837	65 16	+0 21 54.130558
07	+0 43 29.487823	42	+0 32 32.422544	17	+0 21 35.357265
08	+0 43 10.714529	43	+0 32 13.649250	18	+0 21 16.583971
09	+0 42 51.941236	44	+0 31 54.875956	19	+0 20 57.810677
10	+0 42 33.167942	45	+0 31 36.102663	20	+0 20 39.037384
64 11	+0 42 14.394648	64 46	+0 31 17.329369	65 21	+0 20 20.264090
12	+0 41 55.621354	47	+0 30 58.556075	22	+0 20 01.490796
13	+0 41 36.848061	48	+0 30 39.782782	23	+0 19 42.717502
14	+0 41 18.074767	49	+0 30 21.009488	24	+0 19 23.944209
15	+0 40 59.301473	50	+0 30 02.236194	25	+0 19 05.170915
64 16	+0 40 40.528180	64 51	+0 29 43.462901	65 26	+0 18 46.397621
17	+0 40 21.754886	52	+0 29 24.689607	27	+0 18 27.624328
18	+0 40 02.981592	53	+0 29 05.916313	28	+0 18 08.851034
19	+0 39 44.208299	54	+0 28 47.143019	29	+0 17 50.077740
20	+0 39 25.435005	55	+0 28 28.369726	30	+0 17 31.304447
64 21	+0 39 06.661711	64 56	+0 28 09.596432	65 31	+0 17 12.531153
22	+0 38 47.888418	57	+0 27 50.823138	32	+0 16 53.757859
23	+0 38 29.115124	58	+0 27 32.049845	33	+0 16 34.984566
24	+0 38 10.341830	59	+0 27 13.276551	34	+0 16 16.211272
25	+0 37 51.568536	65 00	+0 26 54.503257	35	+0 15 57.437978
64 26	+0 37 32.795243	65 01	+0 26 35.729964	65 36	+0 15 38.664684
27	+0 37 14.021949	02	+0 26 16.956670	37	+0 15 19.891391
28	+0 36 55.248655	03	+0 25 58.183376	38	+0 15 01.118097
29	+0 36 36.475362	04	+0 25 39.410083	39	+0 14 42.344803
30	+0 36 17.702068	05	+0 25 20.636789	40	+0 14 23.571510
64 31	+0 35 58.928774	65 06	+0 25 01.863495	65 41	+0 14 04.798216
32	+0 35 40.155481	07	+0 24 43.090202	42	+0 13 46.024922
33	+0 35 21.382187	08	+0 24 24.316908	43	+0 13 27.251629
34	+0 35 02.608893	09	+0 24 05.543614	44	+0 13 08.478335
35	+0 34 43.835600	10	+0 23 46.770320	45	+0 12 49.705041

Puerto Rico and Virgin Islands, including St. Croix

Table II (Concluded)

1" of Long. = 0.31288823 of θ

Long.	θ	Long.	θ	Long.	θ
65°46'	+0°12'30"931748	66°21'	+0°01'33"866468	66°56'	-0°09'23"198811
47	+0 12 12.158454	22	+0 01 15.093175	57	-0 09 41.972104
48	+0 11 53.385160	23	+0 00 56.319881	58	-0 10 00.745378
49	+0 11 34.611867	24	+0 00 37.546587	59	-0 10 19.518692
50	+0 11 15.838573	25	+0 00 18.773294	67 00	-0 10 38.291985
65 51	+0 10 57.065279	66 26	0 00 00.000000	67 01	-0 10 57.065279
52	+0 10 38.291985	27	-0 00 18.773294	02	-0 11 15.838573
53	+0 10 19.518692	28	-0 00 37.546587	03	-0 11 34.611867
54	+0 10 00.745398	29	-0 00 56.319881	04	-0 11 53.385160
55	+0 09 41.972104	30	-0 01 15.093175	05	-0 12 12.158454
65 56	+0 09 23.198811	66 31	-0 01 33.866468	67 06	-0 12 30.931748
57	+0 09 04.425517	32	-0 01 52.639762	07	-0 12 49.705041
58	+0 08 45.652223	33	-0 02 11.413056	08	-0 13 08.478335
59	+0 08 26.878930	34	-0 02 30.186350	09	-0 13 27.251629
66 00	+0 08 08.105636	35	-0 02 48.959643	10	-0 13 46.024922
66 01	+0 07 49.332342	66 36	-0 03 07.732937	67 11	-0 14 04.798216
02	+0 07 30.559049	37	-0 03 26.506231	12	-0 14 23.571510
03	+0 07 11.785755	38	-0 03 45.279524	13	-0 14 42.344803
04	+0 06 53.012461	39	-0 04 04.052818	14	-0 15 01.118097
05	+0 06 34.239167	40	-0 04 22.826112	15	-0 15 19.891391
66 06	+0 06 15.465874	66 41	-0 04 41.599405	67 16	-0 15 38.664684
07	+0 05 56.692580	42	-0 05 00.372699	17	-0 15 57.437978
08	+0 05 37.919286	43	-0 05 19.145993	18	-0 16 16.211272
09	+0 05 19.145993	44	-0 05 37.919286	19	-0 16 34.984566
10	+0 05 00.372699	45	-0 05 56.692580	20	-0 16 53.757859
66 11	+0 04 41.599405	66 46	-0 06 15.465874		
12	+0 04 22.826112	47	-0 06 34.239167		
13	+0 04 04.052818	48	-0 06 53.012461		
14	+0 03 45.279524	49	-0 07 11.785755		
15	+0 03 26.506231	50	-0 07 30.559049		
66 16	+0 03 07.732937	66 51	-0 07 49.332342		
17	+0 02 48.959643	52	-0 08 08.105636		
18	+0 02 30.186350	53	-0 08 26.878930		
19	+0 02 11.413056	54	-0 08 45.652223		
20	+0 01 52.639762	55	-0 09 04.425517		

Lambert Conformal Conic Projection Tables (Exhibit III)

2

Lambert conformal conic projection tables
PUERTO RICO & VI

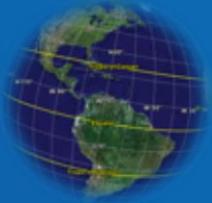
Lat	R (meters)	tab diff.	k
17 35'	19439376.477	30.74500	1.00005784
17 36	19437531.777	30.74495	1.00005460
17 37	19435687.079	30.74491	1.00005145
17 38	19433842.385	30.74487	1.00004839
17 39	19431997.693	30.74483	1.00004541
17 40	19430153.003	30.74479	1.00004251
17 41	19428308.315	30.74476	1.00003970
17 42	19426463.630	30.74473	1.00003697
17 43	19424618.946	30.74470	1.00003432
17 44	19422774.264	30.74468	1.00003176
17 45	19420929.583	30.74465	1.00002928
17 46	19419084.904	30.74463	1.00002689
17 47	19417240.226	30.74462	1.00002458
17 48	19415395.549	30.74460	1.00002235
17 49	19413550.873	30.74459	1.00002021
17 50	19411706.197	30.74458	1.00001815
17 51	19409861.523	30.74457	1.00001618
17 52	19408016.848	30.74457	1.00001429
17 53	19406172.174	30.74457	1.00001248
17 54	19404327.500	30.74457	1.00001076
17 55	19402482.826	30.74457	1.00000912
17 56	19400638.152	30.74458	1.00000757
17 57	19398793.477	30.74459	1.00000609
17 58	19396948.802	30.74460	1.00000471
17 59	19395104.126	30.74461	1.00000340
18 0	19393259.449	30.74463	1.00000219
18 1	19391414.772	30.74465	1.00000105
18 2	19389570.093	30.74467	1.00000000
18 3	19387725.413	30.74469	0.99999903
18 4	19385880.731	30.74472	0.99999815
18 5	19384036.048	30.74475	0.99999735
18 6	19382191.363	30.74478	0.99999664
18 7	19380346.676	30.74482	0.99999601
18 8	19378501.987	30.74486	0.99999546
18 9	19376657.295	30.74490	0.99999500
18 10	19374812.601	30.74494	0.99999462
18 11	19372967.905	30.74498	0.99999432
18 12	19371123.206	30.74503	0.99999411
18 13	19369278.504	30.74508	0.99999399
18 14	19367433.799	30.74514	0.99999394

3

Lambert conformal conic projection tables
PUERTO RICO & VI

Lat	R (meters)	tab diff.	k
18 15'	19365589.091	30.74519	0.99999399
18 16	19363744.379	30.74525	0.99999411
18 17	19361899.664	30.74531	0.99999432
18 18	19360054.945	30.74538	0.99999462
18 19	19358210.223	30.74544	0.99999499
18 20	19356365.496	30.74551	0.99999546
18 21	19354520.765	30.74558	0.99999600
18 22	19352676.030	30.74566	0.99999663
18 23	19350831.291	30.74574	0.99999735
18 24	19348986.547	30.74582	0.99999815
18 25	19347141.798	30.74590	0.99999903
18 26	19345297.044	30.74598	1.00000000
18 27	19343452.285	30.74607	1.00000105
18 28	19341607.521	30.74616	1.00000219
18 29	19339762.751	30.74625	1.00000341
18 30	19337917.976	30.74635	1.00000471
18 31	19336073.195	30.74645	1.00000610
18 32	19334228.408	30.74655	1.00000757
18 33	19332383.615	30.74665	1.00000913
18 34	19330538.816	30.74676	1.00001077
18 35	19328694.011	30.74687	1.00001250
18 36	19326849.199	30.74698	1.00001431
18 37	19325004.380	30.74709	1.00001620
18 38	19323159.555	30.74721	1.00001818
18 39	19321314.722	30.74733	1.00002024
18 40	19319469.882	30.74745	1.00002239

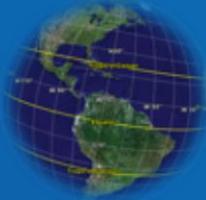




NGS Geodetic Tool Kit

- Son una serie de programas interactivos en línea o que se pueden bajar para hacer conversiones de coordenadas y otras cosas. Usaremos los siguientes:
 - *State Plane Coordinates*
 - *Universal Transverse Mercator Coordinates*
 - NADCON
 - *XYZ Coordinate Conversion*





NGS Geodetic Tool Kit ¿Como acezarlos?

<http://www.ngs.noaa.gov>

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- NGS Releases Updated Ten-Year Strategic Plan 2013-2023, 01.24.2013
- NGS Announces Joint Beta Release of GEOCON and GEOCON11, 01.18.2013
- NGS updates "Bluebooking" process for GPS projects, 11.27.2012
- DEFLEC12A and USDOV2012 Models Released, 10.19.2012
- GEOID12A Model Released, 09.11.2012

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- 02/21/2013 - NGS and Other NOS Offices Present Roundtable Discussion on New Hampshire Coastal Management Issues
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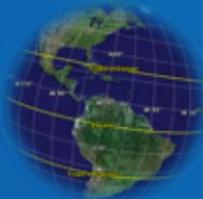
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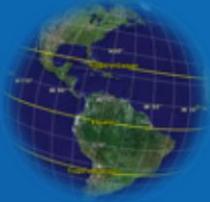
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To learn more about a particular online program, click on its link for a description:

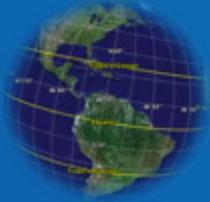
DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON
GEOID06	Online Adjustment Utilities User Services	XYZ Coordinate Conversion
USGG2003	OPUS	
HTDP	State Plane Coordinates	
IGLD85		
Inverse/Forward/Invers3D/Forwrd3D		



Conversión de coordenadas mediante el uso de los *NGS Geodetic Tool Kit*

- *State Plane Coordinates*
 - *GPPCGP*: Convierte de Coordenadas Planas Estatales del NAD27 a coordenadas geograficas del NAD27 (latitudes y longitudes) y viceversa.
 - *SPCS83*: Convierte de Coordenadas Planas Estatales del NAD83 a coordenadas geograficas del NAD83 (latitudes y longitudes) y viceversa.
- *Universal Transverse Mercator Coordinates*
 - Convierte de Coordenadas UTM a coordenadas geográficas NAD27 o NAD83 (latitudes y longitudes) y viceversa.





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit*

- NADCON
 - Transforma entre coordenadas geográficas del NAD27 y Hawaiian, Puerto Rico y Alaska datum a valores de NAD83 y viceversa.
- *XYZ Coordinate Conversion*
 - Convierte entre coordenadas cartesianas (XYZ) con centro en el elipsoide GRS80 a coordenadas geográficas del NAD83



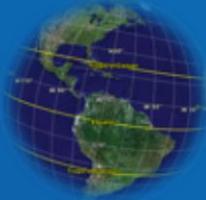


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 1

- Practica 1:
 - Teniendo las coordenadas planas estatales NAD83 (SPC PRVI NAD83), del punto Frio en Humacao.
 - Computa las coordenadas geográficas NAD83.

SPC PRVI NAD83	
Norte (m)	Este (m)
252,476.700	259,590.870





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 1

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

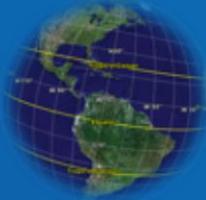
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To learn more about a particular online program, click on its link for a description:

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DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 1

SPC UTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOSS/SPC.html

Geodetic Toolkit: SPC

State Plane Coordinates

The State Plane Coordinate system provides coordinates on a flat grid for easy computation while maintaining a difference between geodetic and grid distance of one part in 10,000 or better.

The State Plane Coordinate system divides the U.S. into a hundred or more distinct grid surfaces (Zones).

Do not mix coordinates from one Zone with that in another. In you need to cross Zone boundaries, use Geodetic Positions.

The utilities in this package provide methods for converting between Geodetic Positions and State Plane Coordinates or for finding an SPC Zone.

For more information about the State Plane Coordinate System contact:
The National Geodetic Survey Information Services Branch
phone: (301) 713-3242; Fax:(301) 713-4172 [Mon.-Fri., 7:00 a.m. - 4:30 p.m. EST]
[ansi](#)

Interactive Conversions

- [Latitude/Longitude to SPC](#)
- [SPC to Latitude/Longitude](#)
- [Point Data](#)

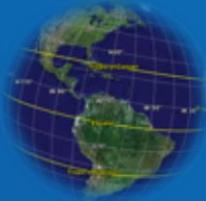
PC Program

- [Download SPCS83](#)

See the text version of an [article](#) about computing State Plane Coordinates that appeared in the *Professional Surveyor* magazine, January 2004 Volume 24, Number 1

2





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit – Practica 1*

NGS SPC TO GEODETIC - Windows Internet Explorer provided

http://www.ngs.noaa.gov/cgi-bin/spc_getgp.prl

NGS SPC TO GEODETIC



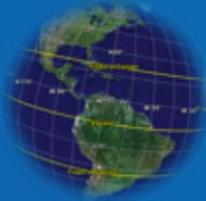
3 This page is maintained by [NGS Software Requests](#)

4 This utility uses NGS program [SPCS83](#) or program [GPPC](#)

5 to convert State Plane Coordinates (SPC)

6 to Geodetic Positions





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 1

NGS SPC RESULTS - Windows Internet Explorer provided by Yahoo!

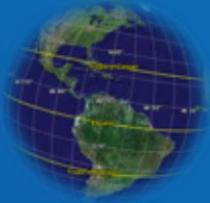
http://www.ngs.noaa.gov/cgi-bin/spc_getgp.prl

Favorites NGS SPC RESULTS

Resultado

	North (Meters)	East (Meters)	Datum	Zone
INPUT =	252476.700	259590.870	NAD83	5200



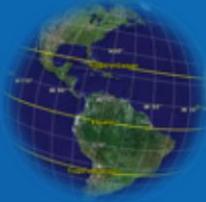


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 2

- Practica 2:
 - Teniendo las coordenadas geográficas NAD83, del punto Frio en Humacao.
 - Computa las coordenadas planas estatales NAD83 (SPC PRVI NAD83).

NAD83	
Latitud	Longitud
18° 18'23.86483" N	65° 52'10.79346" W





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 2

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

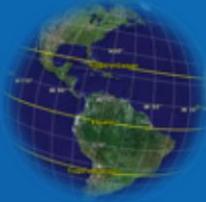
See the text version of an article about the NGS Geodetic Toolkit that appeared in the *Professional Surveyor* magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 2

SPC UTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOSS/SPC.html

Geodetic Toolkit: SPC

State Plane Coordinates

The State Plane Coordinate system provides coordinates on a flat grid for easy computation while maintaining a difference between geodetic and grid distance of one part in 10,000 or better.

The State Plane Coordinate system divides the U.S. into a hundred or more distinct grid surfaces (Zones).

Do not mix coordinates from one Zone with that in another. In you need to cross Zone boundaries, use Geodetic Positions.

The utilities in this package provide methods for converting between Geodetic Positions and State Plane Coordinates or for finding an SPC Zone.

For more information about the State Plane Coordinate System contact:
The National Geodetic Survey Information Services Branch
phone: (301) 713-3242; Fax:(301) 713-4172 [Mon.-Fri., 7:00 a.m. - 4:30 p.m. EST]
[amsi](#)

Interactive Conversions

- [Latitude/Longitude to SPC](#)
- [SPC to Latitude/Longitude](#)
- [Final Zone](#)

PC Program

- [Download SPCS83](#)

See the text version of an [article](#) about computing State Plane Coordinates that appeared in the *Professional Surveyor* magazine, January 2004 Volume 24, Number 1

2





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 2

NGS GEODETIC TO SPC - Windows Internet Explorer provided by Yahoo!



http://www.ngs.noaa.gov/cgi-bin/spc_getpc.prl

★ Favorites

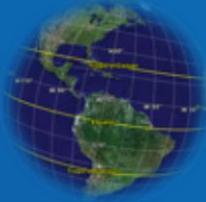
NGS GEODETIC TO SPC



3 This page is maintained by [NGS Software Requests](#)

4 This utility uses NGS program [SPCS83](#) or program [GPPCGP](#)
5 to convert NAD83 or NAD27 Geodetic Positions
to State Plane Coordinates (SPC)





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 2

NGS SPC RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/spc_getpc.prl

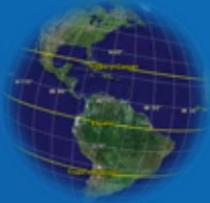
NGS SPC RESULTS

```
=====
Latitude           Longitude          Datum Zone
INPUT =  N181823.86483  W0655210.79346  NAD83  5200
=====
```

NORTH (Y) METERS	EAST (X) METERS	AREA	CONVERGENCE DD MM SS.ss	SCALE
252476.700	259590.870	PRVI	0 10 34.91	0.99999476

Resultado



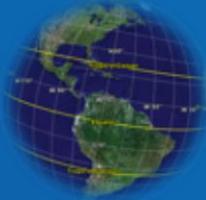


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 3

- Practica 3:
 - Teniendo las coordenadas geográficas NAD83, del punto Frio en Humacao.
 - Computa las coordenadas geográficas del Puerto Rico Datum (27).

NAD83	
Latitud	Longitud
18° 18'23.86483" N	65° 52'10.79346" W





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 3

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

1

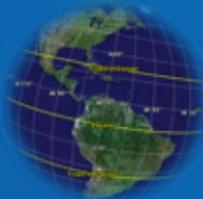
See the text version of an article about the NGS Geodetic Toolkit that appeared in the *Professional Surveyor* magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
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GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit – Practica 3*

NADCON - North American Datum Conversion - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/nadcon/nadcon.shtml

Geodetic Toolkit: NADCON

NADCON - North American Datum Conversion Utility

NAD 83 - NAD 27 Datum Shifts in Seconds of Arc

NADCON

The readjustment of the North American Datum of 1927 (NAD 27), Old Hawaiian Datum and Puerto Rico Datum to the North American Datum of 1983 (NAD 83 (1986)) in July 1996 was both a change in reference ellipsoid and a "clean up" of nearly 100 years of surveying data held by NGS. Based on this readjustment and redefinition, positions of points can change between 10 - 100 meters, in the conterminous United States, more than 300 meters in Alaska, Puerto Rico and the Virgin Island and in excess of 400 meters in Hawaii. Consequently, the shift between the various datums are not uniform across the United States and there is no single value that can be applied to latitudes or to longitudes based on old datums to convert them to NAD 83. NADCON was developed in order to facilitate conversion between the datums. The grids used by the program are based on more than 150,000 horizontal control points whose coordinates reside in NGS' data base, and provide transformed positions based on the shifts of the control nearest to the input position.

Advances in the accuracies now obtainable in geodetic surveys, specifically through use of differential GPS, has allowed for the creation of state High Precision Geodetic Networks (HPGNs), also referred to as High Accuracy Reference Networks (HARNs) throughout the country. NAD 83 coordinates based on the HPON/HARN surveys changed approximately 0.2 to 1.0 meter relative to the original NAD 83 (1986) adjustment. As these high accuracy networks have been completed, the horizontal geodetic network of each state has been re-adjusted to be consistent with its network of A- and B-order control, thus creating a seed for grids that allow for the transformation from the NAD 83(86) adjustment to the new adjusted values. These grids carry the designation HPON to distinguish them from the grids created from the original NAD 83(86) adjustment.

The accuracy of transformations between NAD 27 and NAD 83 (1986) are typically 12-18 cm and 3-6 cm between NAD 83 (1986) and HPGN.

NADCON is the Federal standard for NAD 27 to NAD 83 datum transformations.

- [NADCON Documentation](#)
- [Download the NADCON program and Data Grids for PC, interactive.](#)
- [Interactively compute a datum shift between NAD 27 and NAD 83.](#)
- [HPGNs and their conversion to NAD 83 \(1986\) and HARNs.](#)

Also available on-line: [NADCON: The Application of Minimum-Corvature-Derived Surfaces in the Transformation of Positional Data From the North American Datum of 1927 to the North American Datum of 1983](#). NOAA TM NOS NGS 10

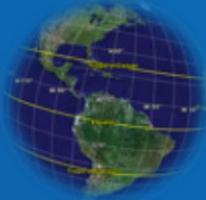
- NOAA's Coastal Services Center offers a [web-based utility](#) that does NADCON conversions using shapefiles as input and output.
- See the text version of an [article](#) about NADCON that appeared in the *Professional Surveyor* magazine, February 2004 Volume 24, Number 2

For more information, or to comment on this Web Page, contact [Cindy Clair](#)

return to [NSA HOME PAGE](#)

Internet 2005





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 3

NADCON computations - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/nadcon.pl

NADCON computations

NADCON computations

Use **NADCON** (North American Datum Conversion) to convert latitude and longitude from NAD 27 to NAD 83 or from NAD 83 to NAD 27.

Computations may be performed for a specific geographical location or for a [file of input points](#).

Compute a datum shift for a specific location:

Select direction of conversion:

NAD 27 to NAD 83 NAD83 to NAD 27

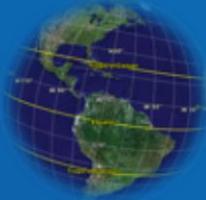
The three formats below may be used for entering latitudes and longitudes. The latitude and longitude must both be positive and will be interpreted as north latitude and west longitude. Degrees, minutes and seconds may be separated by spaces or commas.

Degrees, Minutes, and Seconds

4

5





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 3

NADCON - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/nadcon.prl

NADCON

Output from NADCON for station FRIO

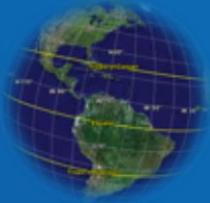
North American Datum Conversion
NAD 83 to NAD 27
NADCON Program Version 2.11

Transformation #: 1

	Latitude
NAD 27 datum values:	18 18 31.03570
NAD 83 datum values:	18 18 23.86483
NAD 27 - NAD 83 shift values:	7.17087

Resultado



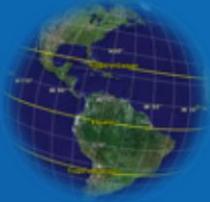


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 4

- Practica 4:
 - Teniendo las coordenadas geográficas NAD83, del punto Frio en Humacao.
 - Computa las coordenadas planas estatales del Puerto Rico Datum (27).

NAD83	
Latitud	Longitud
18° 18'23.86483" N	65° 52'10.79346" W

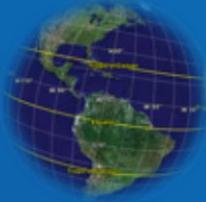




Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 4

- Obtenga las coordenadas geográficas para NAD27 según la Practica 3.
- Luego utilícelas como se muestra a continuación.





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 4

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

See the text version of an article about the NGS Geodetic Toolkit that appeared in the *Professional Surveyor* magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 4

SPC UTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOSS/SPC.html

Geodetic Toolkit: SPC

State Plane Coordinates

The State Plane Coordinate system provides coordinates on a flat grid for easy computation while maintaining a difference between geodetic and grid distance of one part in 10,000 or better.

The State Plane Coordinate system divides the U.S. into a hundred or more distinct grid surfaces (Zones).

Do not mix coordinates from one Zone with that in another. In you need to cross Zone boundaries, use Geodetic Positions.

The utilities in this package provide methods for converting between Geodetic Positions and State Plane Coordinates or for finding an SPC Zone.

For more information about the State Plane Coordinate System contact:
The National Geodetic Survey Information Services Branch
phone: (301) 713-3242; Fax:(301) 713-4172 [Mon.-Fri., 7:00 a.m. - 4:30 p.m. EST]
[ansi](#)

Interactive Conversions

- [Latitude/Longitude to SPC](#)
- [SPC to Latitude/Longitude](#)
- [Final Zone](#)

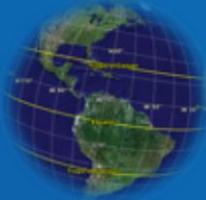
PC Program

- [Download SPCS83](#)

See the text version of an [article](#) about computing State Plane Coordinates that appeared in the *Professional Surveyor* magazine, January 2004 Volume 24, Number 1

2





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 4

NGS GEODETTIC TO SPC - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/spc_getpc.prl

NGS GEODETTIC TO SPC

 **GEODETTIC**

This page is maintained by [NGS Software Requests](#)

3 This utility uses ~~NGS~~ program [SPCS83](#) or program [GPPCGP](#)

4 to convert ~~NAD83 or NAD27~~ Geodetic Positions to State Plane Coordinates (SPC)

5 →

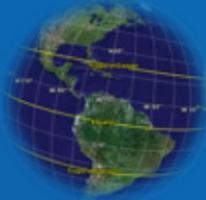
NAD83 (SPCS83)

NAD27 (GPPCGP)

LATITUDE = example = N385930.99999

LONGITUDE = example = W0985930.99999





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 4

NGS SPC RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/spc_getpc.prl

NGS SPC RESULTS

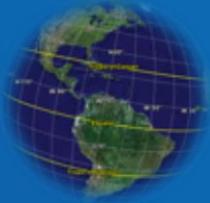
```
=====
Latitude      Longitude     Datum Zone
INPUT =  N181831.03570  W0655212.20380  PR  5201
=====

EAST (X)      NORTH (Y)     AREA  CONVERGENCE  SCALE
FEET          FEET          DD MM SS.ss

-----
695372.447   172881.050  PR    0 10 34.47  0.9999948025
-----
```

Resultado



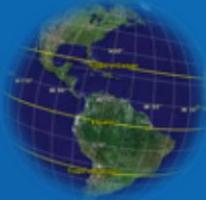


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

- Practica 5:
 - Teniendo las coordenadas planas estatales del Puerto Rico Datum (27), del punto Frio en Humacao.
 - Computa las coordenadas planas estatales NAD83 (SPC PRVI NAD83).

SPC PRVI NAD27	
Norte (ft)	Este (ft)
172881.050	695372.447





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

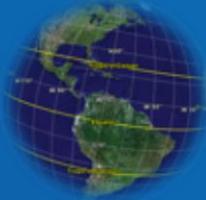
See the text version of an article about the NGS Geodetic Toolkit that appeared in the *Professional Surveyor* magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

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DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

SPC UTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOSS/SPC.html

Geodetic Toolkit: SPC

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The National Geodetic Survey Information Services Branch
phone: (301) 713-3242; Fax:(301) 713-4172 [Mon.-Fri., 7:00 a.m. - 4:30 p.m. EST]
[amsi](#)

Interactive Conversions

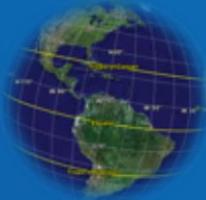
- [Latitude/Longitude to SPC](#)
- [SPC to Latitude/Longitude](#)
- [Point Name](#)

PC Program

- [Download SPCS83](#)

See the text version of an [article](#) about computing State Plane Coordinates that appeared in the *Professional Surveyor* magazine, January 2004 Volume 24, Number 1





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

NGS SPC TO GEODETIC - Windows Internet Explorer provided by Yahoo!

← → http://www.ngs.noaa.gov/cgi-bin/spc_getgp.prl

★ Favorites [NGS SPC TO GEODETIC](#)



3 This page is maintained by [NGS Software Requests](#)

4 This utility uses NGS program [SPCS83](#) or program [GPPCGP](#)

5 → to convert State Plane Coordinates (SPC)
to Geodetic Positions





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

NGS SPC RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/spc_getgp.prl

NGS SPC RESULTS

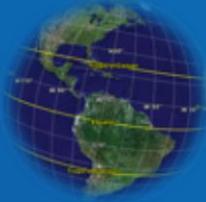
	North (Feet)	East (Feet)	Datum	Zone
INPUT =	172881.050	695372.447	PR	5201

LATITUDE	LONGITUDE	AREA
DD MM SS.sssss	DDD MM SS.sssss	
18 18 31.03569	65 52 12.20383	5201

6

Importante: Las coordenadas geográficas resultantes son del PR Datum (NAD27), se debe utilizar NADCOM para convertirlas a sistema NAD83.





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

7

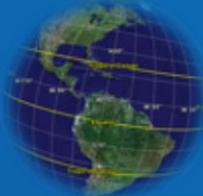
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Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit – Practica 5*

NADCON - North American Datum Conversion - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/nadcon/nadcon.shtml

Geodetic Toolkit: NADCON

NADCON - North American Datum Conversion Utility

NAD 83 - NAD 27 Datum Shifts in Seconds of Arc

NADCON

The readjustment of the North American Datum of 1927 (NAD 27), Old Hawaiian Datum and Puerto Rico Datum to the North American Datum of 1983 (NAD 83 (1986)) in July 1996 was both a change in reference ellipsoid and a "clean up" of nearly 100 years of surveying data held by NGS. Based on this readjustment and redefinition, positions of points can change between 10 - 100 meters, in the conterminous United States, more than 300 meters in Alaska, Puerto Rico and the Virgin Island and in excess of 400 meters in Hawaii. Consequently, the shift between the various datums are not uniform across the United States and there is no single value that can be applied to latitudes or to longitudes based on old datums to convert them to NAD 83. NADCON was developed in order to facilitate conversion between the datums. The grids used by the program are based on more than 150,000 horizontal control points whose coordinates reside in NGS' data base, and provide transformed positions based on the shifts of the control nearest to the input position.

Advances in the accuracies now obtainable in geodetic surveys, specifically through use of differential GPS, has allowed for the creation of state High Precision Geodetic Networks (HPGNs), also referred to as High Accuracy Reference Networks (HARNs) throughout the country. NAD 83 coordinates based on the HPON/HARN surveys changed approximately 0.2 to 1.0 meter relative to the original NAD 83 (1986) adjustment. As these high accuracy networks have been completed, the horizontal geodetic network of each state has been re-adjusted to be consistent with its network of A- and B-order control, thus creating a seed for grids that allow for the transformation from the NAD 83(86) adjustment to the new adjusted values. These grids carry the designation HPON to distinguish them from the grids created from the original NAD 83(86) adjustment.

The accuracy of transformations between NAD 27 and NAD 83 (1986) are typically 12-18 cm and 3-6 cm between NAD 83 (1986) and HPGN.

NADCON is the Federal standard for NAD 27 to NAD 83 datum transformations:

- [NADCON Documentation](#)
- [Download the NADCON program and Data Grids for PC, spreadsheet.](#)
- [Interactively compute a datum shift between NAD 27 and NAD 83.](#)
- [HPGNs: the vertical datum shift between NAD 83 and HPON.](#)

Also available on-line: [NADCON: The Application of Minimum-Curvature-Derived Surfaces in the Transformation of Positional Data From the North American Datum of 1927 to the North American Datum of 1983](#). NOAA TM NOS NGS 10

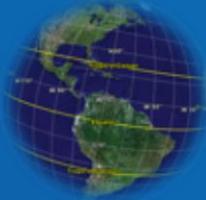
- NOAA's Coastal Services Center offers a [web-based utility](#) that does NADCON conversions using shapefiles as input and output.
- See the text version of an [article](#) about NADCON that appeared in the *Professional Surveyor* magazine, February 2004 Volume 24, Number 2

For more information, or to comment on this Web Page, contact [Cindy Clair](#)

return to [NSA HOME PAGE](#)

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Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

NADCON computations - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/nadcon.prl

NADCON computations

NADCON computations

Use NADCON (North American Datum Conversion) to convert latitude and longitude from NAD 27 to NAD 83 or from NAD 83 to NAD 27.

9 Computations may be performed for a specific geographical location or for a [file of input points](#).

Compute a datum shift for a specific location:

Select direction of conversion:

10 NAD 27 to NAD 83 NAD83 to NAD 27

The three formats below may be used for entering latitudes and longitudes. The latitude and longitude must both be positive and will be interpreted as north latitude and west longitude. Degrees, minutes and seconds may be separated by spaces or commas.

11 →

... Degrees, Minutes, and Seconds





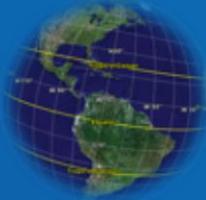
Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

```
NADCON - Windows Internet Explorer provided by Yahoo!  
http://www.ngs.noaa.gov/cgi-bin/nadcon.pl  
NADCON  
Output from NADCON for station FRIO  
  
North American Datum Conversion  
NAD 27 to NAD 83  
NADCON Program Version 2.11  
  
-----  
  
Transformation #: 1      Region: Puerto Rico, Vi  
  
Latitude      Longitude  
NAD 27 datum values:  18 18 31.03569      65 52 12.20383  
NAD 83 datum values:  18 18 23.86482      65 52 10.79346  
NAD 83 - NAD 27 shift values:      -7.17087      -1.41037 (secs.)  
                        -220.472      -41.418 (meters)  
  
Magnitude of total shift:      224.329(meters)
```

12

Importante: Las coordenadas resultantes son geográficas del NAD83, se debe utilizar *State Plane Coordinates* para convertirlas a coordenadas planas estatales NAD83 (SPC PRVI NAD83).





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

See the text version of an article about the NGS Geodetic Toolkit that appeared in the *Professional Surveyor* magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

SPC UTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOSS/SPC.html

Geodetic Toolkit: SPC

State Plane Coordinates

The State Plane Coordinate system provides coordinates on a flat grid for easy computation while maintaining a difference between geodetic and grid distance of one part in 10,000 or better.

The State Plane Coordinate system divides the U.S. into a hundred or more distinct grid surfaces (Zones).

Do not mix coordinates from one Zone with that in another. In you need to cross Zone boundaries, use Geodetic Positions.

The utilities in this package provide methods for converting between Geodetic Positions and State Plane Coordinates or for finding an SPC Zone.

For more information about the State Plane Coordinate System contact:
The National Geodetic Survey Information Services Branch
phone: (301) 713-3242; Fax:(301) 713-4172 [Mon.-Fri., 7:00 a.m. - 4:30 p.m. EST]
[ansi](#)

Interactive Conversions

- [Latitude/Longitude to SPC](#)
- [SPC to Latitude/Longitude](#)
- [Final Zone](#)

PC Program

- [Download SPCS83](#)

See the text version of an [article](#) about computing State Plane Coordinates that appeared in the *Professional Surveyor* magazine, January 2004 Volume 24, Number 1

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Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

NGS GEODETTIC TO SPC - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/spc_getpc.prl

NGS GEODETTIC TO SPC

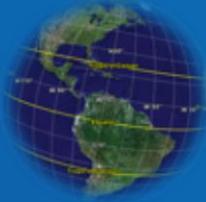


15 This page is maintained by [NGS Software Requests](#)

16

17 This utility uses NGS program [SPCS83](#) or program [GPPCGP](#) to convert NAD83 or NAD27 Geodetic Positions to State Plane Coordinates (SPC)





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 5

NGS SPC RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/spc_getpc.prl

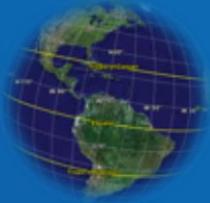
NGS SPC RESULTS

```
=====
Latitude           Longitude          Datum Zone
INPUT =  N181823.86483  W0655210.79346  NAD83  5200
=====
```

NORTH (Y) METERS	EAST (X) METERS	AREA	CONVERGENCE DD MM SS.ss	SCALE
252476.700	259590.870	PRVI	0 10 34.91	0.99999476

Resultado



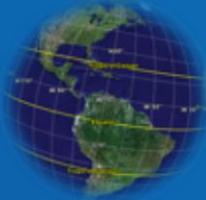


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 6

- Practica 6:
 - Teniendo las coordenadas geográficas NAD83, del punto Frio en Humacao.
 - Computa las coordenadas del sistema UTM con su numero de zona.

NAD83	
Latitud	Longitud
18° 18'23.86483" N	65° 52'10.79346" W





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 6

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

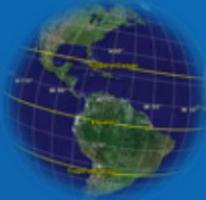
See the text version of an article about the NGS Geodetic Toolkit that appeared in the Professional Surveyor magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 6

UTMUTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOOLKIT/utm.html

UTM UTILITIES

Geodetic Toolkit: UTM

Universal Transverse Mercator Coordinates

Important Note

A problem has been found with UTM that produces incorrect results for the southern hemisphere. The problem has not yet been corrected. This notice will be removed once the program has been corrected.

The Universal Transverse Mercator Coordinate (UTM) system provides coordinates on a world wide flat grid for easy computation.

The Universal Transverse Mercator Coordinate system divides the World into 60 zones, each being 6 degrees longitude wide, and extending from 80 degrees south latitude to 84 degrees north latitude. The polar regions are excluded. The first zone starts at the International Date Line (longitude 180 degrees) proceeding eastward.

Do not mix coordinates from one zone with that in another. In you need to cross zone boundaries, use Geodetic Positions.

The utilities in this package provide methods for converting between Geodetic Positions and UTM.

For more information about the UTM contact:
The National Imagery and Mapping Agency (NIMA)
at http://earth-info.nga.mil/GandG/publications/20083382/20083382_2.pdf
for publication "TM 8338.2, The Universal Grids: Universal Transverse Mercator (UTM) and Universal Polar Stereographic (UPS) "
or The National Geospatial Survey Information Services Branch
phone: (301) 713-3242, Fax: (301) 713-4172 [Mon -Fri, 7:00 am - 4:30 p.m. EST]
[email](mailto:utm@ngs.noaa.gov)

Interactive Conversions

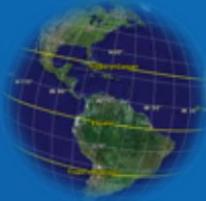
- **Latitude/Longitude -> UTM**
- UTM -> Latitude/Longitude

PC Program

- Download [UTM6](#)

2





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 6

NGS GEODETTIC TO UTM - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/utm_getut.prl

★ Favorites NGS GEODETTIC TO UTM

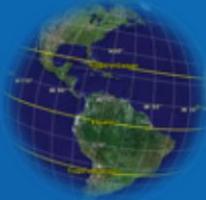


3 This page is maintained by [NGS Software Requests](#)

4 This utility uses NGS program [UTMS](#)
to convert NAD83 or NAD27 Geodetic Positions

5 → to Universal Transverse Mercator (UTM)





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 6

NGS UTM RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/utm_getut.prl

NGS UTM RESULTS

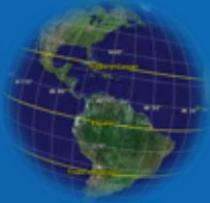
```
=====
                Latitude           Longitude           Datum
INPUT =         N181823.86483      W0655210.79346    NAD83
=====

NORTH (Y)       EAST (X)         ZONE  CONVERGENCE     SCALE
METERS          METERS                DD MM SS.ss

-----
2026497.987     196636.634           20    -0 54  7.42      1.00073791
-----
```

Resultado



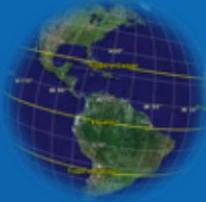


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 7

- Practica 7:
 - Teniendo las coordenadas del sistema UTM con su numero de zona, del punto Frio en Humacao.
 - Computa las coordenadas geográficas NAD83.

Coordenadas UTM		
Norte (m)	Este (m)	Zona
2,026,497.987	196,636.634	20





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 7

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

See the text version of an article about the NGS Geodetic Toolkit that appeared in the Professional Surveyor magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 7

UTMUTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/GTOOLKIT/utm.html

Geodetic Toolkit: UTM

Universal Transverse Mercator Coordinates

Important Note

A problem has been found with UTM that produces incorrect results for the southern hemisphere. The problem has not yet been corrected. This notice will be removed once the program has been corrected.

The Universal Transverse Mercator Coordinate (UTM) system provides coordinates on a world wide flat grid for easy computation.

The Universal Transverse Mercator Coordinate system divides the World into 60 zones, each being 6 degrees longitude wide, and extending from 80 degrees south latitude to 84 degrees north latitude. The polar regions are excluded. The first zone starts at the International Date Line (longitude 180 degrees) proceeding eastward.

Do not mix coordinates from one zone with that in another. In you need to cross zone boundaries, use Geodetic Positions.

The utilities in this package provide methods for converting between Geodetic Positions and UTM.

For more information about the UTM contact:
The National Imagery and Mapping Agency (NIMA)
at http://earth-info.nga.mil/GandG/publications/20083382/20083382_2.pdf
for publication "TM 8338.2, The Universal Grids: Universal Transverse Mercator (UTM) and Universal Polar Stereographic (UPS) "
or The National Geodetic Survey Information Services Branch
phone: (301) 713-3242, Fax: (301) 713-4172 [Mon -Fri, 7:00 am - 4:30 pm EST]
[email](#)

Interactive Conversions

- [Latitude Longitude -> UTM](#)
- [UTM -> Latitude Longitude](#)

PC Program

- [Download UTM](#)

2





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 7

NGS UTM TO GEODETIC - Windows Internet Explorer provided

http://www.ngs.noaa.gov/cgi-bin/utm_getgp.prl

NGS UTM TO GEODETIC



3 → This page is maintained by [NGS Software Requests](#)

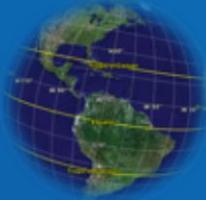
4 → **This utility uses NGS program [UTMS](#)**

5 → **to convert Universal Transverse Mercator Coordinates (**

6 → **to Geodetic Positions**

7 → Northern Hemisphere Southern Hemisphere





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 7

NGS UTM RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/utm_getgp.pr

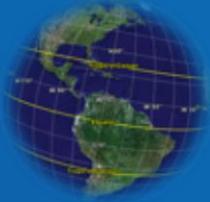
Favorites NGS UTM RESULTS

```
=====
                North (Meters)      East (Meters)      Datum      Zone
INPUT = 2026497.987      196636.634      NAD83      20
=====

LATITUDE          LONGITUDE          ZONE  CONVERGENCE  SCALE FACTOR
DD MM SS.sssss   DDD MM SS.sssss   DD MM SS.ss
-----
18 18 23.86483 N 065 52 10.79345 W 20 - 0 54 7.42 1.00073791
=====
```

Resultado



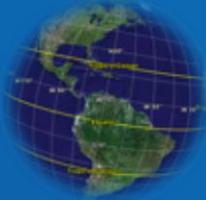


Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 8

- Practica 8:
 - Teniendo las coordenadas geográficas NAD83, del punto 975 5371 A TIDAL en San Juan.
 - Computa las coordenadas cartesianas (XYZ) en el elipsoide GRS80.

NAD83		
Latitud	Longitud	Ellipsoid Height
18° 27' 32.23631" N	66° 06' 59.20616" W	-41.644 m





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 8

The NGS Geodetic Tool Kit - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/

The NGS Geodetic Tool Kit

NGS Geodetic Tool Kit

on-line interactive computation of geodetic values

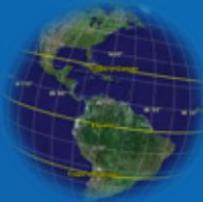
See the text version of an article about the NGS Geodetic Toolkit that appeared in the Professional Surveyor magazine, May 2003 Volume 23, Number 4

(See all the Professional Surveyor Articles about the NGS Geodetic Toolkit)

To learn more about a particular online program, click on its link for a description:

DEFLEC99	LVL_DH	Surface Gravity Prediction
DYNAMIC_HT	Magnetic Declination	Tidal and Orthometric Elevations
G99SSS	NADCON	U.S. National Grid
GEOID99	NAVD 88 Modelled Gravity	Universal Transverse Mercator Coordinates
GEOID03	Online Adjustment User Services	VERTCON





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 8

XYZ UTILITIES - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/TOOLS/XYZ/xyz.shtml

Geodetic Toolkit: XYZ

XYZ Conversion

$P(X, Y, Z) = P(\phi, \lambda, h)$

Earth's Surface

Cartesian Coordinates (XYZ) allow for Geodetic quality three dimensional positioning on an earth centered ellipsoid.

The utilities in this package provide methods for converting between Geodetic Latitude-Longitude-Ellipsoid_Ht and XYZ on the GRS80 Ellipsoid.

For more information about the XYZ coordinates contact:
or The National Geodetic Survey Information Services Branch
phone: (301) 713-3242; Fax:(301) 713-4172 [Mon.-Fri., 7:00 a.m. - 4:30 p.m. EST]
[email](#)

Interactive Conversions

- Latitude/Longitude/Height -> XYZ
- XYZ -> Latitude/Longitude/Height

PC Program

Done

Internet 100%

2





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 8

NGS GEODETTIC TO XYZ - Windows Internet Explorer provide

http://www.ngs.noaa.gov/cgi-bin/xyz_getxyz.prl

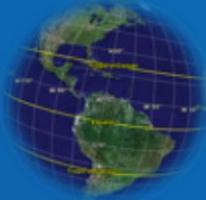
Favorites NGS GEODETTIC TO XYZ



This page is maintained by [NGS Software Requests](#)

3 This utility converts
Latitude, Longitude, and Ellipsoid Height
4 to
XYZ





Conversión de coordenada mediante el uso de los *NGS Geodetic Tool Kit* – Practica 8

NGS XYZ RESULTS - Windows Internet Explorer provided by Yahoo!

http://www.ngs.noaa.gov/cgi-bin/xyz_getxyz.prl

NGS XYZ RESULTS

```
=====
      Latitude      Longitude      Ellip_Ht      Ellipsoid
INPUT =  N182732.23631  W0660659.20616  -41.644      GRS80
=====

X (Meters)  Y (Meters)  Z (Meters)  ELLIPSOID
-----
2450319.7137  -5533748.4971  2006620.1224  GRS80
```

Resultado





RevistaTP.com

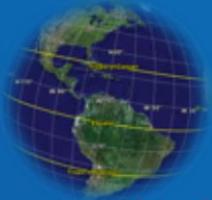


www.revistatp.com

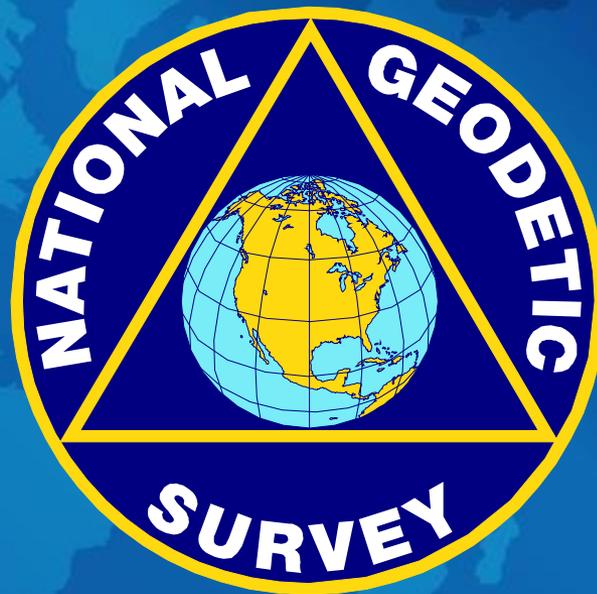
“Dominio” al servicio de la comunidad
geo-espacial

www.gitpr.org





GOOD COORDINATION BEGINS WITH GOOD COORDINATES



GEOGRAPHY WITHOUT GEODESY IS A FELONY

