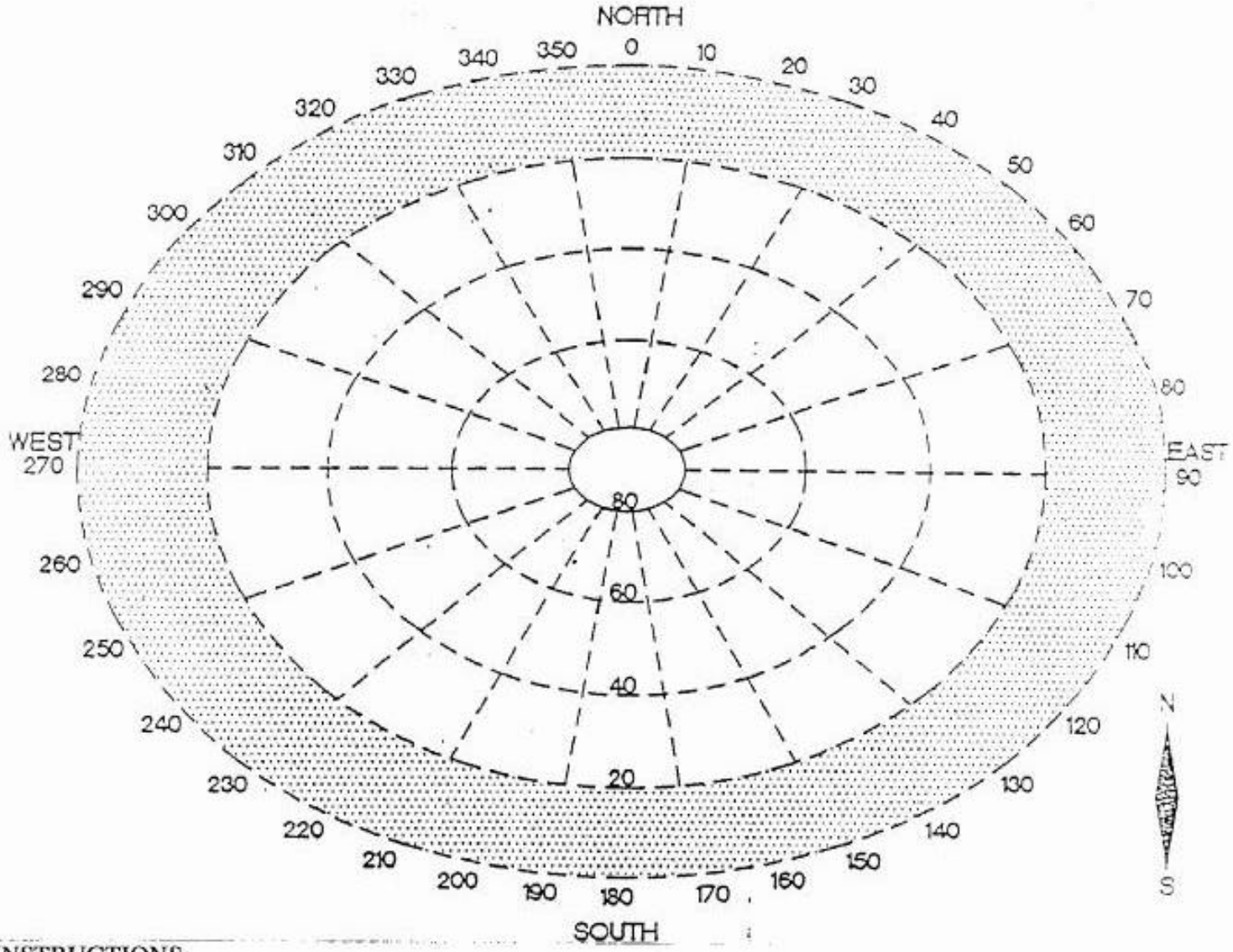
GPS SATELLITE VISIBILITY OBSTRUCTION DATA SHEET



INSTRUCTIONS:

Identify obstructions by azimuth (magnetic) and elevation angle (above the horizon) as seen from the station mark. Indicate the direction and distance to nearby metallic structures and reflective surfaces (potential multipath sources). Indicate distance, direction, frequency, and power (if known) of nearvy HF microwave radio transmitters.

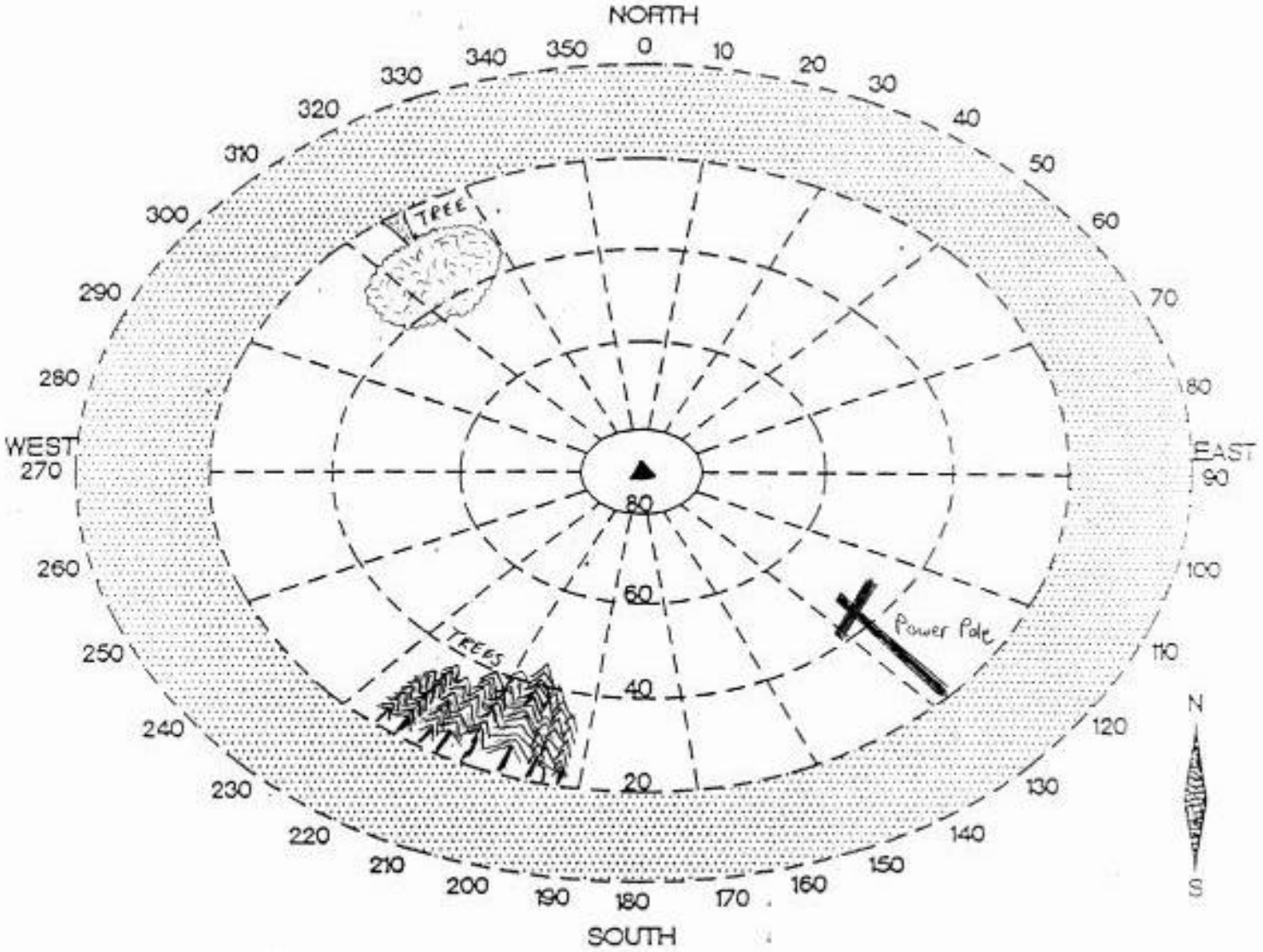
Station Name (& PID if existing NSRS station) _____

Airport Name or ID (PACS / SACS / OTHER) _____
Circle One

Reconnaissance By (Name, Organization,& Date) _____

Height of Observer's Eye (Above Station Mark) _____ feet/meters _____

GPS SATELLITE VISIBILITY OBSTRUCTION DATA SHEET



INSTRUCTIONS:

Identify obstructions by azimuth (magnetic) and elevation angle (above the horizon) as seen from the station mark. Indicate the direction and distance to nearby metallic structures and reflective surfaces (potential multipath sources). Indicate distance, direction, frequency, and power (if known) of nearvy HF microwave radio transmitters.

Station Name (& PID if existing NSRS station) TWF A

Airport Name or ID (PACS / SACS / OTHER) Twin Falls - Sun Valley Airport, ID

Reconnaissance By (Name, Organization,& Date) J D Smith NGS 3/15/98

Height of Observer's Eye (Above Station Mark) 1.5 (feet/meters)

IDENTIFICATION OF GPS STATION

Name & Agency of Observer Date_____

_____

_____

Station Name_____

Airport Name_____

Remarks_____

_____

Station Rubbing

National Geodetic Survey - GPS Observation Log

Station Name	4 Character ID	J-Day	Date
Location	Station SSN	Session	Obs. Agency

Project Name	Project Number

Latitude	Longitude	Elevation (m)	Observer

X	Y	Z

START TIME	(Scheduled):	UTC
	(Actual):	UTC
STOP TIME	(Scheduled):	UTC
	(Actual):	UTC

Other Stations Observed:

Receiver Model:

Receiver S/N:

Antenna Model:

Antenna S/N:

Tripod Type & S/N:

Cable Length (m):

Obstruction Survey Performed? (If No, explain):

Y N

Checked Antenna Plumb?

Before: Y N After: Y N

File Name:

5-Digit Weather Code (See back of form)

START	
MIDPOINT	
END	

SV Health and Observed:

Antenna Measurements: (See back of form for *slip-leg tripod* measurements)

Measurements with *Fixed Height* Poles: (See diagram on back of form)	Meters (m)	Feet (ft)
ANTENNA CONSTANT Antenna Base to Top of Groundplane (TGP): (Specify Other)		
FIXED HEIGHT POLE: Top of Mark to Top of Tripod Head: (Specify Other)		
Top of Tripod Head to Antenna Base: (If Applicable)		
TOTAL [True Vertical Height to TGP]:		

Antenna Height Entered into Receiver:

Weather Data

	START	MIDPOINT	END	MEAN
Barometer __MB __IN				MB
Dry Temp. __C __F				C
Wet Temp. __C __F				C
Rel. Humidity %				%

Comments:

National Oceanic and Atmospheric Administration

SLIP-LEG TRIPOD MEASUREMENTS: (SLOPE HEIGHT)

1) Measure the slope height from the mark to the inside notch of the Top of the Groundplane (TGP). Measure the slope height to three notches.

2) Calculate the MEAN Slope Height.

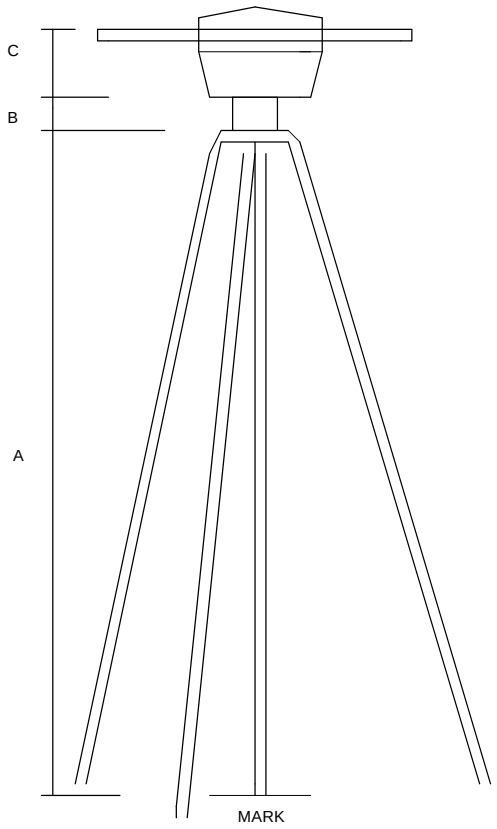
3) Calculate the True Vertical Height from the mark to the (TGP).

True Vertical Height = SQRT [(Slope Height)^2 - (Antenna Radius)^2]

	Notch 1	Notch 2	Notch 3
Beginning			
Midpoint			
End			
MEAN			

Mean Slope Height: _____m

True Vertical Height (to TGP): _____m



NOTES / SKETCH OF STATION:

CALCULATION OF ANTENNA HEIGHT: (Vertical/Fixed Height)

A) Top of Mark to Top of Tripod Head: _____m

B) Top of Tripod to Antenna Base: _____m

C) Antenna Base to TGP (Constant): _____m

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	NONE	GOOD (OVER 15 MI)	NORMAL RANGE (32F TO 80F)	CLEAR (BELOW 20%)	CALM (UNDER 5 MPH)
1	PROBLEM ENCOUNTERED	FAIR (7 - 15 MI)	HOT (OVER 80F)	PARTLY CLOUDY (20% TO 70%)	MODERATE (5 TO 15 MPH)
2	NOT USED	POOR (UNDER 7 MI)	COLD (BELOW 32F)	OVERCAST (OVER 70%)	STRONG (OVER 15 MPH)

National Geodetic Survey - GPS Observation Log

Station Name	4 Character ID	J-Day	Date
TWF A	TWFA	074	980315

Location	Station SSN	Session	Obs. Agency
Twin Falls, ID	0002	074-0	NGS

Project Name: Twin Falls - Sun Valley Reg. Joslin Field Air Art (TWF)

Project Number:

Latitude	Longitude	Elevation (m)	Observer
42 28 48.51628 N	114 28 33.16436 W	1265.45	JDS

X: Y: Z:

START TIME	(Scheduled):	1600	UTC
	(Actual):	1600	UTC
STOP TIME	(Scheduled):	2100	UTC
	(Actual):	2100	UTC

Other Stations Observed:
TWF B BUZZARD RESET
TWF C U 298 Y243

Receiver Model: Trimble 4000SSE
Receiver S/N: 3423A00004883
Antenna Model: Trimble 22020-00
Antenna S/N: 00800076723
Tripod Type & S/N: Seco #16
Cable Length (m): 10m
Obstruction Survey Performed? (If No, explain): (Y) N
Checked Antenna Plumb? Before: (Y) N After: (Y) N
File Name: TWFA-074-0

5-Digit Weather Code (See back of form)

START	00011
MIDPOINT	00001
END	00000

SV Health and Observed: 2,4,7,14,15,18,19,22,23,29,31

Antenna Measurements: (See back of form for *slip-leg tripod* measurements)

Measurements with *Fixed Height* Poles: (See diagram on back of form)	Meters (m)	Feet (ft)
ANTENNA CONSTANT Antenna Base to Top of Groundplane (TGP): (Specify Other)	.0591	
FIXED HEIGHT POLE: Top of Mark to Top of Tripod Head: (Specify Other)	2.000	
Top of Tripod Head to Antenna Base: (If Applicable)	—	
TOTAL [True Vertical Height to TGP]:	2.0591	
Antenna Height Entered into Receiver:	2.0591	

Weather Data

		START	MIDPOINT	END	MEAN	
Barometer	✓MB	999.6	996.8	995.3	997.2	MB
	_IN					
Dry Temp.	✓C	18.6	20.8	19.1	19.5	C
	_F					
Wet Temp.	✓C	11.3	12.2	11.9	11.8	C
	_F					
Rel. Humidity %		43	37	44	41.3	%

Comments:

National Oceanic and Atmospheric Administration

KNOW THESE MARKERS

BENCH
(Old Type)

BENCH
(New Type)
Two Bench Marks Consolidated

BENCH
(Old Type)

TRAVERSE

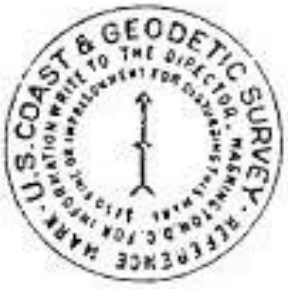
TRIANGULATION

GRAVITY
(Old Type)

GRAVITY
(New Type)

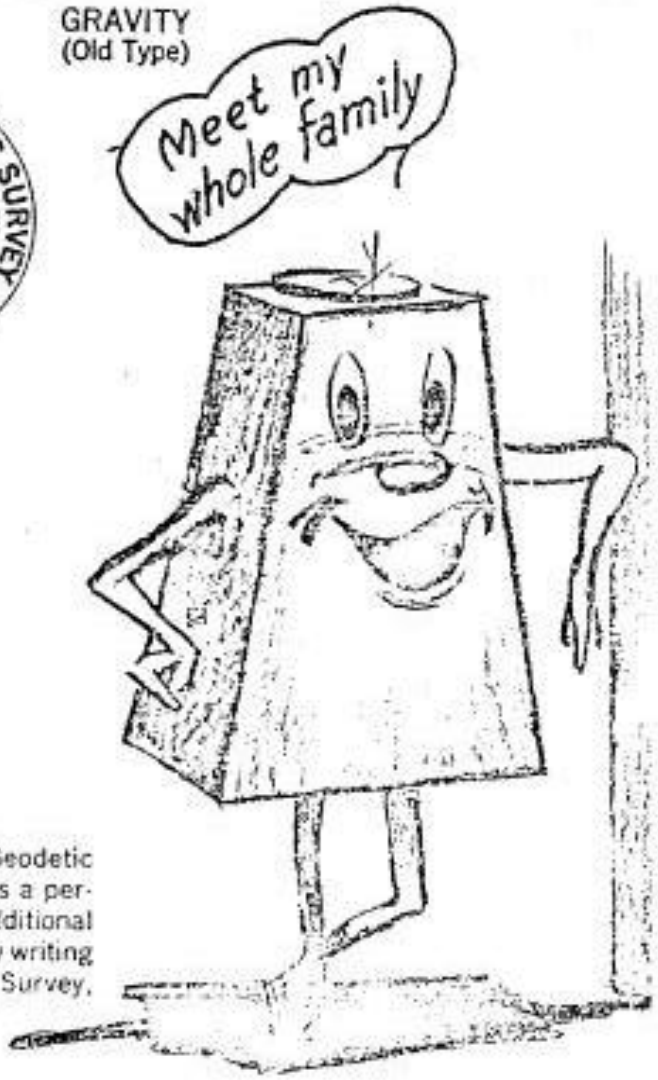
TOPOGRAPHIC

AZIMUTH



REFERENCE

MAGNETIC



FACE LEGENDS

Standard bronze station marks of the Coast and Geodetic Survey that are set in concrete or bedrock to serve as a permanent mark for the particular station it represents. Additional information concerning these marks may be obtained by writing to the Director, United States Coast and Geodetic Survey, Washington 25, D.C.

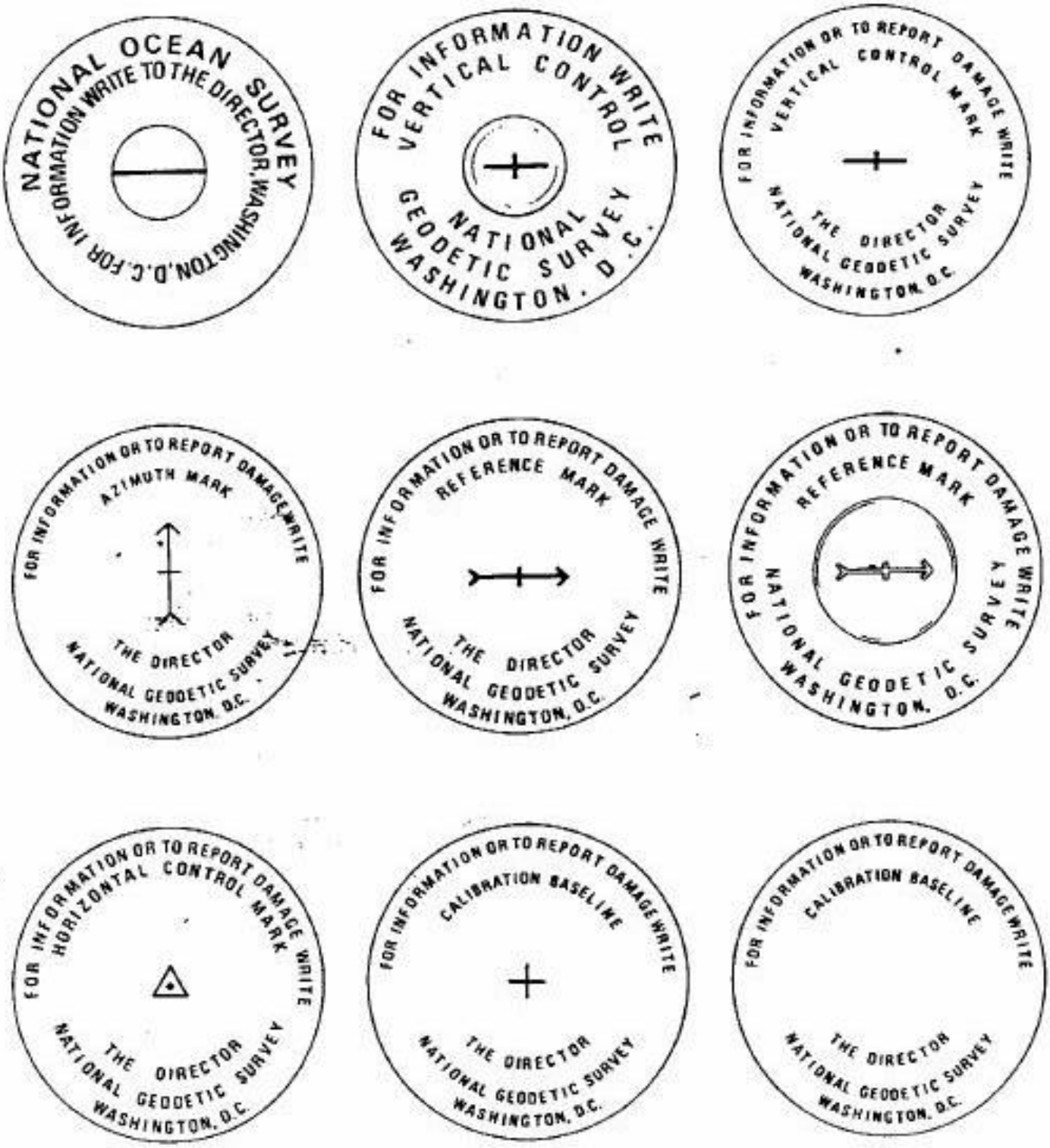


Figure 3b.—Standard marks of the National Ocean Survey/National Geodetic Survey

Federal Base Network
Station Selection Guidelines

(Revised & ESC Approved: 8 MAY 96)

Monumented points at all NGS-approved continuously operating reference stations (CORS) will be stations of the Federal Base Network (FBN). This document provides the guidelines to be used to select additional FBN stations. These guidelines address the issues of selection priorities, station spacing, monumentation, stability, and accessibility.

Selection Priorities

Station selection shall be based on the following priorities which are given in order with the highest priority first. Within each priority category, preference should be given to selection of older monuments having a known history of previous measurements. Each FBN station should be selected from:

1. Existing A- and B-order station, where possible. At special survey sites such as CORS, WAAS, and VLBI, where several high accuracy monumented stations exist, only one of the monumented stations shall be selected as a FBN. In cases where a protected area exists at the site, the most accessible station shall be selected as the FBN. Other stations at the site shall be designated as CBNs, with the appropriate agency being responsible (FAA, USCG, or State agency).

2. Primary Airport Control Stations (PACS) will be candidates for FBN station selection. Those PACS that are not selected as FBNs will be designated as Cooperative Base Network (CBN) stations, with the responsible agency being FAA. The Secondary Airport Control Stations (SACS) will be designated as User Densification Network (UDN) stations; the responible agency again being FAA. Where necessary, an additional nearby station, which is easily accessible by the public, will be established and directly connected to the airport station.

3. Existing National Geodetic Reference System (NGRS) station with a first- or second-order elevation AND first- or second-order horizontal coordinates, with higher accuracy classification being preferred both vertically and horizontally (giving vertical accuracy top priority).

4. Existing NGRS station with first- or second-order elevation, again the higher accuracy classification being preferred.

5. Existing NGRS station with first- or second-order horizontal coordinates which would require a minimum amount of first- or second-order leveling to establish a precise elevation (within 10 km).

6. New station or existing station not in NGRS suitable for GPS observations, set in bedrock, which would require a minimum amount of first- or second-order leveling to establish a precise

elevation (within 10 km).

7. New station or existing station not in NGRS suitable for GPS observations, established by setting a 3D monument, which would require a minimum amount of first- or second-order leveling to establish a precise elevation (within 10 km).

Station Spacing

Unless specified otherwise, the overall FBN shall consist of stations spaced on average approximately 100 km apart. The actual station spacing shall be flexible enough (from 50 km up to 150 km) to allow for optimum station selection. In addition, existing horizontal NGRS stations should be selected in a pattern so that overall, these stations are located in each one-degree block throughout the project. When impossible to meet the above criteria, an additional first- or second-order horizontal NGRS station must be recovered that is suitable for GPS observations. These additional stations shall be selected approximately midway between FBN stations.

Monumentation and Station Environment

The following are a list of considerations for every monument in the FBN. The intent is to ensure that station monuments will be locally stable and remain usable indefinitely. Each of these considerations is important.

- Adequate GPS satellite visibility (unrestricted at 15 degrees above the horizon). Minor obstructions may be acceptable, but must be depicted on the Visibility Obstruction Diagram.
- Accessible by vehicle (two-wheel drive preferred).
- Stability, bedrock mark being most preferred. (See Stability)
- Permanency.
- Ease of recovery.
- Minimal multi-path sources.
- Appropriate geographic location and spacing.
- Location allows efficient use by surveying community.
- Accessible by public. (See Accessibility)
- No known potential conflict with future development.
- Aerial-photo identifiable.
- Free of electronic interference.

Stability

Mark stability is difficult to assess in the field with limited resources. For existing NGRS station monumentation, the NGS database contains stability qualifiers which were assigned for the majority of marks when they were set. Existing NGRS stations must have a stability quality code of ‘C’ or better. Quality codes A and B are preferred. New monuments will have a stability quality code of B or better. Quality codes are as follows:

Quality Code A = most reliable which are expected to hold an elevation. Examples: Rock outcrops; rock ledges; rock cuts; bedrock; massive structures with deep foundations; large structures with foundations on bedrock; or sleeved deep settings (10 feet or more) with galvanized steel pipe or galvanized steel, stainless steel, or aluminum rods.

Quality Code B - probably hold an elevation. Examples: Unsleeved deep settings (10 feet or more) with galvanized steel pipe or galvanized steel, stainless steel or aluminum rods; massive structures other than those listed under code A; massive retaining walls; abutments and piers of large bridges or tunnels; unspecified rods or pipe in a sleeve less than 10 feet; or sleeved copper-clad steel rods.

Quality Code C - may hold precise elevation but subject to ground movement. Examples: Metal rods with base plates less than 10 feet deep; concrete posts (3 feet or more deep); unspecified rods or pipe more than 10 feet deep; large boulders; retaining walls for culverts or small bridges; footings or foundation walls of small to medium-size structures; or foundations such as landings, platforms, or steps.

Quality Code D - questionable stability. Examples: Generally, objects of unknown character; shallow set rods or pipe (less than 10 feet); light structures; pavements such as streets, curbs, or aprons; piles and poles such as spikes in utility poles; masses of concrete; or concrete posts less than 3 feet deep.

Quality code C exception -- When selecting FBN stations, only quality codes A and B are recommended. However, concrete posts may be selected with a C stability if the mark is deemed stable from review of historical releveling, soil type, and frost depth. Final selection is subjective, and it is based on local knowledge of soil and frost heave, plus knowledge of how well the mark has held its horizontal and vertical positions over the years.

Accessibility

Accessible public property should be utilized where feasible. If the station is located on private property, permission must be obtained from the land owner for station accessibility. The name of the person or organization granting permission to occupy the station, and a telephone number, must be noted in the station description.

ATTACHMENT 9
POLICY OF THE NATIONAL OCEAN SERVICE REGARDING THE INCORPORATION OF GEODETIC DATA OF OTHER ORGANIZATIONS INTO THE NATIONAL GEODETIC SURVEY DATA BASE
(September 1994)

The National Ocean Service (NOS), Coast and Geodetic Survey, National Geodetic Survey (NGS), has determined that the value to the National Spatial Reference System (NSRS) of geodetic observations obtained by other Federal, state, and local organizations compensates for the costs incurred by the Federal Government to provide quality assurance, archiving, and distribution functions for surveys contributing to the public good. Agencies submitting data must adhere to the following requirements. The final decision whether to accept data will be the responsibility of the Chief, NGS.

FORMAT The survey data must be submitted in the automated formats specified in the Federal Geographic Data Committee (FGDC), Federal Geodetic Control Subcommittee (FGCS), publication Input Formats and Specifications of the National Geodetic Survey Data Base (September 1994), which describes the formats and procedures of submitting data for adjustment and assimilation into the NGS data base. Separate volumes of this publication refer to horizontal control data (volume I), vertical control data (volume II), and gravity control data (volume III). Guidelines for submitting three-dimensional Global Positioning System (GPS) relative positioning data are contained in Annex L of volume I.

ACCURACY Standards of accuracy are given in Standards and Specifications for Geodetic Control Networks (1984) and Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques (May 1988).

The survey data must be properly formatted as set forth by FGCS and meet the minimum accuracy requirements of:

First-order horizontal accuracy standards for GPS or conventional horizontal surveys.

Second-order, class II vertical accuracy standards for conventional geodetic leveling.

Third-order gravity accuracy standards for gravity surveys.

In addition, these data standards and accuracies must be verified, using currently

available NGS software, by the provider prior to submitting the survey project to NGS.

Please note: Effective September 1, 1995, survey project data must meet the above minimum accuracy standards to be accepted for inclusion in the NGS data base. Surveys that are of lower order than given above will be accepted **only** in exceptional cases approved by the Chief, NGS.

MONUMENTATION — Monumentation must be uniquely identified and conform to minimum prescribed standards. Guidelines for control monuments are given in NOAA Manual NOS NGS 1 (1978), Coast and Geodetic Survey Special Publication 247 (1950), and in Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques, appendix H (May 1988). Monument descriptions must be submitted in the automated format specified in Input Formats and Specifications of the National Geodetic Survey Data Base (September 1994).

FIELD RECORDS — Original field records (or acceptable copies) are requested with data submission. NGS will retain these records in the National Archives and Records Administration. This is necessary in the event that questions arise concerning the surveys upon which the adjusted data are based. Where digital records are required, e.g., GPS projects, such records will be submitted to NGS in a format specified by NGS at the time of submission. If field records are not submitted with the data, NGS reserves the right to inspect these records upon request. If field records are not submitted on request, NGS reserves the right to not accept and/or not publish the data, and if published, a disclaimer may be attached to the published data.

PROJECT REPORT — A project report, including sketches, is required for geodetic control projects. It should be submitted with the data and adhere to the form outlined in annexes K and L (GPS) of Input Formats and Specifications of the National Geodetic Survey Data Base (September 1994).

REVIEW — Reconnaissance reports describing proposed connections to the NSRS, along with the planned instrumentation and field procedures, must be submitted prior to beginning a project. This will enable NGS to comment on the proposed connections, using information available in the NGS data base concerning the accuracy and condition of these points, and to assure conformance with minimum accuracy standards and criteria. The project review could save the submitting agency the expense of placing data in computer-readable form that will fail accuracy or monumentation criteria. NGS work schedules and computer requirements can also be developed from

this information. Upon receipt of the reconnaissance reports, NGS will respond within 10 working days.

RETURNED SUBMISSIONS

With verbal concurrence of the submitting organization, a limited number number of errors in the submitted data will be corrected by NGS. Beyond a reasonable limit of about 1 percent, the entire project will be returned to the sender.

SUBMITTED PROJECTS

Projects must be submitted such that the unit of field work will compute independently of other projects. They must be connected to points already in the NGS data base. All data pertaining to a project (observations, descriptions, adjustments, reports, etc.) must be simultaneously received by NGS. Due to a limited capability to review, analyze, and edit survey data before they are loaded into the NGS data base, data contributed for inclusion into the data base should be processed and adjusted by the provider, using currently available NGS software, prior to submittal to NGS.

COST

There is no cost to submitters for NGS quality review, archiving, and distribution functions for survey data submitted according to the requirements discussed above. When NGS is requested to provide on-site instruction with respect to data formatting and/or data processing, the requesting organization will be charged for travel and per diem costs.

PUBLICATIONS

All the publications referenced in this statement are available from the National Geodetic Information Branch, N/NGS12, NOAA, 1315 East-West Highway, Silver Spring, MD 20910-3282.

Telephone (301) 713-3242 Fax (301) 713-4172

Email: info_center@ngs.noaa.gov

SUBMISSION OF HORIZONTAL CONTROL SURVEYS TO THE NATIONAL GEODETIC SURVEY

ANNOUNCEMENT: Effective June 1, 1997, the National Geodetic Survey (NGS) will only accept horizontal control projects (GPS or conventional terrestrial observations) that have been adjusted to the National Spatial Reference System (NSRS) with the available NGS network adjustment software ADJUST. This is in accordance with the September 1994, "Policy of the National Ocean Service regarding the incorporation of geodetic data of other organizations into the National Geodetic Survey Data Base,". This policy statement is published as part of the "Input Formats and Specifications of the National Geodetic Survey Data Base," also referred to as the "Blue Book." The ADJUST package, which includes a least squares network adjustment program and data checking programs, is available from the NGS World Wide Web Home Page at http://www.ngs.noaa.gov or by calling the NGS Information Services Branch, telephone (301) 713-3242.

All projects to be submitted for inclusion in NSRS must also be reviewed by NGS for appropriate NSRS connections, and observing and computional specifications. Reviews are performed within 10 working days of submittal of the proper information to the NGS State Geodetic Advisor (where available), or the NGS Project Development Branch, telephone (301) 713-3194. Surveys that do not conform to these requirements will be returned to the submitter for reprocessing.

Questions concerning these requirements should be directed to Ms. Madeline White, NGS Project Analysis Branch, telephone (301) 713-3211, or e-mail madeline@ngs.noaa.gov.

Approved by NGS Executive Steering Committee, March 26, 1997.
