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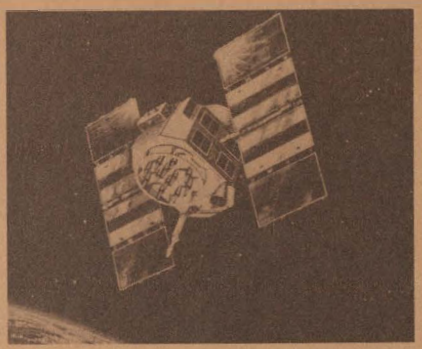

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service

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Products and Services of the National Geodetic Survey

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National Geodetic Survey

(Supersedes *NOAA Technical Memorandum* NOS NGS 5, National Geodetic Survey data: availability, explanation, and application, by Joseph F. Dracup, 1976)

Rockville, Md.
1983

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
National Oceanic and Atmospheric Administration
John V. Byrne, Administrator
National Ocean Service
Paul M. Wolff, Assistant Administrator
Office of Charting and Geodetic Services
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For sale by the
National Geodetic Information Center,
NOAA, Rockville, Md. 20852

Contents

Exhibits

Abstract

The National Geodetic Survey disseminates a variety of products to users of geodetic information. These include horizontal and vertical geodetic control network data and diagrams; gravimetric, astronomic, and satellite surveying information; calibration base line data; geodetic computer programs; geodetic survey specifications; geodetic data base specifications and formats; and polar and crustal motion information. In addition, NGS publishes technical reports and publications, provides geodetic reference library and information services, an extension service to aid in technology transfer and innovation with State and local governments, and special purpose geodetic surveys to support scientific and engineering projects of other agencies and institutions.

Introduction

The National Geodetic Survey (NGS), a component of Charting and Geodetic Services, National Ocean Service (NOS) in the National Oceanic and Atmospheric Administration (NOAA), is responsible for developing and maintaining the National Geodetic Reference System, as defined by the National Networks of Geodetic Control. These networks consist of approximately three-quarters of a million precisely positioned points, known as geodetic control points. The points provide the base of reference to correlate longitude, latitude, elevation, scale, and orientation throughout the Nation for communication, transportation, and defense systems; boundary and property surveys and land records systems; public utilities; mapping and charting; and a variety of other scientific and engineering applications.

NGS conducts field surveys and research and development activities to improve the collection and dissemination of geodetic data, as well as to improve the understanding of dynamic Earth processes. NGS also provides Federal leadership in the establishment of specifications and standards for conducting geodetic surveys, development and application of new surveying instrumentation, and assistance to State, county, and municipal agencies through cooperative programs. Many of these agencies also submit survey data to NGS which eventually become part of the national networks.

Horizontal Geodetic Information

Latitude, Longitude, and Azimuth

Published horizontal geodetic information consists of geographic positions (latitude and longitude), State plane coordinates, Universal Transverse Mercator grid coordinates, azimuths, and descriptive location and mark condition information for approximately one-quarter-million stations in the horizontal control networks of the conterminous United States, Alaska, Hawaii, and Puerto Rico. Most data are derived from precise field surveys using conventional triangulation, traverse, and trilateration methods. The surveys are adjusted to either the North American Datum (NAD) of 1927, Old Hawaiian Datum, or Puerto Rican Datum. Horizontal control products are usually presented in booklet form for 30' x 30' quadrangle areas, or for congested regions in 15' or 7½' quadrangle areas. In some areas of Alaska, data are in 1°x 1° units due to the sparsity of control. The 30-minute quadrangles are identified by a six-digit number, successively depicting degrees of latitude, longitude, and quadrants of the 1° quadrangle. Exhibit 1 is an alphabetic index included in the quadrangle booklet. Exhibit 2 shows the published data for one horizontal control station in the automated format. Exhibit 3 illustrates the information in the manual format which will be gradually replaced in the future by the automated format.

Coordinate and azimuth data are also available on magnetic tape, microfilm, or microfiche. Complete control station information is available on these media for limited areas of the country. Horizontal geodetic data are also available for projects recently adjusted but not yet published. Position and descriptive information similar to that found in the published data are issued by survey project.

US DEPARTMENT OF COMMERCE - NOAA
NOS - NATIONAL GEODETIC SURVEY
ROCKVILLE MD 20852 - JUL 1980

ALPHABETIC INDEX TO
HORIZONTAL CONTROL DATA
NORTH AMERICAN DATUM 1927

QUAD N27080400
CONTROL DIAGRAM NG 17-2

PAGE	STATION NAME	YEAR ESTAB	YEAR RECOV	STATION ORDER	LATITUDE	LONGITUDE	ELEV (METERS)	GEOID HGT	OTHER CONTROL	QUAD	QSN	ST
176	ADAMS	1960	1961G	TCT	27 38 24.27127N	80 37 42.17277W	10.0	6.9		N27080424	0001	FL
80	AIRWAY BEACON 14	1934	1948X	LOW	27 49 33.19200N	80 30 12.03200W				N27080412	0002	FL
23	AIRWAY BEACON 15	1934	1949X	LOW	27 57 53.74900N	80 34 09.40800W				N27080411	0010	FL
44	ATSS BM	1962		2ND	27 57 23.64758N	80 33 30.57915W	12.56	6.1	V	N27080411	0029	FL
215	BC 4 FC 2	1960		TCT	27 50 41.57711N	80 58 16.57990W	23.04	6.8	V	N27080443	0002	FL
93	BC 4 VB 1	1960		TCT	27 46 02.94784N	80 33 10.54976W	8.44	6.5	V	N27080412	0009	FL
216	BENCH MARK U 197	1960		TCT	27 50 41.58307N	80 58 16.56739W	23.03	6.8	V	N27080443	0003	FL
94	BENCH MARK Z 190	1960		TCT	27 46 02.96016N	80 33 10.54970W	8.44	6.5	V	N27080412	0010	FL
182	BLUE	1960		1ST	27 44 05.40364N	80 48 43.93253W	9	6.9		N27080431	0003	FL
75	BROOKSIDE	1934	1976X	TCT	27 46 02.44497N	80 33 10.89108W	7.95	6.5	V	N27080412	0001	FL
97	BROOKSIDE AZ MK	1956		2ND	27 46 02.04395N	80 33 31.57873W	7.33	6.5	V	N27080412	0012	FL
95	BROOKSIDE RM 4	1956	1976X	2ND	27 46 02.93631N	80 33 11.80884W	7.68	6.5	V	N27080412	0011	FL
89	BROOKSIDE RM 5	1960		TCT	27 46 02.90820N	80 33 10.13827W	7.75	6.5	V	N27080412	0007	FL
49	CENTRAL BORE TRAV	1962		2ND	27 57 27.77897N	80 33 46.69170W	7.14	6.1	V	N27080411	0035	FL
46	CENTRAL PIER 1	1962		2ND	27 57 24.04385N	80 33 31.47264W	8.72	6.1	V	N27080411	0031	FL
42	CENTRAL PIER 2	1962		1ST	27 57 22.99647N	80 33 29.17052W	8.72	6.1	V2	N27080411	0027	FL
43	CENTRAL PIER 3	1962		2ND	27 57 20.95202N	80 33 30.35005W	8.71	6.1	V	N27080411	0028	FL
47	CENTRAL PIER 4	1962		2ND	27 57 21.99934N	80 33 32.65219W	8.72	6.1	V	N27080411	0032	FL
45	CENTRAL PMSS	1962		1ST	27 57 22.49796N	80 33 30.91135W	8.71	6.1	V	N27080411	0030	FL
10	FARM	1930	1948O	3RD	27 55 14.29400N	80 30 49.79900W	2	6.1		N27080411	0005	FL
131	FELLSMERE ATT CO MICRO-WAVE TOWER	1960		LOW	27 45 02.88775N	80 37 40.93080W				N27080413	0001	FL
91	FLEMING	1960		TCT	27 48 46.36617N	80 31 27.38887W	8.00	6.4	V	N27080412	0008	FL
184	FORT DRUM MICRO WAVE LINK RML SITE 4	1961		LOW	27 31 39.55192N	80 46 52.32714W				N27080432	0001	FL
185	FORT DRUM US IMMIGRATION CONTROL TOWER	1961		LOW	27 32 29.13736N	80 49 21.45070W				N27080432	0002	FL
12	GRANT	1930	1971G	2ND	27 55 15.79000N	80 31 10.34500W	0.80	6.1	V	N27080411	0006	FL
16	HOG	1930	1971P	3RD	27 58 35.53200N	80 31 38.74600W	1	6.0		N27080411	0008	FL
179	INDIAN	1960	1963G	TCT	27 38 30.40994N	80 45 03.56204W	10.5	7.1		N27080431	0001	FL
8	ISLE	1930	1971G	3RD	27 57 05.48500N	80 30 56.61800W	0	6.0		N27080411	0004	FL
155	I95 73 A01	1973		2ND	27 38 19.18762N	80 31 04.37810W	16.33	6.8	V	N27080421	0003	FL
158	I95 73 A02	1973		2ND	27 39 16.52126N	80 31 24.98897W	9.29	6.7	V	N27080421	0005	FL
160	I95 73 A03	1973		2ND	27 39 44.41848N	80 31 35.47283W	9.47	6.7	V	N27080421	0006	FL
162	I95 73 A04	1973		2ND	27 40 11.86406N	80 31 49.97833W	10.05	6.7	V	N27080421	0007	FL
164	I95 73 A05	1973		2ND	27 40 58.59511N	80 32 05.22532W	12.75	6.7	V	N27080421	0008	FL
166	I95 73 A06	1973		2ND	27 42 02.55709N	80 32 25.52206W	8.94	6.6	V	N27080421	0009	FL
168	I95 73 A07	1973		2ND	27 42 55.04261N	80 32 37.14777W	8.90	6.6	V	N27080421	0010	FL
170	I95 73 A08	1973		2ND	27 43 48.67215N	80 32 49.08227W	9.84	6.6	V	N27080421	0011	FL
172	I95 73 A09	1973		2ND	27 44 23.37968N	80 32 56.65516W	9.06	6.6	V	N27080421	0012	FL
110	I95 73 A10	1973		2ND	27 45 07.90777N	80 33 06.11368W	8.99	6.5	V	N27080412	0019	FL
108	I95 73 A11	1973		2ND	27 46 00.70280N	80 33 04.81975W	15.71	6.5	V	N27080412	0018	FL
114	I95 73 A12	1973		2ND	27 46 02.36577N	80 33 32.92683W	8.81	6.5	V	N27080412	0021	FL
115	I95 73 A13	1973		2ND	27 46 02.37115N	80 33 58.06487W	9.94	6.5	V	N27080412	0022	FL
118	I95 73 A14	1973		2ND	27 46 02.77064N	80 34 37.22569W	8.43	6.6	V	N27080412	0024	FL
121	I95 73 A15	1973		2ND	27 46 01.65569N	80 35 08.51365W	7.76	6.6	V	N27080412	0026	FL
129	I95 73 A16	1973		2ND	27 46 01.90327N	80 35 36.37732W	7.95	6.6	V	N27080412	0030	FL
106	I95 73 A17	1973		2ND	27 46 55.98466N	80 33 00.69090W	8.52	6.5	V	N27080412	0017	FL

Exhibit 1.—Alphabetic index to Horizontal Control Data.

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US DEPARTMENT OF COMMERCE - NOAA
NOS - NATIONAL GEODETIC SURVEY
ROCKVILLE MD 20852 - JUL 1980

HORIZONTAL CONTROL DATA
NORTH AMERICAN DATUM 1927
PROJECT ACCESSION NUMBER 12647

QUAD NZ7080431 QSN 0003
CONTROL DIAGRAM NG 17-2
FL-INDIAN RIVER COUNTY

HORIZONTAL CONTROL STATION: BLUE

GEODETIC POSITION DATA----------

	DEG MIN SECONDS	
LATITUDE:	27 44 05.40364N	
LONGITUDE.	80 48 43.93253W	
AZIMUTH 1:	127 53 37.3	FROM SOUTH
ELEVATION:	9 METERS	
	29.5 FEET	
GEOID HEIGHT:	6.9 METERS	

STATION INFORMATION----------

TYPE: 1ST-ORDER TRIANGULATION
OBSERVATIONS BY US COAST AND GEODETIC SURVEY (NOW NOS) IN 1960
ADJUSTED BY NATIONAL GEODETIC SURVEY IN 1979
AZIMUTH REFERENCE OBJECT 1: KENAN 1936

ELEVATION SCALED FROM TOPOGRAPHIC MAP

STATE PLANE AND UNIVERSAL TRANSVERSE MERCATOR COORDINATE SYSTEMS----------

GRID	ZONE	X FEET	Y FEET	X/EASTING METERS	Y/NORTHING METERS	POINT SCALE FACTOR	CONVERGENCE DEG MIN SEC	GRID AZIMUTH 1 DEG MIN SEC	GRID AZIMUTH 2 DEG MIN SEC
FL-TM	E	560748.95	1236296.47	170916.621	376823.917	0.99994541	+0 05 14.6	127 48 22.6*	
UTM	17			518509.999	3067672.775	0.99960423	+0 05 14.6	307 48 22.6*	
UTM	18			-73435.216	3081224.568	1.00366140	-2 42 44.2	310 36 21.5*	

*CAUTION - ARC-TO-CHORD CORRECTION ASSUMED ZERO

STATION DESCRIPTION----------

ORGANIZATIONS MARK: US COAST AND GEODETIC SURVEY (NOW NOS)
YEAR DESCRIBED: 1960 CHIEF OF PARTY: GWM REACHED BY: LIGHT TRUCK
HEIGHT OF TELESCOPE: 35 METERS
PACK TIME: 00 HRS 00 MIN

CODE	MARK	TYPE OF MARK	SETTING/LANDMARK TYPE	MAGNETIC PROPERTY
	SURFACE	TRIANG STA DISK	SET INTO THE TOP OF A SQUARE CONCRETE MONUMENT	UNKNOWN
D04	UNDERGROUND	SURVEY DISK	SET INTO THE TOP OF AN IRREGULAR MASS OF CONCRETE	UNKNOWN
D09	REFERENCE	SURVEY DISK	SET INTO THE TOP OF A SQUARE CONCRETE MONUMENT	
D11	REFERENCE	SURVEY DISK	SET INTO THE TOP OF A METAL PIPE DRIVEN INTO THE GROUND	

CODE	REFERENCE OBJECT	HEADING	DISTANCE	DIRECTION	MAGNETIC PROPERTY
D09	KENAN			000 00 00.0	UNKNOWN
D09	BLUE RM 2	NW	97.77 FEET 29.802 MTRS	316 11 21	UNKNOWN
D09	BLUE RM 1	W	101.92 FEET 31.066 MTRS	312 28 48	UNKNOWN
D11	SEC COR GLD	W	ESTIM 0.15 MI	320 49 38.1	UNKNOWN
	BLUE RM 1 TO BLUE RM 2		105.49 FEET 32.152 MTRS		

THE STATION IS ABOUT 14 MILES SOUTHEAST OF KENANSVILLE, AND 7 MILES EAST OF YEEHAW JUNCTION IN THE SOUTHWEST 1/4 OF SECTION 35, T. 31 S., R. 35 E., ON THE ROCKING M RANCH OWNED BY MR. FONOERN MITCHELL. IT IS 50 FEET SOUTHEAST OF A 10 INCH PINE TREE, 44 FEET SOUTHWEST OF A 14 INCH PINE TREE, 26 FEET NORTHEAST OF AN EAST GATE POST, 18 FEET NORTH OF AN EAST-WEST WIRE FENCE, AND 2 FEET NORTH OF A WITNESS POST. THE MONUMENT PROJECTS 5 INCHES AND THE DISK IS STAMPED BLUE 1960.

TO REACH THE STATION FROM THE JUNCTION OF U.S. HIGHWAY 441 AND STATE ROAD S-523 IN KENANSVILLE, GO SOUTH ON HIGHWAY 441 FOR 9.9 MILES TO A SIDE ROAD LEFT AND LARGE SIGN ON LEFT ROCKING M RANCH. TURN LEFT AND GO EASTERLY ON A SAND ROAD FOR 1.1 MILES TO BRIDGE OVER BIG LOLLY CREEK. CONTINUE EASTERLY ON THE SAND ROAD FOR 4.5 MILES TO A SIDE ROAD RIGHT, ABOUT 125 FEET SOUTH OF THE ROCKING M RANCH HEADQUARTERS. TURN RIGHT AND GO SOUTH ON TRACK ROAD FOR 0.8 MILE TO A SIDE ROAD RIGHT ABOUT 0.15 MILE BEFORE REACHING ALUMINUM GATE. TURN RIGHT AND GO WESTERLY, SOUTHWEST, AND SOUTH ON A TRACK ROAD FOR 1.4 MILES TO A BOARD GATE. PASS THROUGH GATE AND CONTINUE SOUTHERLY ON A TRACK ROAD FOR 0.35 MILE TO THE STATION ON THE LEFT.

(CONTINUED ON NEXT PAGE)

Exhibit 2.—Horizontal Control Data (new format).

JULY 1967
U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
COAST AND GEODETIC SURVEY

SLIDELL (Continued)

HORIZONTAL CONTROL DATA SHEET 2 of 2

by the
Coast and Geodetic Survey
NORTH AMERICAN 1927 DATUM

QUAD 30094[illegible] STATION 1056
LA-MISS
LATITUDE 30°00' TO 30°30'
LONGITUDE 89°30' TO 90°00'
DIAGRAM NH 16-4 MOBILE

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Forms 0532
Rev. Aug. 1961

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: SLIDELL 2 STATE: Louisiana Parish: ~~County~~ St. Tammany

CHIEF OF PARTY: R.L.E. YEAR: 1953 Described by: A.A. Brown

NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK 31 METERS. HEIGHT OF LIGHT ABOVE STATION MARK 33 METERS.

NOTE: Surface-station mark, Underground-station mark

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

	OBJECT	BEARING	DISTANCE feet	DISTANCE meters	DIRECTION ° ' "
	BARRINGER				00 00 00.0
16a	Azimuth Mark	W.	(0.25 mile)		01 15 37.6
11a	R.M. No. 4	W.	154.31'	47.031m	02 27 11
1a7a	SLIDELL 1930 1934	NE.	13.94'	4.249m	128 39 43.9
11a	R.M. No. 3	S.	164.30'	50.079m	262 45 36

The station is located in the northeast corner of the Slidell High School Athletic Field, 0.2 mile east of U. S. Highway No. 11 on Pennsylvania Ave. It is 17.5 feet south of a brick wall and 16.5 feet west of a brick wall. It is set flush and is stamped SLIDELL 2 1953.

A traverse measurement was made and direction taken to triangulation station SLIDELL 1930 1934.

Reference mark No. 3 is 16 feet east of a goal post and 2.5 feet west of a brick wall. It is set flush and is stamped SLIDELL 2 NO 3 1953.

Reference mark No. 4 is 2.5 feet south of a brick wall, set flush, and is stamped SLIDELL 2 NO 4 1953.

The distance between R.M. No. 3 and R.M. No. 4 is 243.6 feet.

The azimuth mark is located about 0.05 mile west of U.S. Highway No. 11 and the Slidell Post Office. It is set directly under a telephone line, 51.5 feet west of the west rail of the New Orleans and Northeastern railroad tracks, 21 feet south of the center of a graveled street and 8 feet south of a railroad stop sign. It is stamped SLIDELL 2 1953 and projects 4 inches.

To reach the station from the Post Office in Slidell, go east on Pennsylvania Ave. for 0.2 mile to the Slidell High School and the station on the right as described.

To reach the azimuth mark from the station, go west on Pennsylvania Ave. for 0.2 mile to U.S. Highway No. 11, cross U.S. Highway No. 11 and continue straight ahead across the railroad tracks for 0.05 mile and the mark on the left as described.

Form 526
(11-8-55)

U.S. DEPARTMENT OF COMMERCE - COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: SLIDELL 2
ESTABLISHED BY: FLE YEAR: 1953 STATE: Louisiana
RECOVERED BY:* WFDourherty YEAR: 1963 COUNTY: St. Tammany Parish

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station and Azimuth mark were recovered in good condition. Azimuth point cannot be seen at ground from the station at ground due to a brick wall at the station and a railroad embankment at the Azimuth Point.

References are adequate for location. Slidell Municipal Water Tower is no longer visible from Station Slidell 2 at ground due to tree cover.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.
Note.- One of these forms must be used for every station recovered.

Como-DC 34314

(Continued)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: SLIDELL 2
STATE: LOUISIANA YEAR: 1953 FIRST ORDER
LOCALITY: LAKE PONTCHARTRAIN
SOURCE: C-10056, C-13694 FIELD SKETCH: LA 121,130

GEODETIC LATITUDE	30 16 49.51498	ELEVATION	3.10 METERS
GEODETIC LONGITUDE	89 46 42.04177		10.2 FEET

STATE COORDINATES (m)

STATE & ZONE	CODE	X	Y	θ (OR Δ) TO AZ. MK. ANGLE
LA. S.	1702	2,490,814.43	590,166.05	+ 0 46 39

TO STATION OR OBJECT	GEODETIC AZIMUTH (FROM SOUTH)	PLANE AZIMUTH (FROM SOUTH)	CODE
AZIMUTH MARK	94 19 08.6	93 32 30	1702

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: SLIDELL 2 1953
ESTABLISHED BY: YEAR: STATE: Louisiana BENCH MARK ALSO ☐
RECOVERED BY:* John Bickham YEAR: 1965 COUNTY: St. Tammany
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:
HEIGHT OF TELESCOPE ABOVE STATION MARK FEET HEIGHT OF LIGHT ABOVE STATION MARK FEET

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

OBJECT	BEARING	DISTANCE feet	DISTANCE meters	DIRECTION ° ' "
SLIDELL 2 Az.Mk.				0 00 00.0
Reference Mark #4	W	154.41		1 10 46.1
SLIDELL 1930-34				127 22 57.1

This station was recovered in good condition in the corner of the Slidell Jr. High School playground, 16.65 feet south of a brick wall, 16.00 feet west of a brick wall, 45.30 feet south of the centerline of Penn. Avenue, 45.95 feet west of centerline of 5th Street, 22.60 feet southwest of the northeast corner of a brick wall, and 67.80 feet southwest of a fire hydrant.

Station is a standard bronze disk set in a concrete post even with the surface of the ground. Station is stamped Slidell 2 1953.

To reach this station from the Bank of Slidell (on the corner of U.S. Highway 11 and Cousin Street) in Slidell, La., follow U.S. Highway 11 north for 0.63 miles to the corner of Penn. Avenue, thence east along Penn. Avenue for 3 blocks to the corner of Penn. Avenue and 5th Street to station on south side of Penn. Avenue.

Ref. Marker No. 3 is 2.5 feet west of a brick wall, 164.39 feet southeast of station. Station is even with the surface of the ground.

Ref. Marker No. 4 is 2.5 feet south of a brick wall, 154.41 feet west of station. Station projects 2" above the surface of the ground.

USCOMM—ESSA—ASHEVILLE

Exhibit 3.—Horizontal Control Data (old format).

Vertical Geodetic Information

Elevations

Published vertical geodetic information consists of elevations above the National Geodetic Vertical Datum (NGVD) of 1929 (formerly Sea Level Datum of 1929), gravimetric values, descriptive location, and mark condition information for more than one-half million bench marks in the Nation's vertical control network. The data are derived from leveling and gravity observations. Most vertical control information is presented in quadrangle booklets using the same system described under "Horizontal Geodetic Information." Exhibit 4 displays an index from a Vertical Control Data booklet, and Exhibit 5, a typical page of information. Some vertical control data are still published in the old format organized by State level lines, and are available only by complete county coverage. Exhibits 6 and 7 depict elevations and station descriptions, respectively, in the old format. Vertical control data for recently adjusted projects that are not yet published are available and issued by survey project.

US DEPARTMENT OF COMMERCE - NOAA
NOS - NATIONAL GEODETIC SURVEY
ROCKVILLE MD 20852 - APR 1982

ALPHABETIC INDEX TO
VERTICAL CONTROL DATA
NATIONAL GEODETIC VERTICAL DATUM 1929

LAT SPAN 39-30.1N TO 39-59.9N
LON SPAN 76-30.1W TO 77-00.0W
DIAGRAM--NJ 18-1 INDEX PG--06

SEQN	DESIGNATION	YEAR ESTABLISHED	LAST RECOV	ELEVATION ORD	(METERS)	SOURCE	APPROXIMATE POSITION LATITUDE	LONGITUDE	SURFACE GRAVITY	OTHER CONTROL	QUAD	QSN	ST
327	P 304 PADH	1966B	1966G	2ND	121.781	L20778	39-59-43N	76-37-57W	980.117		N39076400		PA
98	P 80	1942D	1971N	2ND	201.082	L10100	39-39-18N	76-32-55W	980.114		N39076400		MD
197	P 82	1942C		2ND	171.855	L10088	39-33-28N	76-53-35W	980.116		N39076400		MD
225	P 83	1942C		2ND	101.918	L10088	39-31-55N	76-42-32W	980.124		N39076400		MD
4	P 97	1959D		2ND	107.738	L17361	39-32-01N	76-39-52W	980.120		N39076400		MD
341	Q 112 MDSRC	1967D		2ND	255.508	L21359	39-40-49N	76-53-31W	980.102		N39076400		MD
175	Q 194	1942C	1953N	2ND	198.577	L10088	39-46-13N	76-46-45W	980.118		N39076400		PA
293	Q 275	1961D		2ND	124.550	L18463	39-56-37N	76-44-28W	980.118		N39076400		PA
193	Q 64 A	1942C		2ND	236.247	L10088	39-35-22N	76-59-58W	980.093		N39076400		MD
99	Q 80	1942C	1971G	2ND	185.121	L10100	39-40-04N	76-32-30W	980.119		N39076400		MD
198	Q 82	1942D		2ND	239.537	L10088	39-33-48N	76-52-58W	980.103		N39076400		MD
224	Q 83	1942C	1959G	2ND	97.829	L17361	39-31-35N	76-41-36W	980.122		N39076400		MD
6	Q 97	1959B	1967G	2ND	85.918	L17361	39-32-14N	76-38-52W	980.123		N39076400		MD
342	R 112 MDSRC	1967D		2ND	248.611	L21359	39-41-18N	76-53-48W	980.101		N39076400		MD
174	R 194	1942C		2ND	181.902	L10088	39-46-56N	76-46-00W	980.124		N39076400		PA
292	R 275	1961D		2ND	128.307	L18463	39-56-45N	76-43-14W	980.118		N39076400		PA
194	R 64 A	1942B	1980X	2ND	229.902	L10088	39-36-17N	76-59-55W	980.094		N39076400		MD
252	R 64 B	1942C		2ND	161.084	L10088	39-34-16N	76-44-26W	980.118		N39076400		MD
118	R 80	1942C	1965G	2ND	158.574	L10100	39-37-53N	76-36-54W	980.122		N39076400		MD
199	R 82	1942C	1970G	2ND	246.331	L10088	39-34-32N	76-52-38W	980.103		N39076400		MD
222	R 83	1942D	1958N	2ND	87.187	L10088	39-31-01N	76-41-04W	980.123		N39076400		MD
343	S 112 MDSRC	1967D		2ND	252.791	L21359	39-41-51N	76-54-18W	980.099		N39076400		MD
345	S 162 PADH	1942B	1961N	2ND	115.194	L09641	39-59-45N	76-44-06W	980.113		N39076400		PA
182	S 180	1942C		2ND	232.745	L10088	39-43-17N	76-52-19W	980.106		N39076400		PA
173	S 194	1942C		2ND	171.612	L10088	39-47-26N	76-45-06W	980.125		N39076400		PA
291	S 275 PADH	1961B	1961G	2ND	134.718	L18463	39-56-30N	76-43-06W	980.117		N39076400		PA
195	S 64 A	1942C		2ND	236.406	L10088	39-37-10N	76-59-51W	980.094		N39076400		MD
251	S 64 B	1942C		2ND	177.287	L10088	39-35-02N	76-44-23W	980.118		N39076400		MD
117	S 80	1942C	1965G	2ND	185.579	L10100	39-38-15N	76-35-54W	980.117		N39076400		MD
200	S 82	1942D		2ND	250.172	L10088	39-35-16N	76-51-49W	980.104		N39076400		MD
221	S 83	1942C	1959G	2ND	109.154	L17361	39-30-28N	76-40-24W	980.116		N39076400		MD
26	SEVENTH	1959C		2ND	241.266	L17361	39-40-54N	76-38-49W	980.116	H	N39076424	0009	MD
324	SHREWS	1961C		2ND	257.714	L18463	39-44-23N	76-39-41W	980.113	H	N39076424	0003	PA
322	SHREWS AZ MK	1961B		2ND	260.272	L18463	39-44-52N	76-39-42W	980.113		N39076400		PA
323	SHREWS RM 1	1961C		2ND	257.533	L18463	39-44-23N	76-39-42W	980.113		N39076400		PA
325	SHREWS RM 2	1961C		2ND	258.022	L18463	39-44-23N	76-39-41W	980.113		N39076400		PA
126	SPRING GROVE	1935B	1942G	2ND	142.362	L06729	39-52-22N	76-51-58W	980.113		N39076400		PA
344	T 112 MDSRC	1967D		2ND	287.171	L21359	39-42-16N	76-54-45W	980.090		N39076400		MD
346	T 162	1942C	1961G	2ND	118.064	L18463	39-59-03N	76-44-07W	980.115		N39076400		PA
181	T 180	1942C		2ND	240.386	L10088	39-43-51N	76-51-21W	980.104		N39076400		PA

*RESET ELEVATION

Exhibit 4.—Alphabetic index to Vertical Control Data.

```
                                                                                                    SEQN--041
US DEPARTMENT OF COMMERCE - NOAA                    VERTICAL CONTROL DATA                    QUAD--N34091100 LINE--102
NOS - NATIONAL GEODETIC SURVEY                NATIONAL GEODETIC VERTICAL DATUM 1929       STATE--AR  DIAGRAM--NI 15-6
ROCKVILLE MD 20852 - DEC 1979                    ADJUSTED BY--CGS    YEAR--1957           COUNTY--PRAIRIE
                                                        SOURCE--L15467

        BENCH MARK                                ORDER--1ST  MONUMENTATION QUALITY--C   APPROX  LAT  34-47-04N
        DESIGNATION--MESA RM 1                    ESTABLISHED BY--CGS    YEAR--1920    POSITION--LON 091-28-48W

             H - ELEVATION                                                                        NORMAL
           ABOVE NGVD 1929          MODELED BOUGUER        MODELED       NORMAL GRAVITY  GEOPOTENTIAL NUMBER
      (NORMAL ORTHOMETRIC HEIGHT)   ANOMALY   SIGMA   SURFACE GRAVITY   (1967 FORMULA)   (GPU=KILOGALMETER)
  68.265 METERS (  223.966 FEET)   -6.2 MGALS 0.5     979.695 GALS       979.715 GALS        66.880 GPUS

        ****************************** B E N C H   M A R K   R E C O V E R Y ****************************
   DESIGNATION--MESA RM 1                          STATE--AR  COUNTY--PRAIRIE              QUAD--N340911 XRN--EH1092
   ************** MONUMENT BY--CGS ***************** YR--1920 COP--UNK  MARK TYPE--REFERENCE MARK DISK ***********
   ************** RECOVERY BY--CGS ***************** YR--1954 COP--HDR  CONDITION--GOOD ************************
                  STAMPING--R M 1 MESA 1916 1920
                  SETTING--CONCRETE POST
                  LOCATED--1.25 MI WEST  FROM THE CITY OR TOWN OF--DE VALLS BLUFF
                  ********************************************************************************
        1.25 MILES WEST ALONG THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD FROM THE STATION AT OE VALLS
        BLUFF, ACROSS THE RAILROAD FROM A LARGE HOUSE, 9 1/2 RAILS WEST OF A ROAD CROSSING, 5 RAILS EAST OF
        SEMAPHORE 87.5, 94 FEET SOUTH OF THE SOUTH RAIL, 58.8 FEET SOUTHEAST OF TRIANGULATION STATION MESA,
        45 FEET NORTH OF THE CENTER LINE OF A GRAVELED ROAD, 20.5 FEET SOUTHWEST OF A TELEPHONE POLE, SET IN
        THE TOP OF A CONCRETE POST WHICH PROJECTS 0.4 FOOT ABOVE THE GROUND.
```

```
                                                                                                    SEQN--042
US DEPARTMENT OF COMMERCE - NOAA                    VERTICAL CONTROL DATA                    QUAD--N34091100 LINE--102
NOS - NATIONAL GEODETIC SURVEY                NATIONAL GEODETIC VERTICAL DATUM 1929       STATE--AR  DIAGRAM--NI 15-6
ROCKVILLE MD 20852 - DEC 1979                    ADJUSTED BY--CGS    YEAR--1957           COUNTY--PRAIRIE
                                                        SOURCE--L15467

        BENCH MARK                                ORDER--1ST  MONUMENTATION QUALITY--C   APPROX  LAT  34-47-03N
        DESIGNATION--MESA RM 2                    ESTABLISHED BY--CGS    YEAR--1920    POSITION--LON 091-28-47W

             H - ELEVATION                                                                        NORMAL
           ABOVE NGVD 1929          MODELED BOUGUER        MODELED       NORMAL GRAVITY  GEOPOTENTIAL NUMBER
      (NORMAL ORTHOMETRIC HEIGHT)   ANOMALY   SIGMA   SURFACE GRAVITY   (1967 FORMULA)   (GPU=KILOGALMETER)
  68.046 METERS (  223.248 FEET)   -6.2 MGALS 0.5     979.695 GALS       979.715 GALS        66.665 GPUS

        ****************************** B E N C H   M A R K   R E C O V E R Y ****************************
   DESIGNATION--MESA RM 2                          STATE--AR  COUNTY--PRAIRIE              QUAD--N340911 XRN--EH1093
   ************** MONUMENT BY--CGS ***************** YR--1920 COP--UNK  MARK TYPE--REFERENCE MARK DISK ***********
   ************** RECOVERY BY--CGS ***************** YR--1954 COP--HDR  CONDITION--GOOD ************************
                  STAMPING--MESA R M 2 B M 1916 1920
                  SETTING--CONCRETE POST
                  LOCATED--1.25 MI WEST  FROM THE CITY OR TOWN OF--DE VALLS BLUFF
                  ********************************************************************************
        1.25 MILES WEST ALONG THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD FROM THE STATION AT DE VALLS
        BLUFF, ACROSS THE RAILROAD FROM THE A LARGE HOUSE, 12 1/2 RAILS WEST OF A ROAD CROSSING, 95.7 FEET
        SOUTH OF THE SOUTH RAIL, 50 FEET NORTH OF THE CENTER LINE OF A GRAVELED ROAD, 48.3 FEET SOUTHWEST OF
        TRIANGULATION STATION MESA, 5.7 FEET EAST OF A TELEPHONE POLE, SET IN THE TOP DF A CONCRETE POST
        WHICH IS 0.1 FOOT BELOW THE TOP OF THE GROUND.
```

Exhibit 5.—Vertical Control Data (new format).

SEPTEMBER 1963

PUBLISHED AND PRINTED BY:
U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY
WASHINGTON D.C.

VERTICAL CONTROL DATA

by the
Coast and Geodetic Survey
SEA-LEVEL DATUM OF 1929

QUAD 461132
MONT.
LATITUDE 46°00' to 46°30'
LONGITUDE 113°00' to 113°30'
DIAGRAM NL 12-4 BUTTE

LINE 101
(Second-order)

The field work (L-2048) was done in the summer of 1934 by a party supervised by A.C.Thorson.

These elevations are based on a supplementary adjustment of 1947.

Bench Mark	Adjusted Elevation (Meters)	(Feet)
M 68	1694.085	5558.010
5623 (USGS)	1713.071	5620.300
N 68	1754.979	5757.794
P 68	1798.086	5899.220
Q 68	1897.520	6225.447
6794 (USGS)	2070.188	6791.942
R 68	1952.354	6405.348
S 68	1946.042	6384.639
T 68	1948.304	6392.061
U 68	1962.488	6438.596
V 68 RESET (1956)		6297.847
W 68	1821.390	5975.677
X 68	1772.320	5814.686
Z 68	1677.750	5504.418

LINE 102
(Second-order)

The field work (L-2692) was done in September 1934 by a party supervised by Curtis LeFever.

These elevations are based on a supplementary adjustment of 1947.

Bench Mark	Adjusted Elevation (Meters)	(Feet)
S 140	1949.918	6397.356
T 140	1924.532	6314.069
U 140	Destroyed	
V 140	1678.398	5506.544
W 140	1634.513	5362.565
X 140	1605.165	5266.279
Y 140	1592.278	5223.999
5278 (USGS)	1606.388	5270.291
PHILLIPSBURG	1614.153	5295.767
5-1 CWA	1537.942	5045.731
Z 140	1522.546	4995.220
B 141	1492.623	4897.047
C 141	1475.245	4840.033
D 141	1434.389	4705.991

Exhibit 6.—Vertical Control Data (old format—elevations).

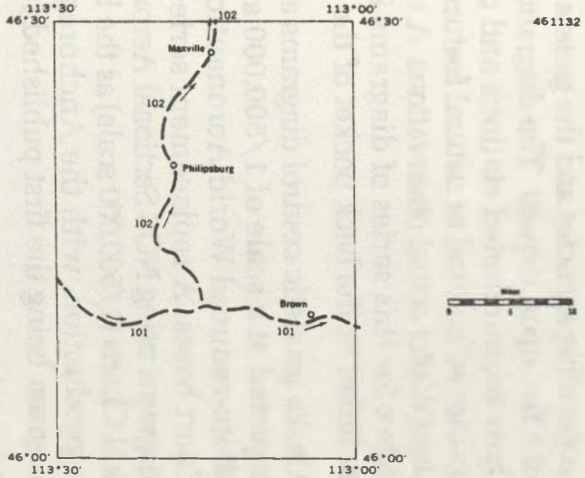
SEPTEMBER 1963

PUBLISHED AND PRINTED BY:
U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY
WASHINGTON D.C.

VERTICAL CONTROL DATA

by the
Coast and Geodetic Survey
SEA-LEVEL DATUM OF 1929

QUAD 461132
MONT.
LATITUDE 46°30' to 46°30'
LONGITUDE 113°00' to 113°30'
DIAGRAM NL 12-4 BUTTE



461132

LINE 1C1

DESCRIPTION OF BENCH MARK

Designation	5623 (USGS)	State	Montana	County	Granite
Nearest town	Quinlan's Ranch	County		Chief of party	
Distance and direction from nearest town	At Quinlan's Ranch			Leveling date	
Character of mark	Standard disk			Stamping	
Established by	USGS				
Detailed description					

At Quinlan's Ranch, Granite County, 700 feet west of the west corner of the ranchhouse, 302 feet southwest of the south corner of a large sheep barn, 36 feet northeast of an irrigation ditch, and in the top of a boulder. A United States Geological Survey standard disk, stamped "5623 MSLA."

DESCRIPTION OF BENCH MARK

Designation	N 68	State	Montana	County	Granite
Nearest town	Quinlan's Ranch	County		Chief of party	
Distance and direction from nearest town	1.8 miles southeast			Leveling date	
Character of mark	Standard disk			Stamping	
Established by	USC&GS				
Detailed description					

1.8 miles southeast along State Highway 38 from United States Geological Survey bench mark 5623 at Quinlan's Ranch, Granite County, 0.6 mile west of the Edwards ranchhouse, southwest of the point where Mungas flume empties into a ditch, 207 feet northwest of a small road bridge over a wash, 166 feet north of East Fork Rock Creek, and 18 feet north of the centerline of the highway. A standard disk, stamped "N 68 1934" and set in the top of a concrete post.

DESCRIPTION OF BENCH MARK

Designation	M 68	State	Montana	County	Granite
Nearest town	Quinlan's Ranch	County		Chief of party	
Distance and direction from nearest town	1.1 miles northwest			Leveling date	
Character of mark	Standard disk			Stamping	
Established by	USC&GS				
Detailed description					

1.1 miles northwest along State Highway 38 from United States Geological Survey bench mark 5623 at Quinlan's Ranch, Granite County, at a gate across the highway, 80 feet south of the south corner of the Gus Irish ranchhouse, 60 feet southwest of a small irrigation ditch, 16 feet southwest of the center of a gate, 12 feet west of a pole fence, and 2.5 feet higher than the highway. A standard disk, stamped "M 68 1934" and set in the top of a concrete post.

DESCRIPTION OF BENCH MARK

Designation	P 68	State	Montana	County	Granite
Nearest town	Quinlan's Ranch	County		Chief of party	
Distance and direction from nearest town	3.3 miles southeast			Leveling date	
Character of mark	Standard disk			Stamping	
Established by	USC&GS				
Detailed description					

3.3 miles southeast along State Highway 38 from United States Geological Survey bench mark 5623 at Quinlanas Ranch, Granite County, 0.2 mile southeast of East Fork School, 0.2 mile east of a gate across the highway, 24 feet south of the south edge of the bridge over the inverted siphon of Mungas flume, and 25 feet south of the centerline of the highway. A standard disk, stamped "P 68 1934" and set in the top of a concrete post.

Exhibit 7.—Vertical Control Data (old format—descriptions).

Indexes to Horizontal and Vertical Geodetic Control Information

Geodetic Network Diagrams

Indexes to horizontal and vertical geodetic control information, commonly referred to as Geodetic Network Diagrams, graphically depict horizontal and/or vertical geodetic control points. Control points are survey monuments of known position (horizontal) or elevation (vertical), or both, forming a geodetic control network. Inserted in the pocket of the back cover of this publication are reduced examples of network diagrams described in this section. There are nearly 900 diagrams contained in the following series:

Geodetic Control Diagrams depict at a scale of 1/250,000 both horizontal and vertical control for areas of 1° latitude by 2° longitude. In these areas, control has been established by NOAA, the U.S. Geological Survey (USGS), and other Federal, State, and local agencies; and the resultant data have been accepted for inclusion into the National Geodetic Networks. These diagrams are published by NGS and are made available to all cooperating agencies and the general public for a fee, upon request. The diagrams show monumented stations and certain positioned cultural or natural features. Lines depict actual observations. A reduced index for this series of diagrams is included in the back pocket of the cover.

Alaska geodetic control diagrams are depicted at a scale of 1/500,000 and use photo-reduced World Aeronautical Chart bases. A replacement series of 17 diagrams using NOS Sectional Aeronautical Charts (1/500,000 scale) as the base is in production, with the Anchorage diagram being the first published in 1980.

Triangulation Diagrams are issued for each State and depict horizontal control established or adjusted by NGS. The diagram shows monumented points and

positioned cultural or natural features. Measured directions and distances are also depicted.

Triangulation Diagrams (coastal areas) are published in certain areas of the conterminous United States, Alaska, Hawaii, and Puerto Rico, using NOS nautical chart bases to depict horizontal and vertical control. Diagrams, with various bases at larger scales, supplement the Triangulation Diagrams in areas where geodetic control is congested such as metropolitan and coastal areas.

Index Maps of Control Leveling are issued for each State, and depict vertical control established or adjusted by NGS. These leveling diagrams show first-order and second-order level lines established in the State.

Network Status Maps—Two diagrams entitled "Status of Horizontal Control, United States" and "Status of Vertical Control, United States" depict the status of these networks. The diagrams for the conterminous United States and Alaska are updated annually.

ILLUSTRATIONS IN BACK POCKET

Astronomic Information

Latitude, Longitude, Azimuth, and Deflection of Vertical

Astronomic information includes final results of astronomic latitude, longitude, azimuth, and deflection of the vertical determinations for more than 5,000 stations in the United States and the U. S. possessions. Astronomic information is listed by station and by 30' quadrangle locations. This information is required for the transformation between survey observations and mathematical models representing the Earth. In horizontal control surveys, the data often provide project orientation.

Exhibit 8 shows the printed data elements, including station identifiers (QID/QSN and name), both astronomic and geodetic positions (AST/GEOD, LAT and LONG), a measure of precision (SIG), the meridional component (M.C.) and prime vertical component (P.V.C.) of the deflection of the vertical, and the elevation. Also available, but not illustrated, are tables for the apparent place of Polaris and sidereal time of 0 hour Universal Time for each day of the year.

Astronomic Information

QID/QSN	ST	STATION NAME	LAT(AST/GEOD)	SIG	M.C.	PD	LONG(AST/GEOD)	SIG	P.V.C.	PD	ELEV(M)
0380772310001	VA	ACADEMY 1934	38 10 28.87	.27		1	77 16 12.21	.36		1	63.10
			38 10 29.92		- 1.05		77 16 22.56		- 8.14		
0380772310007	VA	ASTRO WEST PIER 1975	38 12 07.63	.13		4	77 22 20.52	.23		2	70.08
			38 12 06.93		0.70		77 22 25.44		- 3.86		
0360824210001	VA	BIG KNOB 1893	36 39 48.68	.50		1	0	.00		0	962.00
			36 39 52.48		- 3.80		82 30 21.76		0.00		
0360771240007	VA	BOONE 1965	36 41 02.15	.27		1	77 08 47.22	.36		1	38.30
			36 41 03.78		- 1.63		77 08 52.97		- 4.61		
0380774140002	VA	BULL RUN 1871	38 52 56.38	.40		2	77 42 17.98	.69		1	419.00
			38 52 53.26		3.12		77 42 12.79		4.04		
0370802220001	VA	CAHAS 1877	37 07 00.46	.50		1	0	.00		0	1038.00
			37 07 01.57		- 1.11		80 00 56.91		0.00		
0360761110002	VA	CAPE HENRY LIGHTHOUSE OLD	36 55 30.32	.50		1	0	.00		0	0.00
			36 55 32.33		- 2.01		76 00 30.52		0.00		
0370763340004	VA	CLAREMONT 1932	37 11 57.43	.27		1	76 59 32.46	.36		1	35.40
			37 11 58.81		- 1.38		76 59 43.75		- 8.99		
0380782120001	VA	CLARK ERDL 1957	38 18 43.72	.26		1	78 00 06.61	.40		1	324.20
			38 18 44.14		- 0.42		78 00 06.43		0.14		
0380782120005	VA	CLARK MTN 1871	38 18 39.55	.50		1	0	.00		0	329.70
			38 18 40.76		- 1.21		78 00 11.69		0.00		
0370764340065	VA	COLUMBUS 2 1966	37 41 24.65	.27		1	76 53 18.48	.36		1	38.30
			37 41 28.73		- 4.08		76 53 25.36		- 5.44		
0370764320025	VA	CORPORATION 1934	37 30 11.91	.27		1	76 51 58.72	.38		1	38.10
			37 30 13.82		- 1.91		76 52 04.75		- 4.79		
0380771330003	VA	DAVID 1942	38 34 28.84	.27		1	77 29 42.61	.40		1	140.00
			38 34 30.06		- 1.22		77 29 45.01		- 1.88		
0360771120006	VA	DORY 2 1966	36 51 05.10	.27		1	77 02 58.87	.39		1	35.03
			36 51 05.85		- 0.75		77 03 06.44		- 6.06		

Exhibit 8.—Astronomic station data.

Satellite Surveying Information

Exhibit 9 shows information for three-dimensional results of satellite Doppler surveys. When the Global Positioning System becomes operational within the next several years, information from this new system will be available. The data consist of point positions in the form of geocentric coordinates (X,Y,Z) and geodetic coordinates (latitude, longitude, and geodetic height). Relative positions in the form of vector base lines (DX, DY, DZ) are available for simultaneously observed points. Data for transforming satellite positional data to other datums (and vice versa) are also available. These other datums include the North American Datum (NAD) of 1927, the World Geodetic System (WGS) of 1972, and the predicted NAD 1983 system. The data are derived from satellite radio observations performed with geodetic tracking receivers.

Gravimetric Information

Exhibit 10 shows gravimetric information, or the local acceleration of gravity. The intensity of gravity can be predicted for any location within the continental United States. These predicted values are available for a user's specific location and elevation. Gravimetric data are usually made available by 1 degree square areas in the form of punched cards, printed output, and magnetic tape. Individual station values and descriptions can be provided by special request.

Current gravimetric data include the following information for each 1°x1° subdivision ("block"): position, elevation, observed adjusted gravity value, free air and Bouguer anomalies, and terrain correction. Gravimetric data are available for more than 1 million points throughout the United States.

```
*0        G E O D E T I C O  S U M M A R Y -  D O P P L E R  S A T E L L I T E  O B S E R V A T I O N  S T A T I O N
*0                                                    DATE: 09/08/82

*            L O C A L   D A T U M   C O O R D I N A T E S
*    HORIZONTAL FROM TERRESTRIAL OBS        VERTICAL FROM TERRESTRIAL OBS
*0 LATITUDEO        N  38 12  6.9291      ELEVATION (h)          70.08  M.
*  LONGITUDEO       W  77 22 25.4372      GEOID HEIGHT (N)       -2.6   M.
*  DATUMO           NAD 1927              ELLIPSOID HT(H=N+h)    67.5   M.
*0 ELLIPSOIDO       CLARKE 1866           DATUM FOR N      M-R N=0 NAD1927
*  ORDERO           SECOND- TRIANG        DATUM FOR ELEV       NGVD 1929
*  SURVEYED BY      NGS   ,               ORDER FOR ELEV
*  DATA LOCATION    NGIC, NGS, C18        SOURCE OF N      EXTRAPOLATED-NGS
*                                                          ASTROG. GEOID'75

*      T R A N S F O R M E D   D O P P L E R   C O O R D I N A T E S
*0         WGS 1972 COORDINATESO
*  LATITUDE      N  38 12  7.2574
*  LONGITUDE     E 282 37 35.0486
*0 ELLIPSOID HT (H)O   32.44 M.
*0 GEOID HEIGHT (N)  -37.6  M.O
*ODATUM SHIFT (LOCAL MINUS WGS 72)O
*  DELTA X             23.77 M.O
*  DELTA Y           -160.20 M.
*0 DELTA ZO          -180.05 M.O

*                A R C H I V A L   I N F O R M A T I O N
*    CAHIER ACCESSION NUM    DS 81          TAPE      LOCATION
*                                           RET023    ROCKWALL-306
*    SHELF MARK                863          E12466    IBM-FOB-4
*                                           E12666    IBM-FOB-4
*    MICROFILM REEL NUM                     020806    UNIVAC-FOB-3
*                  ITEM                                  LOCATION
*    1.0 STATION OCCUPATION REPORTO          NGS CAHIER
*    2.ODESCRIPTION, RECOVERY NOTES, ETCO    NGS, C18 AND CAHIER
*    3. ADJUSTED GEODETIC CONTROL DATAO      NGS, C18
*0   4. SURVEY SKETCHO                       NGS CAHIER
*0   5. STATION SITE SKETCHO                 NONE
*0   6. PICTURE POINT IDENTIFICATIONO        NONE
*0   7. SITE PHOTOGRAPHSO                    NONE
*0   8. ASTRO COORDINATESO                   NGS, C152
*0   9. GRAVITY OBSERVATIONSO                NONE OR DMAHTC SAT REC DESK
*0  10. OBSTRUCTION SURVEYO                  NONE
*0  11. STATION OBSERVATION LOGSO            NGS CAHIER
*OREMARKS:

*0  R E M A R K SO:
*0  VERIFICATION:0

*       S T A T I O N   I N F O R M A T I O N
*0  STAMPING ON MARKO                    SOL CODE  STATION NO
*0 ASTRO WEST PIER 19750                   1000       50003
*0
*0        CITY OR TOWNO                      QID       QSN
*0    CORBINO                             038077231   0007
*
*        COUNTRY            STATE/PROV/TERR     UTM ZONE
*  UNITED STATES                 VA

*      O C C U P A T I O N   I N F O R M A T I O N
*   PERIOD OF OCCUPATION     OCC LENGTH      OBSERVED BYO
*   7/21/75 THRU 7/26/750      6 DAYS           BLM
*
*0      EQUIPMENTO     S/N       ECCENTRICITIES (M.)
*0  GEOCEIVERO         055   N=   .000 E=  .000 U=  .637
*0
*   SATS OBSERVED:  30190  30200      0      0      0

*0      R E D U C T I O NO  I N F O R M A T I O N
*0  REDUCED BYO  DATE      PROGRAM  REJECTION FACTOR
*0      NGSO     3/ 4/77   NGS-02      3.0 SIGMA

*0    PASSESO         OBSERVATIONS        DEGREES OF
*    INPUT USEDO      INPUT  USED          FREEDOM
*      390   37         759    715           674
*
*      RESIDUAL       CUTOFF ANGLES        TIMING BIAS
*        RMS        PASSES  DATAPTS                RMS
*0      .15 M.O      10.0     10.0            uS.   uS.

*0          S A T E L L I TOEO  D O P P L EOR
*0 P O I N T - P O S I T I O NO  C O O R D I N A T E S
*              A T   S T A T I O N   M A R K
*                  COORDINATES       EST ERR (1 SIG)
*   X                1097028.88 M.        .78 M.
*0  YO              -4897252.69 M.O       .21 M.
*0  ZO               3923111.78 M.O       .98 M.
*   LATITUDEO        N  38 12  7.2805      .54 M.
*0  LONGITUDEO       E 282 37 34.7886      .72 M.
*0  ELLIPSOID HT (H)O      27.99 M.        .90 M.
*0  GEOID HT (N=H-ELEV)O  -42.1  M.O

*    ELLIPSOID: WGS 1966    COORDINATE      GRAVITY
*       A  = 6378145.0 M.      SYSTEM         MODEL
*      1/F = 298.25           NWL-9D         NWL-10E
```

Exhibit 9.—Satellite surveying data (Doppler).

Gravimetric Information

SUPER BLOCK NO. 114 LOCAL BLOCK NO. 1487

RECORD ADDRESS	LAT DEGS	WLON DEGS	ELEV(METERS) PRIME	SECOND	OBS. GRAV MGAL*1000	SIG	FAA(MGALS)	SIG	BA(MGALS)	SIG	TERR. CORR (MGALS)	SIG	SRCE CODE	T	AG	F	P	STAT ID	BENCH MARK DESIGNATION
1080199	48.517	103.060	709.4	0.0	2738100		20.30	1.00	-59.00	1.00	0.0	0.0	5183	1	1	0	0	296	
1080198	48.605	103.060	699.5	0.0	2750900		22.10	1.00	-56.10	1.00	0.0	0.0	5183	1	1	0	0	295	
1080095	48.692	103.059	700.6	0.0	2761700		25.50	1.00	-52.80	1.00	0.0	0.0	5183	1	1	0	0	294	
1077844	48.879	103.465	683.4	0.0	2774700		16.30	1.00	-60.10	1.00	0.0	0.0	5115	1	1	0	0	293	
1077843	48.779	103.157	709.6	0.0	2763600		22.30	1.00	-57.00	1.00	0.0	0.0	5115	1	1	0	0	292	
1077840	48.765	103.443	635.2	0.0	2776600		13.70	1.00	-57.30	1.00	0.0	0.0	5115	1	1	0	0	291	
1077838	48.982	103.442	609.3	0.0	2799200		8.80	1.00	-59.30	1.00	0.0	0.0	5115	1	1	0	0	290	
1077837	48.894	103.004	592.5	0.0	2809300		21.50	1.00	-44.70	1.00	0.0	0.0	5115	1	1	0	0	289	
1077836	48.967	103.179	581.3	0.0	2809000		11.30	1.00	-53.70	1.00	0.0	0.0	5115	1	1	0	0	288	
1077789	48.663	103.318	695.6	0.0	2756100		20.90	1.00	-56.80	1.00	0.0	0.0	5115	1	1	0	0	287	
933628	48.561	103.232	711.0	0.0	2760000		29.20	2.00	-50.20	2.00	0.0	0.0	4086	1	10	0	0	286	
933622	48.561	103.076	695.2	0.0	2761300		25.70	2.00	-52.00	2.00	0.0	0.0	4086	1	10	0	0	285	
933601	48.879	103.485	694.2	0.0	2787100		22.70	2.00	-54.90	2.00	0.0	0.0	4086	1	10	0	0	284	
933600	48.776	103.482	636.6	0.0	2791800		18.90	2.00	-52.30	2.00	0.0	0.0	4086	1	10	0	0	283	
933599	48.675	103.449	663.6	0.0	2779500		24.00	2.00	-50.20	2.00	0.0	0.0	4086	1	10	0	0	282	
933598	48.983	103.419	601.1	0.0	2814200		11.80	2.00	-55.30	2.00	0.0	0.0	4086	1	10	0	0	281	
933597	48.778	103.332	627.3	0.0	2791700		15.70	2.00	-54.40	2.00	0.0	0.0	4086	1	10	0	0	280	
933596	48.982	103.266	583.2	0.0	2819600		11.80	2.00	-53.40	2.00	0.0	0.0	4086	1	10	0	0	279	
933595	48.881	103.312	598.6	0.0	2806500		12.40	2.00	-54.40	2.00	0.0	0.0	4086	1	10	0	0	278	
933594	48.705	103.319	678.3	0.0	2777300		23.60	2.00	-52.20	2.00	0.0	0.0	4086	1	10	0	0	277	
933593	48.645	103.317	698.0	0.0	2769800		27.60	2.00	-50.40	2.00	0.0	0.0	4086	1	10	0	0	276	
933592	48.981	103.112	576.0	0.0	2829600		19.60	2.00	-44.80	2.00	0.0	0.0	4086	1	10	0	0	275	
933591	48.778	103.200	708.6	0.0	2776000		25.20	2.00	-54.00	2.00	0.0	0.0	4086	1	10	0	0	274	
933590	48.675	103.186	687.3	0.0	2772600		24.40	2.00	-52.40	2.00	0.0	0.0	4086	1	10	0	0	273	
933589	48.880	103.109	612.2	0.0	2812300		22.60	2.00	-45.90	2.00	0.0	0.0	4086	1	10	0	0	272	
933588	48.778	103.067	723.7	0.0	2780900		34.70	2.00	-46.20	2.00	0.0	0.0	4086	1	10	0	0	271	
933587	48.763	103.068	721.8	0.0	2780100		34.60	2.00	-46.00	2.00	0.0	0.0	4086	1	10	0	0	270	
933586	48.720	103.056	710.2	0.0	2778500		33.30	2.00	-46.10	2.00	0.0	0.0	4086	1	10	0	0	269	
933585	48.676	103.012	698.6	0.0	2776800		31.90	2.00	-46.10	2.00	0.0	0.0	4086	1	10	0	0	268	
933562	48.560	103.342	693.1	0.0	2764800		28.70	2.00	-48.70	2.00	0.0	0.0	4086	1	10	0	0	267	
933560	48.546	103.489	644.3	0.0	2772200		22.20	2.00	-49.80	2.00	0.0	0.0	4086	1	10	0	0	266	
219277	48.885	103.010	595.0	0.0	2808100		22.00	1.00	-44.40	1.00	0.0	0.0	3578	1	1	3	0	265	
219276	48.912	103.317	600.5	0.0	2795800		9.00	1.00	-58.00	1.00	0.0	0.0	3578	1	1	1	0	264	
217758	48.908	103.488	684.3	0.0	2776500		15.80	1.00	-60.50	1.00	0.0	0.0	3557	1	1	3	0	263	
24187	48.937	103.267	587.0	0.0	2800400		7.00	1.00	-58.40	1.00	0.0	0.0	1528	1	1	3	0	262	
24186	48.938	103.005	579.7	0.0	2816900		21.30	1.00	-43.40	1.00	0.0	0.0	1528	1	1	3	0	261	
24185	48.938	103.048	579.7	0.0	2814600		19.00	1.00	-45.60	1.00	0.0	0.0	1528	1	1	3	0	260	
24184	48.938	103.289	589.8	0.0	2798500		6.10	1.00	-59.70	1.00	0.0	0.0	1528	1	1	3	0	259	
24183	48.937	103.114	581.3	0.0	2809900		14.80	1.00	-50.10	1.00	0.0	0.0	1528	1	1	3	0	258	
24182	48.937	103.179	583.1	0.0	2805400		10.90	1.00	-54.10	1.00	0.0	0.0	1528	1	1	3	0	257	
24181	48.908	103.355	617.5	0.0	2790000		8.70	1.00	-60.20	1.00	0.0	0.0	1528	1	1	3	0	256	
24180	48.908	103.442	674.2	0.0	2778300		14.50	1.00	-60.70	1.00	0.0	0.0	1528	1	1	3	0	255	
24179	48.908	103.464	675.7	0.0	2778800		15.50	1.00	-60.00	1.00	0.0	0.0	1528	1	1	3	0	254	
24178	48.908	103.486	688.8	0.0	2775800		16.50	1.00	-60.40	1.00	0.0	0.0	1528	1	1	3	0	253	
24177	48.908	103.377	632.5	0.0	2786700		10.00	1.00	-60.50	1.00	0.0	0.0	1528	1	1	3	0	252	
24176	48.908	103.421	663.2	0.0	2780700		13.50	1.00	-60.50	1.00	0.0	0.0	1528	1	1	3	0	251	
24174	48.908	103.311	593.8	0.0	2795000		6.30	1.00	-59.90	1.00	0.0	0.0	1528	1	1	3	0	250	
24173	48.923	103.114	581.3	0.0	2808500		14.70	1.00	-50.10	1.00	0.0	0.0	1528	1	1	3	0	249	
24172	48.923	103.377	621.8	0.0	2790100		8.80	1.00	-60.60	1.00	0.0	0.0	1528	1	1	3	0	248	
24171	48.923	103.399	635.5	0.0	2787600		10.50	1.00	-60.40	1.00	0.0	0.0	1528	1	1	3	0	247	

Exhibit 10.—Gravimetric data.

Calibration Standards for Electronic Distance-Measuring Instruments

Calibration standards for electronic distance measuring instruments are provided by calibration base lines (CBL). They are established for the Nation's surveyors and engineers to provide a means to detect constant and scale errors in measuring instruments. Nearly 200 CBL sites have been established by cooperative cost-sharing arrangements between NGS and State and local agencies, universities, and surveying associations. The cooperating organization installs the base line monuments and assists NGS field party personnel in obtaining measurements. A typical CBL configuration consists of four monuments located at 0, 150, 430, and 1400 meters relatively positioned with accuracies approaching one part per million. Available CBL data (Exhibit 11) include the adjusted distances between monuments, a description of the CBL monuments, and where the base line is located. These data are organized by State. Publications describing the use and establishment of calibration base lines are also available.

US DEPARTMENT OF COMMERCE - NOAA
NOS - NATIONAL GEODETIC SURVEY
ROCKVILLE MD 20852 - APRIL 30, 1982

CALIBRATION BASE LINE DATA
BASE LINE DESIGNATION: VIRGINIA TECH
PROJECT ACCESSION NUMBER: G15767

QUAD: N370802 PAGE 4
VIRGINIA
MONTGOMERY COUNTY

LIST OF ADJUSTED DISTANCES (APRIL 12, 1982)

FROM STATION	ELEV.(M)	TO STATION	ELEV.(M)	ADJ. DIST.(M) HORIZONTAL	ADJ. DIST.(M) MARK - MARK	STD. ERROR(MM)
0	649.385	150	647.452	150.0009	150.0133	.3
0	649.385	430	643.902	429.9545	429.9894	.6
0	649.385	1000	639.379	999.9378	999.9879	.7
0	649.385	1400	641.796	1399.9679	1399.9885	.9
150	647.452	430	643.902	279.9536	279.9761	.5
150	647.452	1000	639.379	849.9370	849.9753	.6
150	647.452	1400	641.796	1249.9670	1249.9798	.8
430	643.902	1000	639.379	569.9833	570.0012	.6
430	643.902	1400	641.796	970.0131	970.0154	.5
1000	639.379	1400	641.796	400.0296	400.0369	.6

DESCRIPTION OF VIRGINIA TECH BASE LINE
YEAR MEASURED: 1981
CHIEF OF PARTY: WJR

THE BASE LINE IS LOCATED ABOUT 10.6 KM (6.6 MI) NORTH OF CHRISTIANSBURG AND ON THE SOUTH SIDE OF BLACKSBURG AT THE VIRGINIA TECH AIRPORT ALONG THE SOUTH WEST SIDE OF THE NORTHWEST-SOUTHEAST RUNWAY.

TO REACH THE 0 METER POINT FROM THE VIRGINIA TECH AIRPORT CONTROL OFFICE, BEAR RIGHT AND FOLLOW TAXIWAY FOR 0.16 KM (0.1 MI) TO MAIN RUNWAY, TURN RIGHT AND FOLLOW RIGHT SIDE OF RUNWAY FOR 0.32 KM (0.2 MI) TO THE 430 METER POINT 150 FEET SOUTHWEST OF EDGE OF RUNWAY, CONTINUE ALONG RUNWAY FOR 0.24 KM (0.15 MI) TO THE 150 METER POINT 150 FEET SOUTHWEST OF EDGE OF RUNWAY, CONTINUE ALONG RUNWAY FOR 0.16 KM (0.1 MI) TO THE END OF RUNWAY AND THE 0 METER POINT 150 FEET SOUTHWEST OF EDGE OF RUNWAY. TO REACH THE 1000 AND 1400 METER POINTS START MILEAGE BACK WHERE TAXIWAY MEETS MAIN RUNWAY, GO NORTHWEST ON LEFT SIDE OF MAIN RUNWAY FOR 0.32 KM (0.2 MI) TO THE 1000 METER POINT 150 FEET SOUTHWEST OF EDGE OF RUNWAY, CONTINUE TO END OF RUNWAY, BEAR LEFT AND CONTINUE WESTERLY ACROSS RAILROAD GRADE FOR 1.3 KM (0.8 MI) TO THE 1400 METER POINT.

THE 0 METER POINT IS A STANDARD NGS DISK SET INTO THE TOP OF A ROUND CONCRETE MONUMENT 50.8 CM (20 IN) IN DIAMETER FLUSH WITH THE GROUND LOCATED 46.88 M (153.8 FT) SW FROM THE SOUTH MOST CORNER OF THE SOUTHEAST END OF RUNWAY, AND 45.72 M (150.0 FT) SW FROM THE SOUTHWEST EDGE OF RUNWAY. THE 1400 METER POINT IS A STANDARD NGS DISK SET INTO THE TOP OF A ROUND CONCRETE MONUMENT 50.8 CM (20 IN) IN DIAMETER RECESSED 5 CM (2 IN) BELOW THE GROUND LOCATED 62.79 M (206.0 FT) SE FROM A 4 FT HIGH CONCRETE ASTRO PILLAR, 62.18 M (204.0 FT) SW FROM THE SOUTHWEST CORNER OF THE SOUTHEAST SET OF RUNWAY LANDING LIGHTS, AND 39.38 M (129.2 FT) NW FROM AN ABANDON RAILROAD GRADE. THE BASE LINE MARKS HAVE NOT BEEN STAMPED AT THIS TIME. THE 150, 430, 1000, AND 1400 METER POINTS HAVE CENTER PUNCH HOLES, NOT CROSSES.

THE BASE LINE IS A NORTHWEST-SOUTHEAST LINE WITH THE 0 METER POINT ON THE SOUTHEAST END. IT IS MADE UP OF THE 0, 150, 430, 1000, AND 1400 METER POINTS.

FOR SITE ACCESS CONTACT MR. BILL BYRNE, AIRPORT MANAGER, POST OFFICE BOX 903, BLACKSBURG, VA. 24060 TELEPHONE (703) 961-6281.

THIS BASE LINE WAS ESTABLISHED IN CONJUNCTION WITH THE CIVIL ENGINEERING DEPARTMENT AT VIRGINIA TECH. FOR FURTHER INFORMATION CONTACT, CIVIL ENGINEERING DEPARTMENT, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, VIRGINIA 24061. TELEPHONE (703) 961-7147.

Exhibit 11.—Calibration base line data.

Computer Programs for Geodetic Applications

Computer programs for the geodetic applications described in this section are available on 9-track tapes. These programs, listed below, are written in FORTRAN, ASSEMBLY, or PL/1 and are for use on an IBM main frame computer; source codes and available documentation are included upon request. In addition, 33 geodetic application programs are available for the HP-41CV and HP-97 programmable calculators.

Program	Purpose
TRAV10	Adjusts a horizontal geodetic network using observation equations and the method of least squares.
TRAVERSE	Adjusts a plane coordinate traverse using condition equations and the method of least squares.
UTMDIR	Computes Universal Transverse Mercator (UTM) coordinates from geodetic positions.
UTMINV	Computes geodetic positions from UTM coordinates
DIRECT	Computes the geodetic position of a station, given the azimuth and distance from another station.
INVERSE	Computes the distance between two stations and the forward and back azimuths, given the latitude and longitude for each station.
GPPCGP	Computes State plane coordinates from geodetic positions or vice versa.
VERTO2	Adjusts a vertical angle survey network using observation equations and the method of least squares.
SPCUTM	Computes UTM coordinates from State Plane Coordinates.
HAVAGO	Adjusts horizontal and vertical geodetic observations. The program adjusts 18 kinds of observations by the method of variation of parameters in three dimensions.

LASSO	Enables application programers to use several existing subroutines for forming and solving very large, sparse sets of normal equations. It provides a method for reordering, solving, and computing a portion of the inverse for sparse matrices.
OBSEXAM	Edits horizontal observation data in conformance with *Input Formats and Specifications of the National Geodetic Survey Data Base* (Blue Book).
OBSDECK	Prepares data from a horizontal project in conformance with *Input Formats and Specifications of the National Geodetic Survey Data Base* (Blue Book) for input to programs TRAV10 and VERT02.
FIXIF	Provides mass changes to horizontal observation data in conformance with *Input Formats and Specifications of the National Geodetic Survey Data Base* (Blue Book).
LHORDE	Reformats and indexes alphabetically into a more readable format horizontal station descriptions given in the *Input Formats and Specifications of the National Geodetic Survey Data Base* (Blue Book).
OBSEDIT	Edits vertical observation data in conformance with *Input Formats and Specifications of the National Geodetic Survey Data Base* (Blue Book).
LEVEL1	Adjusts vertical observation data using the method of least squares.

Federal Geodetic Control Committee Specifications

Survey Specifications and Data Base Formats

The interagency Federal Geodetic Control Committee (FGCC) establishes Federal specifications for geodetic surveys and prescribes formats for entering data into the national geodetic data base. Geodetic survey specifications for the United States are contained in two FGCC publications: *Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys* (1974) and *Specifications to support Classification, Standards of Accuracy,and General Specifications of Geodetic Control Surveys* (1980).

Updated specifications reflecting new technology are being prepared. A third FGCC publication, *Input Format and Specifications of the National Geodetic Survey Data Base* (1980, 1983), is a three-volume user's guide, which gives instructions and specifications for submitting geodetic survey data for entry into the NGS geodetic data base and the subsequent adjustment and processing of the data for publication through the NGS geodetic data base management system. The FGCC publications (Exhibit 12) are used by Federal, State, and local agencies, and private surveying organizations that produce and use geodetic control data.

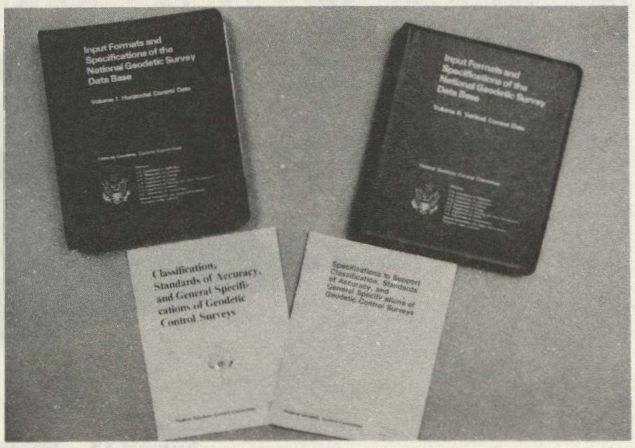


Exhibit 12.—A selection of Federal Geodetic Control Committee publications.

Crustal Movement Information

Exhibit 13 depicts crustal movement information gathered from special surveys performed by NGS to quantify and delineate movements of the Earth's crust, including associated investigations by the NGS Research and Development Laboratory, cooperative and research activities with the other NOAA components, Defense Mapping Agency, National Aeronautics and Space Administration, U.S. Geological Survey and some State agencies. NGS has periodically conducted horizontal and vertical control and gravimetric surveys to measure movement of the Earth's crust at geodetic stations in areas of seismic activity, regional uplift, and land subsidence. The leveling profile library contains historic leveling data for such seismically active areas as California, and subsidence areas such as Houston, Texas. The crustal movement information obtained from these surveys is essential to Federal programs in flood control, earthquake hazards reduction, nuclear site safety, geothermal energy development, geodetic control network maintenance, and basic ongoing research in the earth sciences.

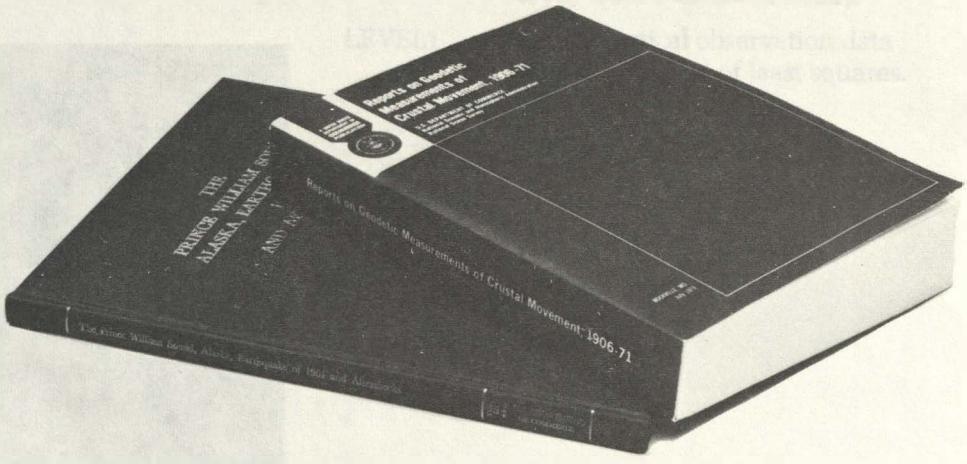


Exhibit 13.—Publications documenting crustal movement investigations.

Polar Motion Information

The POLARIS (POLar-motion Analysis by Radio Interferometric Surveying) network monitors the location of the Earth's axis of rotation using the method of Very Long Baseline Interferometry (VLBI). This method involves observations of extragalactic radio sources to determine polar motion and universal time. Exhibit 14 shows estimates of the X and Y components of the position of the pole, and formal uncertainties are tabulated according to observational dates. The nominal interval between entries is 5 days. The POLARIS Earth orientation information has applications in geodetic control network orientation, satellite and space geodesy requiring high accuracy, geodynamics research, climatology, and related geophysical and meteorological research.

1982 Polar Motion Parameter Determinations from VLBI Observations

Date y	m	d	X	σ_x	Y	σ_y	UT1-UTC	σ_{UT1}
82	1	7	-79.2	2.0	389.8	---	0.00306	0.00015
82	1	14	-64.4	2.0	400.7	---	-.01246	.00015
82	1	20	-51.3	2.1	409.2	---	-.02717	.00017
82	1	28	-46.3	3.0	417.0	---	-.03828	.00023
82	2	2	-36.0	2.7	422.1	---	-.04866	.00023
82	2	11	-5.6	1.6	429.7	---	-.06812	.00012
82	2	18	6.9	2.0	434.5	---	-.08390	.00017
82	2	25	23.1	3.0	437.4	---	-.09816	.00026
82	3	4	44.8	2.8	439.7	---	-.11739	.00024
82	3	11	77.9	2.7	440.0	---	-.13446	.00023
82	3	25	92.2	2.4	435.4	---	-.16445	.00019
82	3	30	131.0	4.2	432.7	---	-.18070	.00037
82	4	8	111.1	2.7	425.6	---	-.20140	.00024
82	4	14	141.2	2.8	420.9	---	-.21872	.00024
82	4	27	146.0	4.4	404.3	---	-.25001	.00039
82	5	4	181.4	2.1	393.7	---	-.27074	.00017
82	5	11	199.8	2.3	381.1	---	-.28854	.00019
82	5	18	200.3	1.9	366.5	---	-.30080	.00015
82	6	3	226.1	2.3	326.9	---	-.33850	.00019
82	6	8	234.8	2.9	312.0	---	-.34869	.00025

Exhibit 14.—Polar motion data and Universal Time.

Geodetic Literature and Archival Record Services

The National Geodetic Information Center houses a Geodetic Reference Services Group that maintains a geodetic library. Included are *NOAA Technical Publications* in the NOS NGS subseries (Exhibit 15), which includes NOAA Technical Reports, NOAA Technical Memorandums, and NOAA Manuals. Articles authored by the NGS staff are published in trade and professional journals and other external media, and are also indexed and stored in the NGS library. Coast and Geodetic Survey *Special Publications* and other literature concerning geodetic surveying and geodesy are also available. Many of these publications are available to the public for a nominal charge.

In addition, the Geodetic Reference Services Group catalogs current and archival geodetic records, arranges for retrieval of these records, and researches historic geodetic data upon specific request from NOAA users, other agencies, and the public.

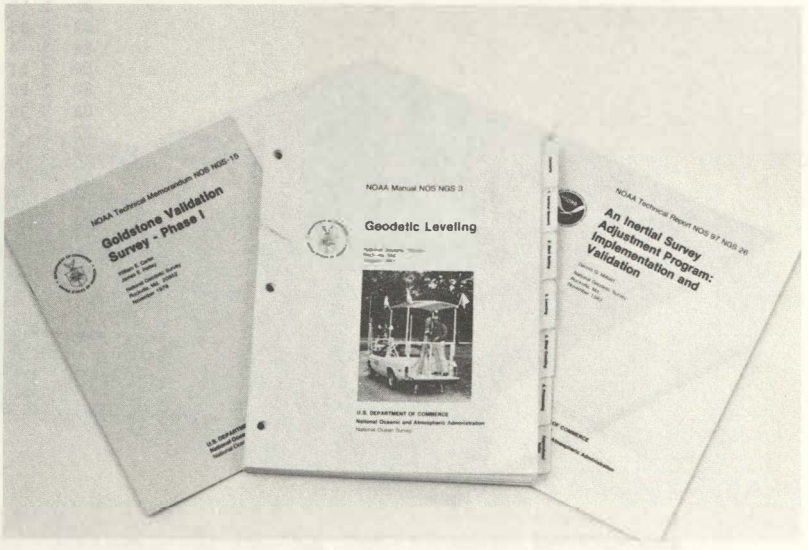


Exhibit 15.—Examples of NGS publications.

Geodetic Products and Services Information

Information on geodetic products and services is provided to users of geodetic data upon request. This marketing information is available from the National Geodetic Information Center and includes an automatic geodetic mailing service agreement, a fact sheet listing geodetic data prices, an irregularly issued periodical entitled *NOAA Geodetic News (Exhibit 16)*, a booklet listing NGS publications and prices, and various brochures and pamphlets describing NGS functions and services.

Exhibit 16.—NGS brochure and *NOAA Geodetic News*.

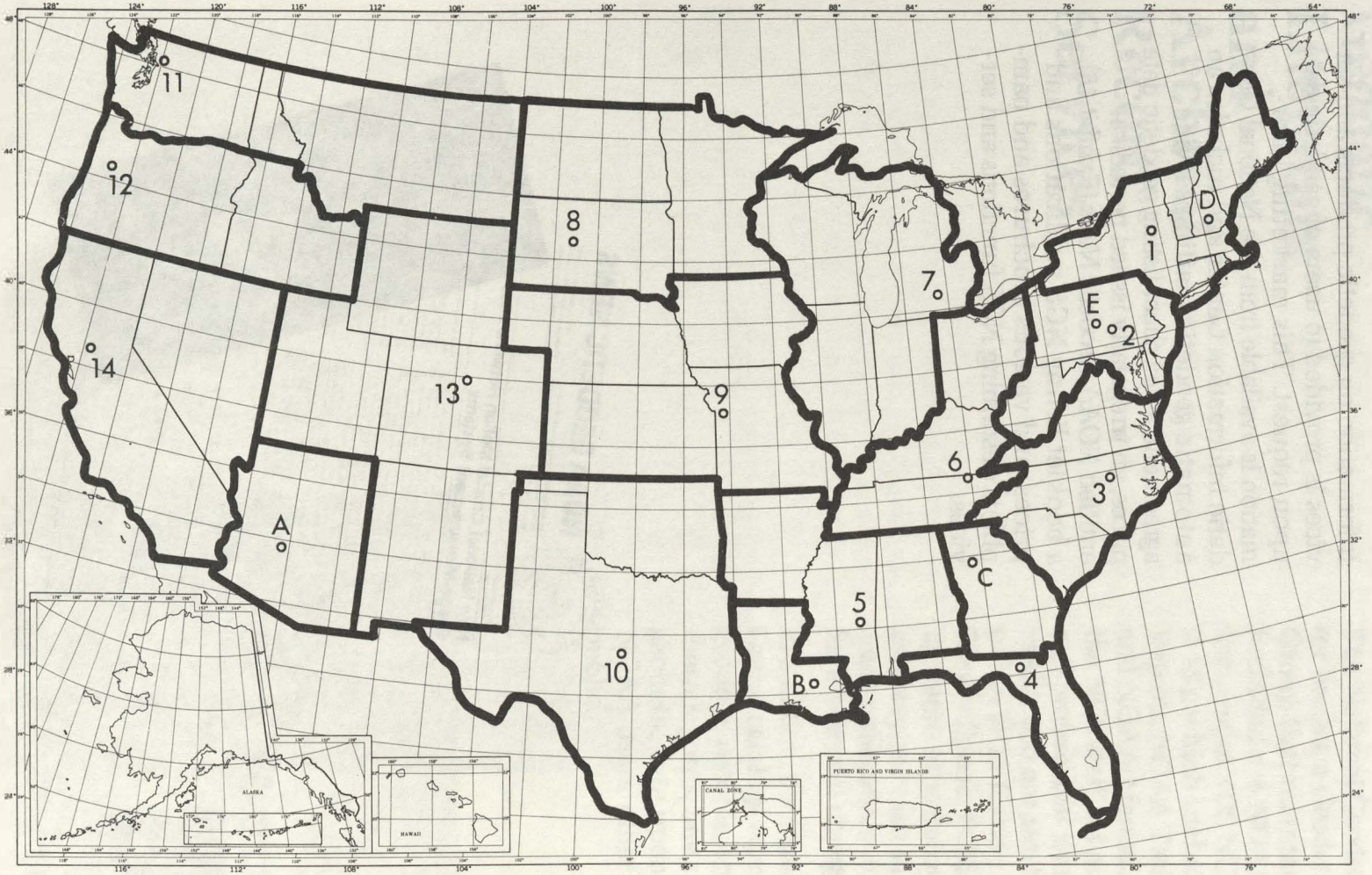


Exhibit 17.—Location of mark maintenance engineers and State geodetic advisors.

NGS Extension Service

Technology Transfer and Consultation

The NGS extension service assists State and local governments in performing supplemental geodetic control surveys. The service includes mark maintenance and State geodetic advisor programs. Arrangements for extension services vary according to the requirements of the State or local agency. The mark maintenance program supports the NGS responsibility for establishing and assuring the accuracy and reliability of the Nation's geodetic control networks. Mark maintenance is carried out by 14 field engineers who are responsible for preserving geodetic marks. These engineers also provide liaison, training, and assistance to local, State, and Federal agencies. In turn, cooperation and volunteered assistance from other agencies, such as State highway departments, save endangered marks. Some States utilize the services of a geodetic advisor to provide liaison between the cooperating State and NGS. NGS provides these States with instructional guidance as to the best methods and procedures for performing geodetic surveys. The advisor program operates on a cost-sharing basis. Exhibit 17 depicts locations of the mark maintenance engineers, designated by 14 regions in the United States, and State geodetic advisors, located in States A-E. Recently, the States of Florida, Alaska, Mississippi, and Rhode Island have also agreed to participate in the State geodetic advisor program.

Special Purpose Geodetic Surveys

Special purpose geodetic surveys are conducted to support scientific and engineering projects for NOAA and other agencies and institutions. The special projects usually have unique requirements, designs, and solutions and involve high precision measurements. Two recent examples of this type of service are: (1) a special survey performed at Stanford University's PEP storage ring (linear accelerator) in Palo Alto, involving the positioning of 12 instruments to millimeter accuracy, and (2) the special resurveys of geodetic networks along the San Andreas fault zone in California to detect and measure crustal motion.

Future Products

New technologies such as the global positioning system, very long baseline interferometry, inertial surveying systems, laser leveling, and precise photogrammetric surveys will have a profound effect on the future of surveying, geodesy, and related earth sciences. The National Geodetic Survey is at the forefront in studying and developing new technologies which reflect the state-of-the-art in geodesy. As new technologies become operational, NGS will improve present products, generate new products and services, and continue to provide accurate and timely information to all users of geodetic data.