April 1, 2000

MEMORANDUM FOR: Distribution

FROM: D.S. Snellgrove, N/NGS23

SUBJECT: Changes to the Blue Book (November 1998 Version)

Proposed page changes to the 1998 version of the Input Formats and Specifications of the National Geodetic Survey Data Base (Blue Book), Volume I. Horizontal Control Data and associated annexes are attached.

Also attached with this memo is an index of the changes to each section of the Blue Book, referencing the proposed updates and additions to each affected page of the current version (November 1998).

Please use your own copy of the Blue Book as a reference for updating the additions and corrections. The current versions of the Blue Book are available on the NGS Web Site at www.ngs.noaa.gov.

The WDDPROC software package (D-FILE Format)written by Janet Mencher is now available from the NGS Web Site. The new D-FILE (description file) format and the nine chapters of the Description Processing Handbook replace the unified format and Chapter 3 text of the published Blue Book, revised in November 1998. Although this change is effective immediately, NGS will continue to accept description files previously coded in the old unified format. The package of programs above were written to create, modify, and work on the new D-FILE format.

Any future additions, corrections, and/or updates to the Blue Book will only be available from the NGS Web Site. From www.ngs.noaa.gov, under Project and Division pages, click on FGCS/GIAC; click on Publications and Presentations; click on Input Formats and Specifications of the National Geodetic Survey.

Blue Book Index of Changes

Listed below are proposed changes to the current version of the Blue Book (November 1998):

Preface

Page iii ... ANNEX M (NGS GPS ANTENNA CODES) was added to supersede ANNEX J. See pages M-1 through M-3.

Page vi .... A new GPS ANTENNA RECORD (*72*) was added to supersede the existing GPS ANTENNA RECORD (*71*). See page 2-76b. Older Blue Book decks with *71* records will continue to be accepted by NGS.

Page viii .. Replace Annex J with Annex M and J-1 with M-1.

Chapter 2

Page 2-2 ... Replace *71* with *72*

Page 2-5 ... Replace *71* with *72*

Page 2-28 .. Replace *71* with *72*

Page 2-76b . Add entire page. [GPS ANTENNA RECORD (*72*)]

Page 2-82 .. Add Deflection Model Code A for DEFLEC99.

Page 2-84 .. Change code G to read “OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS WITH DECIMETER ACCURACY”.

Page 2-85 .. Add Codes T and U added to TABLE OF GEOID HEIGHT (GHT) CODES.

Page 3-10 .. In Marker Inscription paragraph change “UNK” to “NONE”.

Annex M

[Add complete annex; pages M-1,2,3].

Annex N

Page N-1 ...Add optional(I) Record to ANNEX N, GLOBAL POSITIONING SYSTEM TRANSFER FORMAT (G-FILE). If used, this record will follow the SESSION HEADER RECORD (B). See pages N-1 and N-5.

Page N-2 .. Add note regarding the action to take if the number of vectors, recorded in columns 26 through 27 of the Session Header Record, exceeds ninety-nine (99). See page N-2.

Page N-5 .. Add Session Model (I) Record.

Page N-6 .. Add Reference System Code 19.

End of additions and changes.

PREFACE

"Input Formats and Specifications of the National Geodetic Survey (NGS) Data Base," commonly called the "Blue Book," is a user's guide for preparing and submitting geodetic data for incorporation into NGS' data base. Survey data that are entered into NGS' data base become part of the National Spatial Reference System (NSRS), formerly the National Geodetic Reference System. The guide comprises three volumes. Volume I covers classical horizontal geodetic and Global Positioning System (GPS) data, volume II covers vertical geodetic data, and volume III covers gravity data. Beginning with this edition, the three formerly separate volumes are distributed as a set, since a great deal of information is common to each volume. Because some of the chapters and annexes are identical in all three volumes, the original numbering design has been retained.

The formats and specifications are consistent with the aims of the Executive Office of the President, Office of Management and Budget's (OMB) Circular A-16, as revised in 1990. A major goal of the circular, which is titled "Coordination of Surveying, Mapping, and Related Spatial Data Activities," is to develop a national spatial data infrastructure with the involvement of Federal, state, and local governments, and the private sector. This multilevel national information resource, united by standards and criteria established by the Federal Geodetic Control Subcommittee (FGCS) of the Federal Geographic Data Committee (FGDC), will enable the sharing and efficient transfer of geospatial data between producers and users.

Survey data that are submitted to NGS for incorporation into NSRS should be properly formatted and supply minimum accuracies of:

- First-order horizontal accuracy standards for GPS and conventional horizontal surveys;
- Second-order, class II vertical accuracy standards for conventional leveling;
- Third-order gravity standards for gravity surveys.

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

In addition, these data standards and accuracies **must** be verified and the survey data contributed for inclusion into the NGS data base **must** be processed and adjusted by the provider, using currently available NGS software, before submitting the survey project to NGS.

At this time, NGS provides review, archiving, and distribution functions free of charge for survey data submitted in the proper format. These surveys must contain connections to NSRS in accordance with FGCS Standards and Specifications and they must contribute to the public good.

The production of the Blue Book entailed significant contributions from a number of NGS employees. Notable among these are D. Sherrill Snellgrove for his revision of Volume I, originally prepared by then-Commander Ludvik Pfeifer, NOAA (Ret.); Nancy L. Morrison and Commander Pfeifer, for their contributions to preparing Volume II; and then-Lieutenant Warren T. Dewhurst, NOAA, for his preparation of Volume III.

This publication and most of the documents referenced herein may be obtained from:

NOAA, National Geodetic Survey, **N/NGS12**
1315 East-West Highway, Station 9202
Silver Spring, MD 20910-3282
Telephone: (301) 713-3242; Fax: (301) 713-4172
Monday through Friday, 7:00 a.m. - 4:30 p.m. Eastern Time.

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TABLE 2-1

HORIZONTAL OBSERVATION DATA SET RECORDS

aa - Data Set Identification Record **[FIRST RECORD]**
10 - Project Title Record
11 - Project Title Continuation Record
12 - Project Information Record
13 - Geodetic Datum and Ellipsoid Record
20 - Horizontal Direction Set Record
21 - Horizontal Direction Comment Record (Optional)
22 - Horizontal Direction Record
25 - GPS Occupation Header Record
26 - GPS Occupation Comment Record (optional)
27 - GPS Occupation Measurement Record
28 - GPS Clock Synchronization Record
29 - GPS Clock Synchronization Comment Record (optional)
30 - Horizontal Angle Set Record
31 - Horizontal Angle Comment Record (Optional)
32 - Horizontal Angle Record
40 - Vertical Angle Set Record
41 - Vertical Angle Comment Record (Optional)
42 - Vertical Angle Record
45 - Observed Difference of Elevation Record
46 - Observed Difference of Elevation Comment Record (optional)
47 - Observed Difference of Elevation Continuation Record
50 - Taped Distance Record
51 - Unreduced Distance Record
52 - Reduced Distance Record
53 - Unreduced Long Line Record
54 - Reduced Long Line Record
55 - Distance Comment Record (Optional)
60 - Laplace / Astronomic Azimuth Record
61 - Geodetic Azimuth Record
70 - Instrument Record
71 - GPS Antenna Record **[Superseded by *72* Record]**
***72* - GPS Antenna Record**
80 - Control Point Record
81 - Control Point Record (UTM/SPC)
82 - Reference or Azimuth Mark Record
83 - Bench Mark Record [discontinued - Use *86* record instead]
84 - Geoid Height Record (Optional) [discontinued-Use *86*]
85 - Deflection Record (Optional)
86 - Orthometric Height, Geoid Height, Ellipsoid Height Record
aa - Data Set Termination Record **[LAST RECORD]**

Note: The symbol "aa" denotes the two-character job code assigned by the submitting organization - see Chapter 1.

Azimuth Data (*60*-Series) Records:

60 for each observed astronomic/Laplace azimuth in the project
61 for each geodetic azimuth used in the project

Survey Equipment Data (*70*-Series) Records:

70 for each item of survey equipment used in the project
***71* for each GPS antenna used in the project**
***72* [Supersedes *71* Record]**

Survey Point Data (*80*-Series) Records:

80 or *81* for first control point
82 for each peripheral RM or AZ MK at first control point
85,*86*, as applicable, for first control point
80 or *81* (possibly *82*) for second control point
82 for each peripheral RM or AZ MK at second control point
85,*86*, as applicable, for second control point
::::
80 or *81* (possibly *82*) for last control point
82 for each peripheral RM or AZ MK at last control point
85,*86*, as applicable, for last control point

PROJECT DATA RECORDS

10 - Project Title Record
11 - Project Title Continuation Record
12 - Project Information Record
13 - Geodetic Datum and Ellipsoid Record

The project data records, identified by *10*-series data codes, are listed above. The *10* record which contains the title of the project is always required; a *11* record is required only if the project title exceeds the 70-character field allowed on the *10* record. Do not divide words between the *10* and *11* records. The *12* record, which contains the date and general location of the survey, the survey method employed and the order classification of the survey, is always required. The *13* record defines the geodetic datum with respect to which geodetic positions, deflections of vertical, geoid heights, and/or ellipsoidal distances given in this project are specified. This record is required only if the geodetic datum is other than the North American Datum of 1983 (NAD 83). The entries on these records (see FORMAT DIAGRAMS) are self-explanatory; however, the following data items will be explained in greater detail:

Project Title: The elements of a good horizontal control survey project title should include (1) the order of accuracy of the survey, (2) the type of the survey, and (3) the geographic locality of the survey. Since the first two elements are coded elsewhere (*12* record), only the geographic locality of the survey needs to be spelled out in the title. The use of geographic locality alone for the title of a horizontal control survey project has traditionally been the practice of NGS and its predecessors.

Job Specific GPS Antenna Number: In a manner analogous to the assignment of job specific instrument numbers, the job specific GPS antenna numbers are to be unique throughout a job, i.e., each GPS antenna which appears in more than one project in the job must be consistently identified by the same number, while different antennas must be identified by different numbers throughout the HZTL OBS data set. A *72* record must be prepared for each antenna which has been assigned an antenna number - see SURVEY EQUIPMENT DATA RECORDS.

Height of Instrument and Height of Target: Horizontal control survey measurements are seldom observed literally mark-to-mark between the survey points involved. Normally, they are measured from a surveying instrument mounted on a tripod, wooden stand, or survey tower erected over the standpoint to a "target" (e.g., a survey light, retro-reflector, or remote instrument) mounted on a similar structure over the forepoint.

The height of instrument (H.I.) is the vertical distance from the top of the occupied survey mark (standpoint) to the optical center of the surveying instrument, positive if the instrument is above the mark, and negative if it is below the mark. This distance is also known as the "height of telescope." Similarly, the height of target (H.T.) is the vertical distance from the top of the survey mark (forepoint) to the point above or below the mark which is used as the target for angular observations, or to the optical center of the retro-reflector (or of the antenna system of the remote instrument) in the case of electronic distance measurements. This distance is also known as the "height of object."

Together with the elevation (and geoid height) of the respective survey points, the height of instrument and the height of target are desired data items in some horizontal control survey observations and required in others. For horizontal directions and horizontal angles, the height of instrument and the height of target are desired for the computation of skew normal and deflection corrections. For vertical angles and distances, the height of instrument and the height of target are required for the reduction of instrument-to-target measurements to mark-to-mark values.

When the surveying instrument cannot be installed directly over the desired survey point and eccentric observations which are to be reduced to center are submitted, the height of instrument entered on the observation record **must be the vertical distance between the top of the survey point mark to which the eccentric observations are to be reduced and the horizontal plane passing through the optical center of the horizontally-offset surveying instrument**. The
same considerations apply to an eccentric target, retro-reflector, or remote instrument.

Height of GPS Antenna: The desired antenna height is the vertical distance from the top of the occupied survey point mark to the L1 phase center of the antenna used with the GPS receiver. See diagram on page 2-52a.

Visibility Code: Information concerning intervisibility between monumented control points is of great value to the local surveyor, who is not normally prepared to build survey towers over the control points to be occupied or sighted upon. To allow for recording this information, a provision was made for a one-letter visibility code on the observation records which pertains to line-of-sight observations. This code indicates whether or not the forepoint (i.e., a target which might be easily constructed over the forepoint) can be seen from ground level (height of eye) at the standpoint.

SURVEY EQUIPMENT DATA RECORDS

***70* - Instrument Record**
***71* - GPS Antenna Record**
***72* - GPS Antenna Record [Supersedes the *71* Record above]**

The purpose of the *70* record is to provide descriptive information pertaining to an item of survey equipment which has been identified by a Job-Specific Instrument Number (see under OBSERVATION DATA RECORDS). Submit a *70* record for each item of survey equipment used in the project. Individual *70* records should appear in order of increasing Job-Specific Instrument Numbers (JSIN). More than one *70* record is required for any instrument used for more than one type of measurement. In other words, a theodolite used to measure both horizontal and vertical angles would require two *70* records: one to record the resolution of the horizontal measurements and the other to record the resolution of the vertical measurements. The resolution and units symbol (see below) of these two records would be different but, the JSIN and the NGS Survey Equipment Code would be identical.

If a "total station" type instrument is used in a survey, three *70* records may be required (horizontal directions, vertical angles and distance observations) for one JSIN. If this equipment is self-contained, the JSIN and the NGS Survey Equipment Code will be identical in each of the three records as stated above. Refer to the Total Station category (800-860) in ANNEX F. But, if modular type equipment (optional EDM instruments can be mounted on the same "total station" base unit) is used, the NGS Survey Equipment Code in the *70* record, which reflects the resolution of the distance measurements, must be that of the specific EDM instrument used for the observations. (Refer to Distance-Measuring Equipment categories (500-799) in ANNEX F). The equipment code for the other two *70* records would be listed in the Total Station category (861-899) in ANNEX F.

Most of the entries on the *70* record (see FORMAT DIAGRAMS) are self-explanatory; however, the following data items will be explained in greater detail:

NGS Survey Equipment Code: A three-digit numerical identification code is assigned to the different categories of survey equipment, and within each category to specific instruments or other items of survey equipment commonly used in the United States - see ANNEX F.

Resolution of the Instrument and Units: The size of the smallest directly-readable linear or angular measurement unit characteristic of the respective item of survey equipment, followed by a two-letter symbol for the units in which it is expressed:

MT - meters	HS - horizontal seconds of arc
MM - millimeters	HM - horizontal minutes of arc
FT - feet	VS - vertical seconds of arc
MF - millifeet	VM - vertical minutes of arc

The character fields reserved for Resolution of the Instrument and for Units on the *70* record may be left blank if the resolution of the surveying instrument in question cannot be expressed in these units (e.g., if the measurement is obtained in terms of arbitrary "dial" units which do not bear a fixed relationship to the measured quantity). **Leave these fields blank if GPS equipment is used.**

The purpose of the *71*/*72* record is to provide descriptive information pertaining to the GPS antenna which has been identified by a Job-Specific Antenna Number (see under OBSERVATION DATA RECORDS). Submit a *71*/*72* record for each antenna used in the project. Individual *71*/*72* records should appear in order of increasing Job-Specific Antenna Numbers (JSAN).

Most of the entries on the *71* record (see FORMAT DIAGRAMS) are self-explanatory: however, the following data items will be explained in greater detail:

NGS Antenna Code: An alpha-numeric identification code of up to 16 characters is assigned to each different type of GPS antenna commonly used with GPS receivers in the United States. See ANNEX J.

Antenna Phase Pattern File: This file contains phase patterns and offsets for several different types of antennas. As this file is updated, the patterns and/or offsets may be changed, so it is important to record which antenna file was used for the GPS processing. To date (March 1998), NGS has had two files available for use. These files were called ant_info.001 and ant_info.002. These "Antenna Phase Pattern" files will be modified as new antennas are added or as improved patterns are developed. For each antenna in the ant_info.002 file, there are patterns for L1 and L2, and the North, East, Up offsets for the L1 and L2 phase centers.

Source Organization: Use the six character symbol of the organization that maintains the antenna phase pattern files that were used to process the data. This field is required if the antenna phase patterns used are different from those provided by NGS.

NOTE: The *71* record has been superseded by the *72* record and ANNEX J has been superseded by ANNEX M.

The elevation of a survey point is determined most accurately by differential leveling. Other less accurate methods of determining the elevation of a survey point are (1) GPS observations, (2) trigonometric leveling using reciprocal vertical angles, (3) trigonometric leveling using non-reciprocal (i.e., one-sided) vertical angles, and (4) photogrammetric methods. In addition, an estimate of elevation based on the exponential decrease of atmospheric pressure with altitude can be obtained by a barometric leveling scheme (e.g., with the aid of an altimeter). As a last resort, if elevation from another source is not at hand, the approximate elevation can be obtained by interpolation between adjacent elevation contour lines on a map. In situations where ellipsoidal heights are known, the orthometric height can be computed by subtracting some estimate of the geoid height from the ellipsoidal height. Orthometric heights derived in this manner are coded using the "G" code. The geoid height value used in the computation must be submitted on a *86* record.

In every case, the source and general accuracy of the elevation value given on a *80*, *81*, or the **preferred new *86* record** must be indicated by a one-letter Orthometric Height (OHT) Code (See table on page 2-84 for explanations). The possible elevation codes are as follows:

A - The control point is a bench mark (BM) in the NGSIDB.
B - BM determined using FGCS/NGS procedures but **not** in the NGSIDB.
C - The control point is a 'posted' bench mark.
D - OHT determined by datum transformation.
H - OHT determined using FGCS procedures but tied to only one (1) BM.
L - OHT established using NGS leveling RESET procedures.
F - OHT established using fly-leveling.
T - OHT determined by leveling between control points which are not BMs.
R - OHT determined by reciprocal vertical angles.
V - OHT determined by non-reciprocal vertical angles.
P - OHT determined by a photogrammetric method.
M - OHT scaled from a topographic map.
G - **OHT derived from GPS-observed heights with decimeter accuracy.**
J - OHT derived from GPS-observed heights tied to meter accuracy control.
K - OHT derived from GPS-observed heights, according to the 2cm/5cm ellipsoid height standards, and a high resolution national geoid model.

Station Order and Type: A two-character field is reserved on the *80* and *81* records for the order-and-type code. The purpose of this code is to characterize the specific order of accuracy of the horizontal control point and to indicate whether the horizontal control point in question is monumented (or otherwise permanently marked), unmonumented but recoverable (e.g., a landmark), or unmonumented and non-recoverable (e.g., an auxiliary point). In addition, the purpose of this code is to characterize the type of the survey scheme of which the horizontal control point is a part and/or by means of which it is positioned (i.e., triangulation, trilateration, traverse, intersection, or resection). It also indicates whether the horizontal control point in question is considered to be a main-scheme station or a supplemental station in the respective survey scheme.

In every case, care must be taken to assign an order-and-type code which reflects how the horizontal control point was used in the project. For example, if a horizontal control point previously established as a first-order triangulation station is occupied in the course of a second-order traverse project, then it must be assigned an order-and-type code which classifies it as a second-order traverse station rather than as a first-order triangulation station. For control points which cannot be positioned within the project

GPS OCCUPATION HEADER RECORD (*25*)

This record is used to define session information and the raw data file name at a station. There must be an occupation header record for each receiver in each session. Use the Comment Record (*26*) immediately following the *25* record for any comments.

To anticipate the accuracy of an observation, the type of survey equipment used must be known. To identify the instrument employed on each particular observation record in a concise manner, assign a unique three-digit number (Job-Specific Instrument Number) in the range 001 to 999 to each item of survey equipment used in the job. Each unique number will cross reference a NGS survey equipment code in the *70* record. See Chapter 2, page 2-10, Job-Specific Instrument Number and page 2-28, Survey Equipment Data Records. **This record is required.**

25 FORMAT

CC 01-06	SEQUENCE NUMBER. RIGHT JUSTIFIED. MUST BE AN INCREMENT OF 10 FROM PREVIOUS RECORD.
CC 07-10	DATA CODE. MUST BE *25*.
CC 11-14	STATION SERIAL NUMBER (SSN). INSTRUMENT STATION. FOR ADDITIONAL INFORMATION SEE CHAPTER 1, PAGES 1-2 THRU 1-6, JOB CODE AND SURVEY POINT NUMBERING; CHAPTER 2, PAGES 2-8 THRU 2-9, OBSERVATION DATA RECORDS; PAGES 2-12 THRU 2-14, ASSIGNMENT OF STATION SERIAL NUMBERS; AND PAGE 2-14, TREATMENT OF ECCENTRIC OBSERVATIONS.
CC 15-24	DATA MEDIA IDENTIFIER. A CODE WHICH SPECIFICALLY DEFINES THE RECEIVER TYPE, DAY, YEAR, SESSION, AND STATION OBSERVED. FOR USE IN THE B-FILE AND G-FILE. SEE ANNEX L, PAGES L-1 AND L-2. THE FORMAT OF A DATA MEDIA IDENTIFIER IS: ADDDYSNNNN, WHERE: A IS THE CHARACTER WHICH INDICATES THE RECEIVER MANUFACTURER: A = ASHTECH, INC; C = TOPCON CORP; D = DEL NORTE TECHNOLOGY, INC; G = ALLEN OSBORNE ASSOCIATES, INC; I = ISTAC, INC; L = MINI-MAC™; M = Macrometer®; N = NORSTAR INSTRUMENTS, LTD; O = MOTOROLA, INC; R = TRIMBLE NAVIGATION, LTD; S = SERCEL, INC; T = TEXAS INSTRUMENTS,INC; W = LEICA HEERBRUGG AG-WILD HEERBRUGG-MAGNAVOX, INC; V = NOVATEL COMMUNICATIONS, LTD; X = OTHER DDD IS THE DAY OF YEAR OF THE FIRST DATA EPOCH (UTC) Y IS THE LAST DIGIT OF THE YEAR OF THE FIRST DATA EPOCH S IS THE LETTER OR NUMBER OF THE SESSION OBSERVED NNNN IS THE PROJECT UNIQUE, FOUR (4)-CHARACTER ABBREVIATION OF A STATION NAME.
CC 25-27	INITIALS OF THE OBSERVER
CC 28-30	JOB-SPECIFIC INSTRUMENT NUMBER. THE UNIQUE THREE-DIGIT NUMBER IN THE RANGE 001 TO 999 ASSIGNED TO THE INSTRUMENT USED TO OBTAIN THIS OBSERVATION. THIS NUMBER WILL CROSS REFERENCE THE NGS SURVEY EQUIPMENT CODE IN THE *70* RECORD.
CC 31-32	LENGTH OF THE CABLE USED TO CONNECT RECEIVER AND ANTENNA. (XX) METERS
CC 33-35	**JOB-SPECIFIC ANTENNA NUMBER (JSAN). THE UNIQUE THREE-DIGIT NUMBER ASSIGNED TO THE ANTENNA USED TO OBTAIN THIS OBSERVATION. THIS NUMBER WILL CROSS REFERENCE THE NGS ANTENNA CODE IN THE *71*/*72* RECORD.**
CC 36-80	BLANK

INSTRUMENT RECORD (*70*)

Use this record to provide descriptive information for each item of survey equipment used in the job. This information will be used as an accuracy indicator for each observation in the survey. Assign a **unique** three-digit Job-Specific Instrument Number (JSIN) to each piece of equipment used in the project. This record will cross-reference the assigned JSIN to the NGS Survey Equipment Codes found in Annex F. More than one *70* record is required for any instrument used for more than one type of measurement. See Chapter 2, page 2-28, Survey Equipment Data Records.

70 FORMAT

CC 01-06	SEQUENCE NUMBER. RIGHT JUSTIFIED. MUST BE AN INCREMENT OF 10 FROM THE PREVIOUS RECORD.
CC 07-10	DATA CODE. MUST BE *70*.
CC 11-13	JOB-SPECIFIC INSTRUMENT NUMBER (JSIN). MUST BE UNIQUE FOR EACH INSTRUMENT IN JOB. SEE PAGES 2-10 AND 2-28.
CC 14-16	NGS SURVEY EQUIPMENT CODE. SEE ANNEX F. USED TO IDENTIFY THE INSTRUMENT WHICH WAS ASSIGNED THE JSIN IN CC 11-13 ABOVE.
CC 17-20	RESOLUTION OF THE INSTRUMENT. RECORD THE SIZE OF THE SMALLEST DIRECTLY READABLE MEASUREMENT UNIT OR THE RESOLUTION PUBLISHED BY THE INSTRUMENT MANUFACTURER, WHICHEVER IS LARGER (XXxx).
CC 21-22	UNITS. UNITS OF THE RESOLUTION USED IN CC 17-20 ABOVE. SEE PAGE 2-28, RESOLUTION OF THE INSTRUMENT AND UNITS.
CC 23-40	MANUFACTURER OF THE INSTRUMENT. SEE ANNEX F. (EXAMPLES: WILD, ZEISS/JENA, HEWLETT PACKARD).
CC 41-62	TYPE OF INSTRUMENT OR TRADE NAME. SEE ANNEX F. (EXAMPLES; DIRECTION THEODOLITE, CALIB INVAR TAPE, RANGE MASTER, TELLUROMETER).
CC 63-70	MODEL OR CLASS OF INSTRUMENT. SEE ANNEX F. (EXAMPLES: T-3, MA-100, 30-MT, 100-FT).
CC 71-80	SERIAL NUMBER. ALPHANUMERIC AND LEFT JUSTIFIED. LEAVE BLANK IF THE SERIAL NUMBER IS NOT KNOWN.

NOTE: When this record is used to identify GPS equipment, columns 17-20, RESOLUTION OF THE INSTRUMENT, and columns 21-22, UNITS, should be left blank.

GPS ANTENNA RECORD (*71*)

Use this record to provide descriptive information for each GPS antenna used in the job. Assign a **unique** three-digit Job-Specific Antenna Number (JSAN) to each GPS antenna used in the project. This record will cross-reference the assigned JSAN to the NGS GPS Antenna Codes found in Annex J. See Chapter 2, pages 2-28 and 2-28a, Survey Equipment Data Records.

CC 01-06 SEQUENCE NUMBER. RIGHT JUSTIFIED. MUST BE AN INCREMENT OF 10 FROM THE PREVIOUS RECORD.

CC 07-10 DATA CODE. MUST BE *71*

CC 11-13 JOB SPECIFIC ANTENNA NUMBER (JSAN). MUST BE UNIQUE FOR EACH ANTENNA IN JOB.

CC 14-29 NGS ANTENNA CODE. SEE ANNEX J. USED TO IDENTIFY THE ANTENNA WHICH WAS ASSIGNED THE JSAN IN CC 11-13 ABOVE.

CC 30-41 SERIAL NUMBER. ALPHANUMERIC AND LEFT JUSTIFIED. LEAVE BLANK IF THE SERIAL NUMBER IS NOT KNOWN.

CC 42-53 ANTENNA PHASE PATTERN FILE. SEE PAGE 2-28a.

CC 54-59 SOURCE ORGANIZATION

CC 60-80 BLANK

NOTE: See the *72* record that follows on page 2-76b. This record supersedes the *71* record. Older decks that have a *71* record will be accepted by NGS.

GPS ANTENNA RECORD (*72*)

[Note: This record supersedes the *71* record]

Use this record to provide descriptive information for each GPS antenna used in the job. Assign a **unique** three-digit Job-Specific Antenna Number (JSAN) to each GPS antenna used in the project. This record will cross-reference the assigned JSAN to the NGS GPS Antenna Codes found in Annex M.

CC 01-06 SEQUENCE NUMBER. RIGHT JUSTIFIED. MUST BE AN INCREMENT OF 10 FROM THE PREVIOUS RECORD.

CC 07-10 DATA CODE. MUST BE *72*

CC 11-13 JOB SPECIFIC ANTENNA NUMBER (JSAN). MUST BE UNIQUE FOR EACH ANTENNA IN JOB.

CC 14-16 RESERVED

CC 17-36 NGS ANTENNA CODE. SEE ANNEX M. USED TO IDENTIFY THE ANTENNA WHICH WAS ASSIGNED THE JSAN IN CC 11-13 ABOVE.

CC 37-44 RESERVED

CC 45-64 SERIAL NUMBER. ALPHANUMERIC AND LEFT JUSTIFIED. LEAVE BLANK IF THE SERIAL NUMBER IS NOT KNOWN.

CC 65-80 BLANK

CONTROL POINT RECORD (*80*)

Use this record for the designation (name) and geographic position in geodetic coordinates (latitude and longitude) of each control point in the project. If the position is given in Universal Transverse Mercator (UTM) coordinates or in State Plane Coordinates (SPC), use the *81* record. The geodetic position of every horizontal control point for which a *80* record is submitted must be provided in order to serve as either a fixed (constrained) position or as a preliminary position in the adjustment of the horizontal control survey project.

NOTE: Although columns 70-75 and column 76 of this record are currently used for recording the elevation and elevation code, NGS may discontinue this in the near future. NGS prefers that you use the new *86* record for this purpose.

For every *80* or *81* record submitted, the elevation of each control point must be provided, except for unmonumented recoverable landmarks positioned by intersection. For such landmarks, the elevation field may be left blank. However, when the elevation of an unmonumented recoverable landmark is given, it should be the ground level elevation and the height above ground level of the point actually sighted should be entered as the height of target on the respective observation record.

The first character of the order and type code indicates the order of accuracy of the main-scheme network in the project. It reflects the surveying methods used, procedures followed and specifications enforced to obtain the observations of the project.

The second character of the order and type code indicates the type of survey scheme of which the control point in question is a part and/or the (primary) surveying method used to position the control point. Refer to pages 2-35 thru 2-38 for additional information.

TABLE OF ELEVATION CODES

CODE	EXPLANATION
A	The control point is a bench mark (BM) in the NGSIDB.
B	BM determined using FGCS/NGS procedures but the **leveling data are not** in the NGSIDB.
C	The control point is a 'posted' bench mark.
D	OHT determined by datum transformation **(not loaded in the NGSIDB)**.
H	OHT determined using FGCS procedures but tied to only one (1) BM.
L	OHT established using NGS leveling RESET procedures.
F	OHT established using fly-leveling.
T	OHT determined by leveling between control points which are not BMs.
R	OHT determined by reciprocal vertical angles.
V	OHT determined by non-reciprocal vertical angles.
P	OHT determined by a photogrammetric method.
M	OHT scaled from a topographic map.
G	**OHT derived from GPS-observed heights with decimeter accuracy.**
J	**OHT derived from GPS-observed heights tied to meter accuracy control.**
K	**OHT derived from GPS-observed heights, according to the 2cm/5cm ellipsoid height standards, and a high resolution national geoid model.**

DEFLECTION RECORD (*85*)

Use this record to give the source and the values of the meridional component (Xi) and/or prime-vertical component (Eta) of the deflection of vertical. The datum must be North American 1983 or as specified on the Datum and Ellipsoid (*13*) record. This record is optional.

85 FORMAT

CC 01-06	SEQUENCE NUMBER. RIGHT JUSTIFIED. INCREMENT BY 10 FROM THE PREVIOUS RECORD.
CC 07-10	DATA CODE. MUST BE *85*.
CC 11-14	STATION SERIAL NUMBER (SSN). HORIZONTAL CONTROL POINT.
CC 15-20	SOURCE. AGENCY OR ORGANIZATION WHICH DETERMINED THE DEFLECTION. USE THE ABBREVIATIONS LISTED IN ANNEX C OR THE ONE SPECIFIED ON THE DATA SET IDENTIFICATION RECORD (*aa*).
CC 21-61	COMMENT. USE THIS SPACE TO CLARIFY THE SOURCE OF THE DEFLECTION INFORMATION.
CC 62	**DEFLECTION MODEL CODE. SEE THE LIST BELOW.**
CC 63-67	MERIDIONAL COMPONENT (Xi) OF THE DEFLECTION OF VERTICAL. IN SECONDS (XXXxx).
CC 68	DIRECTION OF Xi. USE CODE "N" FOR NORTH OR CODE "S" FOR SOUTH.
CC 69-71	SIGMA. ESTIMATED ACCURACY (STANDARD ERROR) OF Xi. IN SECONDS (Xxx).
CC 72-76	PRIME-VERTICAL COMPONENT (Eta) OF THE DEFLECTION OF VERTICAL. IN SECONDS (XXXxx).
CC 77	DIRECTION OF Eta. USE CODE "E" FOR EAST OR CODE "W" FOR WEST.
CC 78-80	SIGMA. ESTIMATED ACCURACY (STANDARD ERROR) OF Eta. IN SECONDS Xxx).

For a more detailed explanation of the contents of this record see Chapter 2, pages 2-39 and 2-40, Deflection of Vertical.

DEFLECTION MODEL CODES:

Model Name	**Code**
DEFLEC99	**A**
DEFLEC90	**C**
DEFLEC93	**H**
DEFLEC96	**J**
DCAR97	**L**
POST NAD83 180 MODEL	**M**
DMEX97	**N**
NAD83 180 MODEL	**P**
360 MODEL	**Q**
PRE NAD83 DEFLECTION	**T**

CC 46-52 ELLIPSOID HEIGHT. IN METERS (MMMMmmm).
CC 53   ELLIPSOID HEIGHT CODE. SEE FOLLOWING TABLES.
CC 54-55 ELLIPSOID HEIGHT ORDER AND CLASS. SEE ANNEX G.
CC 56   ELLIPSOID HEIGHT DATUM.
CC 57-80 COMMENTS.

ORTHOMETRIC HEIGHT (OHT) NGSIDB INDICATOR

CODE	EXPLANATION
Y	OHT OBTAINED FROM THE NGSIDB.
N	OHT IS **NOT** IN THE NGSIDB.

TABLE OF ORTHOMETRIC HEIGHT (OHT) CODES

CODE	EXPLANATION
A	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES, ADJUSTED HEIGHT DETERMINED USING NGS VERTICAL NETWORK BRANCH PROCEDURES, LEVELING DATA IS IN THE NGSIDB.
B	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES, ADJUSTED HEIGHT DETERMINED USING NGS VERTICAL NETWORK BRANCH PROCEDURES, LEVELING DATA IS **NOT** IN THE NGSIDB. (USGS, COE, SOME STATE DOT DATA.)
C	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES, ADJUSTED HEIGHT IS 'POSTED'. SEE EXPLANATION IN THE FOOTNOTE (*) BELOW.
D	OHT ESTABLISHED BY DATUM TRANSFORMATIONS.
H	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES EXCEPT FOR THE TWO-MARK LEVELING TIE REQUIREMENT. (HORIZONTAL FIELD PARTY LEVEL TIES, SOME STATE DOTS, SOME GPS LEVEL TIES.)
L	OHT ESTABLISHED USING LEVELING RESET SPECIFICATIONS AND PROCEDURES.
F	OHT ESTABLISHED BY FLY-LEVELING.
T	OHT ESTABLISHED BY LEVELING BETWEEN CONTROL POINTS WHICH ARE **NOT** BENCH MARKS.
R	OHT ESTABLISHED BY RECIPROCAL VERTICAL ANGLES.
V	OHT ESTABLISHED BY NON-RECIPROCAL VERTICAL ANGLES.
P	OHT ESTABLISHED BY PHOTOGRAMMETRY.
M	OHT ESTABLISHED BY SCALING FROM A CONTOURED MAP.
G	**OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS WITH DECIMETER ACCURACY.**
J	**OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS TIED TO METER ACCURACY CONTROL.**
K	**OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS, ACCORDING TO THE 2CM/5CM ELLIPSOID HEIGHT STANDARDS, AND A HIGH RESOLUTION NATIONAL GEOID MODEL.**

* DATA FOR LEVEL LINES CONTAINING 'POSTED' BENCH MARKS WERE PURPOSELY NOT INCLUDED IN THE NAVD88 GENERAL ADJUSTMENT. SUBSEQUENTLY, THESE DATA WERE ADJUSTED TO NAVD88 BY FORCING THEM TO FIT THE EXISTING NAVD88 GENERAL ADJUSTMENT HEIGHTS.

TABLE OF ORTHOMETRIC HEIGHT (OHT) DATUMS

CODE	EXPLANATION
29	NATIONAL GEODETIC VERTICAL DATUM OF 1929
88	NORTH AMERICAN VERTICAL DATUM OF 1988
55	INTERNATIONAL GREAT LAKES DATUM OF 1955
85	INTERNATIONAL GREAT LAKES DATUM OF 1985
00	ANY OTHER DATUM. SPECIFY IN COMMENTS.

TABLE OF GEOID HEIGHT (GHT) CODES

CODE	EXPLANATION	CODE	EXPLANATION
P	OSU78 GEOID MODEL	**F**	**G96SSS GEOID MODEL**
Q	OSU86F GEOID MODEL	**G**	**EGM96 GEOID MODEL**
B	OSU89B GEOID MODEL	**H**	**CARIBBEAN GEOID MODEL**
C	GEOID90 GEOID MODEL	**J**	**MEXICO97 GEOID MODEL**
D	GEOID93 GEOID MODEL	**T**	**GEOID99**
E	**GEOID96 GEOID MODEL**	**U**	**G99SSS**

TABLE OF ELLIPSOID HEIGHT (EHT) CODES

CODE	EXPLANATION
A	EHT DETERMINED BY GPS IN A HIGH PRECISION GEODETIC NETWORK OR TIED TO A HIGH PRECISION GEODETIC NETWORK (HPGN).
B	EHT DETERMINED BY GPS **NOT** TIED TO A HPGN.
C	EHT DETERMINED BY ADDING A GEOID HEIGHT TO AN ORTHOMETRIC HEIGHT WITH AN OHT CODE OF A, B, C, F, H, OR L.
D	EHT DETERMINED BY ADDING A GEOID HEIGHT TO AN ORTHOMETRIC HEIGHT WITH AN OHT CODE OF G, R, OR T.
E	EHT DETERMINED BY ADDING A GEOID HEIGHT TO AN ORTHOMETRIC HEIGHT WITH AN OHT CODE OF V, M, P, OR D.

TABLE OF ELLIPSOID HEIGHT (EHT) DATUMS

CODE	EXPLANATION
A	NORTH AMERICAN DATUM OF 1983
B	INTERNATIONAL TERRESTRIAL REFERENCE FRAME OF 1989
C	NATIONAL EARTH ORIENTATION SERVICE (NEOS ANNUAL REPORT FOR 1990)
D	**INTERNATIONAL TERRESTRIAL REFERENCE FRAME OF 1994 (ITRF 94)**
E	**INTERNATIONAL TERRESTRIAL REFERENCE FRAME OF 1996 (ITRF 96)**
Z	ANY OTHER DATUM. SPECIFY IN COMMENTS.

CODE	DESCRIPTION
A	Aluminum marker **(other than a disk)**
B	Bolt
C	Cap-and-Bolt Pair
DB	Bench Mark Disk
DD	Survey Disk
DE	Traverse Station Disk
DH	Horizontal Control Disk
DJ	Tidal Station Disk
DO	Disk of Unspecified Type (See Text)
DQ	Calibration Base Line Disk
DR	Reference Mark Disk
DS	Triangulation Station Disk
DU	Boundary Marker Disk
DV	Vertical Control Disk
DZ	Azimuth Mark Disk
I	Metal Rod
N	Nail

A complete list of these codes is contained in ANNEX I.

Magnetic Code (Surface Marker) [CC 49] - This one-character code indicates the magnetic property of the mark or monument. ANNEX I details acceptable entries for the magnetic property code.

Vertical Stability Override Code (optional) [CC 51] - This one-character entry allows the default vertical stability codes to be overridden when appropriate. The codes are from the following list:

CODE	DEFINITION
A	Monuments of the most reliable nature, expected to hold their elevations very well.
B	Monuments which generally hold their elevations fairly well.
C	Monuments which may be affected by surface ground movements.
D	Monuments of questionable or unknown vertical stability.

Marker Inscription [CC 54-59] - This field is the **symbol** from ANNEX C for the agency or organization whose identity is inscribed or precast on the disk/monument. This entry is not the same as the stamping which usually reflects the station designation. If the appropriate organization is not listed in ANNEX C, contact NGS to have a symbol assigned to that organization. If it is not possible to contact NGS, a longer entry (up to 26 characters) may be made. If there is no agency identification inscribed or precast on the marker (such as a chiseled square, nail, or unidentified disk), enter "**NONE**".

CODE *28* (STAMPING RECORD) (optional) - The stamping field [CC 11-60] should contain the exact stamping as it appears on the geodetic control marker. The entry must not exceed 50 characters, including embedded blanks. If there is no stamping, make no entry here; however, if the marker is a type that is normally stamped, enter a short note about its being unstamped in the accompanying descriptive text.

ANNEX M

NGS GPS ANTENNA CODES

[Note: This annex supersedes Annex J]

The first record field of this table lists the accepted GPS Antenna Codes to be used in the *72* record, which supersedes the *71* record for listing antenna types/serial numbers for a project. Older Blue Book files that have *71* records will continue to be accepted by NGS. The first three characters of the GPS ANTENNA CODE represent an abbreviation for the manufacturer. For most antennas the model number or part number is also represented as part of the GPS ANTENNA CODE, as is the type of radome used. The second record field gives a brief description of each antenna.

Note: If an unlisted antenna is used from one of the known manufacturers shown below, then use its corresponding "_OTHER" code (Example: If you are using a Trimble antenna not listed in Annex M, use the "TRM_OTHER" code). If you have an antenna whose manufacturer is not listed, then use the "XXX_OTHER" code. When using any of these "_OTHER" codes, you should include a *26* record in the B-file that describes the unlisted antenna for each station occupation. Annex M will continuously be modified to incorporate new antennas. The latest version is available from the NGS web site at:

(http://www.ngs.noaa.gov/FGCS/BlueBook/annexm/annexm.html)

If you are using a geodetic GPS antenna that is dual-frequency but is not listed in Annex M, please notify NGS by sending an e-mail to **cors@ngs.noaa.gov** so we can make arrangements to derive an antenna pattern and antenna code for that antenna.

The manufacturer abbreviations identified by the first three characters of the GPS ANTENNA CODE are:

AOA - ALLEN OSBORNE AND ASSOCIATES
ASH - ASHTECH
JPL - JET PROPULSION LABORATORY
JPS - JAVAD POSITIONING SYSTEMS
LEI - LEICA
MAC - MACROMETRICS
NOV - NOVATEL
SPP - SPECTRA PRECISION
TOP - TOPCON
TRM - TRIMBLE

The current list of accepted GPS antennas are shown on the following pages:

GPS ANTENNA CODE		NAME/DESCRIPTION OF ANTENNA
AOAD/M_T		Dorne Margolin T, chokerings (TurboRogue)
AOAD/M_B		Dorne Margolin B, chokerings (Rogue)
AOA_OTHER		Any AOA antenna not yet listed in Annex M
ASH700228A		Geodetic L1/L2, 8 holes, bubble, compass
ASH700228B		Geodetic L1/L2, 8 holes, bubble, compass
ASH700228C		Geodetic L1/L2, 8 holes,no bubble,compass
ASH700228D		Geodetic L1/L2, REV.B, 8 L-SHAPED NOTCHES
ASH700228E		Geodetic L1/L2, REV.B, 8 L-SHAPED NOTCHES
ASH700700.A		Marine L1/L2
ASH700700.B		Marine L1/L2
ASH700700.C		Marine L1/L2
ASH700718A		Geodetic III 'Whopper', REV. D
ASH700718B		Geodetic III 'Whopper', REV. D
ASH700829.2	SNOW	Geodetic III 'Whopper' (USCG) +radome
ASH700829.3	SNOW	Geodetic III 'Whopper' (USCG) +radome
ASH700829.A	SNOW	Geodetic III 'Whopper' (USCG) +radome
ASH700829.A1	SNOW	Geodetic III 'Whopper' (USCG) +radome
ASH700936A_M		D/M element, milled chokerings, -radome
ASH700936B_M		D/M element, milled chokerings, -radome
ASH700936C_M		D/M element, milled chokerings, -radome
ASH700936D_M		D/M element, milled chokerings, -radome
ASH700936E		D/M element, REV E, chokerings, -radome
ASH700936E_C		D/M, chokerings, 700936.02 REV E, SCIGN
ASH700936A_M	SNOW	D/M element, milled chokerings +radome
ASH700936B_M	SNOW	D/M element, milled chokerings +radome
ASH700936C_M	SNOW	D/M element, milled chokerings +radome
ASH700936D_M	SNOW	D/M element, milled chokerings +radome
ASH701008.01B		Geodetic IIIA. P/N: 701008-01(B)
ASH701945.02B		D/M, chokerings, REV B
ASH701946.022		D/M, chokerings, REV 2, GPS+GLONASS
ASH_OTHER		Any ASH antenna not yet listed in Annex M
JPLD/M_R		Dorne Margolin R, chokerings (Rogue,JPL)
JPL_OTHER		Any JPL antenna not yet listed in Annex M
JPSLEGANT_E		Legant on flat groundplane, External
JPSREGANT_SD_E		Regant single depth chokerings, External
JPSREGANT_DD_E		Regant dual depth chokerings, External
JPS_OTHER		Any JPS antenna not yet listed in Annex M
LEIAT202-GP		External micropulse L1/L2 -groundplane
LEIAT302-GP		External micropulse L1/L2 -groundplane
LEIAT303	LEIC	Micropulse chokering antenna +radome
LEIAT303		Micropulse chokering antenna -radome
LEIAT502		Aero element L1/L2, External
LEIAT504		D/M element, with chokerings
LEISR299_INT		SR299, Internal with Ball element L1/L2
LEISR399_INT		SR399, Internal with Ball element L1/L2
LEI_OTHER		Any LEI antenna not yet listed in Annex M
MAC4647942	MMAC	Macrometer crossed dipoles
MAC_OTHER		Any MAC antenna not yet listed in Annex M
NOV501		GPS-501 L1
NOV501+CR		GPS-501 L1, chokerings
NOV502		GPS-502 L1/L2
NOV502+CR		GPS-502 L1/L2, chokerings
NOV531		GPS-531 L1
NOV531+CR		GPS-531 L1, chokerings
NOV_OTHER		Any NOV antenna not yet listed in Annex M

GPS ANTENNA CODE		NAME/DESCRIPTION OF ANTENNA
SPP571908273		chokerings, oblong antenna element housing
SPP571908273	SPKE	chokerings, oblong element housing, +radome
SPP_OTHER		Any SPP antenna not yet listed in Annex M
TOP72110		D/M element (used with Turbo-SII)
TOP_OTHER		Any TOP antenna not yet listed in Annex M
TRM14532.00		4000ST L1/L2 Geodetic
TRM14532.10		4000SSE Kin L1/L2, no groundplane
TRM22020.00+GP		Geodetic L1/L2 COMPACT +groundplane
TRM22020.00-GP		Geodetic L1/L2 COMPACT -groundplane
TRM27947.00+GP		Rugged L1/L2 +groundplane
TRM27947.00-GP		Rugged L1/L2 -groundplane
TRM23903.00		Permanent L1/L2
TRM29659.00		D/M element, chokerings, -radome
TRM33429.00+GP		L1/L2 microcentered Compact Geodetic +GP
TRM33429.20+GP		L1/L2 microcentered Compact Geodetic +GP
TRM4800		Receiver+Internal microcentered antenna
TRM_OTHER		Any TRM antenna not yet listed in Annex M
XXX_OTHER		Any antenna with MANUFACTURER NOT LISTED

ANNEX N

GLOBAL POSITIONING SYSTEM DATA TRANSFER FORMAT
(G-FILE)

This annex contains information about the Global Positioning System (GPS) Data Transfer Format (G-File) records. The G-File consists of nine 80-column record types that are used to document the results of the computation of relative vectors, expressed as components, from simultaneously observed GPS phase measurements. There may be only one G-file for a project. Each G-file must contain one Project Record (A) and one or more Session Header Records (B). A Session Header Record (B) is required for each individually processed vector or each simultaneously processed group of vectors (session) at three or more survey points. Each Session Header Record is followed by an optional Session Model (I) Record, one or more Vector (C) and/or Long Vector (F) Records, Correlation (D) or Covariance (E) Records, optional Coordinate (G) Records, optional and/or required Station Information (H) Records. The optional Session Model Record contains the name of the Antenna Pattern File, its source, and its version (date). Vector and Long Vector Records contain relative vector components between two survey points. Correlation Records contain the off-diagonal elements only of the correlation matrix for the vector components in a session. Covariance Records contain the off-diagonal elements only of the covariance matrix for the vector components in a session. The records for a simultaneously processed vector set may only contain correlation **or** covariance records, but not a mix of the two. A Long Vector Record may only be used when a vector component is larger than +/- 999,999.9999 meters. The Coordinate (G) Records may be used to record, for informational purposes within the G-file, the coordinates of survey points held fixed during the vector computations or to provide location information regarding the G-file. Relative vectors are required even if coordinates are included. Station Information Records are used to document differing conditions or solution types for vectors within a session. The Station Information Record (H) is required only when an external time standard is used with a receiver, when a comment needs to be made about a station occupation, or when information about a station occupation or vector solution is not the same as for all other stations or vectors in a session. Multiple H records are allowed.

This annex documents the record formats, provides an explanation of the fields within each record, and gives G-file examples using the various record types.

CC-1 CODE	RECORD TYPE	
A	Project Record	**(The A record is required)**
B	Session Header Record	**(The B record is required)**
C	Vector Record	**(The C record is required)**
D	Correlation Record	**(Either the D record or the**
E	Covariance Record	**(E record is required)**
F	Long Vector Record	
G	Coordinate/Absolute Position Record (optional)	
H	Station Information Record	
I	Session Models Record (optional)	**[Follows the B record if used]**

Project Record

01-01	A		
02-03	Job Code (Chapter 1)		Alpha
04-07	Year, Start of Project (local) (CCYY)		Integer
08-09	Month, Start of Project (local) (MM)		Integer
10-11	Day, Start of Project (local) (DD)		Integer
12-15	Year, End of Project (local) (CCYY)		Integer
16-17	Month, End of Project (local) (MM)		Integer
18-19	Day, End of Project (local) (DD)		Integer
20-78	Title of project		Alpha
79-80	Reserved		

Session Header Record

01-01	B		
02-05	Year, First Actual Measurement (UTC) (CCYY)		Integer
06-07	Month, First Actual Measurement (UTC) (MM)		Integer
08-09	Day, First Actual Measurement (UTC) (DD)		Integer
10-13	Time, First Actual Measurement (UTC) (HHMM)		Integer
14-17	Year, Last Actual Measurement (UTC) (CCYY)		Integer
18-19	Month, Last Actual Measurement (UTC) (MM)		Integer
20-21	Day, Last Actual Measurement (UTC) (DD)		Integer
22-25	Time, Last Actual Measurement (UTC) (HHMM)		Integer
26-27	Number of Vectors in the Session		Integer
28-42	Software Name & Version		Alpha
43-47	Orbit Source **(agency that computes orbit)**		Alpha
48-51	Orbit accuracy estimate **(XX.xx meters)**		Implied Decimal
52-53	Solution coordinate system code	(table, N-6)	Integer
54-55	Solution meteorological use code	(table, N-6)	Integer
56-57	Solution ionosphere use code	(table, N-6)	Integer
58-59	Solution time parameter use code	(table, N-6)	Integer
60-60	Nominal accuracy code	(table, N-8)	Integer
61-66	Processing agency code	(Annex C)	Alpha
67-70	Year of Processing	(CCYY)	Integer
71-72	Month of processing	(MM)	Integer
73-74	Day of processing	(DD)	Integer
75-80	Solution Type	(table, N-7)	Alpha

Note: Columns 43 through 47 of Record B contains the symbol of the agency which computes and provides GPS satellite orbit information. Columns 61 through 66 contains the symbol of the agency that does the observation reduction processing. Columns 52 through 80 of Record B assume all stations use identical observing and computation procedures. If this is not the case use Record H to record the differences for each of those stations which vary from those conditions noted on the B record.

Note: If the number of vectors in a session exceeds 99, leave columns 26 through 27 blank. In such cases, the number of vectors can be determined by counting the “C” records or the “F” records.

Coordinate Record

```
01-01  G
02-02  Blank
03-03  Record usage code K - see below
04-05  Blank
06-09  Station Serial Number
10-10  Blank
11-14  Optional "short" station name - see below
15-15  Blank
16-20  Coordinate frame designator (e.g. NAD 83, WGS 84, NAD 27,
            WGS 72, ITR 90, etc.; inquire for additions)
21-21  Blank
22-33  X coordinate (XXXXXXXX.xxxx meters)        Implied Decimal
34-34  Blank
35-46  Y coordinate (YYYYYYYY.yyyy meters)        Implied Decimal
47-47  Blank
48-59  Z coordinate (ZZZZZZZZ.zzzz meters)        Implied Decimal
60-60  Blank
61-64  Sigma X (SS.ss m) blank if unknown or greater than 99.99 m
65-65  Blank
66-69  Sigma Y (SS.ss m) blank if unknown or greater than 99.99 m
70-70  Blank
71-74  Sigma Z (SS.ss m) blank if unknown or greater than 99.99 m
75-80  Reserved
```

K = 0 or blank indicates that the position is approximate and has no particular interpretation.
K = 1 indicates that these are exact coordinates (to 0.1 mm) used during the processing of the G-file vectors.

The 4 character "short" name, if used, should be the same abbreviation used elsewhere in the G-file or other related data files.

Station Information Record

```
01-01  H
02-05  Station Serial Number (ssn)                        Integer
06-09  Four Character Identifier                          Alpha
10-11  External frequency standard code (table, N-8)
12-13  Vector meteorological use code   (table, N-6)
14-15  Vector time parameter use code   (table, N-6)
16-17  Vector ionosphere use code       (table, N-6)
18-23  Vector Solution type             (table, N-7)
24-78  Comments                                           Alpha
79-80  Reserved
```

Use comment field to record clarifying information or instrument type if noted as "other" in Data Media Identifier.

Session Model Record

```
01-01  I
02-13  Name of Antenna Pattern File
14-21  Reserved
22-27  Agency/Source of Antenna Pattern File (From Annex C)
28-35  Version/Date for Antenna Pattern File (YYYYMMDD)
36-80  Blank
```

CODE TABLES

Solution Coordinate Reference System Codes

01 -- WGS 72 Precise Ephemeris [DMA] Used from GPS beginning thru 1/3/87
02 -- WGS 84 Precise Ephemeris [DMA] from 1/4/87 thru 1/1/94
03 -- WGS 72 Broadcast Ephemeris [DOD] from GPS beginning thru 1/22/87
04 -- WGS 84 Broadcast Ephemeris [DOD] from 1/23/87 thru 6/28/94
05 -- ITRF 89 Epoch 1988.0 (International Earth Rotation Service
NOT USED AS A GPS REFERENCE FRAME
06 -- NEOS 91.25 Epoch 1988 [NGS] from Spring 1991 thru 10/19/91
SPECIAL VLBI COORDINATE SOLUTION written by Mike Abell
07 -- NEOS 90 Epoch 1988.0 [NGS] from 10/20/91 thru 8/15/92
08 -- ITRF 91 Epoch 1988.0 [NGS] from 8/16/92 thru 12/19/92
09 -- SIO/MIT 1992.57 Epoch 1992.57 [NGS] from 12/20/92 thru 11/30/93
10 -- ITRF 91 Epoch 1992.6 [NGS] from 12/1/93 thru 1/8/94
11 -- ITRF 92 Epoch 1994.0 [NGS] from 1/9/94 thru 12/31/95
12 -- ITRF 93 Epoch 1995.0 [NGS] from 1/1/95 thru 6/29/96
13 -- WGS 84 (G730) Epoch 1994.0 [DMA] from 1/2/94 thru 9/28/96
14 -- WGS 84 (G730) Epoch 1994.0 Broadcast [DOD USAF] from 6/29/94 thru 1/28/97
15 -- ITRF 94 Epoch 1996.0 [NGS] from 6/30/96 thru 2/28/98
16 -- WGS 84 (G873) Epoch 1997.0 [NIMA] (formerly DMA) from 9/29/96 to the present
17 -- WGS 84 (G873) Epoch 1997.0 Broadcast [DOD USAF] from 1/29/97 to the present
18 -- ITRF 96 Epoch 1997.0 [NGS] from 3/1/98 to 7/31/99
19 -- ITRF 97 Epoch 1997.0 [NGS] from 8/01/99 to the present

Solution Meteorological Use Codes
01 -- Default values used (model used)
02 -- Observed meteorological data used
03 -- Water vapor radiometer used

Solution Ionosphere Use Code
01 -- None
02 -- Dual frequency ionospheric correction used
03 -- Ionospheric model used

Solution Time Parameter Use Codes
01 -- Observed time synchronization data used
02 -- Time parameters solved for in data reduction

Data Media Identifier
Required format: ADDDYSCCCC where, A is one of the following characters which indicates the manufacturer of the receiver used for the observation: A = Ashtech, Inc; C = Topcon Corp; D = Del Norte Technology, Inc; E = Magellan;G = Allen Osborne; I = Istac; J = Javad Position Systems; K = Sokkia; L = MINI-MAC^{R}; M = MACROMETER^{R}; N = Norstar Instruments; O = Motorola, Inc; P = Spectra Precision; Q = 3S Navigation; R = Trimble Navigation, Ltd; S = SERCEL, Inc; T = Texas Instruments; V = NovAtel Communications Ltd; W = Wild, Leica, Magnavox; X = other; DDD is the day of the year of the first data epoch (UTC); Y is the last digit of the year of the first data epoch (UTC); S is an alphanumeric designation of the session; CCCC is the project unique, four character abbreviation of a station designation