Supplemental GPS Observations

Contents

GPS units

Receivers

Five (5) Trimble NetR5, P/N: 62800-00
S/Ns: 4619K01307, 4624K01584, 4624K01615, 4624K01631 and 4624K01648
Specifications for Static GPS Surveying
Horizontal: +/- 5 mm + 0.5 ppm RMS   Vertical: +/- 5 mm + 1 ppm RMS

Antennas

Four (4) Topcon CR-G3 choke ring antennas   IGS Antenna Type: TPSCR.G3
S/N: 383-1613, -1614, -1626 and -1628   P/N: 1-044301-01

Analysis software, mode of operation

Post-processing and adjustment were undertaken using NGS's beta version of Online
Positioning User Service (OPUS) Projects, an interactive web page. Data is tagged with
a project identifier during typical OPUS upload. OPUS Projects assigns the data to
survey points and sorts it into sessions. Data manager must log in, select a session and
reconfigure it if desired before starting the processing. Processing reports are generated
and interactive tables display a summary of results. Processed base lines are made
available for the adjustment phase. The user is allowed limited flexibility in setting
adjustment parameters. Processing and adjustment results are automatically forwarded to
user via email.

GPS Overview

GPS data were collected on six main-scheme points and retrieved from four IGS tracking
stations.   The geometry of the point layout and local obstructions at some of the points
caused for a less than ideal observing scheme (see Fig. GPS-1). Many hours of
observations were conducted to help counter these deficiencies.

131A

TP01

KOKB

NGSA

From: MONP
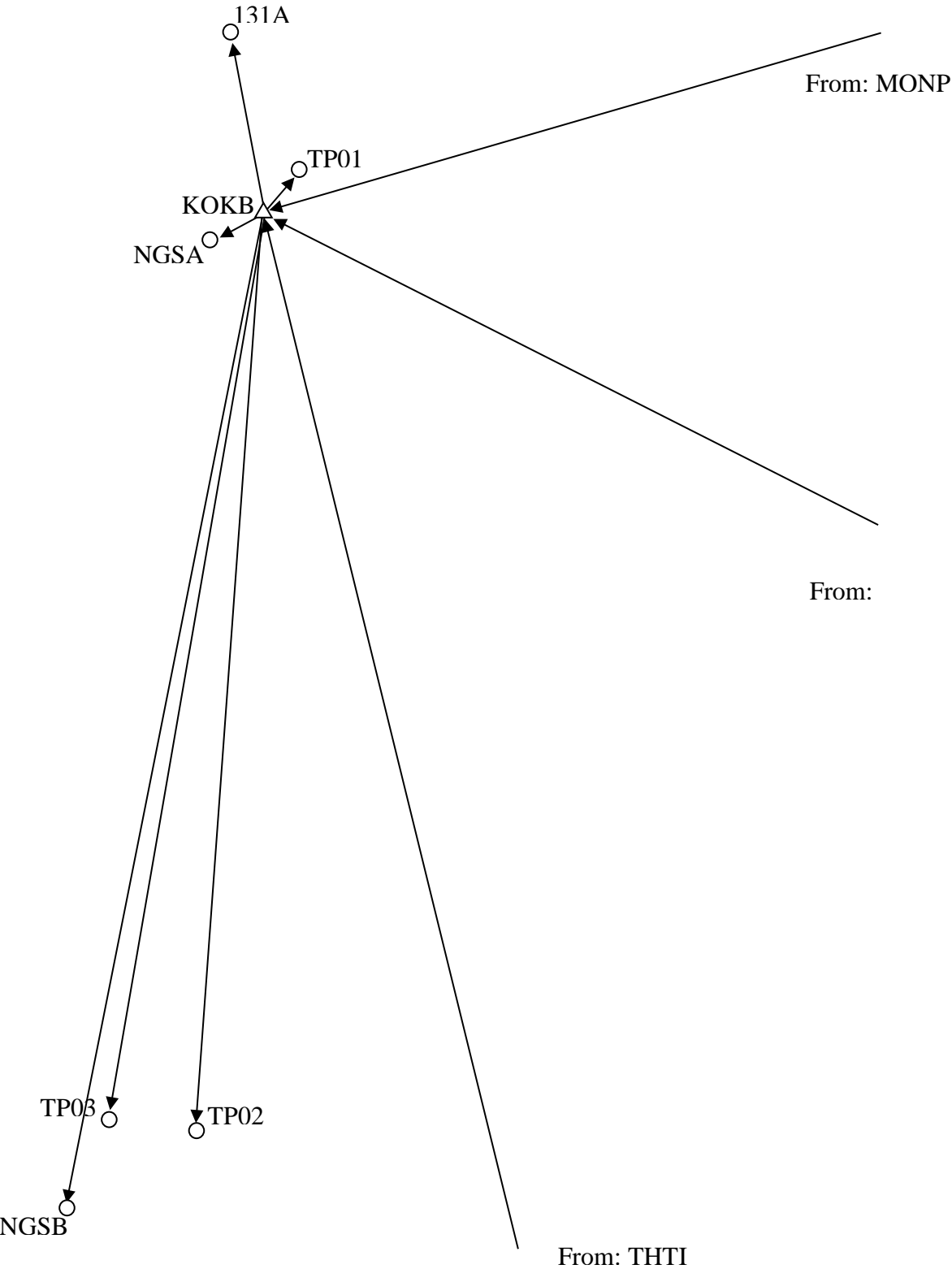
From:

TP03

TP02

NGSB

From: THTI

Table GPS-1 shows sessions and lengths of simultaneous data collection for each session used in processing against the hub station, IGS tracking station KOKB.

Day of Year (session #)	077	078	079	080	081	082	083	084	085
1311 NCMN A	18hr	17hr							
NGS A	17hr	16hr	20hr	24hr	16hr	24hr	19hr	5hr	18hr
NGS B	17hr	23hr	17hr	24hr	21hr	24hr	20hr	5hr	18hr
TP 01	17hr	16hr			14hr	23hr	18hr	5hr	18hr
TP 02			16hr	24hr	21hr	24hr	20hr	5hr	18hr
TP 03			16hr	18hr					

Table GPS-1:   GPS session summary

GPS Observations

Analysis Software

NGS's Online Positioning User's Service (OPUS) Projects was used to post-process and analyze GPS data and to compute least-squares, 3-D estimates of point positions.

OPUS Projects uses NGS's Program for Adjustment of GPS Ephemerides (PAGES) for post-processing. Default settings were used with the following exceptions; 1) hubs were limited to only KOKB, the onsite IGS Tracking Station; 2) the cutoff elevation for processing was lowered to 10°; 3) ITRF2008 was selected as the output reference frame; 4) USGG2012 was selected as the output geoid model; 5) Piecewise Linear was selected as the tropospheric model with an interval of 7200; and 6) constraint weights were set to Loose.   These and the remaining default settings resulted in:

- the use of IGS08.atx absolute antenna calibration file.
- the use of IGS orbits (+/- 2 cm).
- the use of IGS08solution coordinate reference system with coordinates updated to date of observations using velocities.
- the use of default (modeled) meteorological values.
- the use of dual-frequency ionospheric correction.
- time parameters solved in data reduction.
- a double-difference, ionosphere-free (IF) combination solution, where

$$IF = \{f_{21}/(f_{21} - f_{22})\}L_1 - \{f_1f_2/(f_{21} - f_{22})\}L_2$$

not all integer biases being determinable, further resulting in partial, fixed integer estimate of biases.Intended accuracy of vectors is 0.1 ppm plus 0.5 cm (FCGS A-order). All base lines were measured at least twice, once on each of two days.

OPUS Projects uses the program GPSCOM v1203.15, a simple Helmert Blocking normal equation processor which combines multiple GPS data sets that have initially been processed by the program PAGES, to form and partially reduce normal equations eliminating numerous nuisance parameters which are not generally of interest in a large global adjustment. The normal equation elements for the global parameters, those to be passed on to a combined adjustment, are written by PAGES into a normal equation file which becomes the basic input data for the program GPSCOM. One or more of these files as well as its own output normal equation files can then be processed by GPSCOM to provide a combined adjustment of the global parameters. This program was written in

FORTRAN. Predominantly ANSI standard FORTRAN, a few isolated routines query the operating system for time and date, user and system identification. These "system" routines are inherently non-portable but, should be easily modified or disabled. For more information, go to http://www.ngs.noaa.gov/GRD/GPS/DOC/gpscom/gpscom.html

Four IGS tracking stations, including KOKB, one of the co-located techniques tied into the site survey, were normally constrained in the adjustment. The coordinates for the tracking stations used in the adjustment were extracted from the ITRF website, http://itrf.ensg.ign.fr/, in ITRF2008 (epoch date of survey). All points are correlated as seen in Attachment A. GPS Geocentric Coordinates and Covariances. The result was ITRF2008 coordinates for the current survey epoch date for the six ground network points.

Results

Table GPS-2 summarizes redundant GPS vectors from 10 different baselines and shows how well the repeated measurements compare. The last three columns show the magnitude of variance each vector experienced when compared to the final baseline length estimate. In the final adjustment, each vector was weighted based on OPUS-Projects' estimate of quality.

Baseline		Final Baseline Est. (meters)	Var. Δ X (meters)	Var. Δ Y (meters)	Var. Δ Z (meters)	Comb. Var. (meters)
131A	KOKB	67.5808	0.0032	0.0005	0.0004	0.0033
			-0.0031	-0.0005	-0.0005	0.0032
HNLC	KOKB	207385.1359	-0.0018	0.0013	-0.0009	0.0024
			-0.0010	0.0015	-0.0033	0.0038
			-0.0027	-0.0016	0.0005	0.0032
			-0.0058	-0.0075	0.0030	0.0099
			-0.0007	-0.0036	-0.0023	0.0043
			-0.0041	-0.0012	0.0001	0.0043
			-0.0041	0.0015	-0.0039	0.0059
			0.0006	0.0028	0.0004	0.0029
			0.0197	0.0065	0.0063	0.0217
MONP	KOKB	4317184.3171	-0.0195	0.0173	0.0008	0.0261
			0.0088	0.0033	-0.0014	0.0095
			0.0108	0.0072	-0.0022	0.0132
			-0.0035	-0.0016	0.0097	0.0104
			0.0108	-0.0002	0.0038	0.0115
			-0.0073	-0.0017	-0.0264	0.0274
			-0.0003	-0.0148	0.0099	0.0178
			0.0115	-0.0090	-0.0013	0.0147
			-0.0112	-0.0009	0.0071	0.0133

Baseline		Final Baseline Est. (meters)	Var. Δ X (meters)	Var. Δ Y (meters)	Var. Δ Z (meters)	Comb. Var. (meters)
NGSA	KOKB	22.1557	0.0043	0.0017	0.0006	0.0133
			-0.0063	-0.0021	0.0037	0.0047
			0.0040	0.0015	-0.0002	0.0076
			-0.0019	-0.0004	0.0002	0.0043
			-0.0019	-0.0008	0.0016	0.0020
			0.0053	0.0018	-0.0063	0.0026
			0.0041	0.0010	-0.0009	0.0084
			-0.0078	-0.0035	0.0043	0.0043
			0.0006	0.0012	-0.0028	0.0096
NGSB	KOKB	377.7548	0.0048	0.0018	0.0010	0.0031
			-0.0004	-0.0013	0.0001	0.0052
			0.0001	0.0006	0.0018	0.0014
			-0.0011	-0.0001	-0.0008	0.0019
			-0.0026	0.0000	0.0009	0.0014
			0.0046	0.0018	-0.0063	0.0028
			-0.0021	-0.0013	0.0039	0.0080
			-0.0016	-0.0017	0.0009	0.0046
			-0.0014	-0.0001	-0.0017	0.0025
THTI	KOKB	4431538.3598	-0.1024	-0.0233	-0.0164	0.0022
			0.0149	0.0187	-0.0063	0.1063
			-0.0151	0.0059	0.0023	0.0247
			0.0132	0.0079	-0.0103	0.0164
			0.0439	0.0261	0.0115	0.0185
			-0.0179	-0.0061	0.0006	0.0524
			-0.0034	-0.0298	0.0231	0.0189
			0.0314	-0.0015	0.0015	0.0379
			0.0358	0.0021	-0.0060	0.0315
TP01	KOKB	21.7186	0.0046	0.0027	0.0013	0.0364
			-0.0075	-0.0012	0.0038	0.0055
			-0.0020	-0.0019	0.0012	0.0085
			0.0023	0.0013	-0.0057	0.0030
			0.0074	0.0011	-0.0020	0.0063
			-0.0067	-0.0036	0.0048	0.0077
			0.0017	0.0013	-0.0036	0.0090
TP02	KOKB	342.4326	-0.0013	-0.0009	0.0027	0.0042
			-0.0109	-0.0052	0.0049	0.0031
			-0.0050	-0.0006	0.0022	0.0130
			0.0096	0.0039	-0.0079	0.0055
			0.0103	0.0039	-0.0022	0.0130
			-0.0019	-0.0008	0.0013	0.0112
			-0.0008	-0.0003	-0.0011	0.0024
TP03	KOKB	341.4381	0.0019	0.0008	0.0002	0.0014
			-0.0019	-0.0007	-0.0002	0.0021

Table GPS-2: Comparison of redundant vectors.

The final GPS coordinates were computed independently using NGS's OPUS-Projects web-based software. See the following attachment for OPUS Projects output SINEX file.

Attachment: GPS Geocentric Coordinates and Covariances (SINEX)

```
%=SNX 1.00 NOA 14:133:47590 NOA 14:077:00000 14:085:86370 P    30 2 X - -
*-------------------------------------------------------------------------------
+FILE/REFERENCE
 DESCRIPTION     OPUS Projects : NOAA/NOS/NGS
 OUTPUT          network-final FRAME: IGS08
 CONTACT         charles.geoghegan@noaa.gov
 SOFTWARE        pages.e & gpscom.e
 HARDWARE        fermi (SunOS i86pc)
 INPUT           Kokee Park Site Survey GNSS data
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+FILE/COMMENT
 This combined adjustment was made from internal NGS files
 of partially reduced normal equations (information matricies).
 The data sets included in this solution are shown below.
     ../14077/Results/2014-077-kokb hub.nrm                        0
     ../14078/Results/2014-078-kokb hub.nrm                        0
     ../14079/Results/2014-079-kokb hub.nrm                        0
     ../14080/Results/2014-080-kokb hub.nrm                        0
     ../14081/Results/2014-081-kokb hub.nrm                        0
     ../14082/Results/2014-082-kokb hub.nrm                        0
     ../14083/Results/2014-083-kokb hub.nrm                        0
     ../14084/Results/2014-084-kokb hub.nrm                        0
     ../14085/Results/2014-085-kokb hub.nrm                        0
-FILE/COMMENT
*-------------------------------------------------------------------------------
+SOLUTION/STATISTICS
 NUMBER OF OBSERVATIONS                      849554.
 NUMBER OF UNKNOWNS                            1520
 NUMBER OF CONSTRAINT EQUATIONS                  6
 NUMBER OF DEGREES OF FREEDOM                848040.
 VARIANCE FACTOR                 0.813894365739918
-SOLUTION/STATISTICS
*-------------------------------------------------------------------------------
+SITE/ID
*CODE PT DOMES____ T STATION DESCRIPTION___ APPROX_LON_ APPROX_LAT_ _APP_H_
 131a  - --------- P 131a                   200 20  5.8  22  7 36.7  1160.5
 ngsa  - --------- P ngsa                   200 20  5.6  22  7 34.2  1164.7
 ngsb  - --------- P ngsb                   200 20  3.7  22  7 22.5  1158.0
 tp01  - --------- P tp01                   200 20  6.7  22  7 35.1  1161.4
 HNLC  A 49970S001 P Honolulu, USA          202  8  7.7  21 18 11.8    22.0
 KOKB  A 40424M004 P Kokee Park, Waimea,, U 200 20  6.3  22  7 34.5  1167.4
 MONP  A 40497M004 P Laguna Mountains, USA  243 34 39.6  32 53 31.0  1842.5
 THTI  A 92201M009 P Papeete, Tahiti, Frenc 210 23 36.8 -17 34 37.4    98.0
 tp02  - --------- P tp02                   200 20  5.4  22  7 23.5  1156.7
 tp03  - --------- P tp03                   200 20  4.2  22  7 23.6  1161.3
-SITE/ID
*-------------------------------------------------------------------------------
+SITE/RECEIVER
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__ FIRMWARE___
 131a  -    1 P 14:077:00000 14:078:86399 TRIMBLE NETR5        01631 Nav 4.41 Si
 ngsa  -    1 P 14:077:00000 14:085:86399 TRIMBLE NETR5        01631 Nav 4.41 Si
 ngsb  -    1 P 14:077:00000 14:085:86399 TRIMBLE NETR5        01615 Nav 4.41 Si
 tp01  -    1 P 14:077:00000 14:085:86399 TRIMBLE NETR5        01584 Nav 4.41 Si
 HNLC  A    1 P 14:077:00000 14:085:86399 TRIMBLE NETRS        44272 1.3-2
 KOKB  A    3 P 14:077:00000 14:085:86399 ASHTECH UZ-12        IR220 CQ00
 MONP  A    4 P 14:077:00000 14:085:86399 TPS NET-G3A          618-0 3.5
 THTI  A    2 P 14:077:00000 14:085:86399 TRIMBLE NETR8        4906k 4.22
 tp02  -    1 P 14:079:00000 14:085:86399 TRIMBLE NETR5        01584 Nav 4.41 Si
 tp03  -    1 P 14:079:00000 14:080:86399 TRIMBLE NETR5        01307 Nav 4.41 Si
-SITE/RECEIVER
*-------------------------------------------------------------------------------
+SITE/ANTENNA
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__
 131a  -    1 P 14:077:00000 14:078:86399 TPSCR.G3             NONE -----
 ngsa  -    1 P 14:077:00000 14:085:86399 TPSCR.G3             NONE -----
 ngsb  -    1 P 14:077:00000 14:085:86399 TPSCR.G3             NONE -----
 tp01  -    1 P 14:077:00000 14:085:86399 TPSCR.G3             NONE -----
```

```
 HNLC   A    1 P 14:077:00000 14:085:86399 ASH700936D_M    SNOW CR142
 KOKB   A    3 P 14:077:00000 14:085:86399 ASH701945G_M    NONE CR620
 MONP   A    4 P 14:077:00000 14:085:86399 ASH701945B_M    SCIS CR519
 THTI   A    2 P 14:077:00000 14:085:86399 ASH701945E_M    NONE CR520
 tp02   -    1 P 14:079:00000 14:085:86399 TPSCR.G3        NONE -----
 tp03   -    1 P 14:079:00000 14:080:86399 TPSCR.G3        NONE -----
-SITE/ANTENNA
*-------------------------------------------------------------------------------
+SITE/GPS_PHASE_CENTER
* Antenna information is from the file
*      /home/OPUS/files/ngs08.atx
* abbreviated below as  ant.info
*                           UP___  NORTH EAST_  UP___  NORTH EAST_
*DESCRIPTION_____ S/N__ L1->ARP(m)_____ __L2->ARP(m)_____ AZ_EL
 TPSCR.G3         NONE ----- 0.0884 -.0002 0.0003 0.1194 0.0003 -.0000  ant.info
 TPSCR.G3         NONE ----- 0.0884 -.0002 0.0003 0.1194 0.0003 -.0000  ant.info
 TPSCR.G3         NONE ----- 0.0884 -.0002 0.0003 0.1194 0.0003 -.0000  ant.info
 TPSCR.G3         NONE ----- 0.0884 -.0002 0.0003 0.1194 0.0003 -.0000  ant.info
 ASH700936D_M     SNOW CR142 0.0909 0.0003 -.0002 0.1192 0.0001 0.0001  ant.info
 ASH701945G_M     NONE CR620 0.0918 0.0006 -.0004 0.1203 -.0001 -.0006  ant.info
 ASH701945B_M     SCIS CR519 0.0896 0.0005 0.0001 0.1193 -.0006 0.0000  ant.info
 ASH701945E_M     NONE CR520 0.0905 0.0011 -.0001 0.1190 0.0000 0.0006  ant.info
 TPSCR.G3         NONE ----- 0.0884 -.0002 0.0003 0.1194 0.0003 -.0000  ant.info
 TPSCR.G3         NONE ----- 0.0884 -.0002 0.0003 0.1194 0.0003 -.0000  ant.info
-SITE/GPS_PHASE_CENTER
*-------------------------------------------------------------------------------
+SITE/ECCENTRICITY
*SITE PT SOLN T DATA_START__ DATA_END____ AXE ARP->BENCHMARK(m)_____
 131a   -    1 P 14:077:00000 14:078:86399 UNE   1.4414   0.0000  -0.0000
 ngsa   -    1 P 14:077:00000 14:085:86399 UNE   1.0003   0.0000  -0.0000
 ngsb   -    1 P 14:077:00000 14:085:86399 UNE   1.3953   0.0000  -0.0000
 tp01   -    1 P 14:077:00000 14:085:86399 UNE   1.3859   0.0000  -0.0000
 HNLC   A    1 P 14:077:00000 14:085:86399 UNE   0.0000   0.0000   0.0000
 KOKB   A    3 P 14:077:00000 14:085:86399 UNE   0.0614   0.0000  -0.0000
 MONP   A    4 P 14:077:00000 14:085:86399 UNE   0.1176   0.0000  -0.0000
 THTI   A    2 P 14:077:00000 14:085:86399 UNE   1.0470   0.0000  -0.0000
 tp02   -    1 P 14:079:00000 14:085:86399 UNE   1.5450   0.0000  -0.0000
 tp03   -    1 P 14:079:00000 14:080:86399 UNE   1.3735   0.0000  -0.0000
-SITE/ECCENTRICITY
*-------------------------------------------------------------------------------
+SOLUTION/EPOCHS
*SITE PT SOLN T _DATA_START_ __DATA_END__ _MEAN_EPOCH_
 131a   -    1 P 14:077:00000 14:078:86399 14:077:76439
 ngsa   -    1 P 14:077:00000 14:085:86399 14:081:28224
 ngsb   -    1 P 14:077:00000 14:085:86399 14:081:23229
 tp01   -    1 P 14:077:00000 14:085:86399 14:081:67123
 HNLC   A    1 P 14:077:00000 14:085:86399 14:081:46985
 KOKB   A    3 P 14:077:00000 14:085:86399 14:081:36580
 MONP   A    4 P 14:077:00000 14:085:86399 14:081:46795
 THTI   A    2 P 14:077:00000 14:085:86399 14:081:48111
 tp02   -    1 P 14:079:00000 14:085:86399 14:082:23525
 tp03   -    1 P 14:079:00000 14:080:86399 14:079:81452
-SOLUTION/EPOCHS
*-------------------------------------------------------------------------------
+SOLUTION/ESTIMATE
*INDEX TYPE    CODE PT SOLN _REF_EPOCH__ UNIT S __ESTIMATED VALUE___ _STD_DEV___
     1 STAX   131a  -    1 14:081:43185 m    2 -.554381326858763E+07 .834293E-03
     2 STAY   131a  -    1 14:081:43185 m    2 -.205456386412734E+07 .335438E-03
     3 STAZ   131a  -    1 14:081:43185 m    2 0.238786894621683E+07 .407806E-03
     4 STAX   ngsa  -    1 14:081:43185 m    2 -.554384634481772E+07 .353487E-03
     5 STAY   ngsa  -    1 14:081:43185 m    2 -.205456835189454E+07 .150322E-03
     6 STAZ   ngsa  -    1 14:081:43185 m    2 0.238779985383279E+07 .169561E-03
     7 STAX   ngsb  -    1 14:081:43185 m    2 -.554398664798799E+07 .336758E-03
     8 STAY   ngsb  -    1 14:081:43185 m    2 -.205456240398545E+07 .144275E-03
     9 STAZ   ngsb  -    1 14:081:43185 m    2 0.238746367563172E+07 .163956E-03
    10 STAX   tp01  -    1 14:081:43185 m    2 -.554382279958250E+07 .471853E-03
    11 STAY   tp01  -    1 14:081:43185 m    2 -.205459475357767E+07 .200817E-03
    12 STAZ   tp01  -    1 14:081:43185 m    2 0.238782284740330E+07 .227962E-03
    13 STAX   HNLC  A    1 14:081:43185 m    0 -.550679884818015E+07 .538948E-04
    14 STAY   HNLC  A    1 14:081:43185 m    0 -.224004895663957E+07 .445738E-04
```

```
    15 STAZ    HNLC   A    1 14:081:43185 m      0 0.230272071584915E+07 .443509E-04
    16 STAX    KOKB   A    3 14:081:43185 m      0 -.554383827710735E+07 .545441E-04
    17 STAY    KOKB   A    3 14:081:43185 m      0 -.205458617084802E+07 .445441E-04
    18 STAZ    KOKB   A    3 14:081:43185 m      0 0.238781025900913E+07 .445374E-04
    19 STAX    MONP   A    4 14:081:43185 m      2 -.238624736839728E+07 .453722E-03
    20 STAY    MONP   A    4 14:081:43185 m      2 -.480235915579213E+07 .360708E-03
    21 STAZ    MONP   A    4 14:081:43185 m      2 0.344490234884818E+07 .298086E-03
    22 STAX    THTI   A    2 14:081:43185 m      2 -.524641591876331E+07 .652622E-03
    23 STAY    THTI   A    2 14:081:43185 m      2 -.307725953866044E+07 .341787E-03
    24 STAZ    THTI   A    2 14:081:43185 m      2 -.191384190754053E+07 .241936E-03
    25 STAX    tp02   -    1 14:081:43185 m      2 -.554395794211373E+07 .449006E-03
    26 STAY    tp02   -    1 14:081:43185 m      2 -.205460474531268E+07 .186407E-03
    27 STAZ    tp02   -    1 14:081:43185 m      2 0.238748995367733E+07 .216011E-03
    28 STAX    tp03   -    1 14:081:43185 m      2 -.554397191533818E+07 .695935E-03
    29 STAY    tp03   -    1 14:081:43185 m      2 -.205457402866111E+07 .291673E-03
    30 STAZ    tp03   -    1 14:081:43185 m      2 0.238749629558354E+07 .342226E-03
-SOLUTION/ESTIMATE
*-------------------------------------------------------------------------------
+SOLUTION/APRIORI
*INDEX TYPE    CODE PT SOLN _REF_EPOCH__ UNIT S __A-PRIORI VALUE____ _STD_DEV___
    13 STAX    HNLC   A    1 14:081:43185 m      0 -.550679873796584E+07 .166858E+05
    14 STAY    HNLC   A    1 14:081:43185 m      0 -.224004953544123E+07 .166858E+05
    15 STAZ    HNLC   A    1 14:081:43185 m      0 0.230272041992256E+07 .166858E+05
    16 STAX    KOKB   A    3 14:081:43185 m      0 -.554383818735769E+07 .166858E+05
    17 STAY    KOKB   A    3 14:081:43185 m      0 -.205458674999740E+07 .166858E+05
    18 STAZ    KOKB   A    3 14:081:43185 m      0 0.238780996368437E+07 .166858E+05
-SOLUTION/APRIORI
*-------------------------------------------------------------------------------
+SOLUTION/MATRIX_ESTIMATE U COVA
     1      1 0.696045358262857E-06 0.239116152574028E-06 -.307915370436860E-06
     1      4 0.361343528391385E-07 0.129676234104084E-07 -.148443001164052E-07
     1      7 0.348293304085069E-07 0.125479485440814E-07 -.143523949463478E-07
     1     10 0.410927939978546E-07 0.143703518745887E-07 -.168459018726047E-07
     1     13 0.147277411612979E-08 -.235902781995433E-09 -.244381344642576E-09
     1     16 0.162263349597146E-08 0.538420924003504E-09 -.838634269850297E-10
     1     19 0.335536085934835E-07 0.637319406789150E-08 -.104334318950424E-07
     1     22 0.325176779665345E-07 0.998896991951370E-08 -.188872416980893E-07
     1     25 0.000000000000000E+00 0.000000000000000E+00 0.000000000000000E+00
     1     28 0.000000000000000E+00 0.000000000000000E+00 0.000000000000000E+00
     2      2 0.112518962437362E-06 -.112386271553319E-06 0.130503153370039E-07
     2      5 0.783764847814592E-08 -.582649765513296E-08 0.125240571973391E-07
     2      8 0.761135562177886E-08 -.562636953198866E-08 0.150249888173655E-07
     2     11 0.870859767907160E-08 -.670330346263896E-08 0.127458824415482E-09
     2     14 0.102865361873430E-08 -.905978362695757E-10 0.171331683755917E-09
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