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# NASA/MOTS OPTICAL OBSERVATIONS OF THE ANNA IB SATELLITE

*by David W. Harris and John H. Berbert*

*Goddard Space Flight Center*
*Greenbelt, Md.*



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ABSTRACT

The ANNA 1B satellite, launched October 31, 1962, carried a set of high intensity optical beacons which were programmed to flash at predetermined times. Tracking cameras would photograph the flash sequences against the star background and obtain highly accurate positions of the spacecraft through rigorous reductions of the plates. Listed are the positions obtained by successful observations from the Minitrack Optical Tracking System (MOTS) cameras as referenced to an Equator and Equinox of 1950.0. Also listed are corrections for five "apparent place" positions reported in an Air Force Cambridge Research Laboratory publication.

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## INTRODUCTION

On October 31, 1962, the ANNA 1B (B Mu 1) satellite was launched from the Atlantic Missile Range using a Thor/Ablestar launch vehicle. The spacecraft closely achieved its planned orbit of 50 degrees inclination and about 1100 kilometers circular altitude. The name ANNA is an acronym for Army, Navy, NASA, and Air Force. These were the agencies which originally collaborated on formulating the program and which actively participated in the observation program. One of the devices carried on board the spacecraft and used to obtain very accurate determinations of its position was a pair of high intensity optical beacons which, when activated, produced a series of five flashes, each spaced 5.6 seconds apart. For the National Aeronautics and Space Administration, the MOTS (Minitrack Optical Tracking System) cameras were employed in obtaining photographs of the flashing lights. It was the Blossom Point, Maryland, MOTS camera which photographed the first light flashes from ANNA in a special test conducted November 2, 1962, over the East Coast of the United States.

## OPERATIONS

The MOTS camera is an F/5.0, 40-inch focal length system which uses 8 × 10 inch photographic plates and affords an 11 × 14 degree field of view (Figure 1). The camera is driven at the sidereal rate so that all stars appear as points. A listing of the stations successfully obtaining ANNA images on their plates is given in Table 1.

Using the Royal X-Pan emulsion supplied by Eastman Kodak Corporation, the MOTS camera is capable of recording about 12th magnitude stars with a 30-second exposure. Since the Bonner Durchmusterung and Cordoba Durchmusterung star charts used as an aid in locating the flashing light images show stars to only 9.5 magnitudes, a method of offsetting and double-exposing the star images was devised so that faint stars would not be confused with the faint flashes. Predictions for photographing the flashing light images were received from Air Force Cambridge

Research Laboratory and retransmitted from the Goddard Space Flight Center to the tracking stations. A 32-second exposure was taken of the sky field through which the satellite was predicted to pass at the time when it was programmed to flash its beacons in a series of five flashes, each about 5.6 seconds apart. The sidereal drive was then turned off for 20 seconds allowing the stars to move as related to the photographic plate. After the 20 seconds, the drive was turned on and another 32-second exposure was obtained. In this manner, all stars whether bright or faint, appeared as double images while the flashes appeared as single images. An identifying trail was included in the second exposure by halting the drive and exposing for 10 additional seconds. This aided in the plate reduction by positively identifying which images were obtained during the flash sequence. An ANNA 1B photograph appears as Figure 2.

Figure 1—Minitrack Optical Tracking System (MOTS) camera.

## TIMING

The flash times are supplied from the Applied Physics Laboratory of Johns Hopkins University, and are referenced to WWV as emitted. No corrections are applied to the times prior to reduction of the plate. An estimate of the time accuracy was also supplied by Applied Physics Laboratory and is recorded in the listing. For a number of the flash sequences listed, the beacon was commanded by ground equipment used by the Air Force rather than programmed into the satellite memory. In these cases an estimate of 10 milliseconds was assigned (unless otherwise given by the Air Force) and an asterisk appears in Appendices A and B in the time accuracy column.

## REDUCTION

Plate reduction was performed by the Physical Science Laboratory of New Mexico State University in accordance with procedures outlined by Emily W. Good, John H. Berbert, and John D. Oosterhout (Reference 1). The solutions for the positions of the flashing light images are accompanied by the residuals between the positions of the star images from their standard coordinates and their positions as obtained from the catalogues. The standard deviation of these residuals, for each plate, is given in seconds of arc and may be found in the rms columns of Appendices A

Table 1

MOTS Stations Successfully Obtaining ANNA 1B Photographs

| Station Designation | Station Location | East Longitude | | | Geodetic Latitude | | | Elevation Meters Above MSL | Datum/Ellipsoid |
|---|---|---|---|---|---|---|---|---|---|
| BPOINT | Blossom Point, Maryland | 282° | 54' | 49".37 | 38° | 25' | 49".91 | 6.2 | Mercury/Fischer '60 |
| FTMYRS | Fort Myers, Fla. | 278 | 08 | 04.60 | 26 | 32 | 53.78 | 9.2 | Mercury/Fischer '60 |
| GFORKS | East Grand Forks, Minnesota | 262 | 59 | 21.05 | 48 | 01 | 21.18 | 249.8 | Mercury/Fischer '60 |
| JOBURG | Johannesburg, South Africa | 27 | 42 | 28.49 | -25 | 53 | 00.98 | 1564.8 | Mercury/Fischer '60 |
| MOJAVE | Goldstone Lake, California | 243 | 06 | 00.85 | 35 | 19 | 48.56 | 921.8 | Mercury/Fischer '60 |
| OOMERA | Woomera, Australia | 136 | 52 | 10.99 | -31 | 23 | 30.00 | 157.8 | Mercury/Fischer '60 |
| SNTAGO | Santiago, Chile | 289 | 19 | 52.88 | -33 | 08 | 56.23 | 681.2 | Mercury/Fischer '60 |
| WNKFLD | Winkfield, England | 359 | 18 | 13.57 | 51 | 26 | 45.43 | 87.8 | Mercury/Fischer '60 |

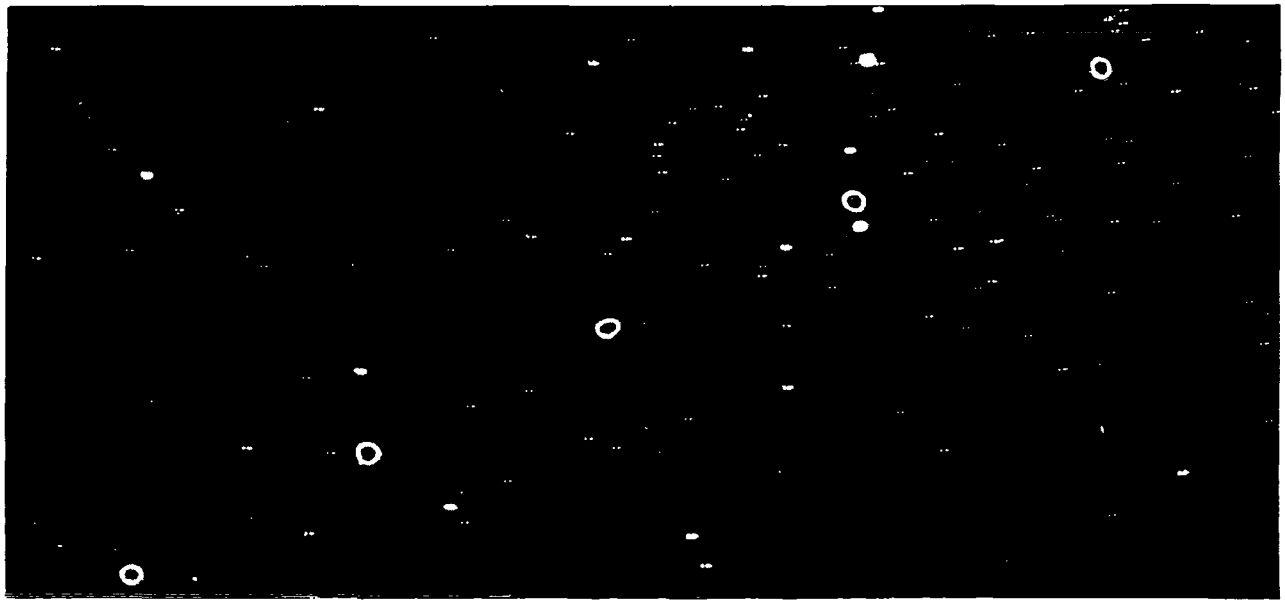

Figure 2—ANNA 1B photograph at Santiago, Chile, on November 11, 1962.

and B. Flashing light positions are given for an equinox and equator of 1950.0. Proper motions have been applied to the positions, where the values were available in the catalogues and the epoch of observation was other than 1950.0. Annual and planetary aberrations have not been included in the reduction. Appendix A has the listing of all successful observations between November 9, 1962, and January 15, 1964. For eleven plates, two solutions for the positions of the ANNA lamp images were computed using entirely different sets of stars for each solution. The differences were, in general, less than one second of arc. Two representative pairs are given in Table 2.

The computed positions were also updated to "apparent place" using Bessel's technique and were given to the Air Force Cambridge Research Laboratory for inclusion in their publication AFCRL-65-195 (Reference 2). Care should be exercised in using MOTS data appearing in that publication, since positions for five sequences of light flashes are based upon flash times which were subsequently changed by the Applied Physics Laboratory or in a later plate reduction. The corrected "apparent place" values for these five sequences appear in Appendix B.

Table 2

Two Representative Pairs Indicating Accuracy of Positions of ANNA 1B

| | | Right Ascension 1950.0 | | | Declination 1950.0 | | |
|---|---|---|---|---|---|---|---|
| | Flash | $\alpha_1$ | $\alpha_2$ | $\Delta\alpha''$* | $\delta_1$ | $\delta_2$ | $\Delta\delta''$** |
| East Grand Forks Plate #2 December 4, 1962 | 1 | $05^h\ 29^m\ 13^s.873$ | $05^h\ 29^m\ 13^s.931$ | -0".791 | 24° 34' 24".523 | 24° 34' 23".398 | 1".125 |
| | 2 | 05 33 51.254 | 05 33 51.267 | -0.179 | 23 40 04.747 | 23 40 04.565 | 0.182 |
| | 3 | 05 38 18.181 | 05 38 18.142 | 0.539 | 22 46 22.670 | 22 46 22.795 | -0.125 |
| | 4 | 05 42 35.011 | 05 42 34.996 | 0.209 | 21 53 31.794 | 21 53 32.567 | -0.773 |
| | 5 | 05 47 23.022 | 05 47 23.021 | 0.014 | 20 55 43.996 | 20 55 44.918 | -0.922 |
| Woomera Plate #5 December 16, 1962 | 1 | $07^h\ 52^m\ 22^s.466$ | $07^h\ 52^m\ 22^s.330$ | 1".332 | -49° 14' 08".620 | -49° 14' 08".610 | -0".010 |
| | 2 | 08 01 16.323 | 08 01 16.390 | -0.646 | -50 02 03.540 | -50 02 02.950 | -0.590 |
| | 3 | 08 10 33.171 | 08 10 33.228 | -0.541 | -50 47 09.210 | -50 47 09.070 | -0.140 |
| | 4 | 08 19 56.422 | 08 19 56.370 | 0.486 | -51 28 39.170 | -51 28 39.400 | 0.230 |
| | 5 | 08 29 24.185 | 08 29 24.094 | 0.838 | -52 06 34.510 | -52 06 35.220 | 0.710 |

*$\Delta\alpha'' = (\alpha_1 - \alpha_2)\ 15 \cos \delta_1$.

**$\Delta\delta = \delta_1 - \delta_2$.

## ACKNOWLEDGMENTS

The data presented in this report is a result of the fine efforts of the personnel stationed at the Minitrack sites and those who reduced the successful observations at the Physical Science Laboratory of the New Mexico State University. It is only through their cooperation and through the help supplied by many personnel from the Goddard Space Flight Center that this publication is able to appear.

(Manuscript received June 14, 1965)

## REFERENCES


1. Good, Emily W., Berbert, J. H., and Oosterhout, J. D., "Reduction of the Minitrack Astrographic Plates," *Photo. Sci. and Eng.* 6(6):324-327, November-December 1962.
2. Dishong, P. H., and Hadgigeorge, G., "Project ANNA Optical Observations," Bedford, Massachusetts: Air Force Cambridge Research Laboratories, AFCRL-65-195; Paper No. ERP-92, March 1965.

Appendix A

## All Successful Observations of ANNA 1B from November 9, 1962 to January 15, 1964

| DATE | | | TIME(WWV) | | | ACC.† | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1962 | 11 | 09 | 07 | 52 | 33.6440 | 10.0 | 04 | 55 | 26.709 | 1.288 | 16 | 13 | 12.471 | 1.234 | MOJAVE |
| | 11 | 09 | 07 | 52 | 39.2360 | 10.0 | 05 | 00 | 16.573 | 1.288 | 17 | 02 | 12.477 | 1.234 | MOJAVE |
| | 11 | 09 | 07 | 52 | 44.8290 | 10.0 | 05 | 05 | 20.368 | 1.288 | 17 | 55 | 06.979 | 1.234 | MOJAVE |
| | 11 | 09 | 07 | 58 | 09.2140 | 10.0 | 05 | 23 | 51.660 | 1.848 | 18 | 12 | 48.069 | 1.597 | GFORKS |
| | 11 | 09 | 07 | 58 | 14.8060 | 10.0 | 05 | 29 | 07.678 | 1.848 | 18 | 59 | 36.993 | 1.597 | GFORKS |
| | 11 | 09 | 07 | 58 | 20.3990 | 10.0 | 05 | 34 | 32.707 | 1.848 | 19 | 49 | 05.035 | 1.597 | GFORKS |
| | 11 | 09 | 11 | 47 | 27.5880 | 10.0 | 11 | 42 | 48.012 | 1.839 | 35 | 05 | 46.810 | 1.836 | GFORKS |
| | 11 | 09 | 11 | 47 | 33.1800 | 10.0 | 11 | 45 | 47.240 | 1.839 | 33 | 26 | 49.140 | 1.836 | GFORKS |
| | 11 | 09 | 11 | 47 | 38.7730 | 10.0 | 11 | 48 | 40.488 | 1.839 | 31 | 47 | 33.670 | 1.836 | GFORKS |
| | 11 | 11 | 00 | 48 | 50.4849 | 1.0 | 23 | 20 | 51.804 | 1.454 | 03 | 52 | 52.417 | 1.678 | SNTAGO |
| | 11 | 11 | 00 | 48 | 56.0777 | 1.0 | 23 | 24 | 56.650 | 1.454 | 04 | 49 | 24.357 | 1.678 | SNTAGO |
| | 11 | 11 | 00 | 49 | 01.6706 | 1.0 | 23 | 29 | 24.614 | 1.454 | 05 | 49 | 06.083 | 1.678 | SNTAGO |
| | 11 | 11 | 00 | 49 | 07.2634 | 1.0 | 23 | 33 | 47.714 | 1.454 | 06 | 47 | 42.442 | 1.678 | SNTAGO |
| | 11 | 11 | 00 | 49 | 12.8562 | 1.0 | 23 | 38 | 05.576 | 1.454 | 07 | 44 | 58.521 | 1.678 | SNTAGO |
| | 11 | 11 | 04 | 46 | 37.8105 | 1.0 | 03 | 26 | 53.607 | 2.063 | 34 | 49 | 25.950 | 2.120 | FTMYRS |
| | 11 | 11 | 04 | 46 | 43.4033 | 1.0 | 03 | 33 | 37.907 | 2.063 | 35 | 58 | 56.980 | 2.120 | FTMYRS |
| | 11 | 11 | 04 | 46 | 48.9962 | 1.0 | 03 | 40 | 29.220 | 2.063 | 37 | 06 | 17.500 | 2.120 | FTMYRS |
| | 11 | 11 | 04 | 46 | 54.5890 | 1.0 | 03 | 47 | 25.960 | 2.063 | 38 | 11 | 06.930 | 2.120 | FTMYRS |
| | 11 | 11 | 04 | 47 | 00.1818 | 1.0 | 03 | 54 | 28.925 | 2.063 | 39 | 13 | 22.300 | 2.120 | FTMYRS |
| | 11 | 21 | 11 | 26 | 29.2132 | 0.5 | 06 | 44 | 41.631 | 1.040 | 64 | 31 | 49.340 | 1.042 | MOJAVE |
| | 11 | 21 | 11 | 26 | 34.8061 | 0.5 | 06 | 58 | 12.738 | 1.040 | 63 | 53 | 31.470 | 1.042 | MOJAVE |
| | 11 | 21 | 11 | 26 | 40.3989 | 0.5 | 07 | 11 | 18.480 | 1.040 | 63 | 10 | 10.780 | 1.042 | MOJAVE |
| | 11 | 21 | 11 | 26 | 45.9917 | 0.5 | 07 | 23 | 55.384 | 1.040 | 62 | 21 | 59.380 | 1.042 | MOJAVE |
| | 12 | 04 | 03 | 01 | 42.1307 | 0.5 | 03 | 13 | 34.874 | 1.522 | 59 | 35 | 16.010 | 1.735 | GFORKS |
| | 12 | 04 | 03 | 01 | 47.7235 | 0.5 | 03 | 26 | 03.306 | 1.522 | 58 | 52 | 59.160 | 1.735 | GFORKS |
| | 12 | 04 | 03 | 01 | 53.3164 | 0.5 | 03 | 37 | 51.928 | 1.522 | 58 | 07 | 06.870 | 1.735 | GFORKS |
| | 12 | 04 | 03 | 01 | 58.9092 | 0.5 | 03 | 49 | 00.342 | 1.522 | 57 | 18 | 16.710 | 1.735 | GFORKS |
| | 12 | 04 | 03 | 02 | 04.5020 | 0.5 | 03 | 59 | 30.605 | 1.522 | 56 | 26 | 37.820 | 1.735 | GFORKS |

†For entries marked by an asterisk(*), the beacon was flashed by ground command.

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1962 | 12 | 04 | 04 | 56 | 21.3193 | 0.5 | 05 | 29 | 13.873 | 1.664 | 24 | 34 | 24.523 | 1.143 | GFORKS |
| | 12 | 04 | 04 | 56 | 26.9121 | 0.5 | 05 | 33 | 51.254 | 1.664 | 23 | 40 | 04.747 | 1.143 | GFORKS |
| | 12 | 04 | 04 | 56 | 32.5050 | 0.5 | 05 | 38 | 18.181 | 1.664 | 22 | 46 | 22.670 | 1.143 | GFORKS |
| | 12 | 04 | 04 | 56 | 38.0978 | 0.5 | 05 | 42 | 35.011 | 1.664 | 21 | 53 | 31.794 | 1.143 | GFORKS |
| | 12 | 04 | 04 | 56 | 43.6906 | 0.5 | 05 | 47 | 23.022 | 1.664 | 20 | 55 | 43.996 | 1.143 | GFORKS |
| | 12 | 08 | 01 | 05 | 53.9597 | 0.5 | 07 | 52 | 33.638 | 1.400 | -13 | 43 | 30.130 | 1.343 | JOBURG |
| | 12 | 08 | 01 | 05 | 59.5525 | 0.5 | 07 | 57 | 48.209 | 1.400 | -15 | 07 | 42.386 | 1.343 | JOBURG |
| | 12 | 08 | 01 | 06 | 05.1453 | 0.5 | 08 | 03 | 09.492 | 1.400 | -16 | 32 | 00.013 | 1.343 | JOBURG |
| | 12 | 13 | 06 | 57 | 54.3679 | 0.5 | 05 | 43 | 16.630 | 1.202 | -19 | 45 | 48.625 | 1.263 | SNTAGO |
| | 12 | 13 | 06 | 57 | 59.9607 | 0.5 | 05 | 47 | 08.078 | 1.202 | -21 | 05 | 02.016 | 1.263 | SNTAGO |
| | 12 | 13 | 06 | 58 | 05.5536 | 0.5 | 05 | 51 | 08.228 | 1.202 | -22 | 25 | 41.855 | 1.263 | SNTAGO |
| | 12 | 13 | 06 | 58 | 11.1464 | 0.5 | 05 | 55 | 17.239 | 1.202 | -23 | 47 | 29.437 | 1.263 | SNTAGO |
| | 12 | 16 | 15 | 52 | 06.9089 | 0.5 | 07 | 52 | 22.330 | 1.256 | -49 | 14 | 08.610 | 0.937 | OOMERA |
| | 12 | 16 | 15 | 52 | 12.5017 | 0.5 | 08 | 01 | 16.390 | 1.256 | -50 | 02 | 02.950 | 0.937 | OOMERA |
| | 12 | 16 | 15 | 52 | 18.0946 | 0.5 | 08 | 10 | 33.228 | 1.256 | -50 | 47 | 09.070 | 0.937 | OOMERA |
| | 12 | 16 | 15 | 52 | 23.6874 | 0.5 | 08 | 19 | 56.370 | 1.256 | -51 | 28 | 39.400 | 0.937 | OOMERA |
| | 12 | 16 | 15 | 52 | 29.2802 | 0.5 | 08 | 29 | 24.094 | 1.256 | -52 | 06 | 35.220 | 0.937 | OOMERA |
| | 12 | 18 | 16 | 25 | 36.5989 | 0.5 | 02 | 52 | 25.154 | 1.071 | -51 | 46 | 42.630 | 1.082 | OOMERA |
| | 12 | 18 | 16 | 25 | 42.1917 | 0.5 | 02 | 53 | 24.739 | 1.071 | -53 | 03 | 43.350 | 1.082 | OOMERA |
| | 12 | 18 | 16 | 25 | 47.7846 | 0.5 | 02 | 54 | 26.257 | 1.071 | -54 | 21 | 13.510 | 1.082 | OOMERA |
| | 12 | 18 | 16 | 25 | 53.3774 | 0.5 | 02 | 55 | 30.168 | 1.071 | -55 | 39 | 05.190 | 1.082 | OOMERA |
| | 12 | 18 | 16 | 25 | 58.9702 | 0.5 | 02 | 56 | 36.787 | 1.071 | -56 | 57 | 22.870 | 1.082 | OOMERA |
| | 12 | 19 | 13 | 54 | 34.3384 | 0.5 | 07 | 36 | 16.885 | 0.980 | -04 | 47 | 06.407 | 1.137 | OOMERA |
| | 12 | 19 | 13 | 54 | 39.9312 | 0.5 | 07 | 40 | 37.326 | 0.980 | -05 | 40 | 03.430 | 1.137 | OOMERA |
| | 12 | 19 | 13 | 54 | 45.5241 | 0.5 | 07 | 44 | 57.321 | 0.980 | -06 | 32 | 18.312 | 1.137 | OOMERA |
| | 12 | 19 | 13 | 54 | 51.1169 | 0.5 | 07 | 49 | 17.130 | 0.980 | -07 | 23 | 52.253 | 1.137 | OOMERA |
| | 12 | 19 | 13 | 54 | 56.7097 | 0.5 | 07 | 53 | 36.513 | 0.980 | -08 | 14 | 33.972 | 1.137 | OOMERA |
| | 12 | 20 | 15 | 07 | 31.6638 | 0.5 | 03 | 48 | 59.324 | 1.039 | -44 | 30 | 15.010 | 1.362 | OOMERA |
| | 12 | 20 | 15 | 07 | 37.2567 | 0.5 | 03 | 53 | 29.296 | 1.039 | -45 | 58 | 28.790 | 1.362 | OOMERA |
| | 12 | 20 | 15 | 07 | 42.8495 | 0.5 | 03 | 58 | 13.774 | 1.039 | -47 | 26 | 32.940 | 1.362 | OOMERA |
| | 12 | 20 | 15 | 07 | 48.4423 | 0.5 | 04 | 03 | 14.892 | 1.039 | -48 | 54 | 13.950 | 1.362 | OOMERA |
| | 12 | 21 | 03 | 39 | 29.0738 | 0.5 | 06 | 05 | 48.816 | 1.187 | -01 | 51 | 18.617 | 1.368 | SNTAGO |
| | 12 | 21 | 03 | 39 | 34.6666 | 0.5 | 06 | 10 | 42.379 | 1.187 | -02 | 52 | 27.993 | 1.368 | SNTAGO |
| | 12 | 21 | 03 | 39 | 40.2595 | 0.5 | 06 | 15 | 39.104 | 1.187 | -03 | 53 | 45.571 | 1.368 | SNTAGO |
| | 12 | 21 | 03 | 39 | 45.8523 | 0.5 | 06 | 20 | 38.702 | 1.187 | -04 | 55 | 02.559 | 1.368 | SNTAGO |
| | 12 | 21 | 03 | 39 | 51.4451 | 0.5 | 06 | 25 | 40.415 | 1.187 | -05 | 56 | 06.146 | 1.368 | SNTAGO |
| | 12 | 21 | 14 | 28 | 15.2141 | 0.5 | 04 | 12 | 34.394 | 1.499 | -32 | 08 | 29.550 | 1.562 | OOMERA |
| | 12 | 21 | 14 | 28 | 20.8069 | 0.5 | 04 | 17 | 44.250 | 1.499 | -33 | 34 | 40.960 | 1.562 | OOMERA |
| | 12 | 21 | 14 | 28 | 26.3998 | 0.5 | 04 | 23 | 07.145 | 1.499 | -35 | 00 | 53.810 | 1.562 | OOMERA |
| | 12 | 21 | 14 | 28 | 31.9926 | 0.5 | 04 | 28 | 43.332 | 1.499 | -36 | 26 | 45.820 | 1.562 | OOMERA |

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1963 | 08 | 16 | 12 | 33 | 28.0488 | 0.5 | 20 | 46 | 39.606 | 1.145 | 03 | 03 | 28.851 | 0.713 | OOMERA |
| | 08 | 16 | 12 | 33 | 33.6416 | 0.5 | 20 | 51 | 14.212 | 1.145 | 02 | 03 | 16.039 | 0.713 | OOMERA |
| | 08 | 16 | 12 | 33 | 39.2345 | 0.5 | 20 | 55 | 50.831 | 1.145 | 01 | 02 | 54.720 | 0.713 | OOMERA |
| | 08 | 16 | 12 | 33 | 44.8273 | 0.5 | 21 | 00 | 29.331 | 1.145 | 00 | 02 | 26.460 | 0.713 | OOMERA |
| | 08 | 16 | 12 | 33 | 50.4201 | 0.5 | 21 | 05 | 09.721 | 1.145 | -00 | 58 | 01.546 | 0.713 | OOMERA |
| | 08 | 16 | 14 | 25 | 19.4522 | 0.5 | 16 | 52 | 12.329 | 1.004 | -32 | 25 | 29.260 | 0.809 | OOMERA |
| | 08 | 16 | 14 | 25 | 25.0450 | 0.5 | 16 | 53 | 12.052 | 1.004 | -33 | 34 | 57.510 | 0.809 | OOMERA |
| | 08 | 16 | 14 | 25 | 30.6379 | 0.5 | 16 | 54 | 18.538 | 1.004 | -34 | 45 | 21.030 | 0.809 | OOMERA |
| | 08 | 16 | 14 | 25 | 36.2307 | 0.5 | 16 | 55 | 26.739 | 1.004 | -35 | 56 | 48.130 | 0.809 | OOMERA |
| | 08 | 16 | 14 | 25 | 41.8235 | 0.5 | 16 | 56 | 36.583 | 1.004 | -37 | 09 | 19.790 | 0.809 | OOMERA |
| | 08 | 17 | 11 | 54 | 28.3769 | 0.5 | 20 | 53 | 24.776 | 1.095 | 11 | 01 | 45.315 | 1.018 | OOMERA |
| | 08 | 17 | 11 | 54 | 33.9697 | 0.5 | 20 | 57 | 16.189 | 1.095 | 10 | 09 | 36.414 | 1.018 | OOMERA |
| | 08 | 17 | 11 | 54 | 39.5626 | 0.5 | 21 | 01 | 08.049 | 1.095 | 09 | 17 | 18.218 | 1.018 | OOMERA |
| | 08 | 17 | 11 | 54 | 45.1554 | 0.5 | 21 | 05 | 00.601 | 1.095 | 08 | 24 | 51.133 | 1.018 | OOMERA |
| | 08 | 17 | 11 | 54 | 50.7482 | 0.5 | 21 | 08 | 53.357 | 1.095 | 07 | 32 | 19.351 | 1.018 | OOMERA |
| | 08 | 18 | 18 | 25 | 56.4227 | 0.5 | 20 | 39 | 07.397 | 0.850 | 10 | 47 | 10.606 | 0.625 | JOBURG |
| | 08 | 18 | 18 | 26 | 07.6084 | 0.5 | 20 | 46 | 16.469 | 0.850 | 08 | 54 | 51.936 | 0.625 | JOBURG |
| | 08 | 18 | 18 | 26 | 13.2012 | 0.5 | 20 | 49 | 50.665 | 0.850 | 07 | 58 | 47.768 | 0.625 | JOBURG |
| | 08 | 18 | 18 | 26 | 18.7940 | 0.5 | 20 | 53 | 24.680 | 0.850 | 07 | 02 | 49.995 | 0.625 | JOBURG |
| | 08 | 19 | 20 | 06 | 34.8194 | 0.5 | 23 | 14 | 06.919 | 0.916 | -56 | 12 | 52.770 | 0.981 | OOMERA |
| | 08 | 19 | 20 | 06 | 40.4122 | 0.5 | 23 | 22 | 49.900 | 0.916 | -56 | 14 | 30.300 | 0.981 | OOMERA |
| | 08 | 19 | 20 | 06 | 46.0051 | 0.5 | 23 | 31 | 47.833 | 0.916 | -56 | 13 | 49.780 | 0.981 | OOMERA |
| | 08 | 19 | 20 | 06 | 51.5979 | 0.5 | 23 | 40 | 59.599 | 0.916 | -56 | 10 | 36.460 | 0.981 | OOMERA |
| | 08 | 19 | 20 | 06 | 57.1907 | 0.5 | 23 | 50 | 24.936 | 0.916 | -56 | 04 | 44.170 | 0.981 | OOMERA |
| | 08 | 20 | 11 | 48 | 58.3934 | 0.5 | 18 | 01 | 35.080 | 0.896 | 02 | 51 | 10.718 | 1.171 | OOMERA |
| | 08 | 20 | 11 | 49 | 03.9862 | 0.5 | 18 | 05 | 34.918 | 0.896 | 01 | 49 | 18.410 | 1.171 | OOMERA |
| | 08 | 20 | 11 | 49 | 09.5790 | 0.5 | 18 | 09 | 40.177 | 0.896 | 00 | 46 | 09.084 | 1.171 | OOMERA |
| | 08 | 20 | 18 | 59 | 31.7038 | 0.5 | 17 | 04 | 11.652 | 1.148 | -09 | 20 | 53.433 | 1.113 | JOBURG |
| | 08 | 20 | 18 | 59 | 37.2967 | 0.5 | 17 | 07 | 50.256 | 1.148 | -10 | 38 | 47.763 | 1.113 | JOBURG |
| | 08 | 20 | 18 | 59 | 42.8895 | 0.5 | 17 | 11 | 35.024 | 1.148 | -11 | 58 | 07.771 | 1.113 | JOBURG |
| | 08 | 20 | 18 | 59 | 48.4823 | 0.5 | 17 | 15 | 26.019 | 1.148 | -13 | 18 | 50.790 | 1.113 | JOBURG |
| | 08 | 22 | 12 | 25 | 04.6813 | 0.5 | 16 | 02 | 30.129 | 0.802 | -43 | 41 | 56.150 | 0.720 | OOMERA |
| | 08 | 22 | 12 | 25 | 10.2741 | 0.5 | 16 | 04 | 53.117 | 0.802 | -45 | 04 | 56.220 | 0.720 | OOMERA |
| | 08 | 22 | 12 | 25 | 15.8670 | 0.5 | 16 | 07 | 23.076 | 0.802 | -46 | 28 | 34.660 | 0.720 | OOMERA |
| | 08 | 22 | 12 | 25 | 21.4598 | 0.5 | 16 | 10 | 00.787 | 0.802 | -47 | 52 | 47.420 | 0.720 | OOMERA |
| | 08 | 22 | 12 | 25 | 27.0526 | 0.5 | 16 | 12 | 46.728 | 0.802 | -49 | 17 | 25.310 | 0.720 | OOMERA |
| | 08 | 22 | 17 | 41 | 04.3960 | 0.5 | 17 | 50 | 34.679 | 0.581 | 16 | 31 | 00.388 | 0.754 | JOBURG |
| | 08 | 22 | 17 | 41 | 09.9888 | 0.5 | 17 | 54 | 37.432 | 0.581 | 15 | 33 | 25.181 | 0.754 | JOBURG |
| | 08 | 22 | 17 | 41 | 15.5817 | 0.5 | 17 | 58 | 42.790 | 0.581 | 14 | 34 | 38.185 | 0.754 | JOBURG |
| | 08 | 22 | 17 | 41 | 21.1745 | 0.5 | 18 | 02 | 50.812 | 0.581 | 13 | 34 | 46.134 | 0.754 | JOBURG |
| | 08 | 22 | 17 | 41 | 26.7673 | 0.5 | 18 | 07 | 01.574 | 0.581 | 12 | 33 | 47.191 | 0.754 | JOBURG |

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1963 | 08 | 22 | 18 | 11 | 50.0320 | 0.5 | 05 | 25 | 57.983 | 0.970 | -60 | 00 | 27.580 | 0.747 | OOMERA |
| | 08 | 22 | 18 | 11 | 55.6248 | 0.5 | 05 | 27 | 47.646 | 0.970 | -58 | 35 | 33.150 | 0.747 | OOMERA |
| | 08 | 22 | 18 | 12 | 01.2177 | 0.5 | 05 | 29 | 31.034 | 0.970 | -57 | 10 | 41.820 | 0.747 | OOMERA |
| | 08 | 22 | 18 | 12 | 06.8105 | 0.5 | 05 | 31 | 08.688 | 0.970 | -55 | 46 | 02.390 | 0.747 | OOMERA |
| | 08 | 22 | 18 | 12 | 12.4033 | 0.5 | 05 | 32 | 41.441 | 0.970 | -54 | 21 | 37.350 | 0.747 | OOMERA |
| | 08 | 22 | 20 | 03 | 41.4354 | 0.5 | 00 | 06 | 06.096 | 0.979 | -17 | 16 | 10.574 | 0.746 | OOMERA |
| | 08 | 22 | 20 | 03 | 47.0282 | 0.5 | 00 | 11 | 13.609 | 0.979 | -16 | 25 | 06.279 | 0.746 | OOMERA |
| | 08 | 22 | 20 | 03 | 52.6211 | 0.5 | 00 | 16 | 22.485 | 0.979 | -15 | 32 | 34.215 | 0.746 | OOMERA |
| | 08 | 22 | 20 | 03 | 58.2139 | 0.5 | 00 | 21 | 32.612 | 0.979 | -14 | 38 | 33.372 | 0.746 | OOMERA |
| | 08 | 22 | 20 | 04 | 03.8067 | 0.5 | 00 | 26 | 43.314 | 0.979 | -13 | 43 | 05.504 | 0.746 | OOMERA |
| | 08 | 27 | 02 | 33 | 45.5820 | 0.5 | 23 | 51 | 15.192 | 0.671 | -03 | 44 | 59.726 | 0.527 | JOBURG |
| | 08 | 27 | 02 | 33 | 51.1748 | 0.5 | 23 | 55 | 35.673 | 0.671 | -02 | 42 | 11.722 | 0.527 | JOBURG |
| | 08 | 27 | 02 | 33 | 56.7677 | 0.5 | 23 | 59 | 56.779 | 0.671 | -01 | 38 | 34.705 | 0.527 | JOBURG |
| | 08 | 27 | 02 | 34 | 02.3605 | 0.5 | 00 | 04 | 18.308 | 0.671 | -00 | 34 | 19.215 | 0.527 | JOBURG |
| | 08 | 27 | 02 | 34 | 07.9533 | 0.5 | 00 | 08 | 40.189 | 0.671 | 00 | 30 | 34.368 | 0.527 | JOBURG |
| | 08 | 29 | 17 | 22 | 57.5006 | 0.5 | 21 | 56 | 12.379 | 1.059 | -43 | 33 | 07.270 | 1.121 | OOMERA |
| | 08 | 29 | 17 | 23 | 03.0934 | 0.5 | 22 | 03 | 43.006 | 1.059 | -43 | 05 | 23.620 | 1.121 | OOMERA |
| | 08 | 29 | 17 | 23 | 08.6863 | 0.5 | 22 | 11 | 17.828 | 1.059 | -42 | 34 | 56.920 | 1.121 | OOMERA |
| | 08 | 29 | 17 | 23 | 14.2791 | 0.5 | 22 | 18 | 56.008 | 1.059 | -42 | 01 | 46.390 | 1.121 | OOMERA |
| | 08 | 29 | 17 | 23 | 19.8719 | 0.5 | 22 | 26 | 37.142 | 1.059 | -41 | 25 | 44.080 | 1.121 | OOMERA |
| | 08 | 31 | 16 | 05 | 42.8994 | 0.5 | 00 | 01 | 26.760 | 1.252 | -64 | 21 | 16.110 | 0.933 | OOMERA |
| | 08 | 31 | 16 | 05 | 48.4922 | 0.5 | 00 | 13 | 05.526 | 1.252 | -63 | 18 | 52.690 | 0.933 | OOMERA |
| | 08 | 31 | 16 | 05 | 54.0851 | 0.5 | 00 | 24 | 04.712 | 1.252 | -62 | 12 | 25.550 | 0.933 | OOMERA |
| | 08 | 31 | 16 | 05 | 59.6779 | 0.5 | 00 | 34 | 25.439 | 1.252 | -61 | 02 | 11.890 | 0.933 | OOMERA |
| | 08 | 31 | 16 | 06 | 05.2707 | 0.5 | 00 | 44 | 09.601 | 1.252 | -59 | 48 | 30.940 | 0.933 | OOMERA |
| | 09 | 01 | 17 | 21 | 00.0448 | 0.5 | 22 | 56 | 25.857 | 1.075 | 07 | 22 | 19.508 | 1.069 | OOMERA |
| | 09 | 01 | 17 | 21 | 05.6376 | 0.5 | 23 | 00 | 41.538 | 1.075 | 08 | 19 | 44.312 | 1.069 | OOMERA |
| | 09 | 01 | 17 | 21 | 11.2305 | 0.5 | 23 | 04 | 50.118 | 1.075 | 09 | 18 | 24.040 | 1.069 | OOMERA |
| | 09 | 01 | 17 | 21 | 16.8233 | 0.5 | 23 | 09 | 10.377 | 1.075 | 10 | 13 | 55.765 | 1.069 | OOMERA |
| | 09 | 01 | 17 | 21 | 22.4161 | 0.5 | 23 | 13 | 23.655 | 1.075 | 11 | 10 | 28.815 | 1.069 | OOMERA |
| | 09 | 02 | 09 | 50 | 28.0011 | 0.5 | 04 | 49 | 41.790 | 1.287 | 05 | 53 | 50.129 | 0.983 | FTMYRS |
| | 09 | 02 | 09 | 50 | 33.5939 | 0.5 | 04 | 55 | 04.596 | 1.287 | 07 | 08 | 23.987 | 0.983 | FTMYRS |
| | 09 | 02 | 09 | 50 | 39.1868 | 0.5 | 05 | 00 | 28.567 | 1.287 | 08 | 22 | 18.986 | 0.983 | FTMYRS |
| | 09 | 02 | 09 | 50 | 44.7796 | 0.5 | 05 | 05 | 53.569 | 1.287 | 09 | 35 | 16.325 | 0.983 | FTMYRS |
| | 09 | 02 | 09 | 50 | 50.3724 | 0.5 | 05 | 11 | 19.633 | 1.287 | 10 | 47 | 19.830 | 0.983 | FTMYRS |
| | 09 | 02 | 23 | 55 | 15.8755 | 0.5 | 00 | 32 | 04.001 | 1.881 | -02 | 22 | 56.402 | 1.537 | JOBURG |
| | 09 | 02 | 23 | 55 | 21.4683 | 0.5 | 00 | 36 | 58.420 | 1.881 | -01 | 03 | 30.288 | 1.537 | JOBURG |
| | 09 | 02 | 23 | 55 | 27.0612 | 0.5 | 00 | 41 | 47.760 | 1.881 | 00 | 14 | 53.902 | 1.537 | JOBURG |
| | 09 | 02 | 23 | 55 | 32.6540 | 0.5 | 00 | 46 | 31.703 | 1.881 | 01 | 31 | 59.149 | 1.537 | JOBURG |
| | 09 | 04 | 22 | 35 | 19.0718 | 10.0 | 23 | 51 | 28.222 | 1.893 | -57 | 16 | 19.090 | 2.094 | JOBURG |
| | 09 | 04 | 22 | 35 | 24.6647 | 10.0 | 23 | 59 | 48.725 | 1.893 | -56 | 03 | 06.550 | 2.094 | JOBURG |
| | 09 | 04 | 22 | 35 | 30.2575 | 10.0 | 00 | 07 | 46.762 | 1.893 | -54 | 46 | 54.090 | 2.094 | JOBURG |
| | 09 | 04 | 22 | 35 | 35.8503 | 10.0 | 00 | 15 | 21.341 | 1.893 | -53 | 28 | 06.470 | 2.094 | JOBURG |

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1963 | 09 | 08 | 14 | 41 | 12.0237 | 0.5 | 22 | 17 | 23.391 | 1.352 | -05 | 00 | 42.580 | 1.143 | OOMERA |
| | 09 | 08 | 14 | 41 | 17.6165 | 0.5 | 22 | 22 | 34.044 | 1.352 | -03 | 49 | 55.798 | 1.143 | OOMERA |
| | 09 | 08 | 14 | 41 | 23.2094 | 0.5 | 22 | 27 | 39.669 | 1.352 | -02 | 39 | 42.236 | 1.143 | OOMERA |
| | 09 | 08 | 14 | 41 | 28.8022 | 0.5 | 22 | 32 | 40.460 | 1.352 | -01 | 30 | 02.894 | 1.143 | OOMERA |
| | 09 | 08 | 14 | 41 | 34.3950 | 0.5 | 22 | 37 | 36.554 | 1.352 | -00 | 21 | 08.471 | 1.143 | OOMERA |
| | 09 | 09 | 09 | 06 | 59.8395 | 0.5 | 03 | 37 | 48.594 | 2.000 | 46 | 45 | 23.660 | 2.172 | BPOINT |
| | 09 | 09 | 09 | 07 | 05.4323 | 0.5 | 03 | 48 | 11.756 | 2.000 | 47 | 46 | 30.190 | 2.172 | BPOINT |
| | 09 | 09 | 09 | 07 | 11.0252 | 0.5 | 03 | 58 | 51.551 | 2.000 | 48 | 43 | 21.230 | 2.172 | BPOINT |
| | 09 | 09 | 09 | 07 | 16.6180 | 0.5 | 04 | 09 | 46.513 | 2.000 | 49 | 35 | 44.140 | 2.172 | BPOINT |
| | 09 | 09 | 09 | 07 | 22.2108 | 0.5 | 04 | 20 | 54.334 | 2.000 | 50 | 23 | 33.030 | 2.172 | BPOINT |
| | 09 | 09 | 14 | 02 | 01.1661 | 0.5 | 22 | 32 | 26.230 | 1.295 | -20 | 16 | 21.504 | 0.910 | OOMERA |
| | 09 | 09 | 14 | 02 | 06.7589 | 0.5 | 22 | 38 | 04.011 | 1.295 | -18 | 54 | 44.345 | 0.910 | OOMERA |
| | 09 | 09 | 14 | 02 | 12.3518 | 0.5 | 22 | 43 | 22.847 | 1.295 | -17 | 32 | 35.559 | 0.910 | OOMERA |
| | 09 | 09 | 14 | 02 | 17.9446 | 0.5 | 22 | 48 | 52.899 | 1.295 | -16 | 12 | 09.082 | 0.910 | OOMERA |
| | 09 | 09 | 14 | 02 | 23.5374 | 0.5 | 22 | 54 | 04.662 | 1.295 | -14 | 51 | 29.618 | 0.910 | OOMERA |
| | 09 | 09 | 21 | 14 | 31.9260 | 0.5 | 23 | 46 | 50.356 | 1.381 | -31 | 43 | 57.060 | 1.168 | JOBURG |
| | 09 | 09 | 21 | 14 | 37.5188 | 0.5 | 23 | 51 | 33.234 | 1.381 | -30 | 11 | 22.300 | 1.168 | JOBURG |
| | 09 | 09 | 21 | 14 | 43.1117 | 0.5 | 23 | 56 | 05.818 | 1.381 | -28 | 39 | 00.160 | 1.168 | JOBURG |
| | 09 | 09 | 21 | 14 | 48.7045 | 0.5 | 00 | 00 | 28.549 | 1.381 | -27 | 07 | 03.047 | 1.168 | JOBURG |
| | 09 | 09 | 21 | 14 | 54.2973 | 0.5 | 00 | 04 | 42.298 | 1.381 | -25 | 35 | 40.306 | 1.168 | JOBURG |
| | 09 | 10 | 08 | 23 | 20.0926 | 10.0* | 23 | 44 | 50.702 | 1.291 | 29 | 36 | 34.690 | 1.240 | FTMYRS |
| | 09 | 10 | 08 | 23 | 25.6391 | 10.0* | 23 | 48 | 28.971 | 1.291 | 31 | 11 | 10.490 | 1.240 | FTMYRS |
| | 09 | 10 | 08 | 23 | 31.8235 | 10.0* | 23 | 52 | 42.029 | 1.291 | 32 | 57 | 41.980 | 1.240 | FTMYRS |
| | 09 | 10 | 08 | 23 | 37.4307 | 10.0* | 23 | 56 | 42.524 | 1.291 | 34 | 35 | 02.400 | 1.240 | FTMYRS |
| | 09 | 10 | 08 | 23 | 43.0892 | 10.0* | 00 | 00 | 56.550 | 1.291 | 36 | 13 | 51.640 | 1.240 | FTMYRS |
| | 09 | 11 | 07 | 44 | 15.0000 | 100.0* | 00 | 15 | 35.297 | 1.322 | 15 | 44 | 31.569 | 1.177 | FTMYRS |
| | 09 | 11 | 07 | 44 | 20.8000 | 100.0* | 00 | 20 | 06.276 | 1.322 | 17 | 13 | 59.225 | 1.177 | FTMYRS |
| | 09 | 11 | 07 | 44 | 26.9000 | 100.0* | 00 | 25 | 17.881 | 1.322 | 18 | 55 | 22.832 | 1.177 | FTMYRS |
| | 09 | 11 | 07 | 44 | 32.3000 | 100.0* | 00 | 30 | 29.798 | 1.322 | 20 | 33 | 43.963 | 1.177 | FTMYRS |
| | 09 | 13 | 11 | 24 | 49.7663 | 5.0 | 00 | 13 | 34.909 | 1.110 | -63 | 48 | 11.200 | 0.558 | OOMERA |
| | 09 | 13 | 11 | 24 | 55.3591 | 5.0 | 00 | 15 | 12.119 | 1.110 | -62 | 29 | 26.810 | 0.558 | OOMERA |
| | 09 | 13 | 13 | 18 | 16.2480 | 5.0 | 20 | 17 | 39.981 | 1.282 | -08 | 11 | 03.225 | 0.878 | OOMERA |
| | 09 | 13 | 13 | 18 | 21.8408 | 5.0 | 20 | 22 | 54.323 | 1.282 | -07 | 05 | 11.056 | 0.878 | OOMERA |
| | 09 | 13 | 13 | 18 | 27.4337 | 5.0 | 20 | 28 | 06.028 | 1.282 | -05 | 58 | 58.094 | 0.878 | OOMERA |
| | 09 | 13 | 13 | 18 | 33.0265 | 5.0 | 20 | 33 | 15.354 | 1.282 | -04 | 52 | 30.197 | 0.878 | OOMERA |
| | 09 | 13 | 13 | 18 | 38.6193 | 5.0 | 20 | 37 | 24.150 | 1.282 | -03 | 59 | 04.943 | 0.878 | OOMERA |
| | 09 | 15 | 11 | 57 | 17.9333 | 0.5 | 16 | 28 | 45.230 | 1.281 | -55 | 05 | 00.580 | 1.199 | OOMERA |
| | 09 | 15 | 11 | 57 | 23.5261 | 0.5 | 16 | 36 | 08.999 | 1.281 | -55 | 10 | 21.470 | 1.199 | OOMERA |
| | 09 | 15 | 11 | 57 | 29.1190 | 0.5 | 16 | 43 | 46.175 | 1.281 | -55 | 14 | 11.890 | 1.199 | OOMERA |
| | 09 | 15 | 11 | 57 | 34.7118 | 0.5 | 16 | 51 | 36.344 | 1.281 | -55 | 16 | 14.490 | 1.199 | OOMERA |
| | 09 | 15 | 11 | 57 | 40.3046 | 0.5 | 16 | 59 | 39.211 | 1.281 | -55 | 16 | 28.070 | 1.199 | OOMERA |

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1963 | 09 | 16 | 08 | 17 | 50.5305 | 0.5 | 03 | 31 | 48.365 | 1.375 | 12 | 40 | 11.631 | 1.552 | GFORKS |
| | 09 | 16 | 08 | 17 | 56.1234 | 0.5 | 03 | 37 | 54.885 | 1.375 | 13 | 14 | 48.155 | 1.552 | GFORKS |
| | 09 | 16 | 08 | 18 | 01.7162 | 0.5 | 03 | 44 | 01.614 | 1.375 | 13 | 48 | 24.905 | 1.552 | GFORKS |
| | 09 | 16 | 08 | 18 | 07.3090 | 0.5 | 03 | 50 | 07.686 | 1.375 | 14 | 20 | 56.126 | 1.552 | GFORKS |
| | 09 | 16 | 11 | 23 | 42.6459 | 0.5 | 23 | 12 | 46.136 | 1.248 | -10 | 57 | 13.569 | 1.215 | OOMERA |
| | 09 | 16 | 11 | 23 | 48.2387 | 0.5 | 23 | 14 | 54.960 | 1.248 | -09 | 54 | 21.464 | 1.215 | OOMERA |
| | 09 | 16 | 11 | 23 | 53.8316 | 0.5 | 23 | 17 | 00.478 | 1.248 | -08 | 53 | 00.192 | 1.215 | OOMERA |
| | 09 | 16 | 11 | 23 | 59.4244 | 0.5 | 23 | 19 | 02.904 | 1.248 | -07 | 53 | 05.925 | 1.215 | OOMERA |
| | 09 | 16 | 11 | 24 | 05.0172 | 0.5 | 23 | 21 | 02.484 | 1.248 | -06 | 54 | 39.137 | 1.215 | OOMERA |
| | 09 | 19 | 11 | 15 | 24.8771 | 0.5 | 17 | 16 | 26.197 | 1.112 | -33 | 09 | 10.410 | 1.128 | OOMERA |
| | 09 | 19 | 11 | 15 | 30.4699 | 0.5 | 17 | 22 | 34.915 | 1.112 | -32 | 30 | 21.360 | 1.128 | OOMERA |
| | 09 | 19 | 11 | 15 | 36.0628 | 0.5 | 17 | 28 | 45.820 | 1.112 | -31 | 49 | 23.580 | 1.128 | OOMERA |
| | 09 | 19 | 11 | 15 | 41.6556 | 0.5 | 17 | 34 | 58.039 | 1.112 | -31 | 06 | 22.050 | 1.128 | OOMERA |
| | 09 | 21 | 08 | 51 | 20.2124 | 0.5 | 07 | 18 | 42.030 | 1.065 | 37 | 59 | 58.910 | 1.243 | GFORKS |
| | 09 | 21 | 08 | 51 | 25.8052 | 0.5 | 07 | 22 | 20.788 | 1.065 | 37 | 17 | 26.280 | 1.243 | GFORKS |
| | 09 | 21 | 08 | 51 | 31.3981 | 0.5 | 07 | 25 | 49.613 | 1.065 | 36 | 35 | 40.190 | 1.243 | GFORKS |
| | 09 | 21 | 08 | 51 | 36.9909 | 0.5 | 07 | 29 | 09.471 | 1.065 | 35 | 54 | 39.780 | 1.243 | GFORKS |
| | 09 | 21 | 08 | 51 | 42.5837 | 0.5 | 07 | 32 | 21.104 | 1.065 | 35 | 14 | 29.290 | 1.243 | GFORKS |
| | 09 | 22 | 06 | 17 | 30.2303 | 10.0* | 02 | 48 | 23.726 | 1.321 | 12 | 55 | 40.891 | 1.157 | GFORKS |
| | 09 | 22 | 06 | 17 | 35.6737 | 10.0* | 02 | 53 | 40.641 | 1.321 | 13 | 22 | 04.349 | 1.157 | GFORKS |
| | 09 | 22 | 06 | 17 | 41.7861 | 10.0* | 02 | 59 | 33.496 | 1.321 | 13 | 50 | 31.376 | 1.157 | GFORKS |
| | 09 | 22 | 06 | 17 | 47.6009 | 10.0* | 03 | 05 | 06.402 | 1.321 | 14 | 16 | 23.531 | 1.157 | GFORKS |
| | 09 | 22 | 06 | 17 | 53.1191 | 10.0* | 03 | 10 | 19.155 | 1.321 | 14 | 39 | 50.216 | 1.157 | GFORKS |
| | 09 | 22 | 08 | 12 | 08.4705 | 10.0* | 06 | 35 | 09.094 | 1.414 | 38 | 12 | 40.640 | 1.172 | GFORKS |
| | 09 | 22 | 08 | 12 | 14.0923 | 10.0* | 06 | 39 | 25.564 | 1.414 | 37 | 34 | 51.530 | 1.172 | GFORKS |
| | 09 | 22 | 08 | 12 | 20.1581 | 10.0* | 06 | 43 | 49.913 | 1.414 | 36 | 54 | 30.930 | 1.172 | GFORKS |
| | 09 | 22 | 08 | 12 | 25.8875 | 10.0* | 06 | 47 | 48.231 | 1.414 | 36 | 16 | 59.470 | 1.172 | GFORKS |
| | 09 | 22 | 08 | 12 | 31.5355 | 10.0* | 06 | 51 | 48.429 | 1.414 | 35 | 38 | 13.720 | 1.172 | GFORKS |
| | 09 | 26 | 03 | 38 | 10.1362 | 0.5 | 19 | 57 | 00.319 | 1.808 | 35 | 40 | 42.400 | 1.548 | FTMYRS |
| | 09 | 26 | 03 | 38 | 15.7290 | 0.5 | 20 | 00 | 39.825 | 1.808 | 37 | 14 | 23.530 | 1.548 | FTMYRS |
| | 09 | 26 | 03 | 38 | 21.3219 | 0.5 | 20 | 04 | 29.239 | 1.808 | 38 | 48 | 32.700 | 1.548 | FTMYRS |
| | 09 | 26 | 03 | 38 | 26.9147 | 0.5 | 20 | 08 | 29.223 | 1.808 | 40 | 22 | 56.520 | 1.548 | FTMYRS |
| | 09 | 26 | 03 | 38 | 32.5075 | 0.5 | 20 | 12 | 40.951 | 1.808 | 41 | 57 | 30.360 | 1.548 | FTMYRS |
| | 09 | 26 | 05 | 32 | 49.3248 | 0.5 | 00 | 18 | 43.035 | 1.132 | 14 | 04 | 26.614 | 1.120 | GFORKS |
| | 09 | 26 | 05 | 32 | 54.9176 | 0.5 | 00 | 25 | 16.073 | 1.132 | 14 | 46 | 40.858 | 1.120 | GFORKS |
| | 09 | 26 | 05 | 33 | 00.5105 | 0.5 | 00 | 31 | 53.367 | 1.132 | 15 | 28 | 03.478 | 1.120 | GFORKS |
| | 09 | 26 | 05 | 33 | 06.1033 | 0.5 | 00 | 38 | 34.417 | 1.132 | 16 | 08 | 30.165 | 1.120 | GFORKS |
| | 09 | 26 | 05 | 33 | 11.6961 | 0.5 | 00 | 45 | 19.229 | 1.132 | 16 | 47 | 52.196 | 1.120 | GFORKS |
| | 09 | 28 | 02 | 19 | 48.4211 | 0.5 | 20 | 57 | 30.417 | 1.313 | 07 | 06 | 39.069 | 1.314 | FTMYRS |
| | 09 | 28 | 02 | 19 | 54.0139 | 0.5 | 21 | 02 | 31.798 | 1.313 | 08 | 29 | 13.686 | 1.314 | FTMYRS |
| | 09 | 28 | 02 | 19 | 59.6068 | 0.5 | 21 | 07 | 39.388 | 1.313 | 09 | 52 | 32.544 | 1.314 | FTMYRS |
| | 09 | 28 | 02 | 20 | 05.1996 | 0.5 | 21 | 12 | 54.169 | 1.313 | 11 | 16 | 39.586 | 1.314 | FTMYRS |
| | 09 | 28 | 02 | 20 | 10.7924 | 0.5 | 21 | 18 | 15.795 | 1.313 | 12 | 41 | 13.845 | 1.314 | FTMYRS |

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1963 | 09 | 28 | 02 | 39 | 22.9167 | 0.5 | 00 | 37 | 41.037 | 1.266 | 35 | 11 | 38.160 | 0.974 | WNKFLD |
| | 09 | 28 | 02 | 39 | 28.5095 | 0.5 | 00 | 46 | 09.575 | 1.266 | 35 | 24 | 58.250 | 0.974 | WNKFLD |
| | 09 | 28 | 02 | 39 | 34.1024 | 0.5 | 00 | 54 | 50.864 | 1.266 | 35 | 36 | 07.970 | 0.974 | WNKFLD |
| | 09 | 28 | 02 | 39 | 39.6952 | 0.5 | 01 | 03 | 44.504 | 1.266 | 35 | 44 | 52.180 | 0.974 | WNKFLD |
| | 09 | 28 | 02 | 39 | 45.2880 | 0.5 | 01 | 12 | 49.236 | 1.266 | 35 | 51 | 07.580 | 0.974 | WNKFLD |
| | 10 | 01 | 02 | 19 | 55.2091 | 10.0* | 21 | 42 | 27.081 | 1.222 | 35 | 19 | 27.320 | 1.161 | BPOINT |
| | 10 | 01 | 02 | 20 | 00.8033 | 10.0* | 21 | 50 | 22.212 | 1.222 | 36 | 33 | 16.900 | 1.161 | BPOINT |
| | 10 | 01 | 02 | 20 | 06.9082 | 10.0* | 21 | 59 | 19.368 | 1.222 | 37 | 51 | 28.800 | 1.161 | BPOINT |
| | 10 | 01 | 02 | 20 | 12.5949 | 10.0* | 22 | 07 | 56.340 | 1.222 | 39 | 01 | 54.990 | 1.161 | BPOINT |
| | 10 | 01 | 02 | 20 | 18.2343 | 10.0* | 22 | 16 | 43.949 | 1.222 | 40 | 09 | 04.230 | 1.161 | BPOINT |
| | 10 | 01 | 09 | 49 | 56.2206 | 0.5 | 01 | 49 | 32.654 | 1.133 | 17 | 57 | 57.096 | 1.042 | GFORKS |
| | 10 | 01 | 09 | 50 | 01.8134 | 0.5 | 01 | 56 | 11.607 | 1.133 | 17 | 25 | 33.879 | 1.042 | GFORKS |
| | 10 | 01 | 09 | 50 | 07.4063 | 0.5 | 02 | 02 | 50.785 | 1.133 | 16 | 51 | 46.432 | 1.042 | GFORKS |
| | 10 | 01 | 09 | 50 | 12.9991 | 0.5 | 02 | 09 | 29.812 | 1.133 | 16 | 16 | 40.722 | 1.042 | GFORKS |
| | 10 | 01 | 09 | 50 | 18.5919 | 0.5 | 02 | 16 | 08.003 | 1.133 | 15 | 40 | 15.569 | 1.042 | GFORKS |
| | 10 | 01 | 11 | 41 | 47.6241 | 0.5 | 04 | 09 | 03.128 | 1.350 | 42 | 09 | 55.550 | 0.876 | MOJAVE |
| | 10 | 01 | 11 | 41 | 53.2169 | 0.5 | 04 | 17 | 54.238 | 1.350 | 40 | 55 | 37.880 | 0.876 | MOJAVE |
| | 10 | 01 | 11 | 41 | 58.8098 | 0.5 | 04 | 26 | 28.517 | 1.350 | 39 | 38 | 26.990 | 0.876 | MOJAVE |
| | 10 | 01 | 11 | 42 | 04.4026 | 0.5 | 04 | 34 | 45.656 | 1.350 | 38 | 18 | 45.500 | 0.876 | MOJAVE |
| | 10 | 01 | 11 | 42 | 09.9954 | 0.5 | 04 | 42 | 45.281 | 1.350 | 36 | 56 | 48.810 | 0.876 | MOJAVE |
| | 10 | 02 | 01 | 57 | 29.8603 | 0.5 | 01 | 56 | 10.826 | 1.254 | 26 | 48 | 34.865 | 1.208 | WNKFLD |
| | 10 | 02 | 01 | 57 | 35.4531 | 0.5 | 02 | 04 | 27.601 | 1.254 | 26 | 19 | 16.408 | 1.208 | WNKFLD |
| | 10 | 02 | 01 | 57 | 41.0460 | 0.5 | 02 | 12 | 38.489 | 1.254 | 25 | 48 | 03.020 | 1.208 | WNKFLD |
| | 10 | 02 | 01 | 57 | 46.6388 | 0.5 | 02 | 20 | 43.373 | 1.254 | 25 | 14 | 57.389 | 1.208 | WNKFLD |
| | 10 | 02 | 01 | 57 | 52.2316 | 0.5 | 02 | 28 | 40.986 | 1.254 | 24 | 40 | 10.072 | 1.208 | WNKFLD |
| | 10 | 05 | 07 | 13 | 35.1615 | 0.5 | 23 | 29 | 36.221 | 1.142 | 48 | 57 | 20.970 | 1.028 | GFORKS |
| | 10 | 05 | 07 | 13 | 40.7543 | 0.5 | 23 | 41 | 00.717 | 1.142 | 49 | 06 | 02.310 | 1.028 | GFORKS |
| | 10 | 05 | 07 | 13 | 46.3472 | 0.5 | 23 | 52 | 40.590 | 1.142 | 49 | 10 | 38.100 | 1.028 | GFORKS |
| | 10 | 05 | 07 | 13 | 51.9400 | 0.5 | 00 | 04 | 33.211 | 1.142 | 49 | 10 | 38.720 | 1.028 | GFORKS |
| | 10 | 05 | 07 | 13 | 57.5328 | 0.5 | 00 | 16 | 35.211 | 1.142 | 49 | 06 | 05.580 | 1.028 | GFORKS |
| | 10 | 05 | 07 | 19 | 10.7317 | 0.5 | 02 | 13 | 38.215 | 1.549 | 56 | 14 | 13.920 | 1.326 | BPOINT |
| | 10 | 05 | 07 | 19 | 16.3245 | 0.5 | 02 | 26 | 08.449 | 1.549 | 55 | 24 | 44.830 | 1.326 | BPOINT |
| | 10 | 05 | 07 | 19 | 21.9174 | 0.5 | 02 | 38 | 16.619 | 1.549 | 54 | 30 | 04.290 | 1.326 | BPOINT |
| | 10 | 05 | 07 | 19 | 27.5102 | 0.5 | 02 | 49 | 59.618 | 1.549 | 53 | 30 | 24.920 | 1.326 | BPOINT |
| | 10 | 05 | 07 | 19 | 33.1030 | 0.5 | 03 | 01 | 16.499 | 1.549 | 52 | 26 | 07.570 | 1.326 | BPOINT |
| | 10 | 10 | 07 | 51 | 05.3353 | 0.5 | 00 | 54 | 55.945 | 1.394 | 26 | 14 | 34.990 | 1.097 | FTMYRS |
| | 10 | 10 | 07 | 51 | 10.9281 | 0.5 | 01 | 00 | 55.788 | 1.394 | 25 | 17 | 26.803 | 1.097 | FTMYRS |
| | 10 | 10 | 07 | 51 | 16.5210 | 0.5 | 01 | 06 | 56.421 | 1.394 | 24 | 18 | 08.692 | 1.097 | FTMYRS |
| | 10 | 10 | 07 | 51 | 22.1138 | 0.5 | 01 | 12 | 57.708 | 1.394 | 23 | 16 | 34.650 | 1.097 | FTMYRS |
| | 10 | 10 | 07 | 51 | 27.7066 | 0.5 | 01 | 18 | 59.292 | 1.394 | 22 | 12 | 52.799 | 1.097 | FTMYRS |
| | 10 | 18 | 02 | 35 | 13.1460 | 10.0* | 01 | 24 | 17.686 | 0.868 | 35 | 47 | 45.150 | 0.852 | GFORKS |
| | 10 | 18 | 02 | 35 | 18.6411 | 10.0* | 01 | 28 | 25.670 | 0.868 | 34 | 46 | 35.660 | 0.852 | GFORKS |
| | 10 | 18 | 02 | 35 | 24.9205 | 10.0* | 01 | 32 | 54.424 | 0.868 | 33 | 38 | 03.420 | 0.852 | GFORKS |
| | 10 | 18 | 02 | 35 | 30.4731 | 10.0* | 01 | 36 | 40.050 | 0.868 | 32 | 38 | 45.020 | 0.852 | GFORKS |
| | 10 | 18 | 02 | 35 | 36.1867 | 10.0* | 01 | 40 | 21.418 | 0.868 | 31 | 38 | 58.280 | 0.852 | GFORKS |

| DATE | | | TIME(WWV) | | | ACC. | R.A.(1950.0) | | | RMS | DECL.(1950.0) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1963 | 12 | 06 | 05 | 15 | 52.8268 | 10.0* | 04 | 05 | 13.714 | 1.424 | 11 | 27 | 16.460 | 1.407 | FTMYRS |
| | 12 | 06 | 05 | 15 | 58.3364 | 10.0* | 04 | 10 | 07.194 | 1.424 | 12 | 52 | 36.057 | 1.407 | FTMYRS |
| | 12 | 06 | 05 | 16 | 04.5593 | 10.0* | 04 | 15 | 46.827 | 1.424 | 14 | 29 | 53.133 | 1.407 | FTMYRS |
| | 12 | 06 | 05 | 16 | 10.1621 | 10.0* | 04 | 21 | 01.376 | 1.424 | 15 | 58 | 02.008 | 1.407 | FTMYRS |
| | 12 | 06 | 05 | 16 | 15.8410 | 10.0* | 04 | 26 | 28.120 | 1.424 | 17 | 27 | 43.941 | 1.407 | FTMYRS |
| | 12 | 11 | 03 | 54 | 49.3117 | 10.0* | 03 | 39 | 20.916 | 1.740 | 34 | 48 | 06.870 | 2.025 | FTMYRS |
| | 12 | 11 | 03 | 54 | 54.7995 | 10.0* | 03 | 46 | 03.313 | 1.740 | 36 | 12 | 12.490 | 2.025 | FTMYRS |
| | 12 | 11 | 03 | 55 | 00.9221 | 10.0* | 03 | 53 | 45.209 | 1.740 | 37 | 43 | 36.740 | 2.025 | FTMYRS |
| | 12 | 11 | 03 | 55 | 06.6152 | 10.0* | 04 | 01 | 06.800 | 1.740 | 39 | 06 | 07.220 | 2.025 | FTMYRS |
| | 12 | 11 | 03 | 55 | 12.2091 | 10.0* | 04 | 08 | 32.436 | 1.740 | 40 | 24 | 31.760 | 2.025 | FTMYRS |
| | 12 | 12 | 03 | 15 | 38.4614 | 10.0* | 04 | 03 | 40.532 | 1.956 | 16 | 58 | 38.737 | 1.213 | FTMYRS |
| | 12 | 12 | 03 | 15 | 44.0603 | 10.0* | 04 | 09 | 41.967 | 1.956 | 18 | 19 | 39.949 | 1.213 | FTMYRS |
| | 12 | 12 | 03 | 15 | 50.1635 | 10.0* | 04 | 16 | 21.019 | 1.956 | 19 | 46 | 39.317 | 1.213 | FTMYRS |
| | 12 | 12 | 03 | 15 | 55.8260 | 10.0* | 04 | 22 | 35.868 | 1.956 | 21 | 05 | 53.322 | 1.213 | FTMYRS |
| | 12 | 12 | 03 | 16 | 01.4993 | 10.0* | 04 | 28 | 55.273 | 1.956 | 22 | 23 | 38.768 | 1.213 | FTMYRS |
| | 12 | 22 | 00 | 30 | 41.5553 | 10.0* | 00 | 19 | 03.203 | 1.290 | 18 | 37 | 52.717 | 1.304 | FTMYRS |
| | 12 | 22 | 00 | 30 | 47.0549 | 10.0* | 00 | 24 | 22.765 | 1.290 | 20 | 09 | 47.648 | 1.304 | FTMYRS |
| | 12 | 22 | 00 | 30 | 53.3179 | 10.0* | 00 | 30 | 37.628 | 1.290 | 21 | 54 | 40.313 | 1.304 | FTMYRS |
| | 12 | 22 | 00 | 31 | 04.5958 | 10.0* | 00 | 42 | 35.871 | 1.290 | 25 | 04 | 00.077 | 1.304 | FTMYRS |
| 1964 | 01 | 03 | 04 | 09 | 00.0176 | 10.0* | 06 | 15 | 22.556 | 1.309 | 28 | 47 | 45.680 | 1.026 | BPOINT |
| | 01 | 03 | 04 | 09 | 05.4685 | 10.0* | 06 | 21 | 40.984 | 1.309 | 27 | 33 | 08.869 | 1.026 | BPOINT |
| | 01 | 03 | 04 | 09 | 11.6116 | 10.0* | 06 | 28 | 32.407 | 1.309 | 26 | 08 | 47.808 | 1.026 | BPOINT |
| | 01 | 03 | 04 | 09 | 17.3485 | 10.0* | 06 | 34 | 40.430 | 1.309 | 24 | 50 | 08.652 | 1.026 | BPOINT |
| | 01 | 03 | 04 | 09 | 22.8186 | 10.0* | 06 | 40 | 15.223 | 1.309 | 23 | 35 | 21.580 | 1.026 | BPOINT |
| | 01 | 09 | 04 | 00 | 37.7576 | 10.0* | 03 | 18 | 28.694 | 1.195 | 25 | 52 | 17.831 | 1.189 | FTMYRS |
| | 01 | 09 | 04 | 00 | 43.1936 | 10.0* | 03 | 24 | 59.961 | 1.195 | 24 | 47 | 33.995 | 1.189 | FTMYRS |
| | 01 | 09 | 04 | 00 | 49.3870 | 10.0* | 03 | 31 | 00.840 | 1.195 | 23 | 45 | 44.541 | 1.189 | FTMYRS |
| | 01 | 09 | 04 | 00 | 55.1001 | 10.0* | 03 | 36 | 45.244 | 1.195 | 22 | 44 | 37.324 | 1.189 | FTMYRS |
| | 01 | 15 | 02 | 00 | 21.3380 | 10.0* | 03 | 06 | 14.947 | 1.560 | 25 | 11 | 04.415 | 1.314 | FTMYRS |
| | 01 | 15 | 02 | 00 | 26.9478 | 10.0* | 03 | 12 | 41.731 | 1.560 | 23 | 51 | 56.845 | 1.314 | FTMYRS |
| | 01 | 15 | 02 | 00 | 33.0863 | 10.0* | 03 | 19 | 37.141 | 1.560 | 22 | 23 | 30.066 | 1.314 | FTMYRS |
| | 01 | 15 | 02 | 00 | 38.7126 | 10.0* | 03 | 25 | 51.979 | 1.560 | 21 | 01 | 13.832 | 1.314 | FTMYRS |
| | 01 | 15 | 02 | 00 | 44.1525 | 10.0* | 03 | 31 | 47.715 | 1.560 | 19 | 40 | 29.197 | 1.314 | FTMYRS |

Appendix B

## Corrected "Apparent Place" Values for Five Sequences

| DATE | | | TIME(WWV) | | | ACC. | R.A.(APP.PL.) | | | RMS | DECL.(APP.PL.) | | | RMS | STATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y | M | D | H | M | S | ±MS | H | M | S | " | ° | ' | " | " | |
| 1962 | 11 | 09 | 07 | 52 | 33.6440 | 10.0 | 04 | 56 | 11.284 | 1.161 | 16 | 14 | 19.971 | 1.205 | MOJAVE |
| | 11 | 09 | 07 | 52 | 39.2360 | 10.0 | 05 | 01 | 01.561 | 1.161 | 17 | 03 | 14.020 | 1.205 | MOJAVE |
| | 11 | 09 | 07 | 52 | 44.8290 | 10.0 | 05 | 06 | 05.480 | 1.161 | 17 | 56 | 01.748 | 1.205 | MOJAVE |
| | 11 | 09 | 07 | 58 | 09.2140 | 10.0 | 05 | 24 | 36.895 | 1.844 | 18 | 13 | 23.324 | 1.680 | GFORKS |
| | 11 | 09 | 07 | 58 | 14.8060 | 10.0 | 05 | 29 | 53.018 | 1.844 | 19 | 00 | 07.001 | 1.680 | GFORKS |
| | 11 | 09 | 07 | 58 | 20.3990 | 10.0 | 05 | 35 | 18.323 | 1.844 | 19 | 49 | 29.557 | 1.680 | GFORKS |
| | 11 | 09 | 11 | 47 | 27.5880 | 10.0 | 11 | 43 | 26.237 | 1.829 | 35 | 01 | 31.380 | 1.830 | GFORKS |
| | 11 | 09 | 11 | 47 | 33.1800 | 10.0 | 11 | 46 | 25.271 | 1.829 | 33 | 22 | 34.080 | 1.830 | GFORKS |
| | 11 | 09 | 11 | 47 | 38.7730 | 10.0 | 11 | 49 | 18.349 | 1.829 | 31 | 43 | 19.020 | 1.830 | GFORKS |
| | 12 | 04 | 04 | 56 | 21.3193 | 0.5 | 05 | 30 | 01.769 | 1.170 | 24 | 34 | 53.577 | 1.150 | GFORKS |
| | 12 | 04 | 04 | 56 | 26.9121 | 0.5 | 05 | 34 | 38.820 | 1.170 | 23 | 40 | 28.605 | 1.150 | GFORKS |
| | 12 | 04 | 04 | 56 | 32.5050 | 0.5 | 05 | 39 | 05.450 | 1.170 | 22 | 46 | 41.541 | 1.150 | GFORKS |
| | 12 | 04 | 04 | 56 | 38.0978 | 0.5 | 05 | 43 | 21.997 | 1.170 | 21 | 53 | 45.880 | 1.150 | GFORKS |
| | 12 | 04 | 04 | 56 | 43.6906 | 0.5 | 05 | 48 | 09.689 | 1.170 | 20 | 55 | 52.686 | 1.150 | GFORKS |
| | 12 | 08 | 01 | 05 | 53.9597 | 0.5 | 07 | 53 | 09.883 | 1.433 | -13 | 45 | 29.596 | 1.249 | JOBURG |
| | 12 | 08 | 01 | 05 | 59.5525 | 0.5 | 07 | 58 | 24.099 | 1.433 | -15 | 09 | 46.419 | 1.249 | JOBURG |
| | 12 | 08 | 01 | 06 | 05.1453 | 0.5 | 08 | 03 | 45.032 | 1.433 | -16 | 34 | 08.549 | 1.249 | JOBURG |

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