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**PZT observations of time and latitude
ottawa and calgary, 1972**

J. POPELAR, S. B. SIM and M. O. WHEELER

DEPARTMENT OF ENERGY, MINES AND RESOURCES

OTTAWA, CANADA 1974

FOREWORD

This publication is a continuation of the Time and Latitude Bulletins published by the Positional Astronomy Group. It presents in summary form the results of time and latitude observations made by the two Photographic Zenith Tubes (PZT) of the Earth Physics Branch which are located near Ottawa, Ontario, and Calgary, Alberta.

The delay in publication of this issue, No. 64, of the Geodynamics Series of the Earth Physics Branch is due to changes in personnel and organization that took place towards the end of 1972 and in the first half of 1973. As of July 1, 1973, responsibility for the PZT program was transferred to the newly organized Geodynamics Section of the Gravity Division where it became part of the Polar Motion Group.

R.I. Walcott, Section Head
Geodynamics

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PZT observations of time and latitude ottawa and calgary, 1972

J. POPELAR, S. B. SIM and M. O. WHEELER

This bulletin presents the results of time and latitude observations made with the Ottawa and Calgary photographic zenith tubes (PZT) in 1972, in continuation of Bulletin No. 63.

Ottawa PZT has been located at Shirleys Bay near Ottawa since December 30, 1970. The adopted BIH co-ordinates for the instrument are:

$5^{\text{h}} 03^{\text{m}} 40^{\text{s}}.8500$ $45^{\circ} 24' 0''.800 \text{ N.}$

The observational program is based on the revised 1972 star catalogue described in detail in Bulletin No. 63. Nightly operation of the PZT is pre-programmed and fully automated. The instrument provided consistent data of high quality throughout the year. Altogether 198 photographic plates were obtained from which 4,049 transits of program stars were processed. For time comparisons the CHU and WWV time signals were used regularly.

Calgary PZT at Priddis near Calgary is located on the same parallel as the Herstmonceux PZT of the Royal Greenwich Observatory and has been in operation since June 1968. The adopted BIH co-ordinates are:

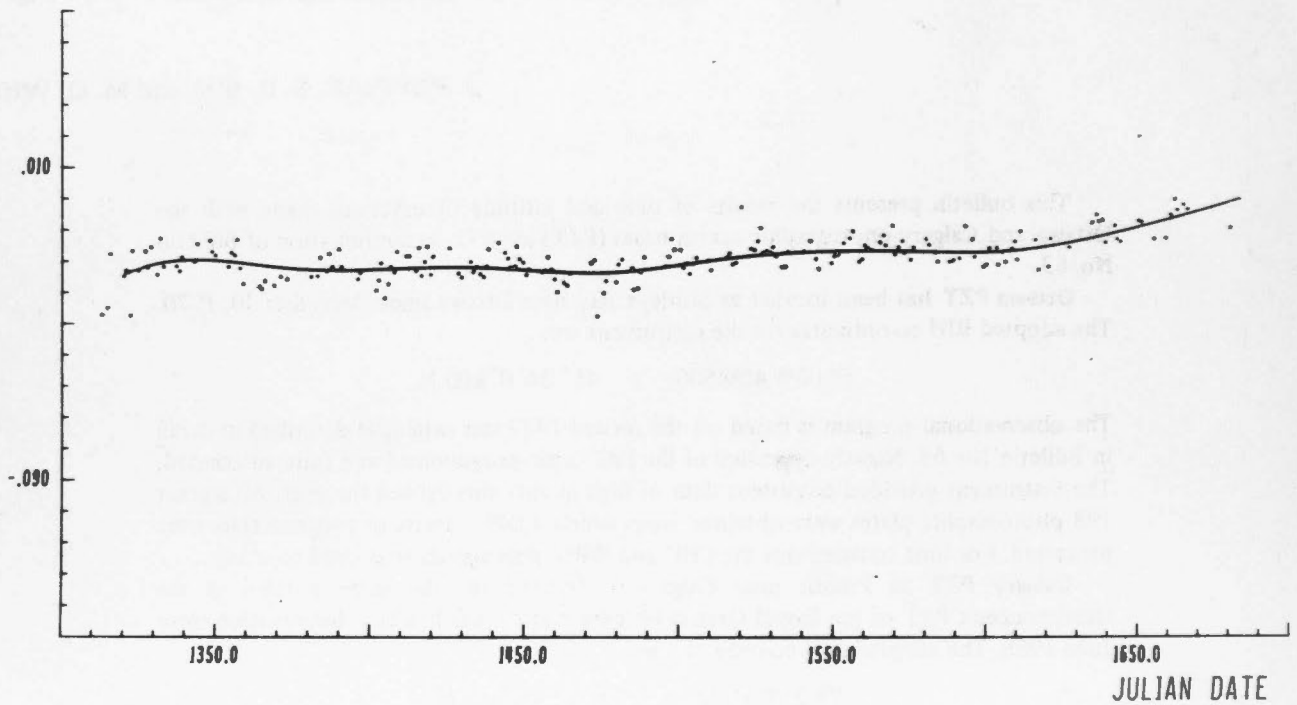
$7^{\text{h}} 37^{\text{m}} 9^{\text{s}}.5000$ $50^{\circ} 52' 22''.500 \text{ N.}$

The observational program is based on the Herstmonceux PZT star catalogue published in Royal Observatory Bulletin No. 113 and revised in April 1971 (Greenwich Time Report, 1971, April-June). The increased scatter of time and latitude observations in 1972 was apparently caused by a radial flaw in the crown component of the objective, reported in the last Bulletin No. 63, and by some mechanical problems of the ageing instrument. Late in December 1972 the old PZT No. 1 was dismantled and replaced by a new instrument of the same construction as the Ottawa PZT. All the data for the Calgary PZT presented in this bulletin were obtained with the old instrument. In 1972, 205 photographic plates were obtained from which 4,168 transits of program stars were processed. For time comparisons the WWV time signals were used predominantly as the reception of the CHU time signals was not always satisfactory.

In comparison with the previous bulletins only minor changes have been made in presentation of the time and latitude data. In accordance with modern practice the results are now given to 4 decimals of a second of time and 3 decimals of a second of arc. The technique suggested by Vondrak (Bull. Astr. Inst. of Czechoslovakia, Vol. 20, No. 6, 1969) and recommended in the BIH Annual Report for 1971 has been applied for smoothing. The smoothing was performed on plate means using weights which were proportional to the number of observed stars. Step adjustments of UTC were removed before smoothing and the value of 10^{-7} was chosen as the coefficient of roughness for all curves. The smoothed time and latitude curves with the plate means are shown in Figures 1 and 2.

UT2-UTC + 3.2MS/DAY

OTTAWA PZT TIME OBSERVATIONS



PHI 1

OTTAWA PZT LATITUDE OBSERVATIONS

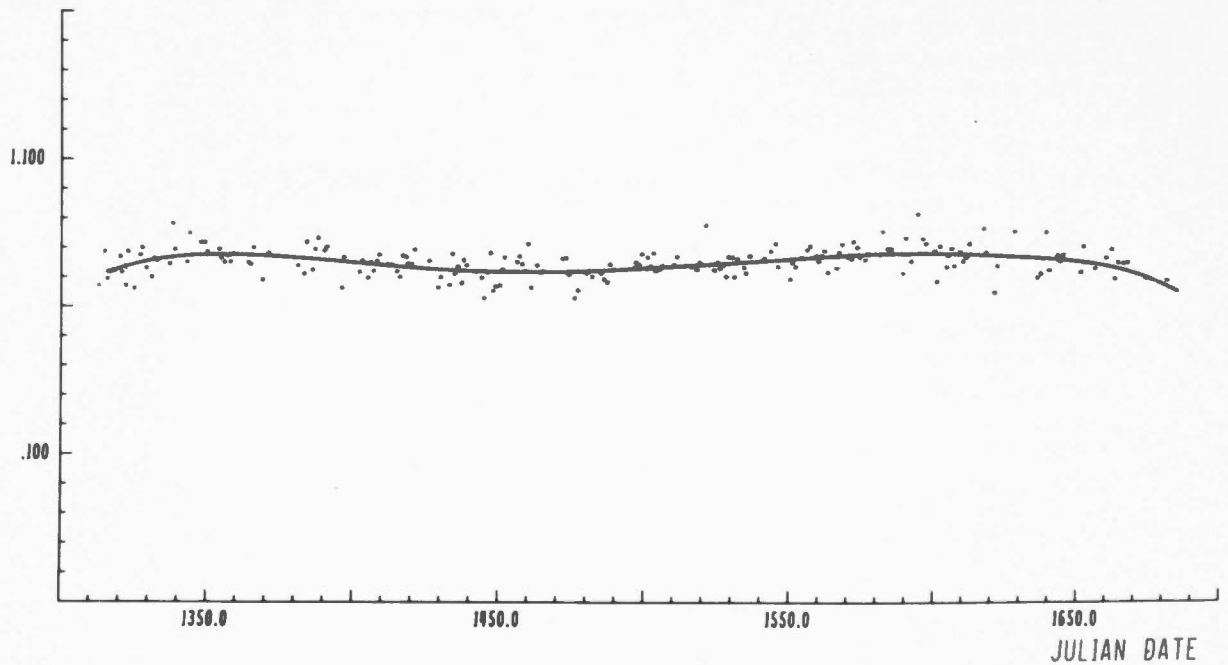
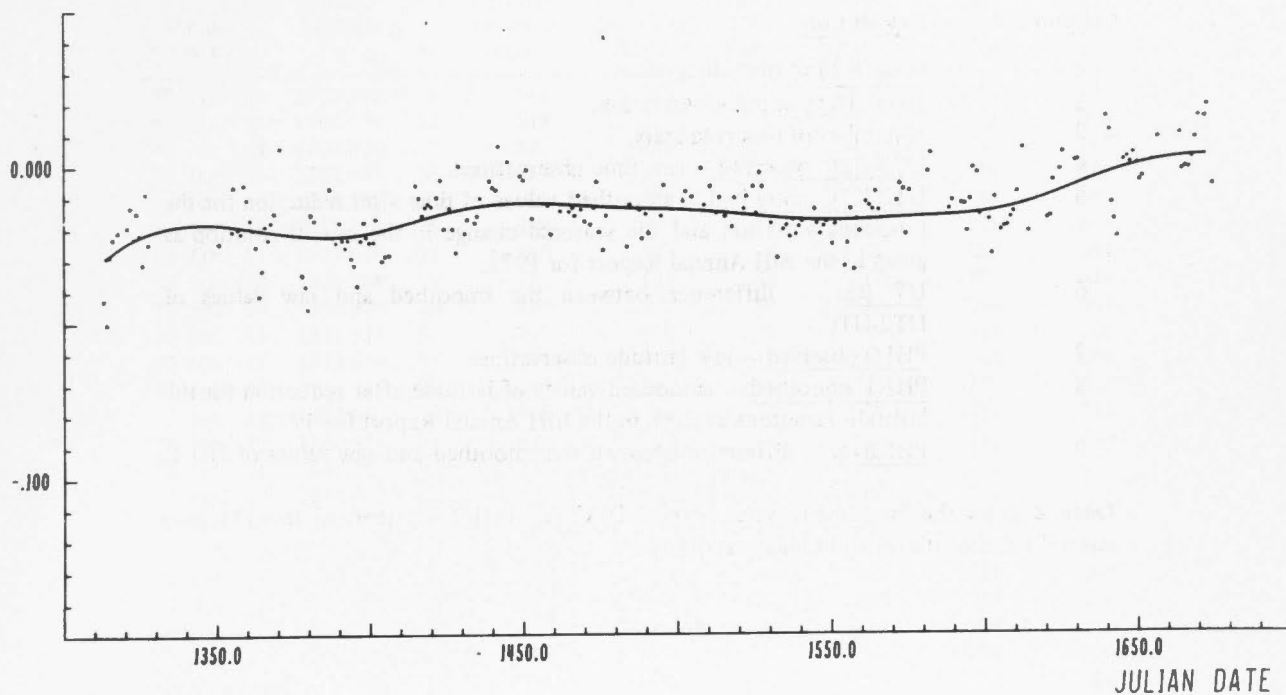


Figure 1. Individual night observations with the Ottawa PZT and the smoothed curves for UT2-UTC + 3.2 ms/day* (STD 4.1 ms) and PHI 1 (STD 0."038).

*The UTC step adjustments have been removed.

UT2-UTC + 3.2MS/DAY

CALGARY PZT TIME OBSERVATIONS



PHI 1

CALGARY PZT LATITUDE OBSERVATIONS

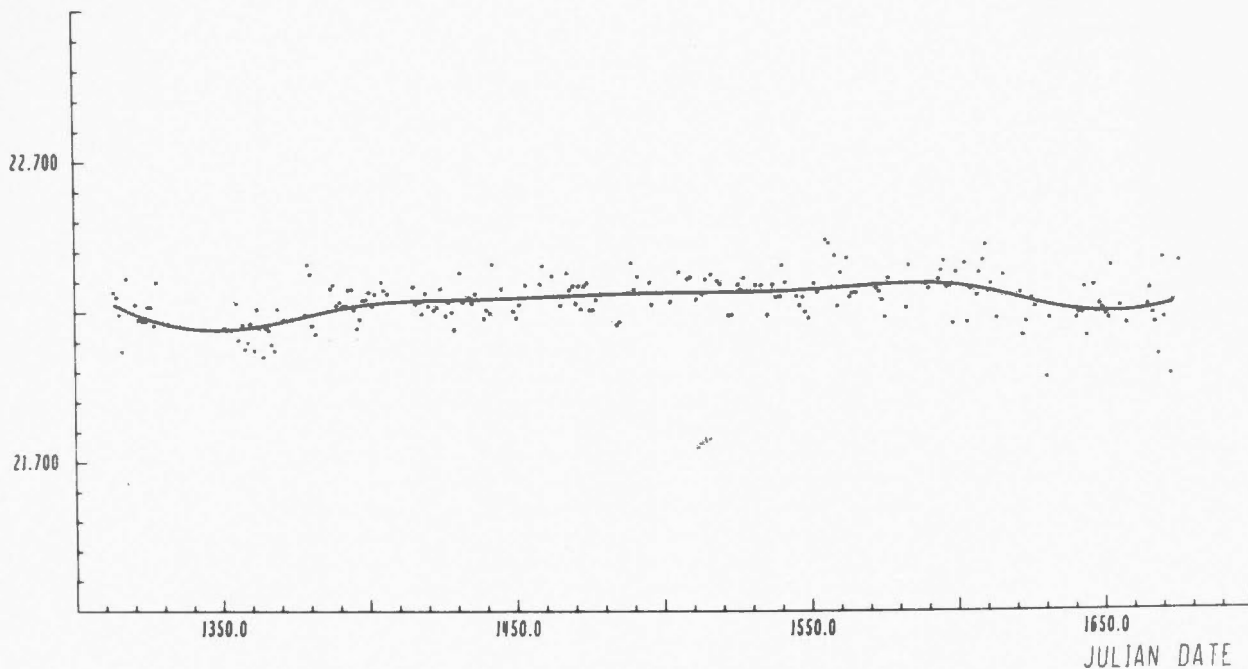


Figure 2. Individual night observations with the Calgary PZT and the smoothed curves for UT2-UTC + 3.2 ms/day* (STD 7.4 ms) and PHI 1 (STD 0."059).

*The UTC step adjustments have been removed.

Table 1 presents the results of time and latitude observations arranged by nights (plates) separately for the Ottawa and Calgary stations.

<u>Column</u>	<u>Description</u>
1	<u>Date (UT)</u> of mid-observation.
2	<u>Julian Date</u> of mid-observation.
3	<u>N</u> number of observed stars.
4	<u>UT0-UTC observed</u> – raw time observations.
5	<u>UT2-UTC smoothed</u> – smoothed values of time after reduction for the longitude variation and the seasonal change in the rate of rotation as given in the BIH Annual Report for 1972.
6	<u>UT Res.</u> – difference between the smoothed and raw values of UT2-UTC.
7	<u>PHI 0 observed</u> – raw latitude observations.
8	<u>PHI 1 smoothed</u> – smoothed values of latitude after reduction for the latitude variations as given in the BIH Annual Report for 1972.
9	<u>PHI Res.</u> – difference between the smoothed and raw values of PHI 1.

Table 2 gives the smoothed values of UT2-UTC and PHI 1 at standard five (5) days interval for the Ottawa and Calgary stations.

Table 1A. Ottawa PZT Time and Latitude Observations

Date (UT)	Julian Date 2440000 +	N	UT0-UTC Observed \$0001	UT2-UTC Smoothed \$0001	UT Res. \$0001	PHI 0 Observed 45°24'	PHI 1 Smoothed 45°24'	PHI Res.
72 Jan. 3	1319.902	8	-547	-559	-6	.827	.732	.036
72 Jan. 4	1320.574	12	-549	-577	9	.776	.734	-.016
72 Jan. 5	1321.920	7	-736	-615	-140	.726	.738	-.067
72 Jan. 6	1322.691	28	-554	-637	62	.840	.741	.046
72 Jan. 8	1324.787	30	-681	-696	-5	.712	.746	-.083
72 Jan. 10	1326.920	5	-689	-758	46	.820	.751	.024
72 Jan. 11	1327.630	25	-763	-779	-6	.844	.753	.048
72 Jan. 12	1328.856	7	-732	-815	58	.771	.756	-.025
72 Jan. 14	1330.823	20	-882	-873	-34	.737	.760	-.059
72 Jan. 15	1331.721	31	-797	-900	77	.799	.761	.002
72 Jan. 16	1332.674	35	-915	-928	-13	.791	.763	-.006
72 Jan. 20	1336.715	28	-1039	-1052	-18	.773	.770	-.023
72 Jan. 21	1337.880	7	-1091	-1088	-35	.907	.771	.112
72 Jan. 22	1338.688	34	-1072	-1113	8	.818	.772	.023
72 Jan. 26	1342.763	34	-1211	-1242	-7	.771	.776	-.024
72 Jan. 27	1343.685	33	-1182	-1272	49	.868	.777	.074
72 Jan. 31	1347.724	35	-1295	-1402	61	.835	.780	.041
72 Feb. 1	1348.655	25	-1359	-1433	26	.833	.780	.039
72 Feb. 2	1349.725	37	-1403	-1467	15	.803	.780	.009
72 Feb. 6	1353.655	19	-1562	-1597	-17	.809	.781	.016
72 Feb. 7	1354.703	29	-1549	-1631	28	.779	.781	-.014
72 Feb. 8	1355.702	40	-1588	-1664	22	.767	.781	-.026
72 Feb. 9	1356.706	37	-1571	-1698	71	.787	.781	-.006
72 Feb. 10	1357.729	35	-1695	-1731	-18	.768	.781	-.025
72 Feb. 11	1358.732	32	-1776	-1765	-66	.793	.781	.000
72 Feb. 16	1363.814	9	-1946	-1934	-69	.768	.779	-.027
72 Feb. 17	1364.716	36	-1980	-1964	-73	.764	.779	-.031
72 Feb. 18	1365.710	35	-1986	-1997	-46	.821	.778	.025
72 Feb. 21	1368.631	24	-2096	-2093	-59	.714	.777	-.084
72 Feb. 23	1370.710	36	-2136	-2162	-29	.808	.776	.008
72 Feb. 25	1372.755	26	-2213	-2230	-38	.802	.775	-.000
72 Mar. 4	1380.727	33	-2464	-2490	-22	.787	.769	-.026
72 Mar. 6	1382.766	25	-2529	-2556	-20	.762	.768	-.054
72 Mar. 7	1383.673	22	-2498	-2585	40	.871	.767	.054
72 Mar. 9	1385.733	29	-2609	-2652	-1	.785	.766	-.037
72 Mar. 10	1386.739	29	-2588	-2684	51	.858	.765	.035
72 Mar. 11	1387.715	26	-2661	-2715	12	.896	.764	.071
72 Mar. 13	1389.775	24	-2675	-2781	66	.858	.762	.030
72 Mar. 14	1390.725	25	-2760	-2811	12	.875	.762	.045
72 Mar. 19	1395.785	20	-2971	-2972	-31	.750	.758	-.090
72 Mar. 20	1396.684	25	-2979	-3001	-8	.857	.757	.015
72 Mar. 25	1401.756	11	-3208	-3161	-67	.821	.752	-.032
72 Mar. 26	1402.774	17	-3211	-3193	-36	.864	.752	.008
72 Mar. 27	1403.727	16	-3188	-3223	18	.860	.751	.002
72 Mar. 28	1404.693	27	-3332	-3254	-92	.813	.750	-.047
72 Mar. 29	1405.767	18	-3327	-3287	-51	.867	.749	.004
72 Mar. 30	1406.636	10	-3298	-3315	6	.842	.748	-.023
72 Mar. 31	1407.716	22	-3354	-3349	-12	.879	.747	.011
72 Apr. 1	1408.696	27	-3322	-3380	53	.905	.747	.034
72 Apr. 4	1411.630	15	-3439	-3473	37	.881	.744	.004
72 Apr. 5	1412.697	26	-3477	-3506	36	.883	.743	.002
72 Apr. 7	1414.662	21	-3592	-3568	-9	.867	.742	-.018
72 Apr. 8	1415.707	29	-3557	-3602	61	.854	.741	-.034
72 Apr. 9	1416.712	28	-3682	-3633	-27	.927	.740	.036
72 Apr. 10	1417.704	29	-3672	-3665	16	.927	.740	.034
72 Apr. 11	1418.634	16	-3657	-3694	65	.909	.739	.013
72 Apr. 12	1419.668	20	-3784	-3727	-24	.910	.738	.011
72 Apr. 13	1420.650	17	-3758	-3759	36	.961	.737	.060
72 Apr. 18	1425.650	8	-3912	-3918	59	.946	.734	.025

Table 1A. Ottawa PZT Time and Latitude Observations -- Continued

Date (UT)	Julian Date 2440000 +	N	UT0-UTC Observed \$0001	UT2-UTC Smoothed \$0001	UT Res. \$0001	PHI 0 Observed 45°24'	PHI 1 Smoothed 45°24'	PHI Res.
72 Apr. 21	1428.743	27	-4102	-4017	-21	.877	.732	-.063
72 Apr. 22	1429.734	27	-4151	-4049	-34	.917	.732	-.025
72 Apr. 25	1432.732	28	-4208	-4146	16	.879	.730	-.050
72 Apr. 26	1433.724	27	-4271	-4178	-11	.979	.730	.053
72 Apr. 27	1434.713	26	-4294	-4210	2	.916	.729	-.010
72 Apr. 28	1435.725	27	-4354	-4243	-21	.945	.729	.012
72 Apr. 29	1436.737	24	-4399	-4275	-31	.899	.728	-.044
72 Apr. 30	1437.715	28	-4398	-4307	4	.987	.728	.034
72 May 1	1438.624	10	-4377	-4337	58	.982	.728	.020
72 May 4	1441.702	8	-4464	-4437	80	.978	.727	-.001
72 May 6	1443.730	27	-4567	-4503	50	.960	.726	-.023
72 May 7	1444.740	6	-4619	-4536	34	.893	.726	-.092
72 May 8	1445.722	27	-4683	-4568	5	.985	.726	-.005
72 May 9	1446.720	25	-4716	-4600	7	1.054	.725	.061
72 May 10	1447.743	19	-4689	-4634	70	.932	.725	-.065
72 May 11	1448.635	10	-4757	-4663	33	.948	.725	-.050
72 May 12	1449.724	25	-4805	-4698	23	.948	.725	-.048
72 May 13	1450.724	25	-4878	-4731	-16	.993	.725	.007
72 May 14	1451.590	5	-4888	-4759	2	1.024	.725	.048
72 May 18	1455.671	17	-5032	-4893	-3	.995	.725	.033
72 May 19	1456.706	23	-5061	-4927	3	1.028	.724	.054
72 May 20	1457.642	13	-5053	-4957	43	1.014	.725	.028
72 May 21	1458.735	20	-5128	-4993	7	1.004	.725	.003
72 May 22	1459.730	20	-5193	-5025	-23	1.104	.725	.093
72 May 23	1460.691	13	-5268	-5056	-65	.962	.725	-.054
72 May 25	1462.725	20	-5303	-5123	-33	1.043	.725	.022
72 May 26	1463.715	20	-5343	-5155	-40	1.021	.725	-.002
72 May 27	1464.715	20	-5337	-5187	-2	1.024	.725	.001
72 June 3	1471.660	8	-5528	-5410	29	1.086	.726	.044
72 June 4	1472.709	16	-5548	-5444	42	1.090	.727	.046
72 June 5	1473.695	20	-5760	-5475	-138	1.035	.727	-.012
72 June 7	1475.696	18	-5752	-5539	-68	.962	.727	-.091
72 June 8	1476.630	9	-5739	-5568	-27	.989	.728	-.067
72 June 11	1479.712	22	-5840	-5665	-33	1.056	.729	-.009
72 June 12	1480.689	8	-5812	-5696	24	1.066	.729	-.002
72 June 13	1481.710	22	-5827	-5728	39	1.051	.730	-.020
72 June 16	1484.734	19	-5949	-5822	6	1.068	.731	-.012
72 June 17	1485.755	17	-6046	-5854	-60	1.052	.732	-.031
72 June 18	1486.731	21	-6071	-5884	-58	1.044	.732	-.042
72 June 19	1487.726	19	-6051	-5915	-8	1.107	.733	.018
72 June 20	1488.707	14	-6030	-5945	39	1.094	.733	.002
72 June 27	1495.744	13	-6265	-6161	1	1.114	.738	.001
72 June 28	1496.734	16	-6261	-6192	32	1.134	.738	.019
72 June 29	1497.708	20	-6235	-6221	84	1.130	.739	.012
72 June 30	1498.740	14	-6296	-6253	52	1.169	.740	.048
72 July 2	1500.723	18	3645	3686	46	1.163	.741	.035
72 July 3	1501.761	10	3559	3655	-12	1.133	.742	.003
72 July 4	1502.775	12	3545	3624	0	1.181	.742	.047
72 July 5	1503.727	19	3486	3594	-33	1.126	.743	-.010
72 July 6	1504.720	20	3490	3564	-2	1.132	.744	-.007
72 July 7	1505.720	20	3481	3533	13	1.145	.744	.003
72 July 11	1509.714	15	3363	3411	0	1.159	.747	.005
72 July 12	1510.668	10	3306	3382	-32	1.186	.747	.030
72 July 17	1515.675	17	3209	3228	1	1.165	.751	-.003
72 July 18	1516.697	21	3197	3197	15	1.164	.751	-.007
72 July 19	1517.691	13	3135	3166	-21	1.156	.752	-.017
72 July 20	1518.716	20	3112	3134	-18	1.180	.752	.005
72 July 22	1520.600	5	3239	3076	157	1.312	.754	.133
72 July 25	1523.704	18	3023	2980	21	1.165	.756	-.020

Table 1A. Ottawa PZT Time and Latitude Observations — Continued

Date (UT)	Julian Date 2440000 +	N	UT0-UTC	UT2-UTC	UT	PHI 0	PHI 1	PHI Res.
			Observed \$0001	Smoothed \$0001	Res. \$0001	Observed 45°24'	Smoothed 45°24'	
72 July 26	1524.723	18	2990	2948	15	1.191	.756	.004
72 July 27	1525.688	24	2991	2918	41	1.173	.757	-.015
72 July 28	1526.774	7	3007	2884	85	1.186	.758	-.005
72 July 29	1527.735	13	2903	2854	6	1.144	.758	-.048
72 July 30	1528.687	24	2880	2825	8	1.214	.759	.020
72 July 31	1529.678	24	2849	2794	2	1.213	.759	.018
72 Aug. 1	1530.600	6	2842	2765	20	1.147	.760	-.050
72 Aug. 2	1531.667	16	2784	2732	-9	1.211	.761	.013
72 Aug. 4	1533.730	18	2693	2667	-46	1.184	.762	-.017
72 Aug. 5	1534.698	23	2667	2637	-46	1.164	.763	-.038
72 Aug. 6	1535.703	24	2686	2605	-0	1.222	.763	.018
72 Aug. 11	1540.704	24	2555	2447	1	1.216	.767	.006
72 Aug. 13	1542.755	14	2532	2383	32	1.243	.768	.031
72 Aug. 15	1544.700	24	2420	2321	-27	1.270	.769	.056
72 Aug. 16	1545.696	24	2363	2290	-57	1.192	.770	-.023
72 Aug. 20	1549.696	25	2272	2163	-40	1.146	.773	-.070
72 Aug. 21	1550.694	25	2270	2131	-16	1.201	.774	-.016
72 Aug. 22	1551.590	7	2249	2103	-12	1.190	.774	-.027
72 Aug. 24	1553.622	9	2230	2038	23	1.218	.776	.000
72 Aug. 26	1555.753	18	2187	1970	39	1.245	.777	.027
72 Aug. 27	1556.705	11	2183	1940	62	1.257	.778	.040
72 Aug. 29	1558.763	17	2028	1874	-35	1.219	.779	.002
72 Aug. 30	1559.723	27	2007	1843	-29	1.204	.780	-.013
72 Aug. 31	1560.720	27	2023	1812	15	1.216	.781	-.000
72 Sept. 1	1561.718	27	1985	1780	5	1.235	.781	.018
72 Sept. 2	1562.697	9	1951	1748	-0	1.160	.782	-.056
72 Sept. 5	1565.730	27	1888	1651	25	1.171	.784	-.043
72 Sept. 6	1566.784	17	1880	1617	47	1.222	.785	.009
72 Sept. 7	1567.659	16	1823	1589	16	1.249	.785	.038
72 Sept. 9	1569.810	14	1822	1520	78	1.200	.786	-.009
72 Sept. 10	1570.720	27	1704	1491	-11	1.192	.787	-.015
72 Sept. 11	1571.658	18	1698	1461	10	1.249	.787	.043
72 Sept. 12	1572.850	7	1684	1422	31	1.227	.788	.023
72 Sept. 13	1573.630	15	1621	1397	-7	1.194	.788	-.009
72 Sept. 15	1575.711	28	1536	1330	-29	1.180	.789	-.020
72 Sept. 16	1576.685	17	1547	1299	11	1.196	.790	-.001
72 Sept. 20	1580.710	30	1449	1169	38	1.184	.791	-.005
72 Sept. 21	1581.710	30	1401	1137	21	1.262	.792	.075
72 Sept. 23	1583.716	32	1312	1072	-3	1.198	.792	.016
72 Sept. 24	1584.570	6	1257	1045	-32	1.195	.792	.014
72 Sept. 28	1588.709	33	1124	912	-32	1.104	.793	-.068
72 Sept. 29	1589.599	16	1099	883	-27	1.221	.793	.052
72 Oct. 1	1591.648	25	1041	817	-19	1.136	.793	-.029
72 Oct. 3	1593.710	5	1075	752	81	1.292	.793	.131
72 Oct. 5	1595.725	30	967	687	40	1.205	.793	.049
72 Oct. 6	1596.656	18	880	658	-15	1.187	.793	.033
72 Oct. 9	1599.636	14	749	563	-47	1.153	.793	.006
72 Oct. 10	1600.560	12	724	534	-41	1.048	.793	-.097
72 Oct. 11	1601.714	27	737	498	10	1.166	.792	.024
72 Oct. 13	1603.868	10	666	430	11	1.093	.792	-.045
72 Oct. 14	1604.510	5	589	410	-43	1.130	.792	-.007
72 Oct. 15	1605.759	22	587	370	-2	1.152	.791	.018
72 Oct. 16	1606.678	20	522	342	-36	1.091	.791	-.041
72 Oct. 18	1608.698	37	492	279	1	1.134	.790	.007
72 Oct. 19	1609.785	26	478	245	25	1.100	.790	-.025
72 Oct. 20	1610.701	37	390	216	-31	1.111	.790	-.012
72 Oct. 21	1611.736	20	442	184	56	1.155	.789	.034
72 Oct. 26	1616.713	17	241	31	25	1.198	.787	.088
72 Oct. 27	1617.691	35	108	1	-73	1.115	.787	.008

Table 1A. Ottawa PZT Time and Latitude Observations — Continued

Date (UT)	Julian Date		UT0-UTC Observed ‰0001	UT2-UTC Smoothed ‰0001	UT Res. ‰0001	PHI 0 Observed 45°24'	PHI 1 Smoothed 45°24'	PHI Res.
	2440000 +	N						
72 Oct. 30	1620.690	12	11	-91	-68	.974	.786	-.126
72 Oct. 31	1621.686	36	66	-121	20	1.062	.785	-.036
72 Nov. 6	1627.655	10	-176	-301	-17	1.169	.782	.086
72 Nov. 14	1635.593	12	-381	-540	48	.999	.778	-.067
72 Nov. 15	1636.851	13	-401	-577	70	1.009	.777	-.054
72 Nov. 16	1637.733	38	-453	-603	48	1.059	.776	-.002
72 Nov. 17	1638.560	10	-480	-628	48	1.145	.776	.086
72 Nov. 18	1639.717	36	-594	-662	-25	1.017	.775	-.039
72 Nov. 21	1642.685	26	-648	-751	20	1.063	.773	.014
72 Nov. 22	1643.610	20	-720	-778	-20	1.039	.772	-.007
72 Nov. 23	1644.605	20	-767	-808	-35	1.058	.771	.015
72 Nov. 29	1650.826	11	-920	-991	17	.991	.765	-.034
72 Nov. 30	1651.649	23	-951	-1016	13	1.075	.764	.052
72 Dec. 4	1655.664	35	-1147	-1134	-52	.993	.758	-.016
72 Dec. 8	1659.549	18	-1279	-1248	-57	1.018	.751	.027
72 Dec. 10	1661.525	12	-1275	-1306	10	1.042	.746	.060
72 Dec. 11	1662.694	37	-1267	-1341	55	.938	.744	-.038
72 Dec. 12	1663.694	29	-1333	-1370	22	.991	.742	.020
72 Dec. 14	1665.539	12	-1383	-1424	31	.983	.737	.023
72 Dec. 15	1666.607	28	-1432	-1456	15	.981	.734	.026
72 Dec. 29	1680.766	37	-1973	-1868	-85	.878	.682	.018

Table 1B. Calgary PZT Time and Latitude Observations

Date (UT)	Julian Date 2440000 +	N	UT0-UTC Observed \$0001	UT2-UTC Smoothed \$0001	UT Res. \$0001	PHI 0 Observed 50°52'	PHI 1 Smoothed 50°52'	PHI Res.
72 Jan. 1	1317.600	6	-464	-506	53	22.333	22.208	.104
72 Jan. 4	1320.675	13	-544	-585	49	22.246	22.195	.030
72 Jan. 5	1321.810	37	-516	-615	106	22.198	22.190	-.013
72 Jan. 6	1322.864	36	-648	-644	1	22.192	22.186	-.015
72 Jan. 7	1323.770	34	-594	-668	79	22.191	22.183	-.013
72 Jan. 8	1324.821	21	-696	-697	4	22.240	22.179	.039
72 Jan. 9	1325.702	10	-816	-722	-92	22.239	22.176	.041
72 Jan. 10	1326.640	8	-620	-749	129	22.178	22.173	-.017
72 Jan. 11	1327.630	8	-811	-777	-34	22.321	22.170	.128
72 Feb. 3	1350.740	27	-1511	-1490	-61	22.195	22.141	.006
72 Feb. 7	1354.945	8	-1603	-1630	-17	22.285	22.144	.085
72 Feb. 8	1355.650	6	-1483	-1654	125	22.165	22.144	-.037
72 Feb. 9	1356.890	13	-1656	-1695	-6	22.217	22.146	.012
72 Feb. 10	1357.756	36	-1698	-1724	-19	22.136	22.147	-.072
72 Feb. 11	1358.746	15	-1576	-1757	134	22.161	22.148	-.050
72 Feb. 12	1359.778	39	-1655	-1792	90	22.227	22.149	.012
72 Feb. 13	1360.982	11	-1759	-1832	27	22.141	22.151	-.078
72 Feb. 14	1361.825	26	-1815	-1860	-0	22.279	22.152	.056
72 Feb. 15	1362.757	36	-1901	-1892	-54	22.220	22.154	-.006
72 Feb. 16	1363.807	11	-2092	-1927	-210	22.124	22.155	-.106
72 Feb. 17	1364.826	30	-2044	-1961	-128	22.224	22.157	-.010
72 Feb. 18	1365.768	25	-1934	-1993	14	22.218	22.159	-.020
72 Feb. 19	1366.847	21	-2011	-2029	-26	22.174	22.161	-.070
72 Feb. 20	1367.780	4	-1990	-2060	27	22.156	22.162	-.092
72 Feb. 21	1368.855	31	-1995	-2096	59	22.297	22.165	.044
72 Feb. 23	1370.808	19	-1850	-2161	271	22.263	22.169	.002
72 Mar. 1	1377.890	9	-2494	-2396	-125	22.302	22.184	.003
72 Mar. 2	1378.990	5	-2567	-2432	-160	22.473	22.187	.168
72 Mar. 3	1379.854	10	-2670	-2460	-233	22.446	22.189	.137
72 Mar. 4	1380.772	28	-2401	-2490	67	22.278	22.191	-.037
72 Mar. 5	1381.812	13	-2453	-2524	51	22.254	22.193	-.067
72 Mar. 10	1386.830	5	-2523	-2685	153	22.423	22.204	.071
72 Mar. 11	1387.787	8	-2710	-2715	-0	22.441	22.206	.084
72 Mar. 12	1388.870	14	-2766	-2750	-19	22.376	22.208	.013
72 Mar. 13	1389.950	8	-2740	-2784	43	22.391	22.210	.021
72 Mar. 14	1390.862	34	-2827	-2812	-12	22.381	22.212	.006
72 Mar. 15	1391.927	21	-2888	-2845	-37	22.387	22.214	.006
72 Mar. 16	1392.770	19	-2894	-2872	-14	22.443	22.215	.056
72 Mar. 17	1393.846	37	-2989	-2905	-73	22.450	22.217	.057
72 Mar. 18	1394.741	11	-3043	-2932	-97	22.387	22.218	-.011
72 Mar. 19	1395.952	14	-3151	-2970	-164	22.326	22.220	-.078
72 Mar. 20	1396.842	32	-3037	-2997	-20	22.361	22.222	-.048
72 Mar. 21	1397.838	34	-3015	-3027	35	22.429	22.223	.013
72 Mar. 22	1398.776	22	-3094	-3055	-11	22.436	22.224	.015
72 Mar. 23	1399.690	9	-3143	-3083	-30	22.465	22.225	.040
72 Mar. 24	1400.920	7	-3187	-3120	-33	22.423	22.227	-.009
72 Mar. 25	1401.838	19	-3147	-3147	38	22.467	22.228	.030
72 Mar. 27	1403.945	12	-3356	-3210	-99	22.516	22.230	.068
72 Mar. 28	1404.945	14	-3377	-3240	-87	22.493	22.231	.040
72 Mar. 29	1405.953	12	-3410	-3269	-87	22.486	22.232	.028
72 Apr. 7	1414.827	12	-3512	-3529	112	22.543	22.237	.047
72 Apr. 8	1415.848	23	-3587	-3559	72	22.492	22.237	-.008
72 Apr. 9	1416.813	18	-3682	-3587	10	22.498	22.238	-.006
72 Apr. 10	1417.846	24	-3694	-3617	34	22.462	22.238	-.046
72 Apr. 11	1418.837	27	-3721	-3646	41	22.534	22.238	.023
72 Apr. 12	1419.852	17	-3766	-3675	32	22.493	22.238	-.021
72 Apr. 14	1421.756	8	-3806	-3731	57	22.484	22.239	-.036
72 Apr. 15	1422.824	25	-3793	-3763	108	22.498	22.239	-.026

Table 1B. Calgary PZT Time and Latitude Observations — Continued

Date (UT)	Julian Date		UT0-UTC Observed \$0001	UT2-UTC Smoothed \$0001	UT Res. \$0001	PHI 0 Observed 50°52'	PHI 1 Smoothed 50°52'	PHI Res.
	2440000 +	N						
72 Apr. 16	1423.893	15	-3989	-3794	-50	22.562	22.239	.034
72 Apr. 18	1425.870	16	-3999	-3853	12	22.484	22.240	-.055
72 Apr. 19	1426.866	18	-4105	-3882	-58	22.536	22.240	-.010
72 Apr. 20	1427.864	9	-4219	-3912	-134	22.509	22.240	-.043
72 Apr. 21	1428.800	5	-3975	-3940	142	22.458	22.240	-.098
72 Apr. 23	1430.870	16	-4268	-4002	-80	22.643	22.240	.087
72 Apr. 24	1431.861	14	-4257	-4032	-38	22.543	22.241	-.010
72 Apr. 26	1433.877	12	-4334	-4093	-50	22.551	22.241	.004
72 Apr. 27	1434.852	13	-4349	-4123	-31	22.535	22.241	-.014
72 Apr. 28	1435.863	10	-4331	-4154	25	22.571	22.241	.016
72 May 1	1438.836	18	-4396	-4245	77	22.512	22.242	-.068
72 May 2	1439.836	18	-4458	-4276	53	22.548	22.242	-.039
72 May 3	1440.836	18	-4503	-4307	44	22.539	22.242	-.051
72 May 4	1441.810	5	-4398	-4337	184	22.706	22.243	.113
72 May 7	1444.810	5	-4554	-4431	134	22.630	22.244	.032
72 May 11	1448.820	16	-4748	-4558	85	22.562	22.245	-.046
72 May 12	1449.815	16	-4793	-4590	72	22.536	22.245	-.070
72 May 13	1450.882	17	-4790	-4624	104	22.574	22.246	-.026
72 May 15	1452.894	13	-5001	-4688	-50	22.627	22.247	.041
72 May 20	1457.863	18	-5139	-4849	-6	22.647	22.249	.042
72 May 21	1458.851	14	-5272	-4881	-98	22.717	22.249	.102
72 May 24	1461.855	17	-5307	-4979	-23	22.695	22.251	.068
72 May 27	1464.845	19	-5408	-5077	-23	22.599	22.252	-.032
72 May 28	1465.845	19	-5428	-5109	-10	22.629	22.252	-.004
72 May 29	1466.841	19	-5486	-5142	-33	22.708	22.253	.074
72 May 30	1467.835	19	-5456	-5174	29	22.653	22.253	.017
72 May 31	1468.833	18	-5533	-5207	-13	22.666	22.254	.029
72 June 1	1469.837	17	-5603	-5240	-50	22.609	22.254	-.030
72 June 2	1470.839	14	-5586	-5272	0	22.668	22.254	.028
72 June 3	1471.825	19	-5679	-5304	-59	22.595	22.255	-.047
72 June 4	1472.880	5	-5660	-5339	-5	22.672	22.255	.029
72 June 5	1473.822	13	-5606	-5370	79	22.681	22.256	.037
72 June 6	1474.824	10	-5801	-5402	-81	22.593	22.256	-.052
72 June 7	1475.815	19	-5892	-5435	-139	22.595	22.256	-.051
72 June 8	1476.860	6	-5815	-5469	-28	22.628	22.257	-.019
72 June 15	1483.790	6	-6136	-5694	-124	22.550	22.259	-.103
72 June 16	1484.795	19	-6033	-5726	10	22.558	22.260	-.096
72 June 19	1487.787	18	-6143	-5823	-5	22.655	22.260	-.001
72 June 20	1488.851	14	-6267	-5857	-96	22.756	22.261	.099
72 June 21	1489.833	21	-6219	-5889	-18	22.668	22.261	.011
72 June 22	1490.880	11	-6311	-5923	-78	22.712	22.261	.055
72 June 26	1494.832	23	-6376	-6051	-21	22.691	22.262	.033
72 June 27	1495.827	23	-6307	-6083	76	22.618	22.262	-.041
72 July 3	1501.810	22	3465	3724	27	22.625	22.264	-.034
72 July 4	1502.807	23	3467	3691	58	22.658	22.264	-.001
72 July 6	1504.810	6	3392	3626	42	22.725	22.264	.066
72 July 9	1507.786	14	3398	3529	135	22.704	22.264	.044
72 July 10	1508.797	19	3252	3496	18	22.708	22.264	.049
72 July 12	1510.730	6	3256	3433	78	22.633	22.264	-.026
72 July 14	1512.855	4	3113	3363	-2	22.650	22.265	-.008
72 July 15	1513.900	6	3133	3329	46	22.698	22.265	.041
72 July 17	1515.850	9	3018	3265	-11	22.714	22.265	.059
72 July 19	1517.890	7	2930	3198	-41	22.690	22.265	.036
72 July 20	1518.834	21	2994	3166	49	22.679	22.265	.025
72 July 23	1521.835	18	2879	3067	19	22.572	22.265	-.079
72 July 24	1522.837	17	2891	3034	60	22.570	22.265	-.080
72 July 26	1524.860	9	2867	2968	93	22.669	22.266	.021
72 July 27	1525.809	19	2753	2936	6	22.654	22.266	.007

Table 1B. Calgary PZT Time and Latitude Observations — Continued

Date (UT)	Julian Date		UT0-UTC Observed \$0001	UT2-UTC Smoothed \$0001	UT Res. \$0001	PHI 0 Observed 50°52'	PHI 1 Smoothed 50°52'	PHI Res.
	2440000 +	N						
72 July 28	1526.828	15	2857	2903	139	22.689	22.266	.044
72 July 29	1527.819	16	2784	2870	94	22.645	22.266	.001
72 Aug. 1	1530.760	5	2588	2773	-19	22.662	22.267	.021
72 Aug. 3	1532.847	30	2420	2705	-127	22.659	22.267	.021
72 Aug. 5	1534.760	9	2459	2642	-35	22.555	22.268	-.081
72 Aug. 6	1535.844	25	2443	2606	-20	22.631	22.268	-.004
72 Aug. 7	1536.824	32	2378	2574	-57	22.653	22.268	.020
72 Aug. 8	1537.859	18	2403	2541	-3	22.611	22.269	-.021
72 Aug. 9	1538.873	11	2329	2508	-49	22.610	22.269	-.021
72 Aug. 10	1539.837	25	2329	2476	-23	22.713	22.270	.083
72 Aug. 11	1540.798	24	2319	2445	-6	22.655	22.270	.027
72 Aug. 15	1544.806	23	2248	2315	32	22.602	22.272	-.022
72 Aug. 16	1545.797	27	2180	2283	-8	22.570	22.272	-.053
72 Aug. 17	1546.796	33	2119	2251	-42	22.597	22.273	-.025
72 Aug. 18	1547.796	33	2114	2219	-20	22.546	22.274	-.075
72 Aug. 19	1548.799	30	2103	2187	-4	22.524	22.274	-.096
72 Aug. 21	1550.731	17	1978	2125	-77	22.635	22.275	.017
72 Aug. 22	1551.788	28	2014	2092	-12	22.604	22.276	-.012
72 Aug. 25	1554.710	5	1798	1999	-149	22.774	22.278	.160
72 Aug. 26	1555.723	18	1844	1967	-75	22.760	22.279	.147
72 Aug. 27	1556.768	32	1925	1934	33	22.612	22.280	.000
72 Aug. 28	1557.756	24	1703	1902	-161	22.716	22.280	.106
72 Aug. 29	1558.758	28	1839	1871	1	22.547	22.281	-.063
72 Aug. 30	1559.708	13	1774	1841	-37	22.656	22.282	.047
72 Sept. 1	1561.784	36	1810	1775	55	22.699	22.283	.094
72 Sept. 2	1562.835	26	1768	1742	41	22.569	22.284	-.036
72 Sept. 3	1563.808	23	1729	1712	30	22.579	22.285	-.024
72 Sept. 4	1564.883	14	1757	1678	87	22.578	22.286	-.023
72 Sept. 5	1565.834	26	1671	1648	28	22.596	22.286	-.004
72 Sept. 11	1571.823	19	1528	1460	52	22.576	22.291	-.014
72 Sept. 12	1572.843	19	1554	1428	106	22.563	22.291	-.025
72 Sept. 13	1573.890	10	1508	1395	89	22.533	22.292	-.053
72 Sept. 14	1574.807	22	1336	1366	-55	22.474	22.293	-.110
72 Sept. 15	1575.870	6	1444	1332	81	22.600	22.293	.018
72 Sept. 21	1581.895	12	1328	1143	141	22.486	22.296	-.083
72 Sept. 22	1582.930	5	1356	1110	200	22.624	22.296	.058
72 Sept. 28	1588.807	32	997	925	18	22.549	22.296	-.002
72 Sept. 29	1589.788	39	992	894	43	22.531	22.296	-.017
72 Oct. 2	1592.772	35	890	800	33	22.552	22.295	.011
72 Oct. 3	1593.806	18	855	768	29	22.580	22.294	.042
72 Oct. 4	1594.784	39	738	738	-57	22.610	22.294	.075
72 Oct. 5	1595.779	41	809	707	44	22.522	22.293	-.010
72 Oct. 6	1596.750	20	878	677	144	22.523	22.292	-.006
72 Oct. 7	1597.923	17	826	641	128	22.395	22.291	-.130
72 Oct. 8	1598.881	26	659	611	-7	22.562	22.290	.041
72 Oct. 11	1601.804	38	547	522	-28	22.587	22.286	.076
72 Oct. 12	1602.792	47	403	492	-141	22.389	22.285	-.119
72 Oct. 13	1603.799	49	552	461	40	22.496	22.283	-.008
72 Oct. 15	1605.784	45	382	401	-66	22.473	22.280	-.024
72 Oct. 16	1606.796	47	357	371	-59	22.546	22.278	.053
72 Oct. 17	1607.768	39	327	342	-58	22.583	22.276	.094
72 Oct. 18	1608.791	49	318	311	-35	22.631	22.274	.147
72 Oct. 19	1609.784	51	302	282	-20	22.476	22.273	-.004
72 Oct. 20	1610.814	17	330	252	40	22.500	22.270	.024
72 Oct. 22	1612.804	9	406	193	179	22.379	22.266	-.088
72 Oct. 24	1614.647	19	73	139	-95	22.520	22.262	.061
72 Oct. 30	1620.747	48	-94	-36	-71	22.449	22.247	.018
72 Oct. 31	1621.744	40	-125	-64	-70	22.304	22.245	-.123

Table 1B. Calgary PZT Time and Latitude Observations — Continued

Date (UT)	Julian Date		UT0-UTC Observed ‰0001	UT2-UTC Smoothed ‰0001	UT Res. ‰0001	PHI 0 Observed 50°52'	PHI 1 Smoothed 50°52'	PHI Res.
	2440000 +	N						
72 Nov. 1	1622.806	34	-45	-95	42	22.347	22.242	-.075
72 Nov. 3	1624.820	44	-81	-151	69	22.420	22.237	.007
72 Nov. 4	1625.852	16	-62	-181	120	22.391	22.235	-.017
72 Nov. 8	1629.965	12	-232	-296	77	22.144	22.225	-.246
72 Nov. 9	1630.798	50	-260	-319	75	22.344	22.223	-.044
72 Nov. 18	1639.910	18	-440	-577	183	22.327	22.208	-.029
72 Nov. 19	1640.926	11	-520	-606	135	22.345	22.207	-.009
72 Nov. 20	1641.752	10	-782	-630	-101	22.342	22.206	-.009
72 Nov. 21	1642.610	12	-864	-655	-155	22.426	22.205	.077
72 Nov. 22	1643.626	16	-955	-684	-214	22.261	22.204	-.085
72 Nov. 24	1645.691	20	-780	-744	26	22.428	22.203	.086
72 Nov. 25	1646.787	54	-808	-776	32	22.340	22.202	-.000
72 Nov. 26	1647.852	37	-861	-807	13	22.360	22.202	.022
72 Nov. 27	1648.784	52	-865	-834	39	22.348	22.202	.012
72 Nov. 28	1649.846	46	-934	-865	3	22.327	22.201	-.008
72 Nov. 29	1650.848	34	-1023	-895	-53	22.312	22.201	-.022
72 Nov. 30	1651.666	25	-1040	-919	-44	22.485	22.201	.152
72 Dec. 3	1654.800	23	-1096	-1013	0	22.348	22.202	.019
72 Dec. 5	1656.874	17	-1090	-1075	72	22.285	22.204	-.042
72 Dec. 12	1663.935	8	-1313	-1290	75	22.331	22.212	.012
72 Dec. 13	1664.782	38	-1457	-1316	-41	22.382	22.213	.063
72 Dec. 14	1665.815	44	-1485	-1348	-36	22.297	22.215	-.021
72 Dec. 15	1666.844	52	-1521	-1380	-39	22.266	22.217	-.053
72 Dec. 16	1667.954	17	-1524	-1415	-7	22.154	22.219	-.164
72 Dec. 17	1668.990	14	-1495	-1447	54	22.476	22.222	.158
72 Dec. 18	1669.964	17	-1455	-1478	125	22.275	22.224	-.043
72 Dec. 20	1672.030	5	-1526	-1543	121	22.082	22.229	-.237
72 Dec. 21	1672.717	8	-1513	-1565	157	22.322	22.231	.003
72 Dec. 23	1674.664	19	-1829	-1627	-96	22.453	22.236	.132

Table 2. Interpolated Smoothed Time and Latitude Observations

Date 0 ^h UT	Julian Date 2440000 +	Ottawa PZT		Calgary PZT	
		UT2-UTC s0001	PHI 1 45°24'	UT2-UTC s0001	PHI 1 50°52'
72 Jan. 3	1319.5	-548	.731	-555	22.199
72 Jan. 8	1324.5	-688	.745	-689	22.180
72 Jan. 13	1329.5	-834	.757	-831	22.165
72 Jan. 18	1334.5	-984	.766	-979	22.154
72 Jan. 23	1339.5	-1139	.773	-1131	22.146
72 Jan. 28	1344.5	-1298	.778	-1288	22.141
72 Feb. 2	1349.5	-1460	.780	-1450	22.140
72 Feb. 7	1354.5	-1625	.781	-1615	22.143
72 Feb. 12	1359.5	-1790	.780	-1783	22.149
72 Feb. 17	1364.5	-1956	.779	-1950	22.156
72 Feb. 22	1369.5	-2122	.776	-2117	22.166
72 Feb. 27	1374.5	-2287	.773	-2284	22.177
72 Mar. 3	1379.5	-2450	.770	-2448	22.188
72 Mar. 8	1384.5	-2612	.767	-2610	22.199
72 Mar. 13	1389.5	-2772	.763	-2769	22.209
72 Mar. 18	1394.5	-2931	.759	-2925	22.218
72 Mar. 23	1399.5	-3090	.754	-3077	22.225
72 Mar. 28	1404.5	-3247	.750	-3226	22.231
72 Apr. 2	1409.5	-3405	.746	-3373	22.234
72 Apr. 7	1414.5	-3563	.742	-3519	22.237
72 Apr. 12	1419.5	-3722	.738	-3665	22.238
72 Apr. 17	1424.5	-3881	.735	-3812	22.239
72 Apr. 22	1429.5	-4042	.732	-3961	22.240
72 Apr. 27	1434.5	-4203	.729	-4112	22.241
72 May 2	1439.5	-4365	.727	-4265	22.242
72 May 7	1444.5	-4528	.726	-4421	22.244
72 May 12	1449.5	-4691	.725	-4580	22.245
72 May 17	1454.5	-4855	.725	-4740	22.247
72 May 22	1459.5	-5018	.725	-4902	22.250
72 May 27	1464.5	-5180	.725	-5065	22.252
72 June 1	1469.5	-5341	.726	-5229	22.254
72 June 6	1474.5	-5501	.727	-5392	22.256
72 June 11	1479.5	-5659	.729	-5554	22.258
72 June 16	1484.5	-5815	.731	-5717	22.259
72 June 21	1489.5	-5969	.734	-5878	22.261
72 June 26	1494.5	-6123	.737	-6040	22.262
72 July 1	1499.5	3723	.740	3797	22.263
72 July 6	1504.5	3570	.743	3635	22.264
72 July 11	1509.5	3417	.747	3472	22.264
72 July 16	1514.5	3263	.750	3308	22.265
72 July 21	1519.5	3109	.753	3143	22.265
72 July 26	1524.5	2954	.756	2978	22.266
72 July 31	1529.5	2798	.759	2814	22.266
72 Aug. 5	1534.5	2642	.763	2649	22.268
72 Aug. 10	1539.5	2484	.766	2486	22.269
72 Aug. 15	1544.5	2327	.769	2324	22.272
72 Aug. 20	1549.5	2168	.773	2164	22.275
72 Aug. 25	1554.5	2009	.776	2004	22.278
72 Aug. 30	1559.5	1850	.780	1846	22.282
72 Sept. 4	1564.5	1690	.783	1689	22.285
72 Sept. 9	1569.5	1529	.786	1532	22.289
72 Sept. 14	1574.5	1368	.789	1375	22.292
72 Sept. 19	1579.5	1207	.791	1217	22.295
72 Sept. 24	1584.5	1046	.792	1059	22.296
72 Sept. 29	1589.5	885	.793	902	22.296
72 Oct. 4	1594.5	725	.793	746	22.294
72 Oct. 9	1599.5	566	.793	591	22.289
72 Oct. 14	1604.5	409	.792	439	22.282

Table 2. Interpolated Smoothed Time and Latitude Observations -- Continued

Date 0 ^h UT	Julian Date 2440000 +	Ottawa PZT		Calgary PZT	
		UT2-UTC #0001	PHI 1 45°24'	UT2-UTC #0001	PHI 1 #0001
72 Oct. 19	1609.5	253	.790	289	22.273
72 Oct. 24	1614.5	98	.788	143	22.262
72 Oct. 29	1619.5	-54	.786	-0	22.250
72 Nov. 3	1624.5	-206	.784	-142	22.238
72 Nov. 8	1629.5	-357	.781	-283	22.226
72 Nov. 13	1634.5	-507	.779	-424	22.216
72 Nov. 18	1639.5	-656	.775	-566	22.208
72 Nov. 23	1644.5	-804	.771	-709	22.204
72 Nov. 28	1649.5	-952	.766	-855	22.201
72 Dec. 3	1654.5	-1100	.760	-1004	22.202
72 Dec. 8	1659.5	-1247	.751	-1154	22.206
72 Dec. 13	1664.5	-1394	.740	-1308	22.213
72 Dec. 18	1669.5	-1540	.726	-1463	22.223
72 Dec. 23	1674.5	-1686	.708		
72 Dec. 28	1679.5	-1831	.687		