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ETL-0065

POST-MISSION SMOOTHING AND ANALYSIS OF
THE MEASUREMENTS OF THE CHANGE IN
THE DEFLECTION OF THE VERTICAL
OBTAINED BY THE RAPID GEODETIC
SURVEY SYSTEM (RGSS) AT THE
WHITE SANDS TEST RANGE

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GUIDANCE & CONTROL SYSTEMS

5500 Canoga Avenue, Woodland Hills, California 91364

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Contract No. DAAG53-75-C-0248

Prepared for

Research Institute

U.S. Army Engineer Topographic Laboratories
Fort Belvoir, Virginia 22060

September 1976

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL 8865	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER 9
4. TITLE (and Subtitle) Post-Mission Smoothing and Analysis of the Measurements of the Change in the Deflection of the Vertical Obtained by the Rapid Geodetic Survey System (RGSS) at the White Sands Test Range,		5. TYPE OF REPORT & PERIOD COVERED Contract Report
6. AUTHOR(s) James R. Huddle Richard H. Lentz		7. PERFORMING ORG. REPORT NUMBER
8. PERFORMING ORGANIZATION NAME AND ADDRESS Litton Guidance and Control Systems 5500 Canoga Avenue Woodland Hills, California 91364		9. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-8248
10. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		11. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 12) 304p.		13. REPORT DATE September 1976
		14. NUMBER OF PAGES 344
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The objectives of this report were: (1) to apply off-line post-mission smoothing to raw real-time estimates of the changes in the deflection of the vertical as collected by the Rapid Geodetic Survey System (RGSS) at White Sands; (2) to analyze the residual errors in the smoothed estimates of the changes in the deflection of the vertical for those runs where reference change information was available to determine significant sources of estimate degradation; and (3) to recommend a further course of action as a result of this analysis which		

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should lead to improvement in the deflection recovery accuracy of the RGSS.

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SECTION I

INTRODUCTION

1.1 Objective of Study

The objectives of this study were to:

- Apply off-line, post-mission smoothing to raw real-time estimates of the changes in the deflection of the vertical as collected by the Rapid Geodetic Survey System (RGSS) at White Sands. Data recorded on tape cassettes from a set of 17 test runs were provided by the Research Institute at the U.S. Army Engineer Topographical Lab (USAETL).
- Analyze the residual errors in the smoothed estimates of the changes in the deflection of the vertical for those runs where reference change information was available to determine significant sources of estimate degradation. A subset of 8 of the test runs was available for this purpose.
- Recommend a further course of action as a result of this analysis which should lead to improvement in the deflection recovery accuracy of the RGSS.

1.2 Error Model of the Deflection Change Measurement Process

Analysis of the error in the measurement of the change in the vertical deflection by the RGSS requires identification of the major sources of error in a model of the measurement process. The block diagram shown in Fig. 1 illustrates the current error model of the deflection change measurement process for the RGSS. Included in this model are:

- Gyro Drift Rate Bias (b) - a residual drift rate after initial system calibration which is constant during the mission and whose effect is essentially removed by post-mission smoothing.

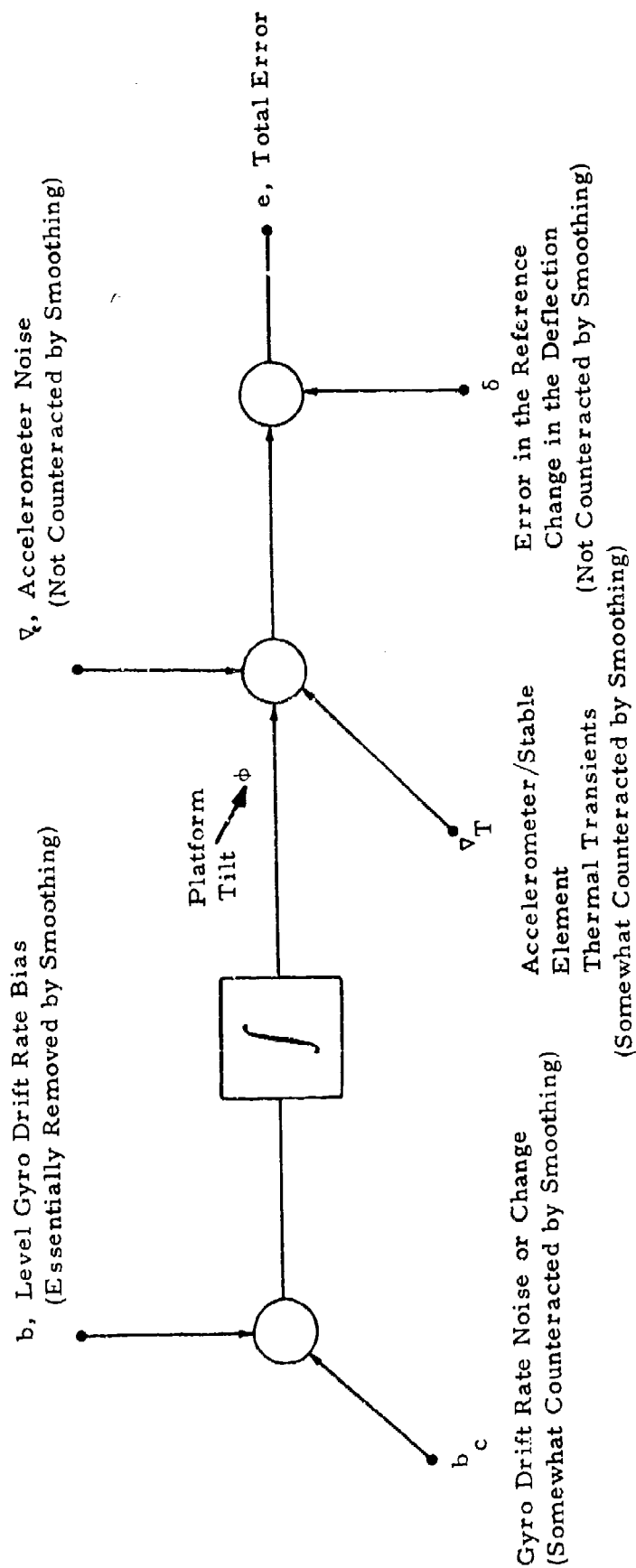


Figure 1. Error Model of the RGSS Deflection Change Measurement Process

- Gyro Drift Rate Noise (b_c) - a component of drift rate which changes during the course of the mission whose effect is only partially removed by post-mission smoothing. (Refer to Appendix A on optimal smoothing of integrated exponentially-correlated noise.) This noise source includes heading-sensitive and thermal induced gyro drift rates as well as drift rate changes resulting from unidentified causes.
- Accelerometer/Stable Element Thermal Transients (∇_T) - change in accelerometer bias and sensitive axis orientation due to thermal non-equilibrium occurring after initial turn-on but also including sensitivity to heading change during the mission. This effect is partially, but unsatisfactorily, compensated for by post-mission smoothing.
- Accelerometer Noise (∇_c) - changes in accelerometer error due to unidentified causes, a random error whose effect is not compensated for by post-mission smoothing.
- Error in the Reference Change in the Deflection (δ) - a random error whose effect is not compensated for by post-mission smoothing. For the White Sands reference data the individual deflections were assumed known to $0.5 \widehat{\text{sec}} (1\sigma)$ which is equivalent to knowing the change to $0.7 \widehat{\text{sec}} (1\sigma)$.

1.3 Theoretical Limit on the Recovery of the Vertical Deflection Due to Correlated Platform Drift Rate

A review of the error model of the deflection recovery process defined above will indicate that the most important limitation in measuring the change in the deflection of the vertical over extended distances/time periods results from the instability in the platform drift rate. The unstable component of platform drift rate can usually be characterized as exponentially-correlated noise. The specific limitation on deflection recovery due to the presence of such a noise source in the RGSS have been analyzed in detail and the mathematical and numerical results are presented in a convenient normalized form in Appendix A.

For our purposes here, if we characterize the platform drift rate as being $0.001^\circ/\text{hr}$ (1σ) with a correlation time of 2 hours, then the time RMS of the error in the estimated deflection change due to this error only over a 2 hour mission once optimal post-mission smoothing has been performed, will be 0.9 sec . If the mission time is reduced to 1 hour or extended to 4 hours, the analysis of Appendix A indicates that for the same correlated drift rate, the time RMS of the error in the estimated deflection change would be 0.3 sec or 2.1 sec , respectively.

1.4 Method of Investigation

Off-line smoothing of the raw deflection change measurement data for each of the 17 test runs was applied using a specially-developed digital computer program written in the FORTRAN language. The results of this process are summarized in tables below and also shown in plots of the deflection change estimates before (real-time estimates) and after smoothing (refer to the various appendices of this report).

For those 8 test runs where reference deflection change data was made available by USAETL, an analysis of the deflection change measurement error characteristics was performed with the intent of determining major sources of performance degradation. For this analysis a model of the error in the deflection change measurement process was constructed using logic and past experience and then where possible, the measurement error characteristics were explained in terms of this model.

Once the dominating error sources were identified in terms of the model, a recommended plan for reducing their effect was evolved.

SECTION II

INVESTIGATION

2.1 General Description of the Test Runs

A general summary of the 17 test runs made with the RGSS at White Sands is shown in Table 1 below within the ruled lines. The table indicates the:

- Identifying number for the run
- Date the run was made
- Time of day at which the run was initiated
- Time duration of the run
- Initial and terminal stations for the run and the general direction between the stations.

The raw measurements were first smoothed with the off-line computer program in the form that they were initially recorded on the tape cassettes. The off-line smoothing program basically employs the errors in the estimated values of the deflection change observed at the terminal station to estimate the platform drift rate vector and remove this effect from the real-time deflection change estimates at the intermediate stations. The reduction of the measurements for the test runs in their original form are identified by the numbers with no following letter (e. g., 1, 2(1), 2(2), 3 etc) throughout the report. For analytical purposes, the raw measurements were also smoothed over sub-sections of the original test run. The reduction of the measurements for these modified test runs are identified by the numbers with a following letter (e. g., 1A, 1B, 2(1)A, etc.). Note these modified test runs necessarily have shorter elapsed time (column 4) and proceed between a different initial or terminal point relative to the original run (column 5). The motivation for the modified reduction of the data is given below.

TABLE 1
SUMMARY OF THE ORIGINAL AND MODIFIED CORRECTION OF THE RGSS WHITE SANDS TEST DATA

Run Number	Date (Mo-Day-Yr)	Start Time (Hr-Min-Sec)	Elapsed Time (Hr)	General Direction and Reference Points
1	3-5-76	7-50-17	2.0	SANDS NE Base (3) S.W. to BEASLEY (2001)
1A	3-5-76	7-50-17	0.8	SANDS NE Base (3) S.W. to SANDS SW Base (10)
1B	3-5-76	8-40-01	1.2	SANDS SW Base (10) S.W. to BEASLEY (2001)
2(1)	3-5-76	13-52-33	1.8	HUEY (2018) W. to M-334 (2034) N. to BEASLEY (2001)
2(1A)	3-5-76	13-52-33	1.2	HUEY (2018) W. to M-334 (2034) N. to NEP (2035)
2(1B)	3-5-76	15-5-4	0.6	NEP (2035) N. to BEASLEY (2001)
2(2)	3-5-76	15-40-30	1.9	BEASLEY (2001) N.E. to SANDS NE Base (3)
2(2A)	3-5-76	15-40-30	1.1	BEASLEY (2001) N. to SANDS SW Base (10)
2(2B)	3-5-76	16-46-16	0.8	SANDS SW Base (10) N.E. to SANDS NE Base (3)
3	3-10-76	8-34-58	2.7	TULAROSA S.B (1) W. to HANFORD (9)
3A	3-10-76	8-34-58	1.0	TULAROSA SB (1) W. to SALT (5)
3B	3-10-76	9-36-55	1.7	SALT (5) W. to HANFORD (9)
4	3-10-76	12-14-40	2.1	HANFORD (9) E. to TULAROSA SB (1)
4A	3-10-76	12-14-40	1.2	HANFORD (9) E. to SALT (5)
4B	3-10-76	13-23-14	0.9	SALT (5) E. to TULAROSA SB (1)
5	3-10-76	15-24-23	2.8	TULAROSA SB (1) W. to 4F953 (7) then E. to TULAROSA (1)
5A	3-10-76	15-24-23	1.4	TULAROSA SB (1) W. to 4F953 (7)
5B	3-10-76	16-40-34	1.4	4F953 (7) E. to TULAROSA SB (1)
6	3-10-76	9-16-6	3.6	WC-50 (1) S. to CONN (15)
6A	3-10-76	9-16-6	1.7	WC-50 (1) S. to D-3 (7)
6B	3-10-76	12-2-38	0.9	GERT (9) S. to CONN (15)
7	3-10-76	14-26-3	3.4	CONN (15) N. to NC-50 (1)
7A	3-10-76	14-26-3	1.6	CONN (15) N. to SEE HORN (8)
7B	3-10-76	15-50-42	1.1	NW-10 (1) N. to WC-50 (1)
8(2)	3-11-76	8-53-2	3.1	BEASLEY (2001) S. to M-334 (2035) E. to HUEY (2018) W. to M-334 (2033) N. to BEASLEY (2001)

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6A	3-10-76	9-16-6	1.7	WC-50 (1) S. to D-3 (7)
6B	3-10-76	12-2-38	0.9	GERI (9) S. to CONN (15)
7	3-10-76	14-26-3	3.4	CONN (14) N. to WC-50 (1)
7A	3-10-76	14-26-3	1.6	CONN (15) N. to SEE HORN (8)
7B	3-10-76	15-6-42	1.1	NW-30 (6) N. to WC-50 (1)
8(2)	3-11-76	8-5-12	3.1	REASLEY (2001) S. to M-334 (2023) E. to HUEY (2018) W. to M-334 (2023) N. to REASLEY (2001)
8(2)A	3-11-76	8-5-12	1.6	REASLEY (2001) S. to M-334 (2023) E. to HUEY (2018)
8(2)B	3-11-76	10-27-57	1.5	HUEY (2018) W. to M-334 (2023) N. to REASLEY (2001)
9	3-11-76	13-13-18	2.0	BEASLEY (2001) N.E. to SANDS NE BASE (3)
9A	3-11-76	13-13-18	1.3	BEASLEY (2001) N.E. to SANDS SW BASE (12)
9B	3-11-76	14-27-47	0.7	SANDS SW BASE (10) N.E. to SANDS NE BASE (3)
10(2)	3-13-76	16-9-0	1.5	REASLEY (2001) S. to M-334 (2023) E. to HUEY (2018)
10(2)A	3-13-76	16-9-0	0.6	REASLEY (2001) S. to NED (2035)
10(2)B	3-13-76	16-41-25	0.9	NED (2035) S. to M-334 (2023) E. to HUEY (2018)
10(4)	3-13-76	17-53-28	1.7	HUEY (2018) W. to M-334 (2023) N. to REASLEY (2001)
10(4)A	3-13-76	17-53-29	1.1	HUEY (2018) W. to M-334 (2023) N. to NED (2035)
10(4)B	3-13-76	18-58-53	0.6	NED (2035) N. to REASLEY (2001)
13	3-14-76	12-44-11	2.6	OASIS (27) W. to WC-50 (203) N. to TS-857 (210)
13A	3-14-76	12-44-11	0.9	OASIS (27) W. to WC-50 (203)
13B	3-14-76	13-18-10	1.7	WC-50 (203) N. to TS-857 (210)
14	3-14-76	17-11-35	1.7	RASIN (208) S. to WC-50 (203) E. to OASIS (27)
14A	3-14-76	17-11-35	0.9	RASIN (208) S. to WC-50 (203)
14B	3-14-76	18-5-57	0.8	WC-50 (203) E. to OASIS (27)
16(1)	3-15-76	11-54-15	1.4	JACK (22) N. to IFS-3 (1) W. to SALT (31)
16(2)	3-15-76	13-17-59	0.8	SALT (31) E. to OASIS (27)
16(3)	3-15-76	14-6-27	0.8	OASIS (27) S. to JACK (22)

2.2 Categorization of Test Runs

The 17 test runs were divided into 3 categories depending upon the number of reference deflection change values that were provided by the Research Institute. A more comprehensive analysis of the system error characteristics can be made when there are a greater number of reference change values available. Clearly, where reference values of the deflection are available at all intermediate stations, the detailed structure of error in the deflection change estimates can be ascertained. The major categories were divided into sets run over the same course. The categories are:

1. All reference change values available -
 - Runs 3, 4, 5
 - Runs 6, 7
2. A majority of the reference change values available:
 - Runs 1, 2(2), 9
3. A minimum number of the reference change values available:
 - Runs 2(1), 8(2), 10(2), 10(4)
 - Runs 13, 14, 16(1), 16(2), 16(3)

2.3 Analysis of System Error Characteristics

A considerable amount of time was spent during the study on the test results from the runs in Category 1. The real-time Kalman estimates were smoothed with the off-line computer program using different values for optional parameters in the smoother program. These optional parameters include platform drift rate (1σ) values and (1σ) values of the error in the observed deflection change estimates due to error in the reference deflection values and accelerometer bias shift at the terminal station. The variation in the RMS error in the smoothed estimates (relative to the reference change values provided) as a function of the selected values for the optional parameters was inspected and used as a criterion in arriving at a final "best" set of values.

In the next phase of the analysis, the characteristics of the error were observed for the individual runs. Two (2) important error characteristics were identified and related to their probable causes:

- A change of the trend in the error of the real-time Kalman estimate of the deflection change with vehicle heading for Runs 5, 6 and 7. Refer to Figs 3.3, 3.4, and 3.5 (ξ) and Figs. 4.3, 4.4, and 4.5 (η) respectively, in Appendix D. This characteristic implies the presence of uncompensated shifts in level gyro drift rate with heading change primarily for the east gyro, but somewhat also for the north gyro.
- Curvature of the trend in the error for the real-time Kalman estimates of the deflection change on Run 3. Refer to Fig. 3.1 (ξ) and Fig. 4.1 (η) of Appendix D. This effect could possibly be induced by an initial thermal transient since this run had an early morning start and the equipment may not have reached thermal equilibrium.

In addition, it was observed that on Run 4, which did not involve major vehicle heading changes and was made after several hours of system operation, the error in the real-time Kalman estimates of the deflection changes were quite linear, indicating the presence of constant gyro drift rate. Refer to Fig. 3.2 (5) and Fig. 4.2 (7) in Appendix D. The linear error characteristic is not of great concern as its effect can essentially be removed by the post-mission smoothing program.

The scatter of data in Fig. 4.2 (7) for Run 4 should not be viewed with alarm as the scale is substantially reduced relative to the other figures. The scatter may be indicative of the noise characteristic of the A200D accelerometers which are used in the level axes of the RGSS, or the error in the reference value of change in the east-west deflection provided for the analysis.

2.4 Modified Off-Line Smoothing of the Deflection Change Estimates

Once the major characteristics of the error in the real-time deflection change estimates were identified, a more complete model of the error in the deflection change process was formulated and is summarized in Section 1.2. This model was then reviewed to arrive at alternate means of smoothing the real-time deflection change estimates. The 2 main conclusions that were made are that:

- Since vehicle heading change induces gyro drift rate change, breaking the test runs down into approximately straight line segments should reduce error in the smoothed estimates of the deflection change
- Since instability in gyro drift leads to greater error in the smoothed estimates of the deflection change as time increases, breaking the test runs down into shorter legs with reduced running time should reduce error in the estimates. The theoretical background for this conclusion is presented in Appendix A, "Optimal Smoothing of Integrated Exponentially-Correlated Noise". Note breaking Run 3 into 2 shorter segments will yield reduced curvature of the error trend over each segment yielding reduced error from the suspected accelerometer/stable element thermal transient.

It was also noted that accelerometer noise and error in the reference values of change in the deflection components have a somewhat equivalent effect on the smoothing process in that little can be done about their presence.

Having arrived at these conclusions, the data for the Category 1 and 2 test runs was smoothed in a modified manner to either reduce heading change and/or the time duration of the leg. The criterion used for judging the success of this modified processing was the RMS value of the error in the smoothed estimates of

the deflection change. The results of these experiments are summarized in Table II which displays the RMS values of the error in the smoothed estimates as originally processed and after modified processing.

As is evident from the table, elimination of heading changes reduced the error in the north-south deflection estimates substantially and improved somewhat on the average the estimates of the east-west deflections.

Reduction of the time duration of the test legs reduced the estimate error significantly for Run 3 but did not seem to benefit on the average the results for the rest of the runs.

The details of this data analysis are presented in the tables of Appendix G. The test runs of Category 3 were broken down in a similar manner and these results are also detailed in the tables of Appendix G. There was less flexibility in dealing with the Category 3 tests in that reference points were sparse along the course. In some cases only one choice was available to implement the reduction.

TABLE II.
RMS VALUES OF ERRORS IN THE SMOOTHED ESTIMATES
OF THE DEFLECTION COMPONENTS

Run Number	RMS Value of Smoothed Estimate Errors for Original Runs		RMS Value of Smoothed Estimate Errors for Runs with Major Heading Changes Removed		RMS Value of Smoothed Estimate Errors for Runs Divided into Multiple (Shorter Time Duration) Legs	
	N-S (ξ)	E-W (η)	N-S (ξ)	E-W (η)	N-S (ξ)	E-W (η)
3	4.5	3.6	NA	NA	2.3	1.3
4	0.6	1.7	NA	NA	0.5	0.4
5	8.6	1.4	1.3	1.5	NA	NA
6	6.9	3.5	1.8	1.0	NA	NA
7	5.0	1.9	1.4	1.4	NA	NA
1(1)	1.4	1.5	NA	NA	1.7	1.1
2(2)	2.1	1.8	NA	NA	0.7	2.1
9	0.9	3.3	NA	NA	0.9	3.0

NA - Not Applicable

2.5 General Organization of Test Data and Analytical Results in the Appendices

The real-time estimates of the deflection change for each of the 17 test runs defined in Table 1 above were smoothed in their original configuration. Also as defined in the table by the numbers with attached letters, segments were smoothed to effect the removal of vehicle heading change or time duration reduction. Computer printouts of the:

- Real-time Kalman estimates of the deflection change components
- Smoothed estimates of the deflection change components
- Error in the smoothed estimates of the deflection change components where fully definable (e. g., Category 1) from the provided reference deflections summarized in Appendix B.

for each test leg defined in Table 1 are given in Appendix C.

Calcomp plots of the same variables are given in Appendix D for the original configurations of the test runs and in Appendices E and F for the test runs as modified for vehicle heading change reduction and test leg time duration reduction, respectively.

A detailed side by side comparison of the results from the original and modified processing for the sets of test runs made over the same course is provided by the tables of Appendix G. In these tables, the errors in the smoothed estimates at those few points where reference deflections were provided (e. g., Categories 2 and 3) are also given.

A summary of the real-time estimates of the free-air gravity anomalies and their errors at the points where reference data was provided is given in the Tables of Appendix I.

Inspection of Table B-1 indicates that no reference values for the deflection components were provided for 27 intermediate stations. Appendix H presents a set of "best" estimates of the deflection components for these stations as derived from smoothed estimates obtained from the raw test data.

SECTION III

DISCUSSION

The analysis of the errors in the real-time and smoothed estimates of the deflection change components where reference change values were available (Category 1), provided valuable information regarding the error characteristics of the RGSS platform. In particular, level gyro drift rate sensitivity to vehicle heading change and possible level accelerometer/stable element thermal transient behavior were identified as error sources for further investigation. Elimination of such identifiable sources of potentially systematic error from the RGSS should be a major objective of an accuracy improvement program. Preliminary tests to determine the nature of platform drift rate change with vehicle heading change have indicated a portion of this error is systematic in nature. Exhaustive tests should be performed in the near future to clarify this issue. Appropriate compensation of heading sensitive drift rate change could allow a substantial reduction in the correlated platform drift rate error component discussed in Section 1.3 and Appendix A which represents the most fundamental limitation on performance at the present time.

Since only a minimal number of reference values were provided for a majority of the test runs, no effort was concentrated on these results except to look for repeatability at individual points and derive "best" estimates from the set of values obtained.

A major area of uncertainty in the analysis was the contribution to error of the:

- Reference deflection values
- Accelerometer bias shift

The error in the reference values of change in the deflection components potentially contribute $0.7 \text{ sec } (1\sigma)$ and the accelerometer bias shift potentially contributes $1.2 \text{ sec } (1\sigma)$ of error to the smoothed estimates. This level of error contribution somewhat clouds the determination of what the accuracy of the RGSS can be under optimal utilization since performance in this range was apparently obtained (Legs 4A and 4B of Run 4).

SECTION IV

CONCLUSIONS

The major conclusions reached in this study are that:

- The east gyro drift rate and to a lesser extent the north gyro drift rate, changes with vehicle heading. Whether or not this change is systematic in nature is unknown
- Accelerometer/stable element thermal transients are potentially a significant source of degradation in the deflection change measurements
- The ultimate deflection recovery capability of the present RGSS when properly employed may be 0.5 to 1 $\widehat{\text{sec}}$ RMS
- The ultimate deflection recovery capability of the present RGSS is not determinable due to the presence of accelerometer noise and error in the reference deflection values used to assess system performance.

SECTION V

RECOMMENDATIONS

The results of this interim study lead to the following recommendations for improving and further assessing system performance:

- Provide reference values of the deflections at the points in those runs where no error analysis of the measurement data was possible to determine if the interim conclusions drawn above remain valid.
- Determine through careful and repeated measurements whether or not the change in level gyro drift rate with vehicle heading change is systematic in nature.
- Determine through testing whether or not an initial extended duration (several hours) thermal transient in the level accelerometer bias or sensing axis direction exists and if so whether or not this effect can be systematically related to ambient temperature.
- Determine through testing the noise characteristic of level axes (A200D) accelerometers and the presence of any bias shift due to platform case heading change. Alternatively, A1000 accelerometers with a demonstrated low noise characteristic could be installed in the level axes, reducing this source of uncertainty in the data analysis. Other factors as thermal and vibration sensitivity will also have to be reviewed in this latter case.
- Select a pair of gyros with particularly low random drift characteristics for replacement of the present RGSS gyros - in particular the east-azimuth gyro which appears to be the noisiest of the present pair.
- Perform any further testing of the RGSS in an area where the deflection values are more precisely known such that this source of uncertainty in the data analysis can be reduced.

APPENDIX A OPTIMAL SMOOTHING OF INTEGRATED EXPONENTIALLY-CORRELATED NOISE

Change in platform tilt relative to the mathematical figure of the earth employed in the inertial system navigation equations can be in part characterized as the integral of a correlated noise representing the gyro drift. Such a system is expressed mathematically as:

$$\frac{d}{dt}[x] = Ax + \xi$$

$$x = \begin{bmatrix} \phi \\ d \end{bmatrix}, \quad \xi = \begin{bmatrix} 0 \\ \epsilon \end{bmatrix}$$

$$A = \begin{bmatrix} 0 & 1 \\ 0 & -\alpha \end{bmatrix}$$

$$E[\epsilon(\mu) \epsilon(\nu)] = 2\alpha \sigma_d^2 \delta(\mu - \nu)$$

ϕ is the change in platform tilt due to correlated gyro drift rate

d is the correlated gyro drift rate with variance σ_d^2 and correlation time $\tau = \alpha^{-1}$

The covariance matrix representing the statistical propagation of the above process with time is given by the solution to the following differential equation:

$$\frac{d}{dt} [\Sigma] = A\Sigma + \Sigma A^T + Q$$

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where:

$$\Sigma(0) = \begin{bmatrix} 0 & 0 \\ 0 & \sigma_d^2 \end{bmatrix}$$

$$Q = \begin{bmatrix} 0 & 0 \\ 0 & 2\alpha\sigma_d^2 \end{bmatrix}$$

The solution to this equation is:

$$\Sigma_{11}(t) = 2\sigma_d^2 \alpha^{-2} [\alpha t + \exp(-\alpha t) - 1]$$

$$\Sigma_{12}(t) = \sigma_d^2 \alpha^{-1} [1 - \exp(-\alpha t)]$$

$$\Sigma_{22}(t) = \sigma_d^2$$

Observation of the tilt change after a time interval $t = T$, offers the opportunity to estimate the prior history of the tilt change and the correlated gyro drift rate via optimal smoothing. The estimates of these states obtained via optimal smoothing assuming a perfectly observed tilt change are:

$$x_s(t|T) = \begin{bmatrix} \phi(t|T) \\ d(t|T) \end{bmatrix} = \begin{bmatrix} \phi(T) \\ D \end{bmatrix} \begin{bmatrix} [2\alpha t + \exp(-\alpha t) - 1 + \exp(-\alpha T)][1 - \exp(\alpha T)] \\ [\alpha[2 - \exp(-\alpha T) - \exp(\alpha(T - T))]] \end{bmatrix}$$

where:

$\phi(T)$ is the tilt change observed at $t = T$

$$D \triangleq 2[\alpha T - 1 + \exp(-\alpha T)]$$

The solution for the covariance matrix for the adjoint vector of the above process is expressed:

$$\Lambda_{11}(t) = \left[\frac{1}{\Sigma_{11}(T)} \right]$$

$$\Lambda_{12}(t) = \left[\frac{[1 - \exp(\alpha(t - T))]}{\alpha \Sigma_{11}(T)} \right]$$

$$\Lambda_{22}(t) = \left[\frac{[1 - \exp(\alpha(t - T))]^2}{\alpha^2 \Sigma_{11}(T)} \right]$$

The covariance matrix $\Sigma_s(t|T)$, of the errors $\delta x(t)$, in the smoothed estimates $x_s(t|T)$, of the state vector $x(t)$, is given by

$$\Sigma_s(t|T) = E[\delta x(t) \delta x(t)] = [I - \Sigma(t) \Lambda(t)] \Sigma(t)$$

Plots of the (1σ) values of the error in the smoothed estimates are given in normalized form in the graphs below for a number time intervals, T . Also shown for reference in Figs. A.1 and A.2 is the (1σ) values of the tilt change prior to smoothing.

Inspection of the curves for the normalized (1σ) value of the error in the integrated correlated noise after smoothing indicates that they are approximated by parabolas of the form:

$$\left[\frac{\sigma_{\phi_s}}{\tau \sigma_d} \right] \approx \left[\frac{\sigma_{\phi_s}(\max)}{\tau \sigma_d} \right] \left[\frac{t}{n\tau} \right] \left[1 - \left(\frac{t}{n\tau} \right) \right] = 4k t^* (1 - t^*)$$

where:

$$k \triangleq \left[\frac{\sigma_{\phi_s}(\max)}{\tau \sigma_d} \right]$$

is the normalized maximum (1σ) value of the error in the smoothed estimate of the correlated noise which occurs at the mid-point of the time interval ($t = 0.5 n\tau$)

$$t^* \triangleq \left[\frac{t}{n\tau} \right]$$

is the normalized mission time

Note as n increases the parabolas become circular arcs.

The time RMS of the error in the smoothed estimate defined as:

$$\overline{\sigma_{\phi_s}} \triangleq \left[\frac{1}{T} \int_0^T \sigma_{\phi_s}^2 dt \right] = 4k\tau\sigma_d \left[\int_0^1 [t^*(1 - t^*)]^2 dt^* \right]^{1/2}$$

is:

$$\overline{\sigma_{\phi_s}} = [\sigma_{\phi_s}(\max)] \sqrt{\frac{8}{15}} \approx 0.73 \sigma_{\phi_s}(\max)$$

To illustrate use of the figures consider the case where:

$$\sigma_d = 0.001^\circ/\text{hr}$$

$$\left. \begin{array}{l} \tau = 2 \text{ hours} \\ T = 2 \text{ hours} \end{array} \right\} n = 1$$

Employing the curve for $n = 1$ yields:

$$k \approx 0.17$$

Hence:

$$\sigma_{\phi_s} \approx 0.9 \widehat{\text{sec}}$$

and

$$\sigma_{\phi_s} (\text{max}) \approx 1.2 \widehat{\text{sec}}$$

Figure A-1. Normalized Error (1σ) in the Smoothed Estimates of Integrated Correlated Noise Versus Normalized Running Time with Normalized Total Time of Integration as a Parameter.

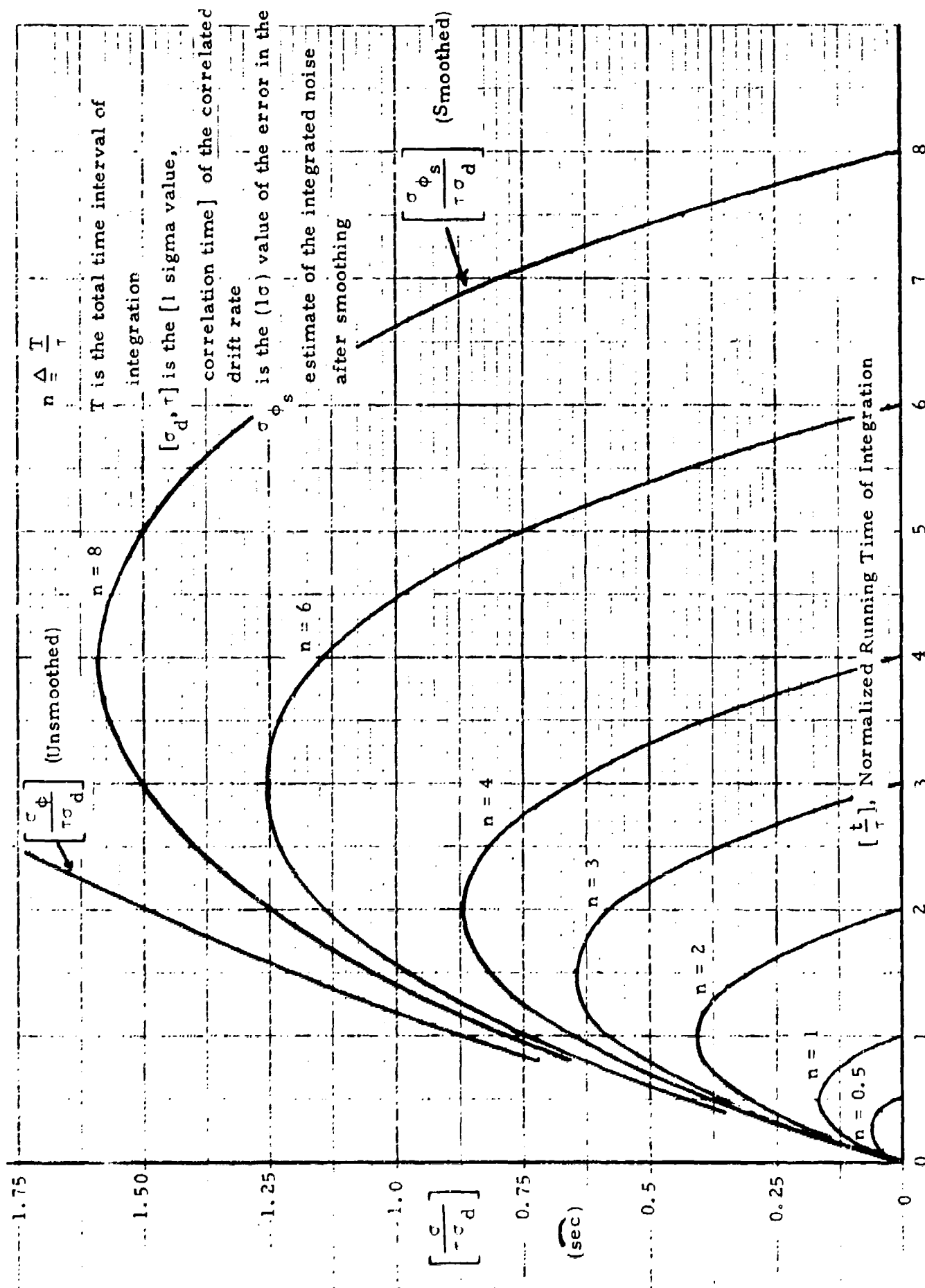


Figure A-2. Normalized Error (1 σ) in the Smoothed Estimates of Integrated Correlated Noise Versus Normalized Running Time with Normalized Total Time of Integration as a Parameter

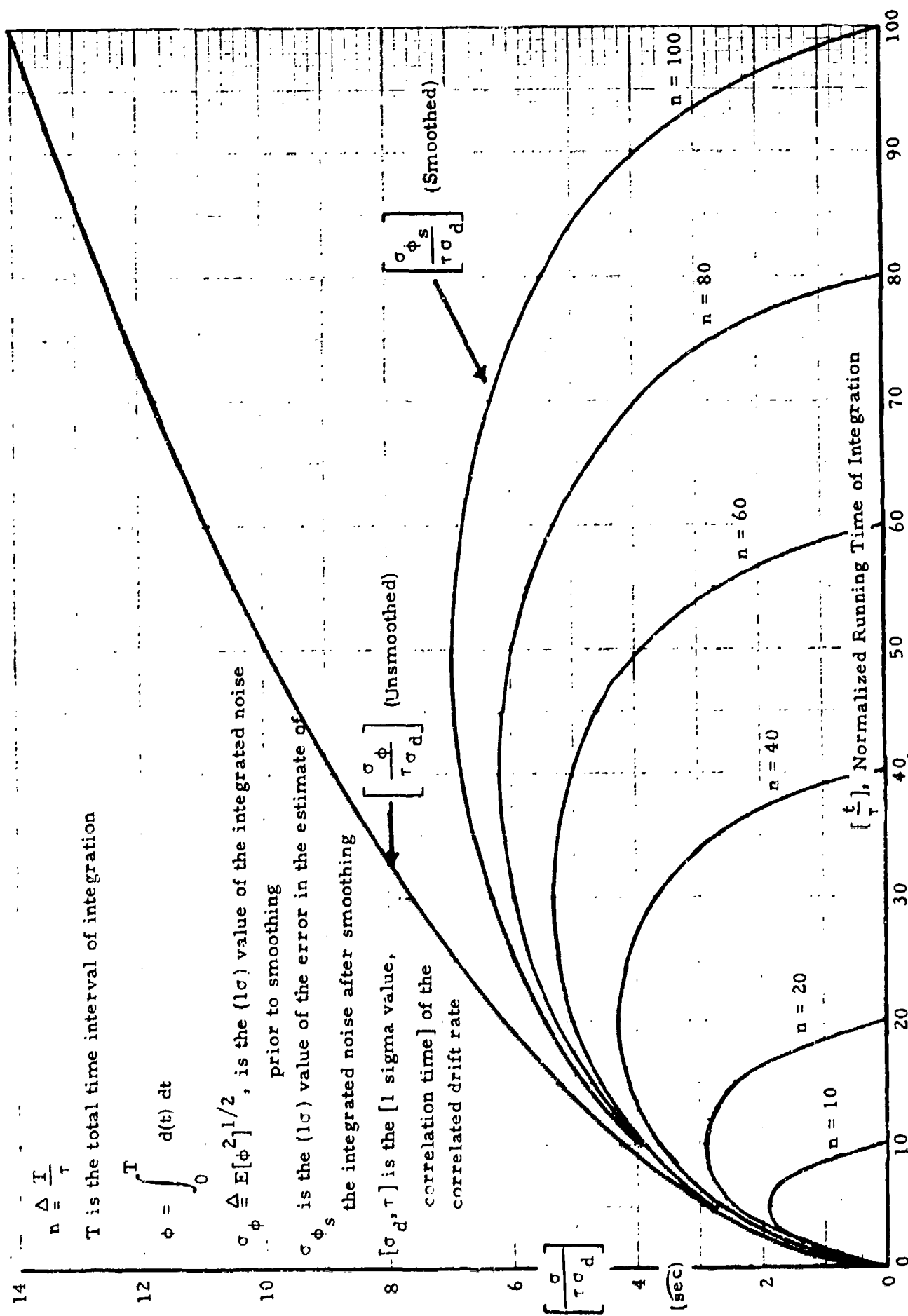
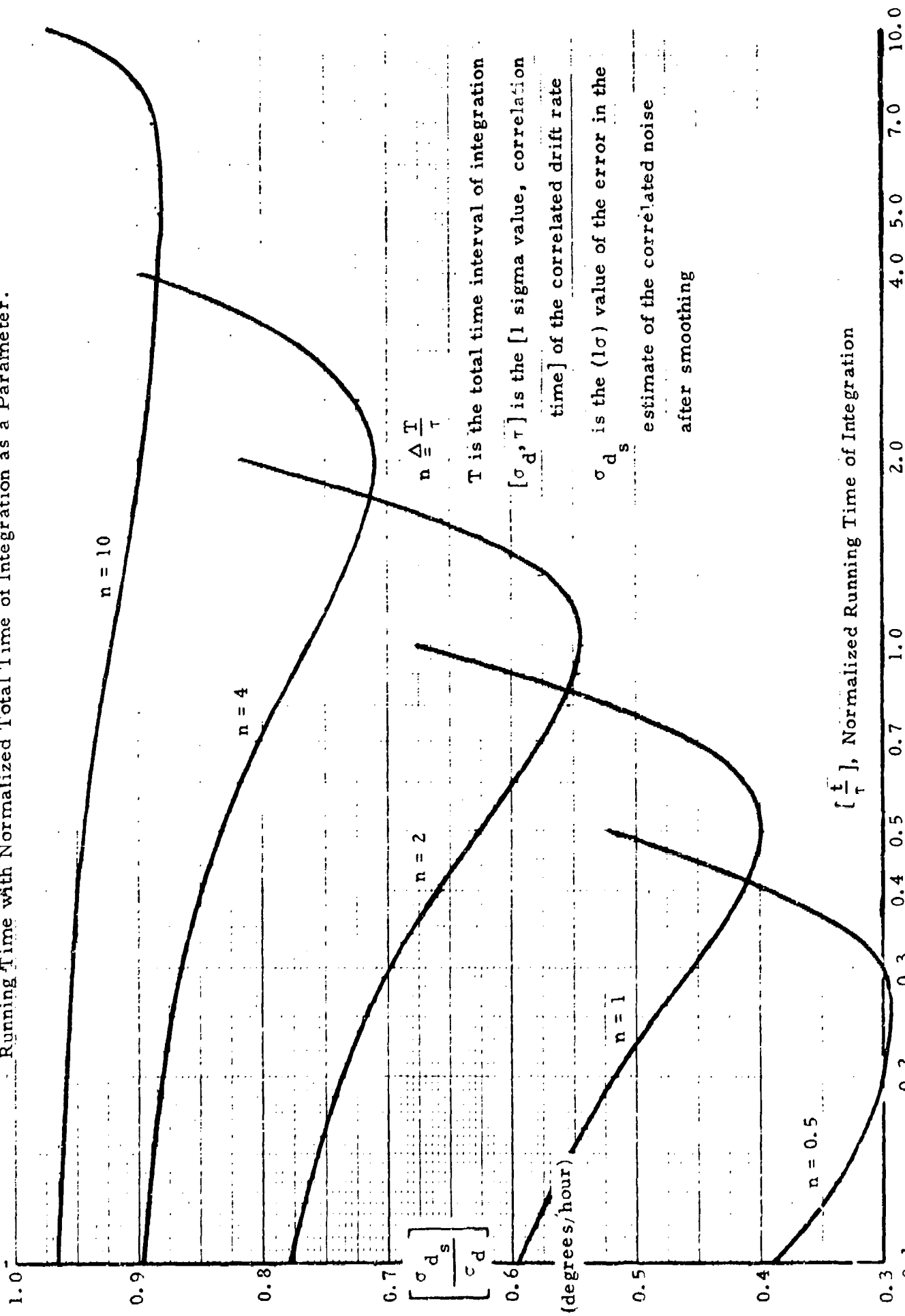


Figure A-3. Normalized Error (1σ) in the Smoothed Estimates of Correlated Noise Versus Normalized Running Time with Normalized Total Time of Integration as a Parameter.



$$\left[\frac{\sigma_{ds}}{\sigma_d} \right]$$

$$n = \frac{\Delta T}{\tau}$$

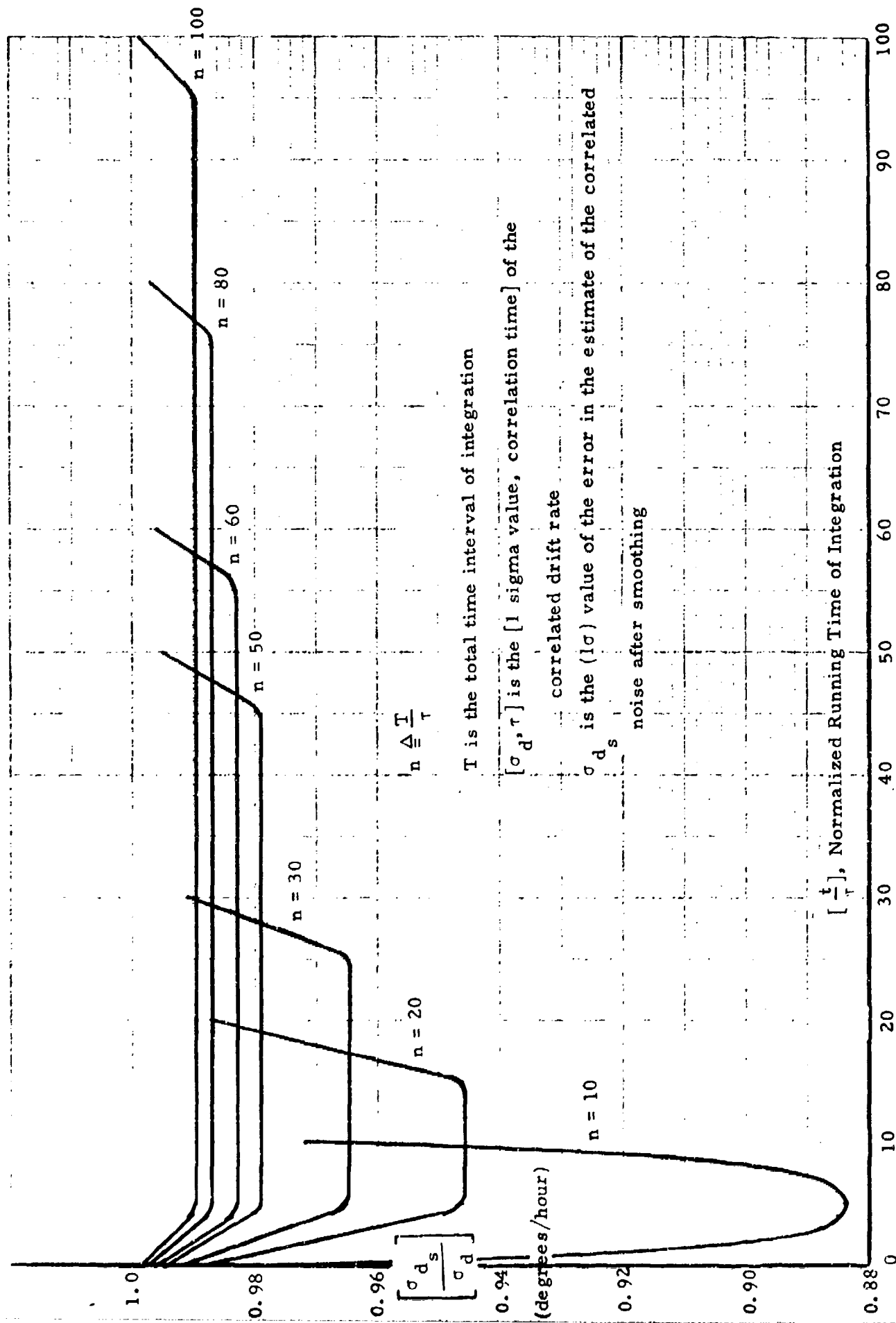
T is the total time interval of integration

$[\sigma_d, \tau]$ is the $[1 \text{ sigma value, correlation time}]$ of the correlated drift rate

σ_{ds} is the (1σ) value of the error in the estimate of the correlated noise after smoothing

$\left[\frac{t}{\tau} \right]$, Normalized Running Time of Integration

Figure A-4. Normalized Error (1σ) in the Smoothed Estimates of Correlated Noise Versus Normalized Running Time with Normalized Total Time of Integration as a Parameter



APPENDIX B

REFERENCE VALUES FOR THE VERTICAL DEFLECTION COMPONENTS AND THE FREE-AIR GRAVITY ANOMALY

All of the individual reference points where data was recorded during the 17 missions are included in Table B-1. In addition to the reference point name, a station identification number was assigned when data was marked and recorded on the cassette. Several of the stations received numerous ID numbers, as noted in Table B-1. All of the reference vertical deflection component values and free-air gravity anomaly values are the best known values provided to Litton. At the time of publication, the following updated values to N-S and E-W deflection were obtained. The old values noted below were used in the analysis of the data.

Station Name	N-S (ξ)		E-W (η)	
	Old	New	Old	New
OASIS	-2.3	-2.0	10.1	10.02
OTERO ECC	-1.2	-1.18	4.6	4.61
SANDS SW BASE	No Change		-1.69	-2.08
MORGAN	-4.3	-4.31	No Change	
EAST	-1.3	-1.31	-8.3	-8.26

TABLE B-1
THE NORTH-SOUTH AND EAST-WEST DEFLECTION OF THE VERTICAL
AND FREE AIR GRAVITY ANOMALY REFERENCE VALUES GIVEN FOR
THE DATA POINTS USED AT THE WHITE SANDS TEST COURSE

Station Name	Station ID Number	Ref. N-S(5) Deflection (Arc-sec)	Ref. E-W(7) Deflection (Arc-sec)	Reference Free Air Gravity Anomaly Values (milligals)	Zenith Camera Station ¹
TULAROSA S.B.	1	-2.77	14.97		
OASIS	2/27	-2.0	10.02	-18.1	
RHODES	3/201	-1.33	9.33		
VALLEY ASTRO	4/202/29	-1.64	6.56	-33.3	
SALT	5/31	-1.99	4.87	-47.3	
WC-50	6/1/203	-4.29	-1.46		
4F053	7	-6.55	-5.44		
Q-43	8	-7.47	-8.86	-35.2	
HANFORD	9	-9.37	-10.89		
LAURA CENTER	2	-2.93	-5.08		
GUN	3	-1.88	-6.83		
SHOT	4	-0.58	-6.15		
D-3-1/2	5	1.46	-8.16		yes
NW-30	6	0.98	-8.56	-22.7	
D-3	7	0.34	-8.99	5.6	
SEE HORN	8	1.67	-7.38	4.9	yes
GERI	9	1.65	-6.37		
NICK 2	10	-1.40	-8.16		
BRYCE	11	-1.14	-11.07		
WHITE	12	-4.08	-10.35	-21.7	yes
FRY	13	-6.78	-8.37		
CARMEN	14	-6.53	-7.64		
CONN	15	-6.31	-5.64		
IPS-1	1			-22.2	
MOTEL	2				
SANDS N.E. BASE	3	-0.96	6.39		
OTERO AZ ECC	4				
OTERO ECC	5	-1.18	4.61	-26.3	
V-321	6				
ADD ECC	7	-2.28	2.55		
IPS-2	8				
C-322	9				
SANDS S.W. BASE	10	-4.44	-2.08	-41.2	
TRAVES	11	-5.27	3.0		
MORGAN	12	-4.31	-6.89		
EASY	13	-1.31	-8.26		yes
BEASLEY	2001	-0.4	-0.35	-43.0	
Z-335	2002			-42.24	

APPENDIX C

OFF-LINE SMOOTHER ESTIMATES OF CHANGE AND ERRORS IN THE CHANGE OF THE VERTICAL DEFLECTION COMPONENTS

Contained in this Appendix are the computer printouts for each original and modified mission as generated by the off-line smoother. They are presented in alpha-numerical order. From the observed error in the estimate of the change in the deflection of the vertical at the mission closure, estimates of platform drift rates (E, N, Z) are generated by the smoother and are printed at the top of each table. These are the estimates used to smooth the real time estimates of change in the deflection (DE and DN) which are recorded at the marks throughout the mission and are listed in the third and fourth data columns. The next two columns (5 and 6) contain the estimate from the smoother of the real time estimate of change in deflection of the vertical due to the above computed platform drift rate estimates. Columns 7 and 8 are the smoothed estimate of change, which is generated by correcting the real-time estimate with the estimated contribution due to platform drift rate obtained from the smoother.

For missions where sufficient reference data was available, columns 9 through 12 are included. Columns 9 and 10 contain the reference value of change for the deflections of the vertical and Columns 11 and 12 show the resulting error between the smoothed estimate of change and the reference value of change. The RMS value of the differences in columns 11 and 12 are shown at the bottom of the columns, respectively.

GYRO-DRIFT RATE EST. VALUES (N,Z) (DEGREES/HOUR)
 2.36424F-03 1.25784F-03-1.46629E-04

RUN #1

IN NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S (ARC-SEC)	E-W (DHR)	N-S (ARC-SEC)	E-W (DHR)	N-S (ARC-SEC)	E-W (DHR)
10003.	0.	0.0	0.0	0.0	0.0	0.0	0.0
4.	550.	-5.783E-01	-1.050E 00	-1.304E 00	6.771E-01	7.295E-01	-1.727E 00
5.	839.	-2.639E 00	-5.874E-01	-2.003E 00	1.022E 00	-6.359E-01	-1.610E 00
6.	1356.	-3.750E 00	-2.179E 00	-3.253E 00	1.618E 00	-4.961E-01	-3.798E 00
7.	1782.	-6.055E 00	-3.328E 00	-4.294E 00	2.091E 00	-1.761E 00	-5.419E 00
8.	2184.	-8.575E 00	-4.668E 00	-5.281E 00	2.521E 00	-3.294E 00	-7.189E 00
9.	2596.	-1.015E 01	-5.409E 00	-6.297E 00	2.945E 00	-3.856E 00	-8.354E 00
10.	2984.	-1.289E 01	-6.211E 00	-7.258E 00	3.329E 00	-5.628E 00	-9.540E 00
11.	3411.	-1.356E 01	-7.112E 00	-8.320E 00	3.735E 00	-5.243E 00	-1.085E 01
12.	4773.	-1.422E 01	-1.033E 01	-1.172E 01	4.909E 00	-2.503E 00	-1.524E 01
13.	5726.	-1.203E 01	-7.559E 00	-1.409E 01	5.622E 00	2.062E 00	-1.318E 01
202001.	7173.	-1.711E 01	-2.795E-01	-1.767E 01	6.535E 00	5.653E-01	-6.815E 00
22001.	7225.	-1.725E 01	-1.611E-01	-1.780E 01	6.564E 00	5.502E-01	-6.725E 00

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
 3.11496E-03 8.03454E-04 -7.28749E-05

RUN #1A

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME CST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(ARC-SEC)	(DHR)	N-S	E-W
10003.	0.	0.0	0.0	0.0	0.0	0.0	0.0
4.	550.	-5.783E-01	-1.050E 00	-1.717E 00	4.229E-01	1.139E 00	-1.473E 00
5.	839.	-2.639E 00	-5.874E-01	-2.625E 00	6.308E-01	-1.425E-02	-1.218E 00
6.	1356.	-3.750E 00	-2.179E 00	-4.249E 00	9.757E-01	4.992E-01	-3.155E 00
7.	1782.	-6.055E 00	-3.328E 00	-5.593E 00	1.235E 00	-4.627E-01	-4.563E 00
8.	2184.	-8.575E 00	-4.668E 00	-6.860E 00	1.460E 00	-1.715E 00	-6.128E 00
9.	2596.	-1.011E 01	-5.409E 00	-8.158E 00	1.668E 00	-1.995E 00	-7.077E 00
20010.	2984.	-1.289E 01	-6.211E 00	-9.381E 00	1.846E 00	-3.505E 00	-8.057E 00

6YRU-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
 1.99407F-03 1.26810E-03-6.65542E-05

RUN #1B

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DHR)	(ARC-SEC)	N-S	E-W
10010.	0.	0.0	0.0	0.0	0.0	0.0	0.0
11.	427.	-6.768E-01	-9.001E-01	-8.134E-01	5.346E-01	1.367E-01	-1.435E 00
12.	1789.	-1.335E 00	-4.114E 00	-3.455E 00	2.147E 00	2.130E 00	-6.261E 00
13.	2742.	8.539E-01	-1.348E 00	-5.362E 00	3.190E 00	6.216E 00	-4.537E 00
202001.	4190.	-4.220E 00	5.932E 00	-8.284E 00	4.636E 00	4.064E 00	1.296E 00
22001.	4241.	-4.362E 00	6.050E 00	-8.389E 00	4.684E 00	4.028E 00	1.366E 00

RUN #2(1)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
 1.73558E-03 1.77401E-03-1.03266E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
12018.	0.	0.0	0.0	0.0	0.0	0.0	0.0
102018.	72.	-2.079E-01	-9.512E-03	-1.254E-01	1.278E-01	-8.243E-02	-1.374E-01
2019.	905.	-3.549E-01	-1.092E 00	-1.600E 00	1.578E 00	1.245E 00	-2.669E 00
2020.	1292.	-1.045E 00	-2.399E 00	-2.301E 00	2.234E 00	1.256E 00	-4.633E 00
2049.	1549.	-1.840E 00	-2.302E 00	-2.772E 00	2.665E 00	9.317E-01	-4.966E 00
2021.	1951.	-1.857E 00	-3.967E 00	-3.517E 00	3.330E 00	1.661E 00	-7.297E 00
2022.	2251.	-3.191E 00	-3.741E 00	-4.079E 00	3.818E 00	8.982E-01	-7.559E 00
2023.	2603.	-3.649E 00	-4.462E 00	-4.744E 00	4.382E 00	1.075E 00	-8.844E 00
2031.	3079.	-3.071E 00	-4.144E 00	-5.653E 00	5.131E 00	2.583E 00	-9.274E 00
3032.	3329.	-3.921E 00	-3.457E 00	-6.135E 00	5.517E 00	2.214E 00	-8.974E 00
2033.	3638.	-5.007E 00	-2.273E 00	-6.735E 00	5.989E 00	1.728E 00	-8.262E 00
2034.	4019.	-5.045E 00	-2.054E 00	-7.478E 00	6.559E 00	2.432E 00	-8.614E 00
2035.	4351.	-6.430E 00	-2.116E 00	-8.130E 00	7.048E 00	1.701E 00	-9.164E 00
2007.	4837.	-7.717E 00	-4.115E-01	-9.091E 00	7.748E 00	1.375E 00	-8.160E 00
2006.	5081.	-8.529E 00	4.510E-01	-9.576E 00	8.093E 00	1.047E 00	-7.642E 00
2005.	5335.	-7.733E 00	9.029E-01	-1.008E 01	8.447E 00	2.350E 00	-7.454E 00
2004.	5587.	-8.508E 00	8.482E-01	-1.059E 01	8.793E 00	1.988E 00	-7.945E 00
2003.	5837.	-9.734E 00	1.994E 00	-1.104E 01	9.131E 00	1.353E 00	-7.137E 00
2002.	6073.	-9.102E 00	2.239E 00	-1.150E 01	9.447E 00	2.369E 00	-7.208E 00
202051.	6454.	-1.040E 01	1.696E 00	-1.229E 01	9.921E 00	1.890E 00	-8.225E 00
22001.	6486.	-1.085E 01	1.792E 00	-1.239E 01	9.998E 00	1.541E 00	-8.196E 00

GYRO-DRIFT RATE EST. VALUES(E+N*2) (DEGREES/HOUR)

1.51308F-03 1.43802E-03-5.66247E-05

RUN #2(1)A

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO UNIT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DHR) (ARC-SEC)	(DHR) (ARC-SEC)	N-S	E-W
12018.	0.	0.0	0.0	0.0	0.0	0.0	0.0
102018.	72.	-2.079E-01	-9.512E-03	-1.093E-01	1.036E-01	-9.853E-02	-1.131E-01
2019.	905.	-3.549E-01	-1.092E 00	-1.393E 00	1.277E 00	1.038E 00	-2.369E 00
2020.	1292.	-1.045E 00	-2.399E 00	-2.001E 00	1.608E 00	9.557E-01	-4.206E 00
2049.	1545.	-1.840E 00	-2.302E 00	-2.409E 00	2.155E 00	5.688E-01	-4.457E 00
2021.	1751.	-1.857E 00	-3.967E 00	-3.055E 00	2.691E 00	1.198E 00	-6.658E 00
2022.	2251.	-3.181E 00	-3.741E 00	-3.549E 00	3.085E 00	3.594E-01	-6.825E 00
2023.	2603.	-3.669E 00	-4.402E 00	-4.115E 00	3.539E 00	4.454E-01	-8.000E 00
2031.	3079.	-3.071E 00	-4.144E 00	-4.899E 00	4.140E 00	1.828E 00	-8.233E 00
3032.	3329.	-3.921E 00	-3.457E 00	-5.314E 00	4.450E 00	1.393E 00	-7.937E 00
2033.	3638.	-5.007E 00	-2.273E 00	-5.830E 00	4.828E 00	8.234E-01	-7.101E 00
2034.	4019.	-5.045E 00	-2.054E 00	-6.469E 00	5.285E 00	1.424E 00	-7.339E 00
22035.	4351.	-6.430E 00	-2.116E 00	-7.029E 00	5.675E 00	5.996E-01	-7.791E 00

RUN #2(1)B

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
2.41894E-03 2.07905E-03-4.18371E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DHR)	(ARC-SEC)	N-S	E-W
12035.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2007.	486.	-1.287E 00	1.704E 00	-1.185E 00	9.993E-01	-1.020E-01	7.048E-01
2006.	730.	-2.099E 00	2.566E 00	-1.787E 00	1.493E 00	-3.122E-01	1.074E 00
2005.	984.	-1.303E 00	3.108E 00	-2.418E 00	2.000E 00	1.115E 00	1.109E 00
2004.	1236.	-2.169E 00	2.964E 00	-3.049E 00	2.497E 00	8.806E-01	4.666E-01
2003.	1486.	-3.304E 00	4.110E 00	-3.679E 00	2.984E 00	3.748E-01	1.125E 00
2002.	1722.	-2.762E 00	4.354E 00	-4.277E 00	3.439E 00	1.515E 00	9.156E-01
202001.	2083.	-3.968E 00	3.812E 00	-5.200E 00	4.123E 00	1.232E 00	-3.118E-01
22001.	2195.	-4.422E 00	3.907E 00	-5.335E 00	4.220E 00	9.108E-01	-3.135E-01

RUN #2(2)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
1.91883F-03 2.91882F-03-1.30538E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHRS) (ARC-SEC)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DDHR) (ARC-SEC)		SMOOTHED EST. OF CHANGE (DHRS) (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W
12001.	0.	0.0	0.0	0.0	0.0	0.0	0.0
13.	1924.	-6.410E 00	1.464E 00	-3.905E 00	5.473E 00	-2.511E 00	-4.008E 00
12.	2027.	-1.172E 01	1.761E 00	-5.429E 00	7.396E 00	-6.293E 00	-5.635E 00
11.	3597.	-1.489E 01	7.198E 00	-7.606E 00	9.982E 00	-7.284E 00	-2.783E 00
10.	3937.	-1.525E 01	4.703E 00	-8.386E 00	1.087E 01	-6.862E 00	-2.165E 00
9.	4307.	-1.548E 01	1.070E 01	-9.249E 00	1.182E 01	-6.232E 00	-1.118E 00
8.	4601.	-1.461E 01	1.248E 01	-1.006E 01	1.272E 01	-4.528E 00	-2.368E-01
7.	4991.	-1.501E 01	1.492E 01	-1.087E 01	1.355E 01	-4.143E 00	1.370E 00
6.	5345.	-1.451E 01	1.702E 01	-1.172E 01	1.443E 01	-2.794E 00	2.595E 00
5.	6019.	-1.628E 01	2.081E 01	-1.335E 01	1.607E 01	-2.925E 00	4.747E 00
4.	6257.	-1.599E 01	2.175E 01	-1.394E 01	1.663E 01	-2.054E 00	5.113E 00
20003.	6841.	-1.595E 01	2.478E 01	-1.536E 01	1.800E 01	-5.716E-01	6.777E 00

GYRO-DRIFT RATE EST. VALUES(E,N,2) (DEGREES/HOUR) RUN #2(2)A
 2.65859F-03 4.74915E-03-8.96300E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DMH) (ARC-SEC)	EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DMH) (ARC-SEC)	SMOOTHED EST. OF CHANGE (DMS) (ARC-SEC)	
		N-S E-W	N-S E-W	N-S E-W	
12001.	0.	0.0	0.0	0.0	
13.	1924.	-6.416E 00	1.464E 00	5.093E 00	-1.109E 00 -3.629E 00
12.	2627.	-1.172E 01	1.761E 00	6.852E 00	-4.393E 00 -5.091E 00
11.	3597.	-1.489E 01	7.198E 00	9.189E 01	-4.712E 00 -1.990E 00
20010.	3937.	-1.525E 01	8.703E 01	9.982E 01	-4.060E 00 -1.278E 00

RUN #2(2)B

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
1.2N301F-03 2.80299E-03-3.35319E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DDHR)		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	N-S	E-W	N-S	E-W
10010.	0.	0.0	0.0	0.0	0.0	0.0	0.0
9.	370.	-2.308E-01	1.999E 00	-4.823E-01	1.034E 00	2.515E-01	9.657E-01
8.	724.	6.404E-01	3.781E 00	-9.570E-01	2.016E 00	1.598E 00	1.765E 00
7.	1054.	2.406E-01	6.217E 00	-1.413E 00	2.926E 00	1.653E 00	3.291E 00
6.	1408.	7.406E-01	8.319E 00	-1.913E 00	3.895E 00	2.654E 00	4.424E 00
5.	2082.	-1.027E 00	1.211E 01	-2.902E 00	5.721E 00	1.075E 00	6.387E 00
4.	2320.	-7.396E-01	1.304E 01	-3.261E 00	6.360E 00	2.521E 00	6.683E 00
20003.	2904.	-7.004E-01	1.608E 01	-4.165E 00	7.912E 00	3.465E 00	8.166E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
2.38041F-03 3.80510E-03-2.55027E-04

RUN #3

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	(DHR)	(ARC-SEC)	N-S	E-W	N-S	E-W	N-S	E-W
10001.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.748E-01	-2.086E-01
100001.	82.	-5.730E-01	1.037E-01	-1.961F-01	3.123E-01	-3.768E-01	-2.086E-01	0.0	0.0	-1.295E 00	-1.953E 00
2.	1113.	-3.575E 00	-2.644E 00	-2.750E 00	4.175E 00	-8.249E-01	-6.923E 00	4.700E-01	-4.870E 00	-3.687E 00	-2.151E 00
3.	2145.	-7.716E 00	1.427E-01	-5.664E 00	7.934E 00	-2.247E 00	-7.791E 00	1.440E 00	-5.640E 00	-4.485E 00	-2.987E 00
4.	2999.	-1.115E 01	-4.392E-01	-7.830E 00	1.096E 01	-3.355E 00	-1.140E 01	1.130E 00	-9.410E 00	-1.010E 01	-4.955E 00
5.	3718.	-1.406E 01	-1.201E 00	-9.888E 00	1.344E 01	-4.175E 00	-1.464E 01	7.800E-01	-1.010E 01	-6.299E 00	-5.010E 00
6.	5355.	-2.261E 01	-2.574E 00	-1.474E 01	1.887E 01	-7.819E 00	-2.144E 01	-1.520E 00	-1.643E 01	-5.526E 00	-4.275E 00
7.	6391.	-2.732E 01	-2.553E 00	-1.802E 01	2.213E 01	-9.306E 00	-2.469E 01	-3.780E 00	-2.041E 01	-3.478E 00	-9.484E-01
8.	7691.	-3.035E 01	-1.230E 00	-2.217E 01	2.604E 01	-8.178E 00	-2.727E 01	-4.700E 00	-2.383E 01	-6.600E 00	-2.586E 01
0.	9493.	-3.565E 01	4.286E 00	-2.806E 01	3.109E 01	-7.590E 00	-2.681E 01	-6.600E 00	-2.586E 01	-6.600E 00	-2.586E 01
200009.	9584.	-3.505E 01	5.378E 00	-2.836E 01	3.134E 01	-6.685E 00	-2.596E 01	-6.600E 00	-2.586E 01	-1.280E-02	3.397E-02
20009.	9642.	-3.517E 01	5.669E 00	-2.856E 01	3.149E 01	-6.613E 00	-2.583E 01	-6.600E 00	-2.586E 01	3.610E 00	2.925E 00

RMS FOR 11 POINTS: 3.610E 00 2.925E 00

RUN #3A

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

3.82262F-03 2.66834F-03-1.16524F-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DIFF		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SFC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	F-W	N-S	F-W	N-S	F-W	N-S	F-W	N-S	F-W
10001.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.545F-01	-1.150E-01
10001.	82.	-5.730E-01	1.037E-01	2.197E-01	-2.595F-01	-1.150E-01	-1.150E-01	4.700E-01	-4.870F 00	2.752E-01	-6.532E-01
2.	1113.	-3.575E 00	-2.649E 00	2.875E 00	7.452E-01	-5.523F 00	-5.523F 00	1.440E 00	-5.640F 00	-7.207F-01	4.157E-01
3.	2145.	-7.716E 00	1.427E-01	5.367E 00	7.103E-01	-5.224F 00	-5.224F 00	1.130E 00	-8.410E 00	-4.349F-01	6.701E-01
4.	2999.	-1.119E 01	-4.392E-01	7.301E 00	6.951E-01	-7.740F 00	-7.740F 00	7.800E-01	-1.010F 01	-2.811E-02	6.274E-02
20005.	3718.	-1.406E 01	-1.201E 00	8.836E 00	7.519E-01	-1.004F 01	-1.004F 01	4.160F-01	5 POINTS:	4.617E-01	4.617E-01

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
 1.87960E-03 4.96659E-03 -1.15130E-04

RUN #3B

IN NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. F-OM SMOOTHED OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUF TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	(DHR)	(ARC-SEC)	N-S	E-W	N-S	E-W	N-S	E-W
10005.	0.	0.0	0.0	0.0	0.0	0.0	0.0	-2.300E 00	-6.330E 00	-2.948E 00	-1.597E 00
5.	1637.	-8.545E 00	-1.373E 00	-3.297E 00	6.554E 00	-5.248E 00	-7.927E 00	-4.560E 00	-1.031E 01	-3.105E 00	-1.626E 00
7.	2673.	-1.320E 01	-1.352E 00	-5.595E 00	1.058E 01	-7.665E 00	-1.194E 01	-5.480E 00	-1.373E 01	-2.120E 00	-1.802E 00
8.	3473.	-1.629E 01	-2.944E-02	-8.648E 00	1.550E 01	-7.600E 00	-1.553E 01	-7.380E 00	-1.576E 01	-8.977E-01	-7.946E-01
0.	5775.	-2.159E 01	5.487E 00	-1.331E 01	2.204E 01	-9.278E 00	-1.645E 01	-7.380E 00	-1.576E 01	-5.075E-02	-2.547E-02
200009.	5866.	-2.099E 01	4.579E 00	-1.356E 01	2.274E 01	-7.431E 00	-1.579E 01	-7.380E 00	-1.576E 01	-1.464E-02	6.063E-02
200009.	5924.	-2.111E 01	6.870E 00	-1.371E 01	2.257E 01	-7.395E 00	-1.570E 01	-7.380E 00	-1.576E 01	1.985E 00	1.230E 00

RMS FOR 6 POINTS: 1.985E 00 1.230E 00

GYRO-DRIFT RATE EST. VALUES (E,N,2) (DEGREES/HOUR)
 4.73589F-03 4.6836F-04-2.80231E-04

RUN #4

IN NUMRFR	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF OF CHANGE IN REAL-TIME EST. TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W	N-S	E-W	N-S	E-W
10009.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10009.	60.	-2.099E-01	3.577E-02	-2.850E-01	2.775E-02	7.606E-02	8.025E-03	0.0	2.030E 00	7.606E-02	8.025E-03
8.	1049.	-3.428E 00	1.779E 00	-4.983E 00	3.854E-01	1.555E 00	1.394E 00	1.000E 00	2.030E 00	-3.452E-01	-6.362E-01
7.	2035.	-8.016E 00	4.144E 00	-9.676E 00	5.571E-01	1.660E 00	3.587E 00	2.820E 00	5.450E 00	-1.160E 00	-1.863E 00
6.	3131.	-1.043E 01	7.736E 00	-1.487E 01	5.313E-01	4.446E 00	7.204E 00	5.080E 00	9.430E 00	-6.341E-01	-2.226E 00
5.	4105.	-1.243E 01	1.329E 01	-1.945F 01	3.183E-01	7.017E 00	1.297E 01	7.380E 00	1.576E 01	-3.628E-01	-2.786E 00
4.	4807.	-1.481E 01	1.547E 01	-2.271E 01	5.492E-02	7.900E 00	1.541E 01	7.730E 00	1.745E 01	1.696E-01	-2.037E 00
3.	5629.	-1.843E 01	1.920E 01	-2.647E 01	-3.688E-01	8.045E 00	1.957E 01	8.040E 00	2.022E 01	4.974E-03	-6.542E-01
2.	6225.	-2.152E 01	1.951E 01	-2.916E 01	-7.528E-01	7.638E 00	2.026E 01	7.070E 00	2.099E 01	5.677E-01	-7.267E-01
20001.	7350.	-2.770E 01	2.420E 01	-3.411E 01	-1.649E 00	6.407E 00	2.585E 01	6.600E 00	2.585E 01	-1.931E-01	-1.251E-02
20001.	7476.	-2.807E 01	2.410E 01	-3.465E 01	-1.764E 00	5.585E 00	2.586E 01	6.600E 00	2.586E 01	-1.549E-02	3.418E-03

RMS FOR 10 POINTS: 4.891E-01 1.473E 00

RUN #4A

SYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
4.89024E-03-2.01673E-04-1.53211E-04

ID NUMBER	TIME (SEC)	REF. TIME EST. OF CHANGE (DHR)		EST. FROM SHOOTER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DHR)		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10009.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1000C9.	60.	-2.009E-01	3.577E-02	-2.002E-01	-1.247E-02	8.528E-02	4.824E-02	0.0	0.0	8.528E-02	4.824E-02
8.	1049.	-3.428E 00	1.779E 00	-5.126E 00	-3.188E-01	1.698E 00	2.098E 00	1.000E 00	2.030E 00	-2.024E-01	6.798E-02
7.	2035.	-8.016E 00	4.144E 00	-9.918E 00	-8.137E-01	1.902E 00	4.954E 00	2.820E 00	5.450E 00	-9.178E-01	-4.922E-01
6.	3131.	-1.043E 01	7.736E 00	-1.519E 01	-1.584E 00	4.757E 00	9.329E 00	5.090E 00	9.430E 00	-3.231E-01	-1.100E-01
20005.	4105.	-1.243E 01	1.329E 01	-1.974E 01	-2.441E 00	7.353E 00	1.575E 01	7.790E 00	1.576E 01	-2.667E-02	-6.616E-03

RMS FOR 5 POINTS: 4.462E-01 2.286E-01

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
 4.39410E-03 5.02840E-04 -1.14586E-04

RUN #45

IN NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DMS)		EST. FROM SMOOTHED OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10095.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.	702.	-2.379E-01	2.17E-01	-3.001E-01	3.007E-01	7.137E-01	1.84E-01	3.00E-01	1.69E-01	3.037E-01	1.756E-01
2.	1524.	-6.00E-01	5.00E-01	-5.71E-01	5.471E-01	7.21E-01	5.34E-01	6.40E-01	4.46E-01	6.14E-01	6.82E-01
3.	2120.	-6.00E-01	4.21E-01	-9.34E-01	6.706E-01	2.541E-01	5.547E-01	5.230E-01	5.051E-01	5.174E-01	3.174E-01
20001.	3245.	-1.527E-01	1.091E-01	-1.327E-01	7.547E-01	-9.037E-01	1.027E-01	-7.00E-01	1.010E-01	-2.137E-01	9.984E-02
20001.	3371.	-1.543E-01	1.091E-01	-1.402E-01	6.050E-01	-9.10E-01	1.011E-01	-7.00E-01	1.010E-01	-3.042E-02	1.142E-02

RMS FOR 5 POINTS: 3.169E-01 4.290E-01

GYRO-DRIFT RATE EST. VALUES (N, Z) (DEGREES/HOUR):
 -2.96471E-03 -2.07011E-03 1.25307E-04

RTRK #5A

IO NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		DEF. VALUE OF CHANGE ERROR IN DEFL. CHANGE	
		N-S	E-W	(DHR)	(ARC-SEC)	N-S	E-W	N-S	E-W
10001.	0.	0.0	0.0	0.0	0.0	0.0	0.0	-1.255E-01	0.900E-02
10001.	52.	2.613E-02	-1.622E-02	1.516E-01	-1.070E-01	-1.255E-01	0.900E-02	0.0	0.0
2.	1067.	4.007E 00	-5.369E 00	3.147E 00	-2.142E 00	5.594E-01	-3.227E 00	4.700E-01	-0.075E 00
3.	1825.	6.543E 00	-7.329E 00	5.435E 00	-3.582E 00	1.100E 00	-3.727E 00	1.640E 00	-5.040E 00
4.	2559.	9.320E 00	-1.193E 01	7.604E 00	-4.310E 00	1.645E 00	-7.021E 00	1.130E 00	-8.410E 00
5.	3189.	1.960E 01	-1.593E 01	9.630E 01	-5.007E 00	4.605E-01	-9.937E 00	7.804E-01	-1.013E 01
6.	4258.	1.126E 01	-2.516E 01	1.298E 01	-7.720E 00	-1.720E 00	-1.720E 00	-1.520E 00	-1.643E 01
20007.	5111.	1.168E 01	-2.045E 01	1.567E 01	-9.000E 00	-3.763E 00	-2.045E 01	-3.700E 00	-2.041E 01

RMS FOR 7 POINTS: 2.975E-01 1.155E 00

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
2.92155E-03-1.25104E-03-5.46725E-05

RUN #53

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHER EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10007.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.	856.	1.775E 00	8.953E-01	-1.732E 00	-1.113E 00	3.508E 01	2.500E 00	2.569E 00	3.900E 00	1.240E 00	-1.971E 00
5.	1803.	2.621E 00	5.719E 00	-3.540E 00	-2.394E 00	6.150E 00	0.103E 00	1.540E 00	1.031E 01	1.620E 00	-2.207E 00
4.	2454.	2.225E 00	6.490E 00	-4.819E 00	-3.322E 00	7.043E 00	1.020E 01	4.010E 00	1.200E 01	2.133E 00	-1.790E 00
3.	3176.	1.022E 00	9.447E 00	-6.135E 00	-4.328E 00	7.157E 00	1.382E 01	5.220E 00	1.477E 01	1.937E 00	-9.549E-01
2.	3805.	-7.444E-01	9.705E 00	-7.265E 00	-5.322E 00	6.510E 00	1.503E 01	4.250E 00	1.550E 01	2.259E 00	-5.134E-01
200001.	4817.	-5.040E 00	1.368E 01	-9.016E 00	-6.917E 00	3.577E 00	2.040E 01	3.750E 00	2.041E 01	1.967E-01	1.806E-01
20001.	4869.	-5.371E 00	1.339E 01	-9.103E 00	-7.000E 00	3.573E 00	2.030E 01	3.780E 00	2.041E 01	-7.202E-03	-2.397E-02

RMS FOR 7 POINTS: 1.590E 00 1.373E 00

RUN #6

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
-R.31083F-05-3.17746F-03 1.24141E-04

ID NUMER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DMR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMR)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	(DUHR) (ARC-SEC)	N-S	N-S	E-W	N-S	E-W	N-S	E-W
10001.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.858E-02	2.279E-01
10001.	56.	4.344E-02	5.002E-02	4.862E-03	-1.779E-01	3.058E-02	2.279E-01	1.360E 00	-3.620E 00	4.566E 00	1.724E 00
2.	1895.	6.324E 00	-7.006E 00	3.977E-01	-6.009E 00	5.926E 00	-1.896E 00	2.410E 00	-5.370E 00	6.160E 00	2.735E 00
3.	2629.	9.250E 00	-1.096E 01	6.797E-01	-8.326E 00	8.570E 00	-2.635E 00	3.710E 00	-4.690E 00	6.742E 00	3.974E 00
4.	3381.	1.149E 01	-1.141E 01	1.042E 00	-1.069E 01	1.045E 01	-7.157E-01	5.750E 00	-6.740E 00	8.344E 00	3.408E 00
5.	3957.	1.546E 01	-1.574E 01	1.368E 00	-1.249E 01	1.409E 01	-3.292E 00	5.270E 00	-7.100E 00	8.619E 00	3.279E 00
6.	4953.	1.592E 01	-1.941E 01	2.032E 00	-1.559E 01	1.389E 01	-3.821E 00	4.430E 00	-7.530E 00	8.440E 00	4.578E 00
7.	6341.	1.623E 01	-2.281E 01	3.150E 00	-1.946E 01	1.307E 01	-2.952E 00	5.960E 00	-5.920E 00	9.877E 00	5.262E 00
8.	8389.	2.107E 01	-2.468E 01	5.234E 00	-2.603E 01	1.544E 01	-6.500E-01	5.940E 00	-4.910E 00	8.280E 00	3.600E 00
9.	9801.	2.115E 01	-3.148E 01	6.926E 00	-3.017E 01	1.422E 01	-1.310E 00	2.890E 00	-6.700E 00	5.516E 00	3.803E 00
10.	10535.	1.629E 01	-3.618E 01	7.884E 00	-3.229E 01	8.406E 00	-2.897E 00	-2.490E 00	-6.910E 00	2.448E 00	2.013E 00
13.	12015.	1.001E 01	-4.153E 01	1.005E 01	-3.463E 01	-4.179E-02	-4.897E 00	-2.240E 00	-6.180E 00	9.131E-01	1.774E 00
14.	12415.	9.229E 00	-4.194E 01	1.056E 01	-3.757E 01	-1.327E 00	-4.406E 00	-2.402E 00	-4.180E 00	5.235E-01	7.045E-03
20015.	12642.	9.707E 00	-4.194E 01	1.120E 01	-3.874E 01	1.496E 00	-4.173E 00	-2.020E 00	-4.160E 00	6.150E-03	-2.149E-02
20015.	12930.	9.325E 00	-4.194E 01	1.134E 01	-3.898E 01	-2.014E 00	-4.201E 00	-2.020E 00	-4.160E 00	6.112E 00	3.070E 00

RMS FOR 14 POINTS: 6.112E 00 3.070E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
-1.53768F-03-2.62419E-03 9.71130E-05

RUN #6A

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DDHR)		SMOOTHED EST. OF CHANGE (ARC-SEC)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10001.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10001.	56.	4.744E-02	5.002E-02	8.525E-02	-1.468E-01	-4.283E-02	1.948E-01	1.760E 00	-3.620E 00	-4.283E-02	1.968E-01
2.	1895.	6.324E 00	-7.006E 00	3.103F 00	-8.858E 00	3.221E 00	-3.048E 00	2.410E 00	-5.370E 00	1.861E 00	5.724E-01
3.	2829.	9.750E 00	-1.046E 01	4.799F 00	-6.674E 00	4.851E 00	-4.286E 00	3.710E 00	-4.690E 00	2.441E 00	1.084E 00
4.	3381.	1.149E 01	-1.141E 01	5.775F 00	-8.495E 00	5.718E 00	-2.910E 00	5.750E 00	-6.700E 00	2.008E 00	1.780E 00
5.	3957.	1.546E 01	-1.578E 01	6.860F 00	-9.862E 00	8.502E 00	-5.922F 00	5.270E 00	-7.100E 00	2.852E 00	7.778E-01
6.	4953.	1.592E 01	-1.941E 01	8.793F 00	-1.217E 01	7.128E 00	-7.244E 00	4.630E 00	-7.530E 00	1.858E 00	-1.462E-01
20007.	6341.	1.623E 01	-2.281E 01	1.154F 01	-1.524E 01	4.640E 00	-7.566E 00	1.034E 00	-7.530E 00	1.034E-02	-3.635E-02

RMS FOR 7 POINTS: 1.691E 00 8.731E-01

RUN #5B

GYRO-DRIFT RATE EST. VALUES (F.N. 2) (DEGREES/HOUR)
 1.44234C-03-J.85589F-03-2.78205E-05

IN NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DMS)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DIF TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10009.	0.	0.0	0.0	0.0	0.0	0.0	0.0	-3.050E 00	-1.790E 00	-7.594E-01	9.336E-01
10.	734.	-4.856E 00	-3.702E 00	-1.047E 00	-2.844E 00	-3.809E 00	-8.564E-01	-8.430E 00	-2.000E 00	2.554E-01	8.620E-01
13.	2274.	-1.114E 01	-1.004E 01	-2.963E 00	-8.907E 00	-8.175E 00	-1.138E 00	-8.180E 01	-1.270E 00	-4.029E-01	1.036E 00
14.	2614.	-1.102E 01	-1.050E 01	-3.334E 00	-1.026E 01	-8.583E 00	-2.338E-01	-8.180E 01	-1.270E 00	-4.029E-01	1.036E 00
20015.	3041.	-1.144E 01	-1.143E 01	-3.771E 00	-1.197E 01	-7.667E 00	5.347E-01	-7.660E 00	7.300E-01	2.923E-01	-1.953E-01
20015.	3129.	-1.142E 01	-1.170E 01	-3.857E 00	-1.232E 01	-7.964E 00	6.186E-01	-7.960E 00	7.300E-01	-3.777E-03	-1.114E-01

RMS FOR 5 POINTS: 4.219E-01 7.401E-01

RUN #7

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
-1.10767E-03-1.66601E-03 1.65945E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DMR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DDMR)		SMOOTHED EST. OF CHANGE (DMR)		REF. VALUE OF CHANGE (ARC-SFC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10015.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.128E-02	7.914E-02
10015.	56.	7.361E-02	-1.437E-02	6.233E-02	-9.350E-02	1.120E-02	7.914E-02	-2.200E-01	-2.000E 00	-2.846E-01	1.648E 00
10.	593.	1.653E-01	-1.312E 00	6.699E-01	-9.802E-01	-5.046E-01	-3.518E-01	-4.700E-01	-2.750E 00	1.223E-01	2.030E 00
13.	1179.	1.009E 00	-2.625E 00	1.357E 00	-1.913E 00	-3.477E-01	-6.919E-01	2.230E 00	-4.710E 00	1.331E 00	3.093E 00
12.	2183.	6.149E 09	-5.233E 00	2.587E 00	-3.529E 00	3.561E 00	-1.701E 00	2.230E 00	-5.430E 00	2.326E 00	2.853E 00
11.	2911.	1.101E 01	-7.231E 00	3.519E 00	-4.655E 00	7.496E 00	-2.577E 00	5.170E 00	-2.520E 00	2.797E 00	1.217E 00
10.	3408.	1.108E 01	-6.711E 00	4.172E 00	-5.408E 00	7.707E 00	-1.303E 00	4.910E 00	-7.300E-01	3.400E 00	1.414E 00
9.	4191.	1.647E 01	-5.752E 00	5.105E 00	-6.434E 00	1.136E 01	6.040E-01	7.060E 00	-1.740E 00	6.254E 00	2.022E 00
8.	5519.	2.146E 01	-8.318E 00	7.226E 00	-9.599E 00	1.423E 01	2.814E-01	7.590E 00	-3.350E 00	7.453E 00	1.437E 00
7.	7345.	2.434E 01	-1.242E 01	9.739E 09	-1.690E 01	1.460E 01	-1.913E 00	6.650E 00	-2.920E 00	7.049E 00	9.414E-01
6.	8560.	2.580E 01	-1.440E 01	1.155E 01	-1.242E 01	1.434E 01	-1.970E 00	7.290E 00	-2.520E 00	7.547E 00	1.991E 00
5.	9179.	2.789E 01	-1.369E 01	1.249E 01	-1.316E 01	1.532E 01	-5.288E-01	7.770E 00	-5.100E-01	7.370E 00	2.133E 00
4.	9713.	2.440E 01	-1.216E 01	1.324E 01	-1.379E 01	1.311E 01	1.623E 00	5.730E 00	-1.190E 00	4.831E 00	1.723E 00
3.	10499.	2.375E 01	-1.413E 01	1.449E 01	-1.446E 01	9.261E 00	5.328E-01	3.430E 00	-5.600E-01	3.285E 00	6.061E-01
2.	11253.	2.729E 01	-1.431E 01	1.563E 01	-1.547E 01	6.665E 00	1.166E 09	3.380E 00	4.180E 00	7.501E-01	-3.244E-02
200001.	12299.	1.097E 01	-1.240E 01	1.720E 01	-1.654E 01	2.770E 00	4.148E 00	2.020E 00	4.180E 00	5.271E-03	-1.134E-02
20001.	12402.	1.934E 01	-1.249E 01	1.736E 01	-1.665E 01	2.825E 00	4.169E 00	2.020E 00	4.180E 00	4.505E 00	1.704E 00

RMS FOR 16 POINTS: 4.505E 00

GYRO-DRIFT RATE EST. VALUES (E,N,Z) (DEGREES/HOUR)
-2.29478E-03-1.42745E-03 1.0804E-04

RUN #7A

IN NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (D-R)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUF		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
10015.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10015.	56.	7.361E-02	-1.417E-02	1.285E-01	-8.004E-02	0.0	6.568E-02	-5.493E-02	-2.200E-01	-2.000E 00	-5.493E-02
14.	593.	1.653E-01	-1.332E 00	1.367E 00	-8.308E-01	-1.201E 00	-5.012E-01	-2.200E-01	-2.730E 00	-1.257E 00	-9.814E-01
13.	1179.	1.009E 00	-2.625E 00	2.736E 00	-1.620E 00	-1.727E 00	-1.005E 00	-4.700E-01	-2.730E 00	-1.257E 00	1.725E 00
12.	2183.	6.148E 00	-5.230E 00	5.120E 00	-2.809E 00	1.028E 00	-2.331E 00	2.230E 00	-4.710E 00	-1.202E 00	2.379E 00
11.	2911.	1.101E 01	-7.231E 00	6.971E 00	-3.768E 00	4.143E 00	-3.463E 00	5.170E 00	-5.430E 00	-1.027E 00	1.967E 00
10.	3408.	1.188E 01	-4.711E 00	8.079E 00	-4.332E 00	3.803E 00	-2.379E 00	4.910E 00	-2.520E 00	-1.107E 00	1.414E-01
9.	4101.	1.647E 01	-5.752E 00	9.761E 00	-5.079E 00	6.704E 00	-6.732E-01	7.960E 00	-7.300E-01	-1.256E 00	5.680E-02
20008.	5619.	2.146E 01	-6.318E 00	1.347E 01	-6.556E 00	7.992E 00	-1.762E 00	7.990E 00	-1.740E 00	1.185E-02	-2.176E-02

RMS FOR 8 POINTS: 9.905E-01 1.359E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

RUN #78

4.25288F-04-1.31292E-03-8.70918E-06

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)		REF. VALUE OF CHANGE (ARC-SEC)		ERROR IN DEFL. CHANGE (ARC-SEC)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W	N-S	E-W	N-S	E-W
10006.	0.	0.0	0.0	0.0	0.0	0.0	0.0	4.800E-01	4.000E-01	1.685E 00	1.126E 00
5.	619.	1.911E 00	7.101E-01	-2.534E-01	-8.156E-01	2.165E 00	1.526E 00	-1.560E 00	2.410E 00	2.526E 00	1.356E 00
4.	1153.	5.103E-01	2.242E 00	-4.559E-01	-1.524E 00	9.662E-01	3.766E 00	-2.860E 00	1.730E 00	1.440E 00	1.114E 00
3.	1939.	-2.146E 00	2.696E-01	-7.263E-01	-2.574E 00	-1.420E 00	2.844E 00	-3.910E 00	3.480E 00	1.264E 00	2.005E-01
2.	2693.	-3.600E 00	9.131E-02	-9.540E-01	-3.589E 00	-2.646E 00	3.681E 00	-5.270E 00	7.100E 00	5.663E-01	-9.059E-02
20001.	3736.	-5.921E 00	2.003E 00	-1.217E 00	-5.006E 00	-4.704E 00	7.009E 00	-5.270E 00	7.100E 00	-1.631E-04	-3.090E-02
20001.	3842.	-6.510E 00	1.922E 00	-1.240E 00	-5.147E 00	-5.270E 00	7.069E 00	-5.270E 00	7.100E 00	1.404E 00	8.560E-01

RMS FOR

6 POINTS:

RUN #8(2)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

2.36469E-03-7.94206E-04-1.87984E-04

ID NUMBR	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR) (ARC-SEC) N-S E-W	EST. FROM SMOOTHER OF CHANGE IN REAL-TIME EST. OF CHANGE IN DEF. DUE TO DRIFT RATE EST. (DDHR) (ARC-SEC) N-S E-W	SMOOTHED EST. OF CHANGE (DHS) (ARC-SEC) N-S E-W
12001.	0.	0.0	0.0	0.0
2002.	409.	-8.049E-01	7.399E-01	1.604E-01
2003.	679.	-1.066E 00	3.314E-01	5.347E-01
2004.	940.	-8.124E-01	-8.458E-01	1.399E-01
2005.	1179.	-6.561E-01	-3.913E-01	2.115E 00
2006.	1429.	-1.413E 00	-9.920E-01	1.941E 00
2007.	1669.	-5.363E-01	-1.396E 00	3.374E 00
2008.	2151.	-2.540E 00	-3.248E 00	2.481E 00
2009.	2563.	-4.034E 00	-2.994E 00	1.928E 00
2010.	2822.	-4.355E 00	-3.080E 00	2.193E 00
2011.	3091.	-3.464E 00	-4.075E 00	3.691E 00
2012.	3335.	-5.362E 00	-3.890E 00	3.210E 00
2013.	3691.	-5.676E 00	-4.204E 00	3.130E 00
2014.	4029.	-6.031E 00	-4.734E 00	3.359E 00
2015.	4365.	-7.236E 00	-2.899E 00	3.935E 00
2016.	4721.	-8.789E 00	-3.001E 00	3.494E 00
2017.	4967.	-1.124E 01	-1.710E 00	2.465E 00
2018.	5289.	-1.442E 01	-2.056E-01	6.966E-01
2019.	5695.	-1.372E 01	-2.108E 00	-1.645E 00
2020.	6103.	-1.385E 01	-5.256E 01	5.007E-02
2021.	6493.	-1.442E 01	-5.766E 00	5.385E-01
2022.	6713.	-1.449E 01	-8.569E 00	4.051E-01
2023.	7047.	-1.572E 01	-8.950E 00	9.821E-01
2024.	7303.	-1.549E 01	-1.061E 01	2.423E-01
2025.	7599.	-1.477E 01	-1.140E 01	1.027E 00
2026.	7943.	-1.544E 01	-1.174E 01	2.386E 00
2027.	8145.	-1.641E 01	-1.148E 01	2.082E 00
2028.	8411.	-1.627E 01	-1.156E 01	1.388E 00
2029.	8647.	-1.763E 01	-1.273E 01	2.154E 00
2030.	8905.	-1.804E 01	-1.189E 01	1.239E 00
2031.	9263.	-1.929E 01	-1.136E 01	1.436E 00
2032.	9709.	-1.402E 01	-1.142E 01	9.205E-01
2033.	9931.	-1.966E 01	-1.214E 01	1.754E 00
2034.	10147.	-2.088E 01	-1.179E 01	1.257E 00
2035.	10393.	-2.056E 01	-1.216E 01	4.171E-01
2036.	10637.	-2.160E 01	-1.367E 01	4.171E-01
2037.	10930.	-2.218E 01	-1.383E 01	1.104E 00
2038.	11092.	-2.271E 01	-1.383E 01	1.990E-01
2039.	11247.	-2.324E 01	-1.383E 01	2.990E-01
2040.	11402.	-2.377E 01	-1.383E 01	3.992E-01
2041.	11557.	-2.430E 01	-1.383E 01	4.994E-01
2042.	11712.	-2.483E 01	-1.383E 01	5.996E-01
2043.	11867.	-2.536E 01	-1.383E 01	6.998E-01
2044.	12022.	-2.589E 01	-1.383E 01	7.999E-01
2045.	12177.	-2.642E 01	-1.383E 01	8.999E-01
2046.	12332.	-2.695E 01	-1.383E 01	9.999E-01
2047.	12487.	-2.748E 01	-1.383E 01	1.099E-02
2048.	12642.	-2.801E 01	-1.383E 01	2.099E-02
2049.	12797.	-2.854E 01	-1.383E 01	3.099E-02
2050.	12952.	-2.907E 01	-1.383E 01	4.099E-02
2051.	13107.	-2.960E 01	-1.383E 01	5.099E-02
2052.	13262.	-3.013E 01	-1.383E 01	6.099E-02
2053.	13417.	-3.066E 01	-1.383E 01	7.099E-02
2054.	13572.	-3.119E 01	-1.383E 01	8.099E-02
2055.	13727.	-3.172E 01	-1.383E 01	9.099E-02
2056.	13882.	-3.225E 01	-1.383E 01	1.099E-01
2057.	14037.	-3.278E 01	-1.383E 01	2.099E-01
2058.	14192.	-3.331E 01	-1.383E 01	3.099E-01
2059.	14347.	-3.384E 01	-1.383E 01	4.099E-01
2060.	14502.	-3.437E 01	-1.383E 01	5.099E-01
2061.	14657.	-3.490E 01	-1.383E 01	6.099E-01
2062.	14812.	-3.543E 01	-1.383E 01	7.099E-01
2063.	14967.	-3.596E 01	-1.383E 01	8.099E-01
2064.	15122.	-3.649E 01	-1.383E 01	9.099E-01
2065.	15277.	-3.702E 01	-1.383E 01	1.099E-02
2066.	15432.	-3.755E 01	-1.383E 01	2.099E-02
2067.	15587.	-3.808E 01	-1.383E 01	3.099E-02
2068.	15742.	-3.861E 01	-1.383E 01	4.099E-02
2069.	15897.	-3.914E 01	-1.383E 01	5.099E-02
2070.	16052.	-3.967E 01	-1.383E 01	6.099E-02
2071.	16207.	-4.020E 01	-1.383E 01	7.099E-02
2072.	16362.	-4.073E 01	-1.383E 01	8.099E-02
2073.	16517.	-4.126E 01	-1.383E 01	9.099E-02
2074.	16672.	-4.179E 01	-1.383E 01	1.099E-01
2075.	16827.	-4.232E 01	-1.383E 01	2.099E-01
2076.	16982.	-4.285E 01	-1.383E 01	3.099E-01
2077.	17137.	-4.338E 01	-1.383E 01	4.099E-01
2078.	17292.	-4.391E 01	-1.383E 01	5.099E-01
2079.	17447.	-4.444E 01	-1.383E 01	6.099E-01
2080.	17602.	-4.497E 01	-1.383E 01	7.099E-01
2081.	17757.	-4.550E 01	-1.383E 01	8.099E-01
2082.	17912.	-4.603E 01	-1.383E 01	9.099E-01
2083.	18067.	-4.656E 01	-1.383E 01	1.099E-02
2084.	18222.	-4.709E 01	-1.383E 01	2.099E-02
2085.	18377.	-4.762E 01	-1.383E 01	3.099E-02
2086.	18532.	-4.815E 01	-1.383E 01	4.099E-02
2087.	18687.	-4.868E 01	-1.383E 01	5.099E-02
2088.	18842.	-4.921E 01	-1.383E 01	6.099E-02
2089.	18997.	-4.974E 01	-1.383E 01	7.099E-02
2090.	19152.	-5.027E 01	-1.383E 01	8.099E-02
2091.	19307.	-5.080E 01	-1.383E 01	9.099E-02
2092.	19462.	-5.133E 01	-1.383E 01	1.099E-01
2093.	19617.	-5.186E 01	-1.383E 01	2.099E-01
2094.	19772.	-5.239E 01	-1.383E 01	3.099E-01
2095.	19927.	-5.292E 01	-1.383E 01	4.099E-01
2096.	20082.	-5.345E 01	-1.383E 01	5.099E-01
2097.	20237.	-5.398E 01	-1.383E 01	6.099E-01
2098.	20392.	-5.451E 01	-1.383E 01	7.099E-01
2099.	20547.	-5.504E 01	-1.383E 01	8.099E-01
2100.	20702.	-5.557E 01	-1.383E 01	9.099E-01
2101.	20857.	-5.610E 01	-1.383E 01	1.099E-02
2102.	21012.	-5.663E 01	-1.383E 01	2.099E-02
2103.	21167.	-5.716E 01	-1.383E 01	3.099E-02
2104.	21322.	-5.769E 01	-1.383E 01	4.099E-02
2105.	21477.	-5.822E 01	-1.383E 01	5.099E-02
2106.	21632.	-5.875E 01	-1.383E 01	6.099E-02
2107.	21787.	-5.928E 01	-1.383E 01	7.099E-02
2108.	21942.	-5.981E 01	-1.383E 01	8.099E-02
2109.	22097.	-6.034E 01	-1.383E 01	9.099E-02
2110.	22252.	-6.087E 01	-1.383E 01	1.099E-01
2111.	22407.	-6.140E 01	-1.383E 01	2.099E-01
2112.	22562.	-6.193E 01	-1.383E 01	3.099E-01
2113.	22717.	-6.246E 01	-1.383E 01	4.099E-01
2114.	22872.	-6.299E 01	-1.383E 01	5.099E-01
2115.	23027.	-6.352E 01	-1.383E 01	6.099E-01
2116.	23182.	-6.405E 01	-1.383E 01	7.099E-01
2117.	23337.	-6.458E 01	-1.383E 01	8.099E-01
2118.	23492.	-6.511E 01	-1.383E 01	9.099E-01
2119.	23647.	-6.564E 01	-1.383E 01	1.099E-02
2120.	23802.	-6.617E 01	-1.383E 01	2.099E-02
2121.	23957.	-6.670E 01	-1.383E 01	3.099E-02
2122.	24112.	-6.723E 01	-1.383E 01	4.099E-02
2123.	24267.	-6.776E 01	-1.383E 01	5.099E-02
2124.	24422.	-6.829E 01	-1.383E 01	6.099E-02
2125.	24577.	-6.882E 01	-1.383E 01	7.099E-02
2126.	24732.	-6.935E 01	-1.383E 01	8.099E-02
2127.	24887.	-6.988E 01	-1.383E 01	9.099E-02
2128.	25042.	-7.041E 01	-1.383E 01	1.099E-01
2129.	25197.	-7.094E 01	-1.383E 01	2.099E-01
2130.	25352.	-7.147E 01	-1.383E 01	3.099E-01
2131.	25507.	-7.200E 01	-1.383E 01	4.099E-01
2132.	25662.	-7.253E 01	-1.383E 01	5.099E-01
2133.	25817.	-7.306E 01	-1.383E 01	6.099E-01
2134.	25972.	-7.359E 01	-1.383E 01	7.099E-01
2135.	26127.	-7.412E 01	-1.383E 01	8.099E-01
2136.	26282.	-7.465E 01	-1.383E 01	9.099E-01
2137.	26437.	-7.518E 01	-1.383E 01	1.099E-02
2138.	26592.	-7.571E 01	-1.383E 01	2.099E-02
2139.	26747.	-7.624E 01	-1.383E 01	3.099E-02
2140.	26902.	-7.677E 01	-1.383E 01	4.099E-02
2141.	27057.	-7.730E 01	-1.383E 01	5.099E-02
2142.	27212.	-7.783E 01	-1.383E 01	6.099E-02
2143.	27367.	-7.836E 01	-1.383E 01	7.099E-02
2144.	27522.	-7.889E 01	-1.383E 01	8.099E-02
2145.	27677.	-7.942E 01	-1.383E 01	9.099E-02
2146.	27832.	-7.995E 01	-1.383E 01	1.099E-01
2147.	27987.	-8.048E 01	-1.383E 01	2.099E-01
2148.	28142.	-8.101E 01	-1.383E 01	3.099E-01
2149.	28297.	-8.154E 01	-1.383E 01	4.099E-01
2150.	28452.	-8.207E 01	-1.383E 01	5.099E-01
2151.	28607.	-8.260E 01	-1.383E 01	6.099E-01
2152.	28762.	-8.313E 01	-1.383E 01	7.099E-01
2153.	28917.	-8.366E 01	-1.383E 01	8.099E-01
2154.	29072.	-8.419E 01	-1.383E 01	9.099E-01
2155.	29227.	-8.472E 01	-1.383E 01	1.099E-02
2156.	29382.	-8.525E 01	-1.383E 01	2.099E-02
2157.	29537.	-8.578E 01	-1.383E 01	3.099E-02
2158.	29692.	-8.631E 01	-1.383E 01	4.099E-02
2159.	29847.	-8.684E 01	-1.383E 01	5.099E-02
2160.	30002.	-8.737E 01	-1.383E 01	6.099E-02
2161.	30157.	-8.790E 01	-1.383E 01	7.099E-02
2162.	30312.	-8.843E 01	-1.383E 01	8.099E-02
2163.	30467.	-8.896E 01	-1.383E 01	9.099E-02
2164.	30622.	-8.949E 01	-1.383E 01	1.099E-01
2165.	30777.	-9.002E 01	-1.383E 01	2.099E-01
2166.	30932.	-9.055E 01	-1.383E 01	3.099E-01
2167.	31087.	-9.108E 01	-1.383E 01	4.099E-01
2168.	31242.	-9.161E 01	-1.383E 01	5.099E-01
2169.	31397.	-9.214E 01	-1.383E 01	6.099E-01
2170.	31552.	-9.267E 01	-1.383E 01	7.099E-01
2171.	31707.	-9.320E 01	-1.383E 01	8.099E-01
2172.	31862.	-9.373E 01	-1.383E 01	9.099E-01
2173.	32017.	-9.426E 01	-1.383E 01	1.099E-02
2174.	32172.	-9.479E 01	-1.383E 01	2.099E-02
2175.	32327.	-9.532E 01	-1.383E 01	3.099E-02
2176.	32482.	-9.585E 01	-1.383E 01	4.099E-02
2177.	32637.	-9.638E 01	-1.383E 01	5.099E-02
2178.	32792.	-9.691E 01	-1.383E 01	6.099E-02
2179.	32947.	-9.744E 01	-1.383E 01	7.099E-02
2180.	33102.	-9.797E 01	-1.383E 01	8.099E-02
2181.	33257.	-9.850E 01	-1.383E 01	9.099E-02
2182.	33412.	-9.903E 01	-1.383E 01	1.099E-01
2183.	33567.	-9.956E 01	-1.383E 01	2.099E-01
2184.	33722.	-1.		

RUN #8(2)A

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
2.44364E-03-1.21734E-03-1.00343E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
12001.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2002.	409.	-6.049E-01	7.399E-01	-9.958E-01	-5.058E-01	1.909E-01	1.246E 00
2003.	679.	-1.066E 00	3.314E-01	-1.649E 00	-8.484E-01	5.932E-01	3.180E 00
2004.	940.	-8.124E-01	-8.458E-01	-2.276E 00	-1.186E 00	1.463E 00	3.397E-01
2005.	1179.	-6.561E-01	-3.913E-01	-2.849E 00	-1.501E 00	2.193E 00	1.110E 00
2038.	1429.	-1.413E 00	-9.920E-01	-3.444E 00	-1.836E 00	2.031E 00	8.439E-01
2037.	1669.	-5.363E-01	-1.396E 00	-4.011E 00	-2.163E 00	3.475E 00	7.668E-01
2035.	2151.	-2.540E 00	-3.248E 00	-5.140E 00	-2.836E 00	2.599E 00	-4.127E-01
2034.	2563.	-4.034E 00	-2.994E 00	-6.092E 00	-3.427E 00	2.058E 00	4.336E-01
2033.	2822.	-4.355E 00	-3.080E 00	-6.683E 00	-3.806E 00	2.327E 00	7.260E-01
2032.	3091.	-3.464E 00	-4.075E 00	-7.293E 00	-4.208E 00	3.829E 00	1.329E-01
2031.	3335.	-4.484E 00	-4.442E 00	-7.841E 00	-4.577E 00	3.357E 00	1.346E-01
2023.	3691.	-5.362E 00	-3.890E 00	-8.632E 00	-5.124E 00	3.270E 00	1.234E 00
2022.	4029.	-5.876E 00	-4.204E 00	-9.372E 00	-5.654E 00	3.496E 00	1.450E 00
2021.	4365.	-6.031E 00	-4.734E 00	-1.010E 01	-6.191E 00	4.067E 00	1.456E 00
2049.	4721.	-7.236E 00	-2.899E 00	-1.085F 01	-6.769E 00	3.618E 00	3.870E 00
2020.	4967.	-8.789E 00	-3.001E 00	-1.137E 01	-7.175E 00	2.582E 00	4.175E 00
2019.	5289.	-1.124E 01	-1.710E 00	-1.204E 01	-7.714E 00	8.016E-01	6.004E 00
22018.	5695.	-1.442E 01	-2.056E-01	-1.286E 01	-8.405E 00	-1.558E 00	8.200E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
1.87909F-03-8.33794F-04-7.25191E-05

RUN #0(2)B

IN NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUF TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
12018.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2019.	488.	7.017E-01	-1.982E 00	-9.135E-01	-4.156E-01	1.615E 00	-1.566E 00
2020.	798.	5.707E-01	-5.051E 00	-1.490E 00	-6.886E-01	2.060E 00	-4.362E 00
2049.	1018.	3.147E-03	-5.560E 00	-1.897E 00	-8.865E-01	1.900E 00	-4.674E 00
2021.	1352.	-6.964E-02	-8.364E 00	-2.511E 00	-1.194E 00	2.441E 00	-7.170E 00
2022.	1608.	-1.300E 00	-8.752E 00	-2.978E 00	-1.435E 00	1.679E 00	-7.317E 00
2023.	1904.	-1.073E 00	-1.041E 01	-3.516E 00	-1.719E 00	2.442E 00	-8.688E 00
2031.	2248.	-3.524E-01	-1.120E 01	-4.135E 00	-2.057E 00	3.782E 00	-9.140E 00
2032.	2450.	-1.024E 00	-1.153E 01	-4.495E 00	-2.259E 00	3.471E 00	-9.271E 00
2033.	2716.	-2.196E 00	-1.128E 01	-4.967E 00	-2.530E 00	2.771E 00	-8.746E 00
2034.	2952.	-1.847E 00	-1.136E 01	-5.383E 00	-2.774E 00	3.536E 00	-8.582E 00
2035.	3210.	-3.210E 00	-1.253E 01	-5.833E 00	-3.046E 00	2.623E 00	-9.481E 00
2037.	3568.	-3.622E 00	-1.168E 01	-6.452E 00	-3.430E 00	2.830E 00	-8.251E 00
2038.	4014.	-4.875E 00	-1.116E 01	-7.211E 00	-3.921E 00	2.337E 00	-7.237E 00
2005.	4236.	-4.398E 00	-1.121E 01	-7.584E 00	-4.170E 00	3.186E 00	-7.041E 00
2004.	4452.	-5.237E 00	-1.193E 01	-7.944E 00	-4.415E 00	2.707E 00	-7.515E 00
2003.	4698.	-6.459E 00	-1.158E 01	-8.350E 00	-4.698E 00	1.891E 00	-6.886E 00
2002.	4942.	-6.143E 00	-1.196E 01	-8.748E 00	-4.983E 00	2.606E 00	-6.972E 00
202001.	5235.	-7.382E 00	-1.347E 01	-9.221E 00	-5.330E 00	1.839E 00	-8.138E 00
22001.	5287.	-7.760E 00	-1.363E 01	-9.304E 00	-5.392E 00	1.543E 00	-8.235E 00

RUN #9

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
-4.44898E-03-1.01005E-03 2.56089E-04

IC NUMRER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DDHR) (ARC-SEC)	N-S	(ARC-SEC)	E-W
12001.	0.	0.0	0.0	0.0	0.0	0.0	0.0
102001.	56.	-6.574E-02	-8.619E-03	2.499E-01	-5.645E-02	-3.157E-01	4.784E-02
2001.	687.	2.267E 00	7.677E-01	3.068E 00	-6.529E-01	-8.012E-01	1.421E 00
14.	1977.	1.087E 01	-4.779E 00	8.873E 00	-1.656E 00	1.996E 00	-3.123E 00
13.	2561.	1.055E 01	-3.427E 00	1.151E 01	-2.014E 00	-9.608E-01	-1.413E 00
12.	3206.	9.291E 00	-4.906E 00	1.441E 01	-2.340E 00	-5.123E 00	-2.567E 00
11.	4129.	1.318E 01	-2.711E 00	1.856E 01	-2.679E 00	-5.376E 00	-3.160E-02
10.	4469.	1.598E 01	-2.510E 00	2.008E 01	-2.767E 00	-4.101E 00	2.567E-01
9.	4808.	1.730E 01	-1.387E 00	2.158E 01	-2.834E 00	-4.282E 00	1.447E 00
8.	5185.	2.016E 01	-4.441E-01	2.325E 01	-2.885E 00	-3.097E 00	2.441E 00
7.	5535.	2.281E 01	7.245E-01	2.479E 01	-2.911E 00	-1.982E 00	3.636E 00
6.	5907.	2.447E 01	1.849E 00	2.642E 01	-2.916E 00	-1.948E 00	4.765E 00
5.	6363.	2.586E 01	3.155E 00	2.840E 01	-2.890E 00	-2.542E 00	6.045E 00
4.	6565.	2.736E 01	2.992E 00	2.927E 01	-2.867E 00	-1.912E 00	5.858E 00
20003.	7057.	3.083E 01	3.947E 00	3.137E 01	-2.783E 00	-5.437E-01	6.729E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
 -4.47501E-03-6.49950E-04 1.57700E-04

RUN #9A

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR) (ARC-SEC) N-S	E-W	EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO ORIFT RATE EST. (DDHR) (ARC-SEC) N-S	E-W	SMOOTHED EST. OF CHANGE (DHS) (ARC-SEC) N-S	E-W
12001.	0.	0.0	0.0	0.0	0.0	0.0	0.0
102001.	56.	-6.574E-02	-8.619E-03	2.514E-01	-3.623E-02	-3.171E-01	2.761E-02
2001.	647.	2.267E 00	7.677E-01	3.081E 00	-6.053E-01	-2.144E-01	1.173E 00
14.	1977.	1.087E 01	-4.779E 00	8.885E 00	-9.431E-01	1.984E 00	-3.836E 00
13.	2561.	1.055E 01	-3.427E 00	1.151E 01	-1.091E 00	-9.514E-01	-2.336E 00
12.	3206.	9.291E 00	-4.906E 00	1.439E 01	-1.164E 00	-5.103E 00	-3.722E 00
11.	4129.	1.318E 01	-2.711E 00	1.850E 01	-1.193E 00	-5.311E 00	-1.518E 00
20010.	4469.	1.598E 01	-2.510E 00	1.999E 01	-1.159E 00	-4.016E 00	-1.351E 00

RUN #9B

GYRO-DRIFT RATE EST. VALUES (E-N-Z) (DEGREES/HOUR)

-4.35506E-03-8.37286E-04 8.81565E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(ARC-SEC)	E-W	N-S	E-W
10010.	0.	0.0	0.0	0.0	0.0	0.0	0.0
9.	339.	1.14E 00	1.123E 00	1.470E 00	-2.737E-01	-1.520E-01	1.397E 00
8.	716.	4.180E 00	2.666E 00	3.127E 00	-5.559E-01	1.054E 00	2.622E 00
7.	1066.	6.835E 00	3.235E 00	4.639E 00	-7.959E-01	2.176E 00	4.030E 00
6.	1438.	8.496E 00	4.359E 00	6.290E 00	-1.023E 00	2.206E 00	5.387E 00
5.	1894.	9.880E 00	5.665E 00	8.290E 00	-1.280E 00	1.590E 00	6.946E 00
4.	2046.	1.138E 01	5.502E 00	9.170E 00	-1.381E 00	2.204E 00	6.882E 00
20003.	2588.	1.485E 01	6.457E 00	1.133E 01	-1.596E 00	3.519E 00	8.053E 00

RUN #10(2)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

-1.37971F-C3-2.15424F-03 6.93195E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
12001.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2002.	277.	4.388E-01	5.110E-01	3.855E-01	-5.946E-01	5.323E-02	1.106E 00
2003.	513.	6.549E-01	3.558E-01	7.192E-01	-1.098E 00	-6.432E-02	1.454E 00
2004.	763.	1.855E 00	-8.687E-01	1.078E 00	-1.628E 00	7.771E-01	7.591E-01
2005.	991.	2.642E 00	-3.513E-01	1.409E 00	-2.108E 00	1.233E 00	1.757E 00
2006.	1225.	2.685E 00	-8.040E-01	1.754E 00	-2.598E 00	9.309E-01	1.794E 00
2007.	1455.	3.964E 00	-1.141E 00	2.097E 00	-3.076E 00	1.867E 00	1.934E 00
2035.	1945.	4.527E 00	-3.186E 00	2.841E 00	-4.084E 00	1.686E 00	8.981E-01
2034.	2279.	4.725E 00	-2.674E 00	3.358E 00	-4.763E 00	1.367E 00	2.089E 00
2033.	2525.	5.622E 00	-3.053E 00	3.744E 00	-5.259E 00	1.878E 00	2.207E 00
2032.	2775.	7.222E 00	-3.887E 00	4.141E 00	-5.760E 00	3.081E 00	1.872E 00
2031.	3007.	7.381E 00	-4.453E 00	4.513E 00	-6.220E 00	2.868E 00	1.767E 00
2023.	3327.	7.921E 00	-4.180E 00	5.031E 00	-6.850E 00	2.889E 00	2.670E 00
2022.	3613.	8.289E 00	-4.378E 00	5.500E 00	-7.408E 00	2.789E 00	3.029E 00
2021.	3857.	9.155E 00	-4.914E 00	5.903E 00	-7.879E 00	3.252E 00	2.965E 00
2049.	4179.	8.894E 00	-3.122E 00	6.441E 00	-8.495E 00	2.453E 00	5.373E 00
2020.	4403.	8.658E 00	-3.437E 00	6.819E 00	-8.920E 00	1.840E 00	5.483E 00
2019.	4727.	7.451E 00	-2.189E 00	7.369E 00	-9.528E 00	8.177E-02	7.340E 00
202018.	5262.	6.740E 00	-2.204E 00	8.290E 00	-1.052E 01	-1.550E 00	8.314E 00
22018.	5314.	6.839E 00	-2.429E 00	8.379E 00	-1.061E 01	-1.540E 00	8.184E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR) RUN #10(2)A
 -2.72729E-03-1.90418E-03 4.23662E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(UDHR)	(ARC-SEC)	N-S	E-W
12001.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2002.	277.	4.388E-01	5.110E-01	7.583E-01	-5.234E-01	-3.196E-01	1.034E 00
2003.	513.	6.549E-01	3.558E-01	1.409E 00	-9.628E-01	-7.540E-01	1.319E 00
2004.	763.	1.855E 00	-8.687E-01	2.102E 00	-1.422E 00	-2.473E-01	5.531E-01
2005.	991.	2.642E 00	-3.513E-01	2.738E 00	-1.834E 00	-9.587E-02	1.483E 00
2006.	1225.	2.685E 00	-8.040E-01	3.394E 00	-2.252E 00	-7.091E-01	1.448E 00
2007.	1455.	3.964E 00	-1.141E 00	4.041E 00	-2.657E 00	-7.765E-02	1.515E 00
22035.	1945.	4.527E 00	-3.186E 00	5.432E 00	-3.499E 00	-9.051E-01	3.131E-01

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
 -7.30421E-04-2.13341E-03 2.38973E-05

RUN #10(2)B

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR) (ARC-SEC)	EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DHR) (ARC-SEC)	SMOOTHED EST. OF CHANGE (DHS) (ARC-SEC)	E-W N-S
12035.	0.	0.0	0.0	0.0	0.0
2034.	334.	1.984E-01	2.486E-01	-5.027E-02	1.223E 00
2033.	580.	1.095E 00	4.377E-01	6.576E-01	1.366E 00
2032.	830.	2.695E 00	6.350E-01	2.060E 00	1.060E 00
2031.	1062.	2.854E 00	8.226E-01	2.031E 00	9.823E-01
2023.	1382.	3.394E 00	1.086E 00	2.305E 00	1.926E 00
2022.	1668.	3.762E 00	1.333E 00	2.429E 00	2.324E 00
2021.	1912.	4.628E 00	1.546E 00	3.082E 00	2.296E 00
2049.	2234.	4.367E 00	1.835E 00	2.532E 00	4.753E 00
2020.	2458.	4.132E 00	2.041E 00	2.091E 00	4.899E 00
2019.	2782.	2.924E 00	2.344E 00	5.798E-01	6.811E 00
202018.	3317.	2.213E 00	2.862E 00	-6.495E-01	7.883E 00
22018.	3369.	2.312E 00	2.914E 00	-6.013E-01	7.763E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR) RUN #10(4)
-2.83275F-03-2.89404F-03 1.54177E-04

ID NUMMER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS) (ARC-SEC)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
12018.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2018.	563.	1.212E 00	-1.454E 00	1.614E 00	-1.612E 00	-4.014E-01	1.581E-01
2019.	1045.	4.597E 00	-4.308E 00	3.024E 00	-2.963E 00	1.573E 00	-1.344E 00
2020.	1319.	5.857E 00	-7.555E 00	3.835E 00	-3.720E 00	2.021E 00	-3.835E 00
2049.	1521.	6.155E 00	-8.140E 00	4.440E 00	-4.272E 00	1.715E 00	-3.868E 00
2021.	1851.	8.067E 00	-1.105E 01	5.435E 00	-5.164E 00	2.632E 00	-5.883E 00
2022.	2109.	8.392E 00	-1.221E 01	6.221E 00	-5.853E 00	2.172E 00	-6.359E 00
2023.	2415.	9.832E 00	-1.414E 01	7.159E 00	-6.659E 00	2.672E 00	-7.478E 00
2031.	2795.	1.245E 01	-1.564E 01	8.336E 00	-7.645E 00	4.116E 00	-7.996E 00
2032.	3097.	1.317E 01	-1.650E 01	9.279E 00	-8.416E 00	3.893E 00	-8.084E 00
2033.	3363.	1.317E 01	-1.659E 01	1.012E 01	-9.086E 00	3.055E 00	-7.503E 00
2034.	3613.	1.440E 01	-1.716E 01	1.091E 01	-9.707E 00	3.490E 00	-7.457E 00
2035.	3925.	1.447E 01	-1.896E 01	1.190E 01	-1.047E 01	2.572E 00	-8.483E 00
2007.	4421.	1.500E 01	-1.849E 01	1.349E 01	-1.166E 01	2.416E 00	-6.826E 00
2006.	4673.	1.622E 01	-1.927E 01	1.430E 01	-1.226E 01	1.926E 00	-7.016E 00
2005.	4919.	1.809E 01	-1.994E 01	1.509E 01	-1.283E 01	2.994E 00	-7.108E 00
2004.	5143.	1.812E 01	-2.113E 01	1.582E 01	-1.334E 01	2.304E 00	-7.790E 00
2003.	5411.	1.802E 01	-2.139E 01	1.669E 01	-1.395E 01	1.329E 00	-7.443E 00
2002.	5649.	1.944E 01	-2.196E 01	1.747E 01	-1.448E 01	1.977E 00	-7.479E 00
202001.	5958.	2.014E 01	-2.343E 01	1.848E 01	-1.516E 01	1.659E 00	-8.269E 00
22001.	6010.	2.021E 01	-2.354E 01	1.865E 01	-1.527E 01	1.566E 00	-8.262E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
 -3.32406E-03-3.08279E-03 1.30792E-04

RUN #10(4)A

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR) (ARC-SEC) N-S E-W	EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST. (DDHR) (ARC-SEC) N-S E-W	SMOOTHED EST. OF CHANGE (DMS) (ARC-SEC) N-S E-W
2018.	0.	0.0	0.0	0.0
2018.	563.	1.212E 00 -1.454E 00	1.891E 00 -1.715E 00	-6.787E-01 2.614E-01
2019.	1045.	4.597E 00 -4.308E 00	3.539E 00 -3.150E 00	1.057E 00 -1.158E 00
2020.	1319.	5.857E 00 -7.555E 00	4.487E 00 -3.952E 00	1.369E 00 -3.602E 00
2049.	1521.	6.155E 00 -8.140E 00	5.191E 00 -4.537E 00	9.640E-01 -3.603E 00
2021.	1851.	8.067E 00 -1.105E 01	6.350E 00 -5.481E 00	1.717E 00 -5.567E 00
2022.	2109.	8.392E 00 -1.221E 01	7.264E 00 -6.208E 00	1.129E 00 -6.004E 00
2023.	2415.	9.832E 00 -1.414E 01	8.353E 00 -7.059E 00	1.478E 00 -7.078E 00
2031.	2795.	1.245E 01 -1.564E 01	9.718E 00 -8.098E 00	2.734E 00 -7.543E 00
2032.	3097.	1.317E 01 -1.650E 01	1.081E 01 -8.908E 00	2.363E 00 -7.591E 00
2033.	3363.	1.317E 01 -1.659E 01	1.178E 01 -9.612E 00	1.393E 00 -6.977E 00
2034.	3613.	1.440E 01 -1.716E 01	1.269E 01 -1.026E 01	1.705E 00 -6.900E 00
22035.	3925.	1.447E 01 -1.896E 01	1.384E 01 -1.107E 01	6.346E-01 -7.889E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
-2.21340E-03-2.05490E-03 3.74759E-05

RUN #10(4)B

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DHR)	(ARC-SEC)	N-S	E-W
12035.	0.	0.0	0.0	0.0	0.0	0.0	0.0
2007.	496.	1.432E 00	4.645E-01	1.108E 00	-1.009E 00	3.242E-01	1.473E 00
2006.	748.	1.754E 00	-3.185E-01	1.678E 00	-1.513E 00	7.603E-02	1.194E 00
2005.	944.	3.617E 00	-9.832E-01	2.234E 00	-2.000E 00	1.379E 00	1.016E 00
2004.	1218.	3.653E 00	-2.179E 00	2.753E 00	-2.438E 00	9.000E-01	2.594E-01
2003.	1486.	3.550E 00	-2.438E 00	3.373E 00	-2.957E 00	1.768E-01	5.199E-01
2092.	1724.	4.973E 00	-3.006E 00	3.427E 00	-3.413E 00	1.046E 00	4.066E-01
202001.	2033.	5.660E 00	-4.476E 00	4.653E 00	-3.997E 00	1.013E 00	-4.793E-01
22001.	2045.	5.742E 00	-4.581E 00	4.775E 00	-4.094E 00	9.675E-01	-4.877E-01

GYRO-DRIFT RATE EST. VALUES (E, N, Z) (DEGREES/HOUR)
 2.85981E-03 2.85786E-04 -2.17861E-04

RUN #13

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHR)		E-M
		N-S	E-W	(ARC-SEC)	(DHR)	(ARC-SEC)	(DHR)	
10027.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10027.	80.	4.403E-02	-2.061E-03	-2.287E-01	2.255E-02	2.727E-01	-2.461E-02	-2.461E-02
201.	822.	-2.172E 00	-9.082E-01	-2.351E 00	1.965E-01	1.785E-01	-1.105E 00	-1.105E 00
202.	1611.	-4.077E 00	-4.854E 00	-4.614E 00	3.127E-01	5.368E-01	-5.167E 00	-5.167E 00
31.	2321.	-6.010E 00	-8.047E 00	-6.652E 00	3.564E-01	6.419E-01	-8.404E 00	-8.404E 00
203.	3239.	-9.831E 00	-1.566E 01	-9.277E 00	3.277E-01	-5.535E-01	-1.599E 01	-1.599E 01
204.	4629.	-1.472E 01	-1.833E 01	-1.321E 01	1.027E-01	-1.512E 00	-1.843E 01	-1.843E 01
205.	5437.	-1.720E 01	-1.799E 01	-1.546E 01	-1.274E-01	-1.745E 00	-1.786E 01	-1.786E 01
206.	6883.	-2.195E 01	-1.903E 01	-1.938E 01	-7.172E-01	-2.569E 00	-1.831E 01	-1.831E 01
207.	7501.	-2.192E 01	-2.056E 01	-2.101E 01	-1.037E 00	-9.141E-01	-1.952E 01	-1.952E 01
208.	8841.	-2.622E 01	-1.490E 01	-2.241E 01	-1.350E 00	-3.816E 00	-1.355E 01	-1.355E 01
209.	8547.	-2.815E 01	-1.283E 01	-2.369E 01	-1.669E 00	-4.455E 00	-1.116E 01	-1.116E 01
20210.	9482.	-3.145E 01	-9.876E 00	-2.600E 01	-2.327E 00	-5.458E 00	-7.549E 00	-7.549E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR) RUN #13A
 2.50375E-03-1.09971E-03-5.97962E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DDHR) (ARC-SEC)	(DDHR) (ARC-SEC)	N-S	E-W
10027.	0.	0.0	0.0	0.0	0.0	0.0	0.0
10027.	80.	4.403E-02	-2.061E-03	-2.006E-01	-8.849E-02	2.446E-01	8.643E-02
201.	822.	-2.172E 00	-9.082E-01	-2.044E 00	-9.377E-01	-1.286E-01	2.952E-02
202.	1611.	-4.077E 00	-4.854E 00	-3.972E 00	-1.900E 00	-1.050E-01	-2.954E 00
31.	2321.	-6.010E 00	-8.047E 00	-5.670E 00	-2.817E 00	-3.339E-01	-5.231E 00
20203.	3239.	-9.831E 00	-1.566E 01	-7.825E 00	-4.073E 00	-2.006E 00	-1.159E 01

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

RUN #13B

2.90018E-03 6.46699E-04-1.45188E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE		SMOOTHED EST. OF CHANGE (DHS)	
		(ARC-SEC) N-S	E-W	(DDHR) N-S	(ARC-SEC) E-W	(ARC-SEC) N-S	(ARC-SEC) E-W
10203.	0.	0.0	0.0	0.0	0.0	0.0	0.0
204.	1390.	-4.891E 00	-2.665E 00	-4.058E 00	7.869E-01	-8.328E-01	-3.452E 00
205.	2198.	-7.372E 00	-2.327E 00	-6.431E 00	1.141E 00	-9.412E-01	-3.468E 00
206.	3644.	-1.212E 01	-3.364E 00	-1.067E 01	1.584E 00	-1.447E 00	-4.948E 00
207.	4262.	-1.209E 01	-4.895E 00	-1.247E 01	1.699E 00	3.801E-01	-6.594E 00
208.	4802.	-1.639E 01	7.681E-01	-1.404E 01	1.763E 00	-2.354E 00	-9.949E-01
209.	5308.	-1.832E 01	2.833E 00	-1.549E 01	1.793E 00	-2.822E 00	1.040E 00
20210.	6243.	-2.162E 01	5.789E 00	-1.815E 01	1.771E 00	-3.472E 00	4.018E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

RUN #14

3.29089E-03 4.07786E-03-1.88435E-04

ID NUMBR	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
10208.	0.	0.0	0.0	0.0	0.0	0.0	0.0
207.	544.	1.154E-01	-5.062E 00	-1.816E 00	2.199E 00	1.931E 00	-7.261E 00
206.	992.	-2.451E 00	-2.273E 00	-3.348E 00	3.979E 00	8.971E-01	-6.252E 00
205.	1608.	-4.041E 00	4.314E-01	-5.506E 00	6.382E 00	1.465E 00	-5.950E 00
204.	2335.	-4.824E 00	2.345E 00	-8.122E 00	9.146E 00	3.297E 00	-6.801E 00
203.	3262.	-5.901E 00	7.008E 00	-1.156E 01	1.256E 01	5.660E 00	-5.554E 00
31.	4072.	-7.520E 00	1.693E 01	-1.465E 01	1.544E 01	7.126E 00	1.489E 00
202.	4770.	-1.054E 01	2.155E 01	-1.736E 01	1.784E 01	6.816E 00	3.714E 00
201.	5530.	-1.414E 01	2.870E 01	-2.035E 01	2.036E 01	6.213E 00	8.338E 00
200027.	6117.	-1.808E 01	3.248E 01	-2.269E 01	2.225E 01	4.613E 00	1.023E 01
20027.	6169.	-1.829E 01	3.270E 01	-2.290E 01	2.241E 01	4.610E 00	1.029E 01

RUN #14A

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
2.45221E-03 2.70133E-03-6.69562E-05

ID NUMRER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DDHR) (ARC-SEC)	N-S	(ARC-SEC)	E-W
10208.	0.	0.0	0.0	0.0	0.0	0.0	0.0
207.	544.	1.154E-01	-5.062E 00	-1.350E 00	1.455E 00	1.466E 00	-6.517E 00
206.	992.	-2.451E 00	-2.273E 00	-2.486E 00	2.631E 00	3.506E-02	-4.903E 00
205.	1608.	-4.041E 00	4.314E-01	-4.079E 00	4.214E 00	3.838E-02	-3.782E 00
204.	2335.	-4.824E 00	2.345E 00	-6.003E 00	6.029E 00	1.179E 00	-3.684E 00
20203.	3262.	-5.901E 00	7.008E 00	-8.520E 00	8.265E 00	2.618E 00	-1.257E 00

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR) RUN #14B
 4.65957E-03 5.09096E-03-1.12147E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (OHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS)	
		N-S	E-W	(DUHR) (ARC-SEC)	(ARC-SEC)	N-S	E-W
10203.	0.	0.0	0.0	0.0	0.0	0.0	0.0
31.	810.	-1.618E 00	5.920E 00	-3.841E 00	4.062E 00	2.223E 00	5.859E 00
202.	1508.	-4.638E 00	1.454E 01	-7.252E 00	7.460E 00	2.614E 00	7.084E 00
201.	2268.	-8.237E 00	2.169E 01	-1.106E 01	1.105E 01	2.825E 00	1.064E 01
200027.	2855.	-1.218E 01	2.547E 01	-1.407E 01	1.374E 01	1.888E 00	1.172E 01
20027.	2907.	-1.239E 01	2.569E 01	-1.433E 01	1.398E 01	1.945E 00	1.172E 01

RUN #16(1)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)
1.18281E-03-1.54473E-03-3.78962E-05

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		FST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DMS)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
10022.	0.	0.0	0.0	0.0	0.0	0.0	0.0
10022.	96.	-1.893E-01	-5.467E-01	-1.135E-01	-1.488E-01	-7.582E-02	-3.980E-01
26.	1429.	3.206E-01	-9.829E-01	-1.627E 00	-2.253E 00	1.947E 00	1.270E 00
3.	1957.	7.604E-01	-8.210E-01	-2.194E 00	-3.110E 00	2.955E 00	2.269E 00
27.	2479.	2.571E 00	-1.936E 00	-2.736E 00	-3.967E 00	5.307E 00	2.031E 00
29.	3551.	8.946E-01	-9.423E 00	-3.784E 00	-5.761E 00	4.679E 00	-3.662E 00
29.	3619.	3.860E-01	-9.534E 00	-3.848E 00	-5.876E 00	4.234E 00	-3.658E 00
30.	4125.	-1.571E 00	-1.055E 01	-4.309E 00	-6.740E 00	2.738E 00	-3.805E 00
200031.	4972.	-3.355E 00	-1.417E 01	-5.034E 00	-8.206E 00	1.679E 00	-5.962E 00
20031.	5024.	-3.719E 00	-1.419E 01	-5.076E 00	-8.296E 00	1.357E 00	-5.898E 00

RUN #16(2)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

5.62151E-03 4.55125E-04 -1.25910E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHR)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
10031.	0.	0.0	0.0	0.0	0.0	0.0	0.0
30.	1097.	-5.739E 00	1.937E 00	-6.176E 00	3.643E-01	4.366E-01	1.573E 00
29.	1603.	-7.508E 00	1.605E 00	-9.024E 00	4.414E-01	1.515E 00	1.164E 00
200027.	2849.	-1.626E 01	5.530E 00	-1.595E 01	3.886E-01	-3.038E-01	5.142E 00
20027.	2908.	-1.669E 01	5.617E 00	-1.633E 01	3.758E-01	-3.545E-01	5.242E 00

RUN #16(3)

GYRO-DRIFT RATE EST. VALUES(E,N,Z) (DEGREES/HOUR)

5.04237E-03-6.63752E-04-1.13205E-04

ID NUMBER	TIME (SEC)	REAL-TIME EST. OF CHANGE (DHR)		EST. FROM SMOOTHER OF ERROR IN REAL-TIME EST. OF CHANGE IN DEFL. DUE TO DRIFT RATE EST.		SMOOTHED EST. OF CHANGE (DHS) (ARC-SEC)	
		N-S	E-W	(DDHR)	(ARC-SEC)	N-S	E-W
10027.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3.	797.	-5.168E 00	9.289E-01	-4.010E 00	-5.927E-01	-1.157E 00	1.514E 00
26.	1323.	-7.669E 00	3.592E-01	-6.644E 00	-1.053E 00	-1.026E 00	1.413E 00
200022.	2886.	-1.570E 01	-1.942E 00	-1.437E 01	-2.745E 00	-1.335E 00	8.034E-01
20022.	2962.	-1.582E 01	-2.222E 00	-1.473E 01	-2.840E 00	-1.087E 00	6.176E-01

APPENDIX D

REAL TIME ESTIMATES, SMOOTHED ESTIMATES AND ERRORS IN THE ESTIMATES OF THE DEFLECTION OF THE VERTICAL CHANGE FOR THE ORIGINAL MISSIONS

This appendix presents deflection of the vertical data associated with the original 17 missions as they were run at White Sands. The data is divided into four groups:

- I. Real Time Estimates of the Change in the Vertical Deflection Components (DE and DN generated by the real time software)
- II. The Error in the Real Time Estimate of the Change in the Vertical Deflection Components (The difference between the known reference value and the real time estimates).
- III. The Smoothed Estimate of the Change in the Vertical Deflection Components (Generated by the off-line Fortran Smoother)
- IV. The Error in the Smoothed Estimates of the Change in the Vertical Deflection Components (The difference between the smoother computed change and the known reference value change)

LIST OF ILLUSTRATIONS FOR ORIGINAL MISSION DATA

I. Real Time Estimate of the Change in the Deflections

<u>N-S (ξ)</u>	<u>Run Identification</u>	<u>E-W (η)</u>
<u>Figure</u>		<u>Figure</u>
D1.1	# 3	D2.1
D1.2	# 4	D2.2
D1.3	# 5	D2.3
D1.4	# 6	D2.4
D1.5	# 7	D2.5
D1.6	# 1	D2.6
D1.7	# 2(2)	D2.7
D1.8	# 9	D2.8
D1.9	# 2(1)	D2.9
D1.10	# 8(2)	D2.10
D1.11	# 10(2)	D2.11
D1.12	# 10(4)	D2.12
D1.13	# 13	D2.13
D1.14	# 14	D2.14
D1.15	# 16(1)	D2.15
D1.16	# 16(2)	D2.16
D1.17	# 16(3)	D2.17

II. The Error In the Real Time Estimate of Change in the Deflections

<u>N-S (ξ)</u>	<u>Run Identification</u>	<u>E-W (η)</u>
<u>Figure</u>		<u>Figure</u>
D3.1	# 3	D4.1
D3.2	# 4	D4.2
D3.3	# 5	D4.3
D3.4	# 6	D4.4
D3.5	# 7	D4.5

III. Smoothed Estimate of the Change in the Deflections

<u>N-S (ξ)</u>	<u>Run Identification</u>	<u>E-W (η)</u>
<u>Figure</u>		<u>Figure</u>
D5.1	# 3	D6.1
D5.2	# 4	D6.2
D5.3	# 5	D6.3
D5.4	# 6	D6.4
D5.5	# 7	D6.5
D5.6	# 1	D6.6
D5.7	# 2(2)	D6.7
D5.8	# 9	D6.8

LIST OF ILLUSTRATIONS FOR ORIGINAL MISSION DATA (cont)

III. Smoothed Estimate of the Change in the Deflections (cont)

<u>N-S (ξ)</u> <u>Figure</u>	<u>Run Identification</u>	<u>E-W (η)</u> <u>Figure</u>
D5.9	# 2(1)	D6.9
D5.10	# 8(2)	D6.10
D5.11	# 10(2)	D6.11
D5.12	# 10(4)	D6.12
D5.13	# 13	D6.13
D5.14	# 14	D6.14
D5.15	# 16(1)	D6.15
D5.16	# 16(2)	D6.16
D5.17	# 16(3)	D6.17

IV. The Error In the Smoothed Estimate of the Change in the Deflections

<u>N-S (ξ)</u> <u>Figure</u>	<u>Run Identification</u>	<u>E-W (η)</u> <u>Figure</u>
D7.1	# 3	D8.1
D7.2	# 4	D8.2
D7.3	# 5	D8.3
D7.4	# 6	D8.4
D7.5	# 7	D8.5

WHITESANDS DATA RUN - 3. LEG-1

ARC SECONDS

0.00

#1 - TULAROSA S.B.

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

-5.00

-10.00

#3 - RHODES

-15.00

-20.00

-25.00

#6 - WC-50

-30.00

-35.00

#11 - Q-48

-40.00

0.00

0.50

1.00

1.50

2.00

2.50

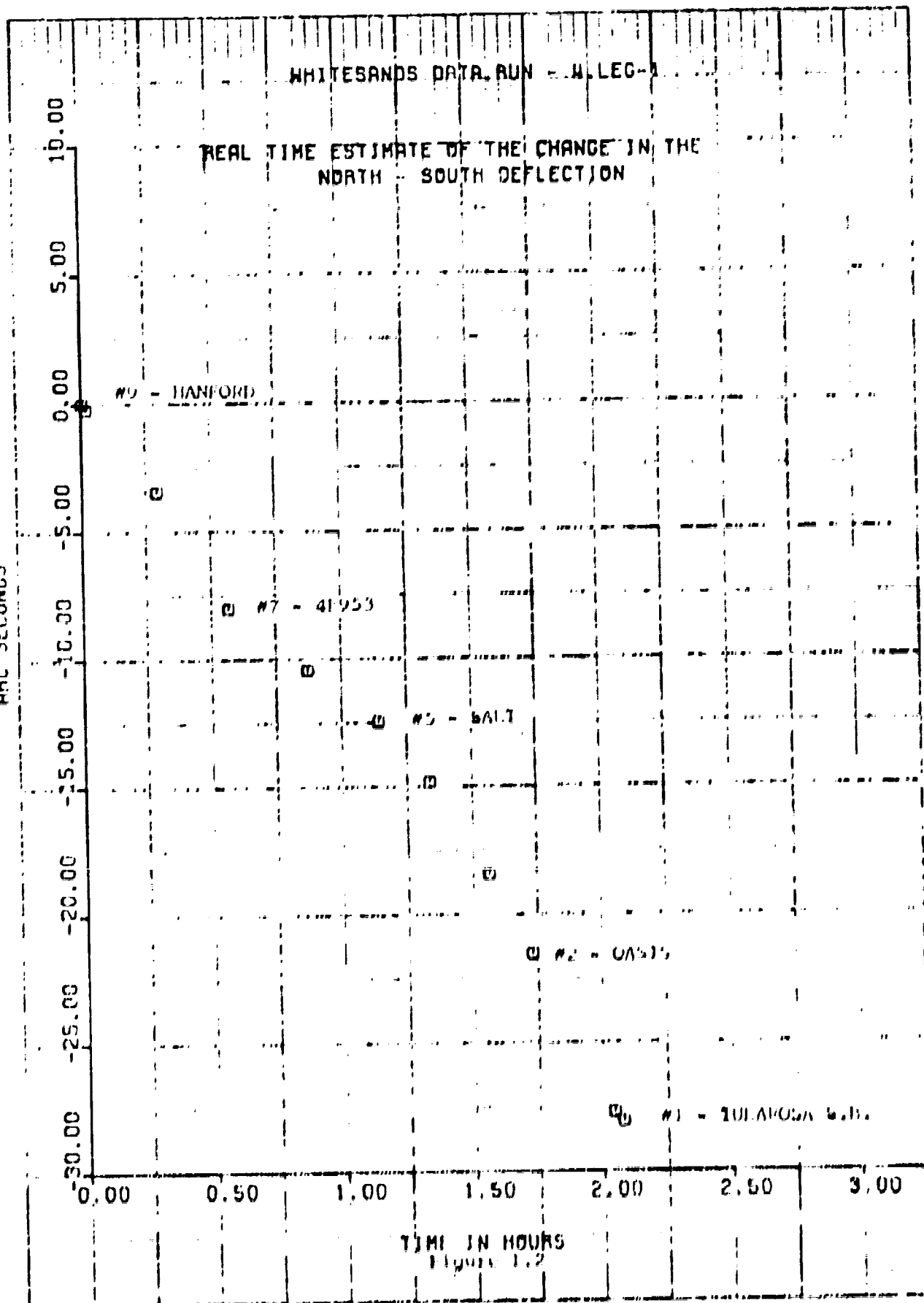
3.00

#9 - HANFORD

TIME IN HOURS

Figure 1.1

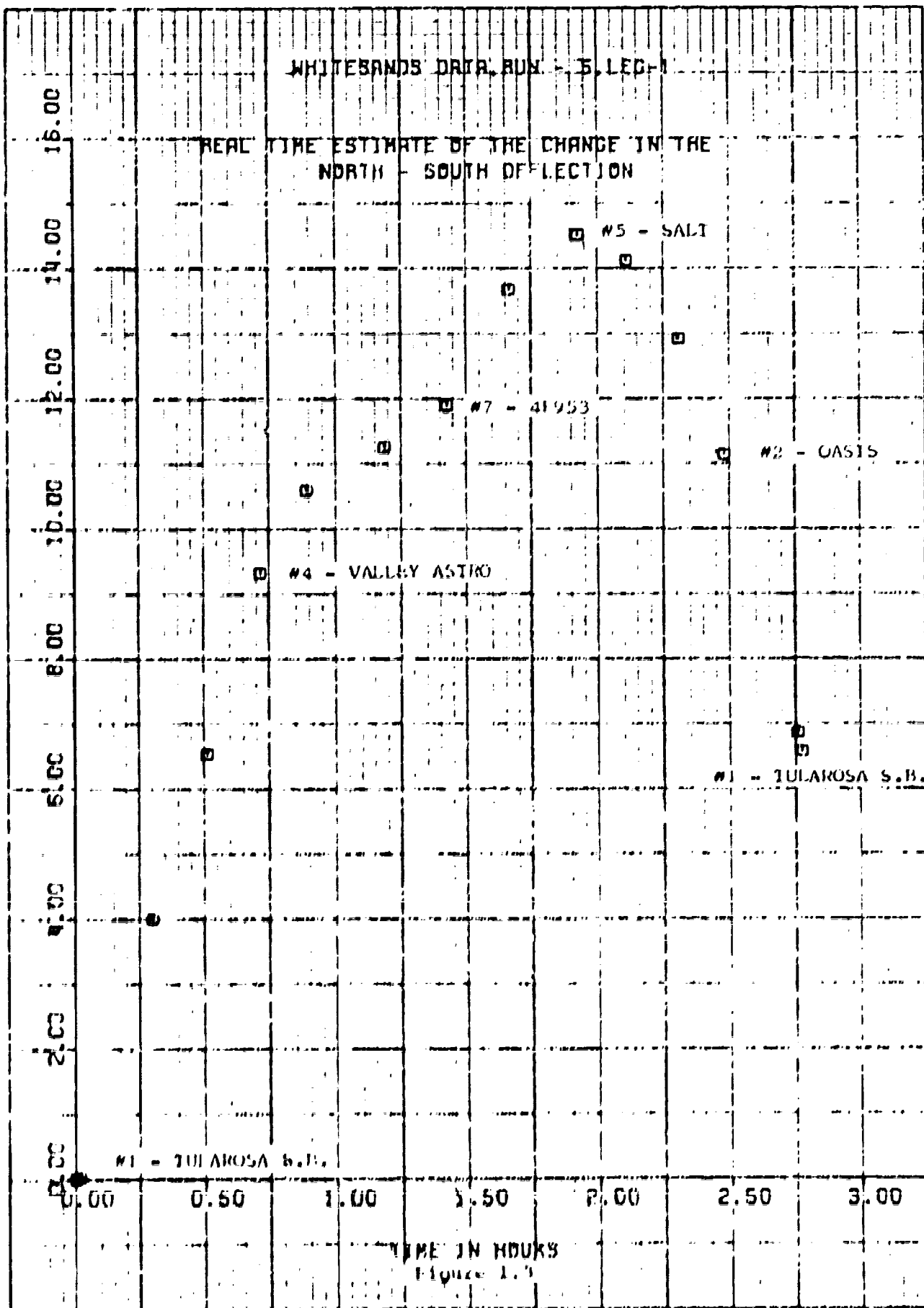
ARC SECONDS



PAC SECONDS

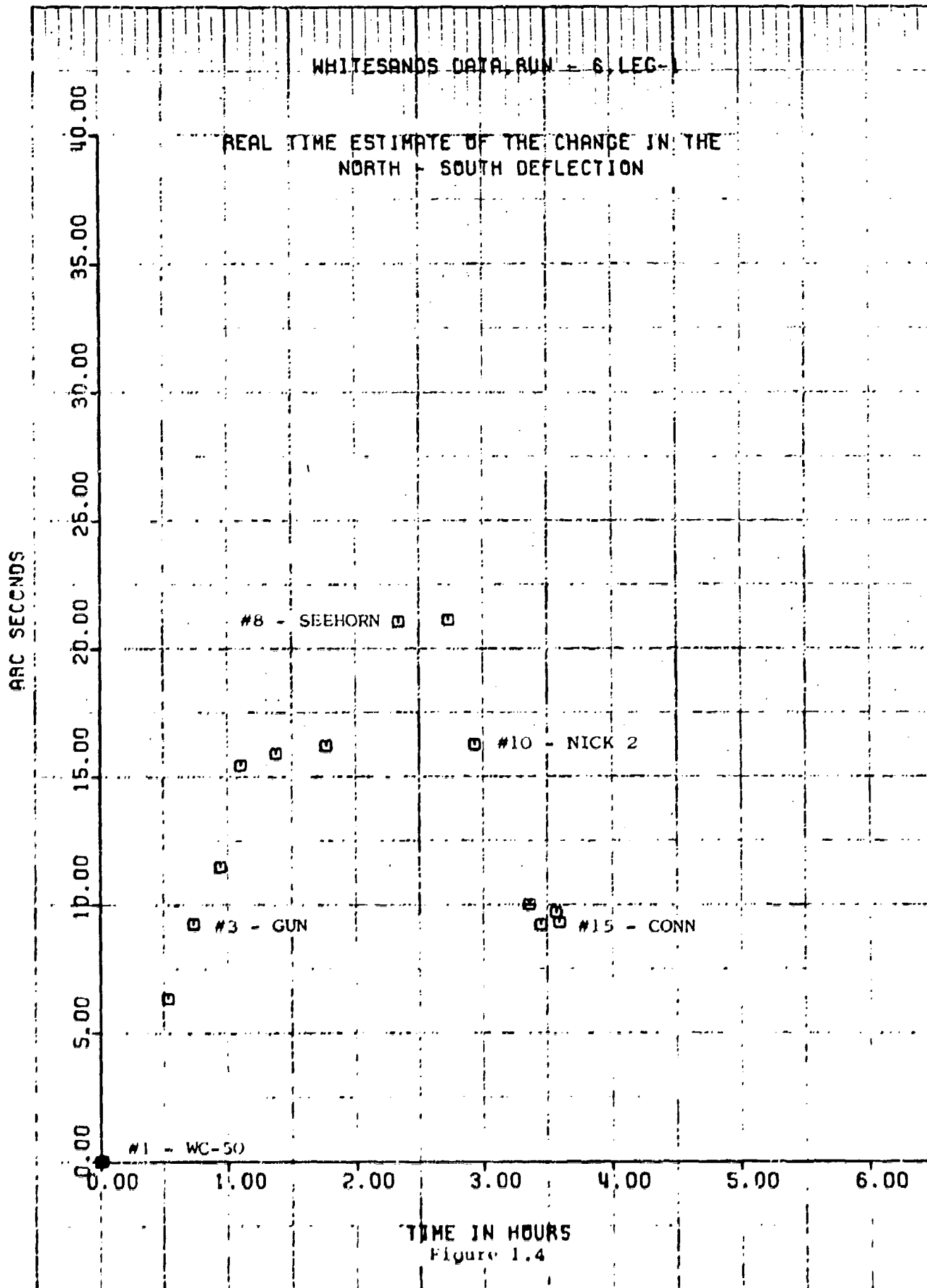
WHITEBANDS DATA RUN - 3. LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS

Figure 1.1



WHITESANDS DATA RUN - 7, LEC-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

#15 - CONN

#12 - WHITE

#7 - D-3

#3 - GUN

#1 - WC-50

TIME IN HOURS

Figure 1.5

WHITESANDS DATA RUN - 1, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00

#3 - SANDS NE BASE

#7 - ADD ECC

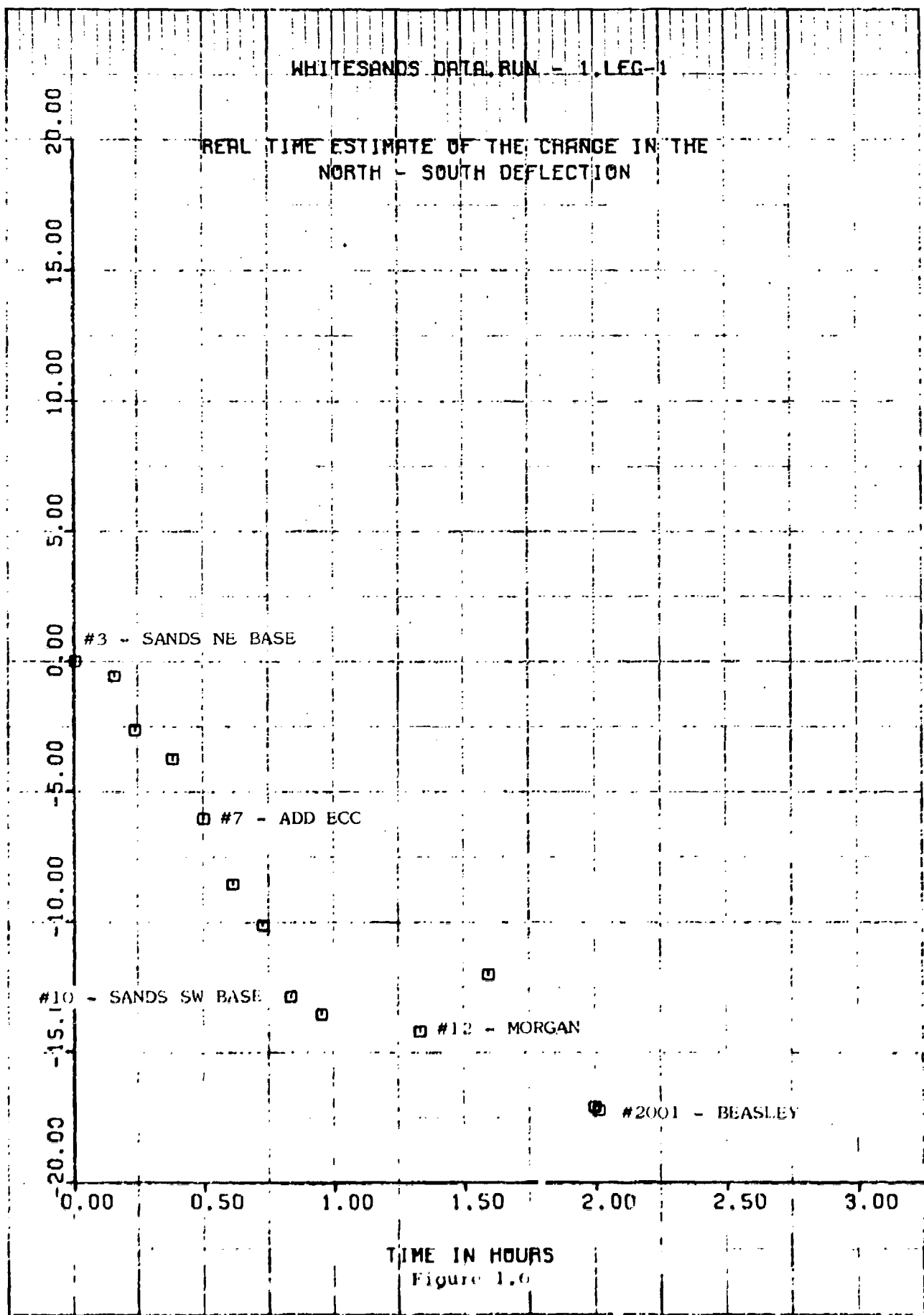
#10 - SANDS SW BASE

#12 - MORGAN

#2001 - BEASLEY

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS
Figure 1.0



WHITESANDS DATA RUN - 2, LEC-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

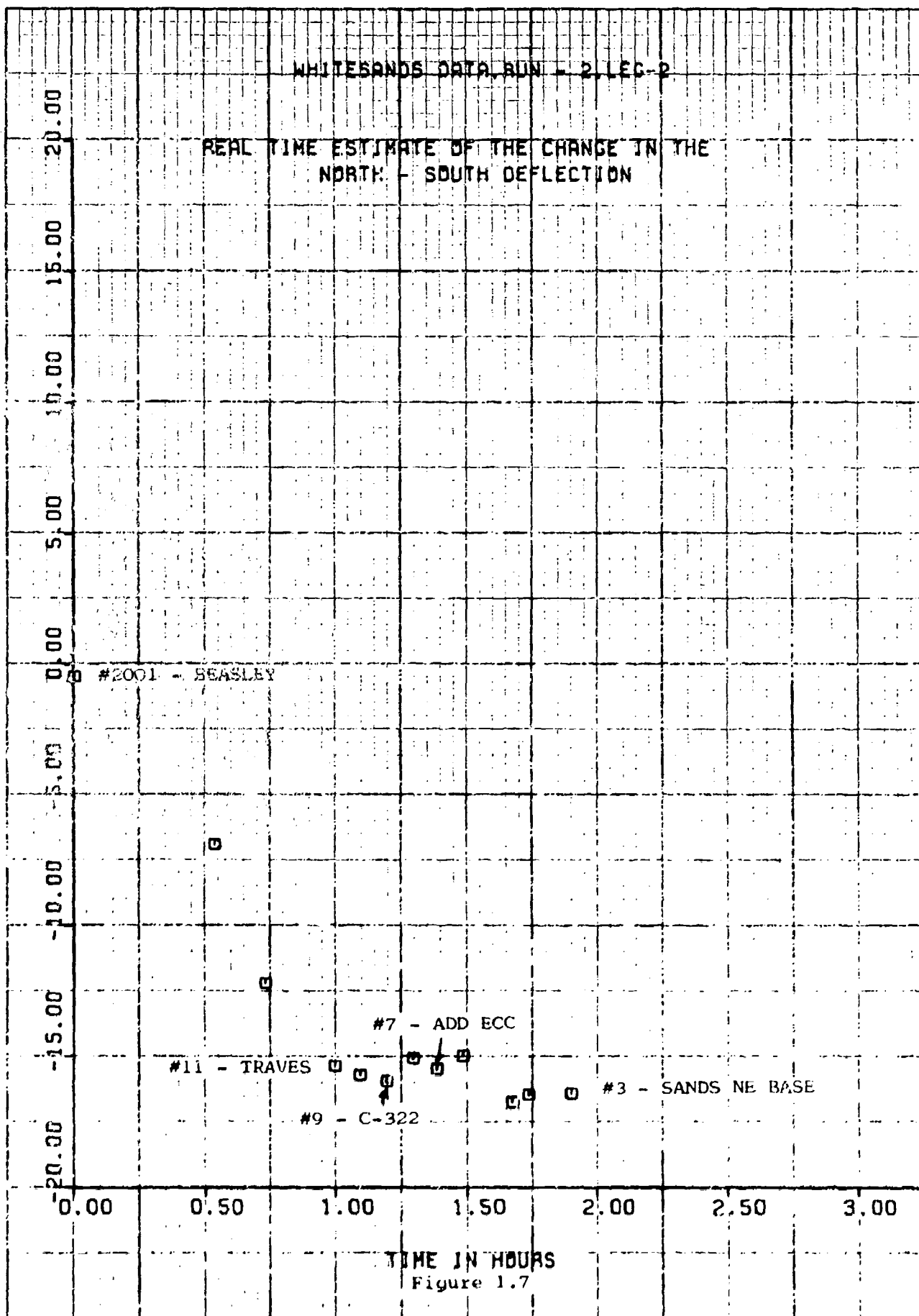


Figure 1.7

WHITESANDS DATA RUN - 9. LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

□ #3 - SANDS NE BASE

□ #5 - OTERO ECC

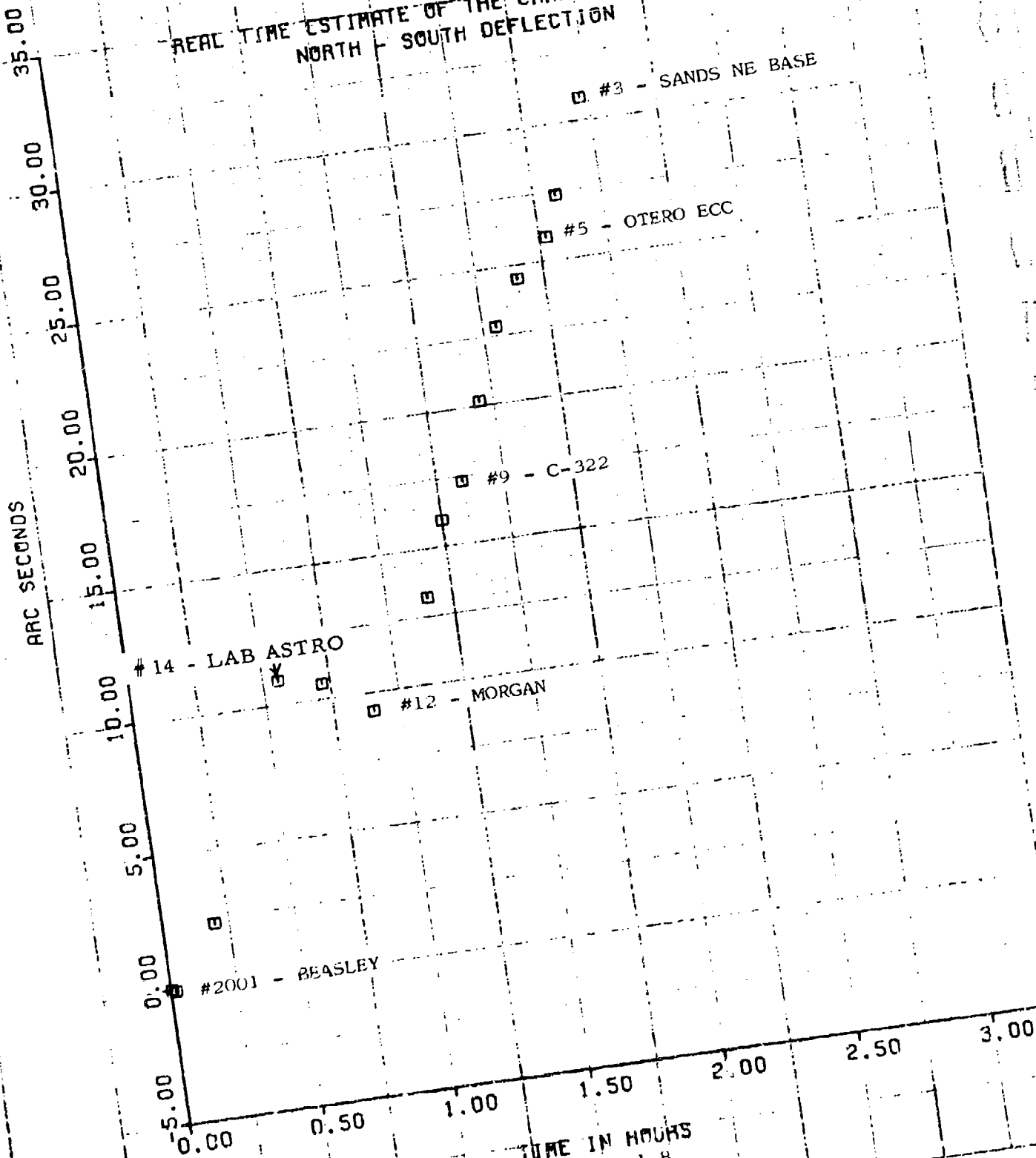
□ #9 - C-322

□ #14 - LAB ASTRO

□ #12 - MORGAN

□ #2001 - BEASLEY

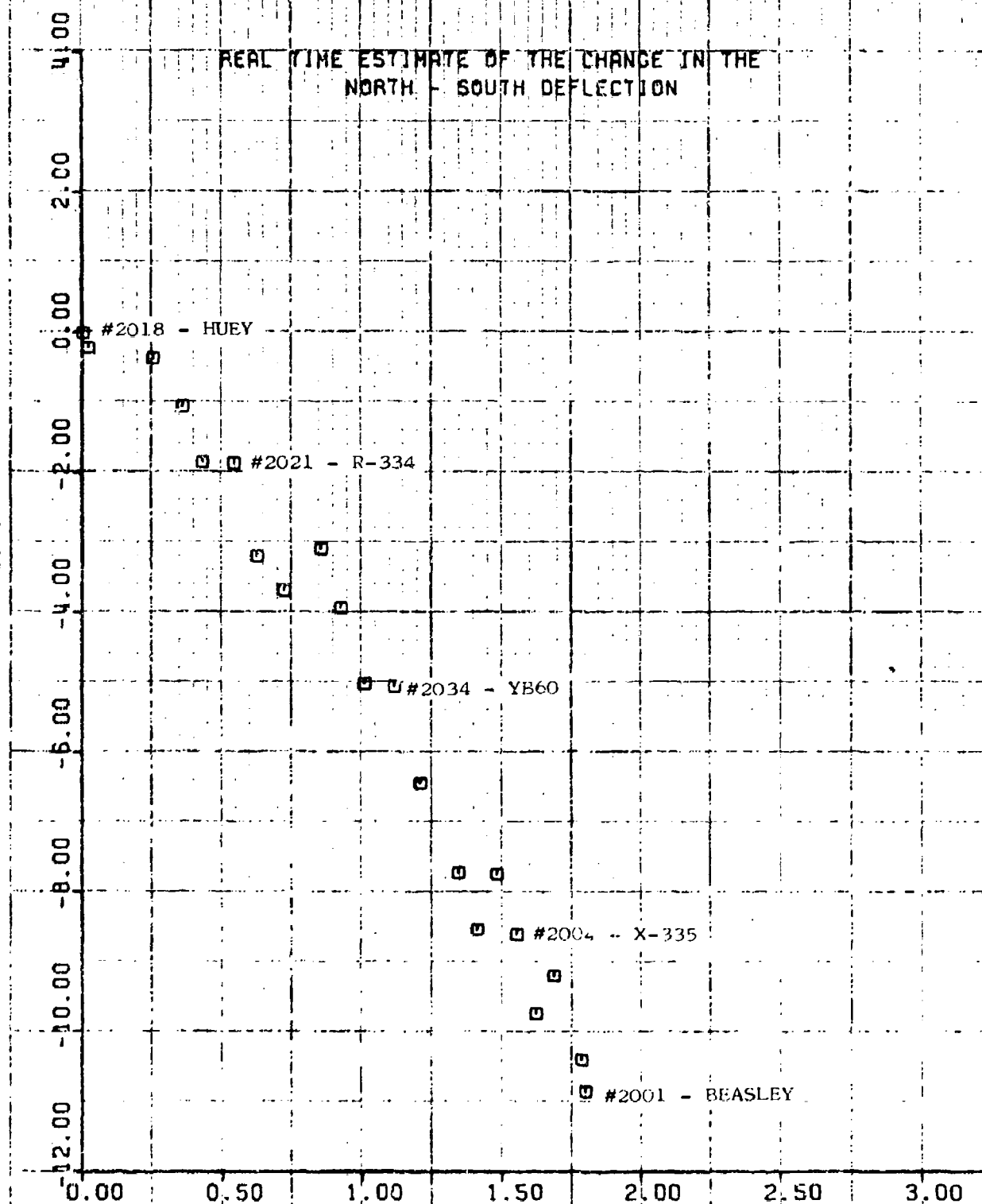
TIME IN HOURS
Figure 1.8



WHITESANDS DATA RUN - 2 LEC-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

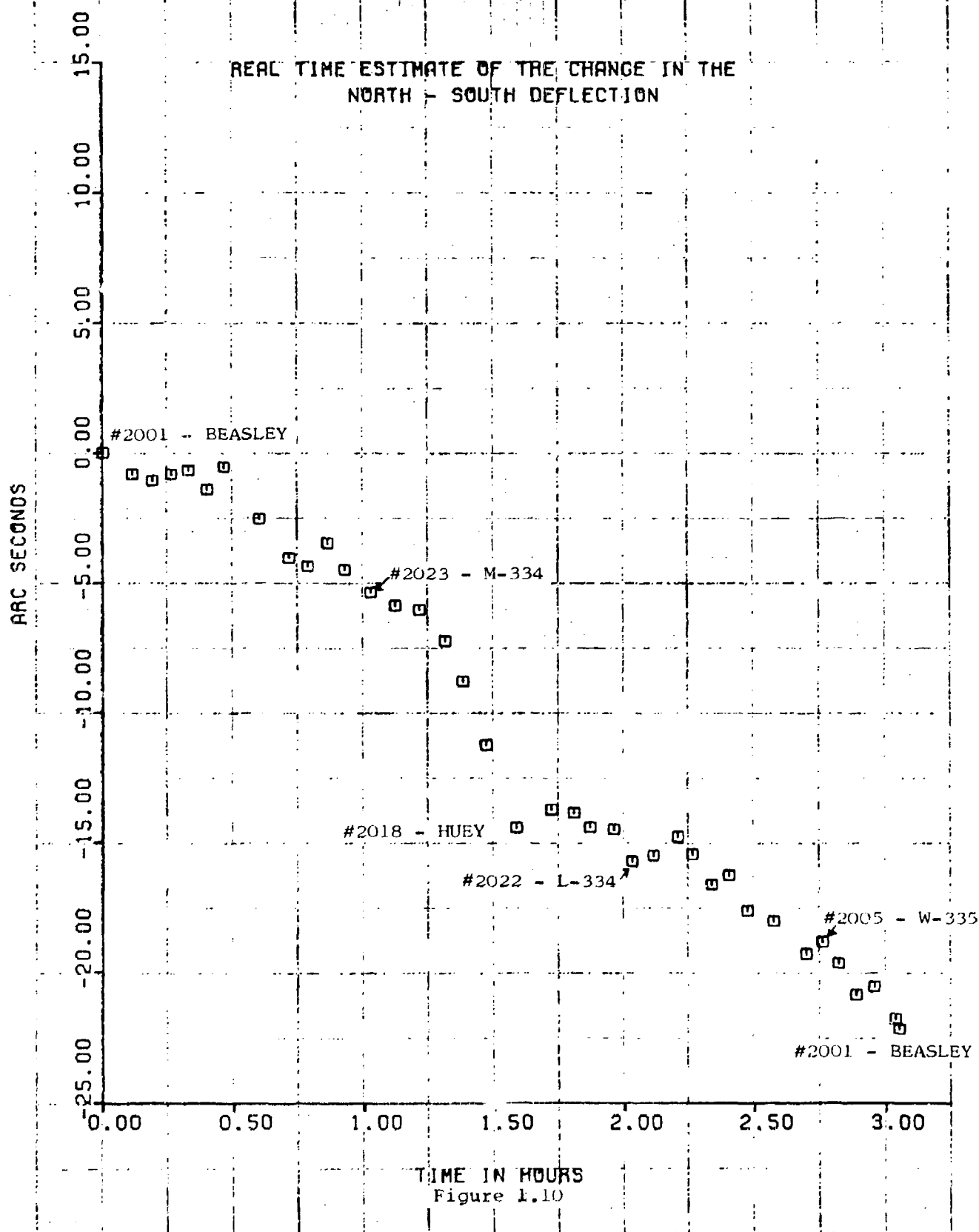


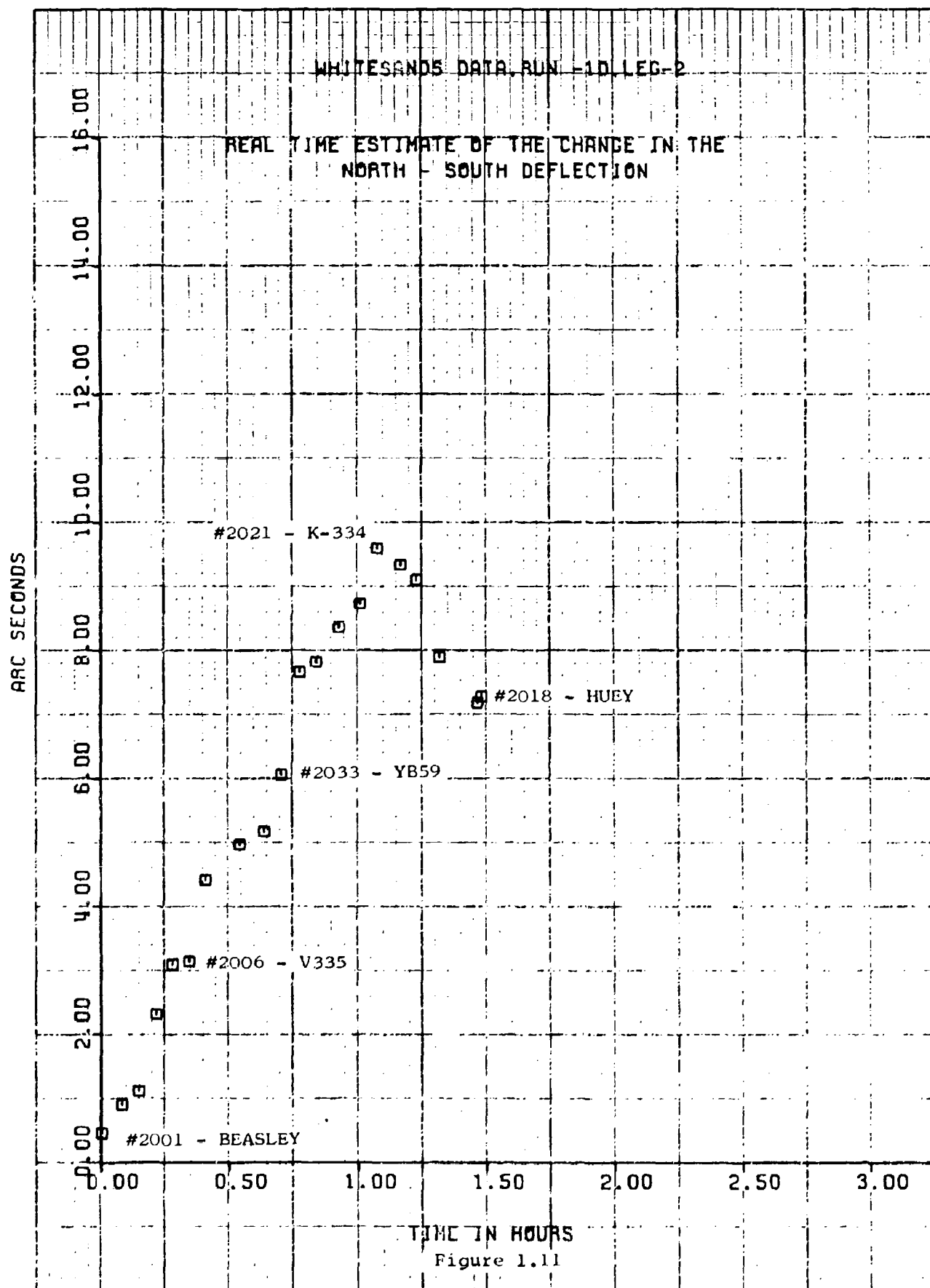
TIME IN HOURS

Figure 1.9

WHITESANDS DATA RUN - 8, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION





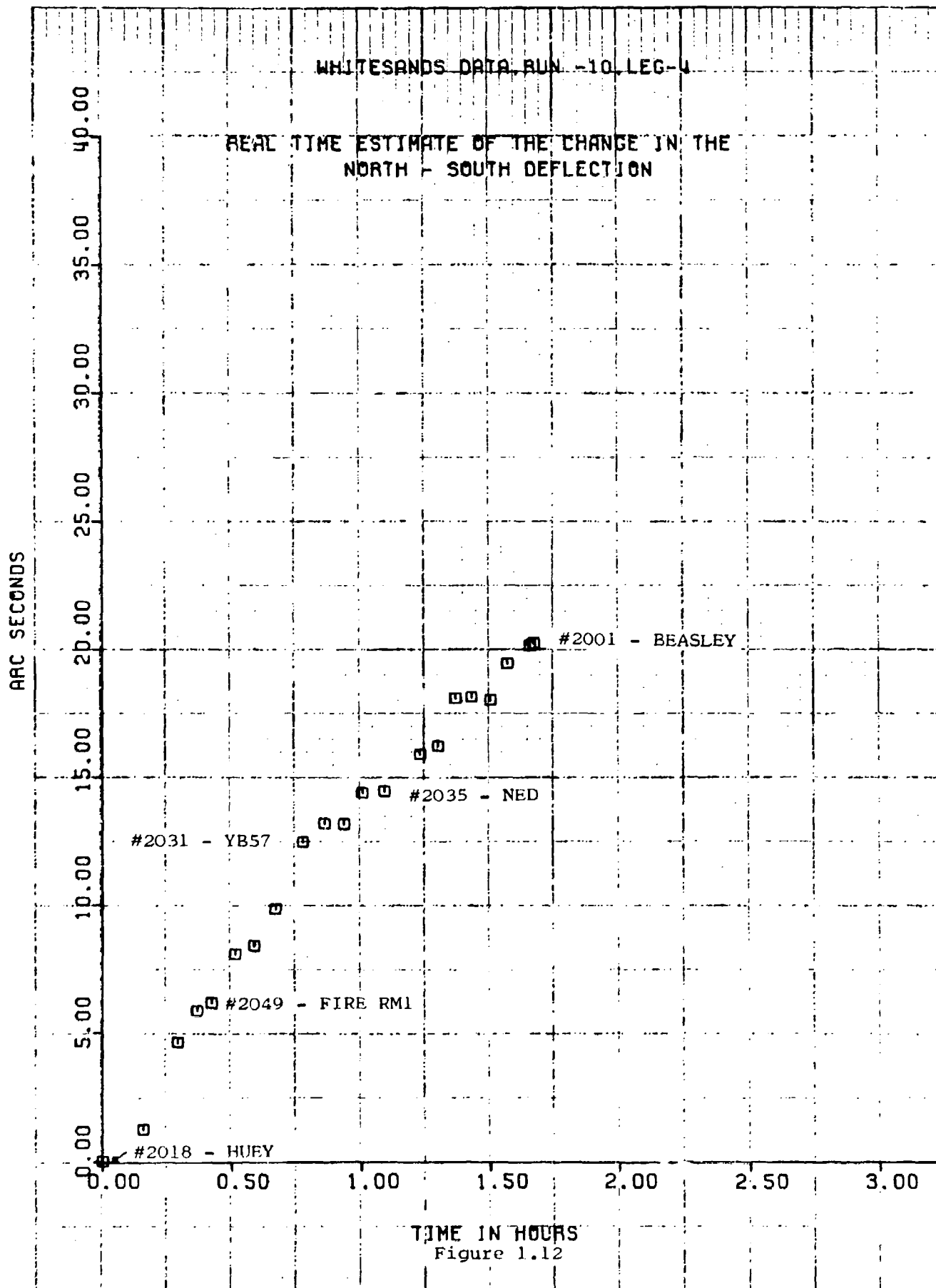
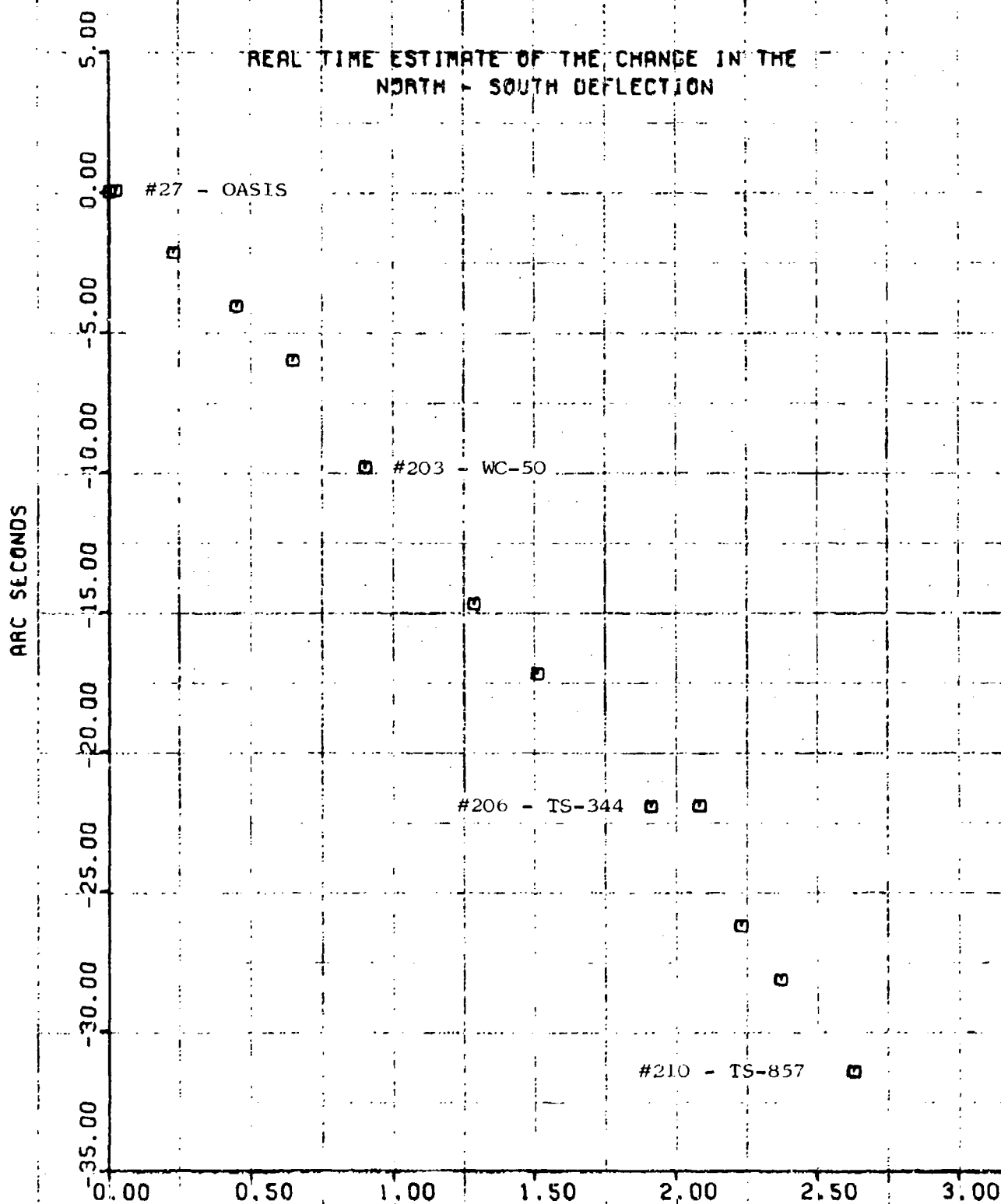


Figure 1.12

WHITESANDS DATA RUN -13, LEG-1

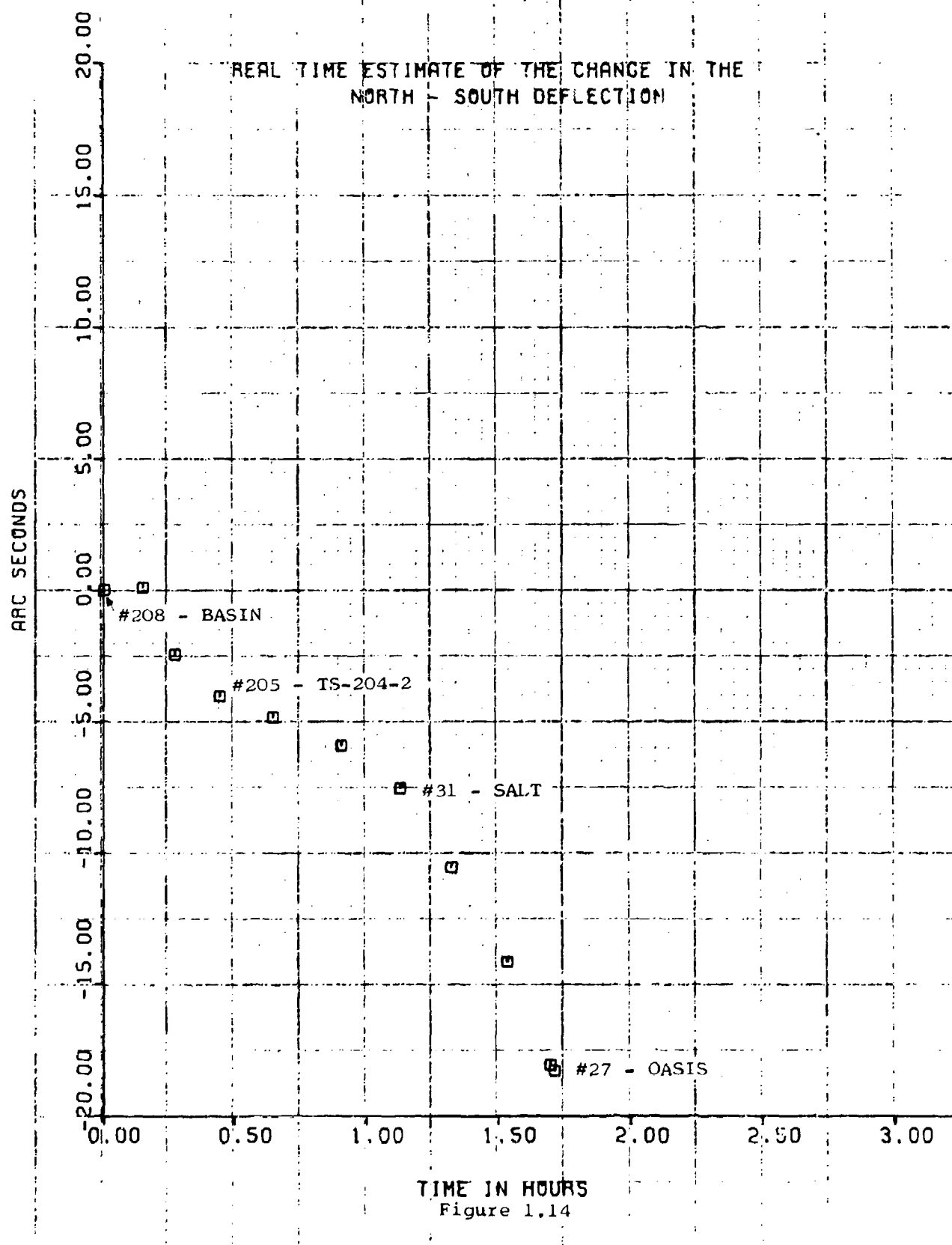
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

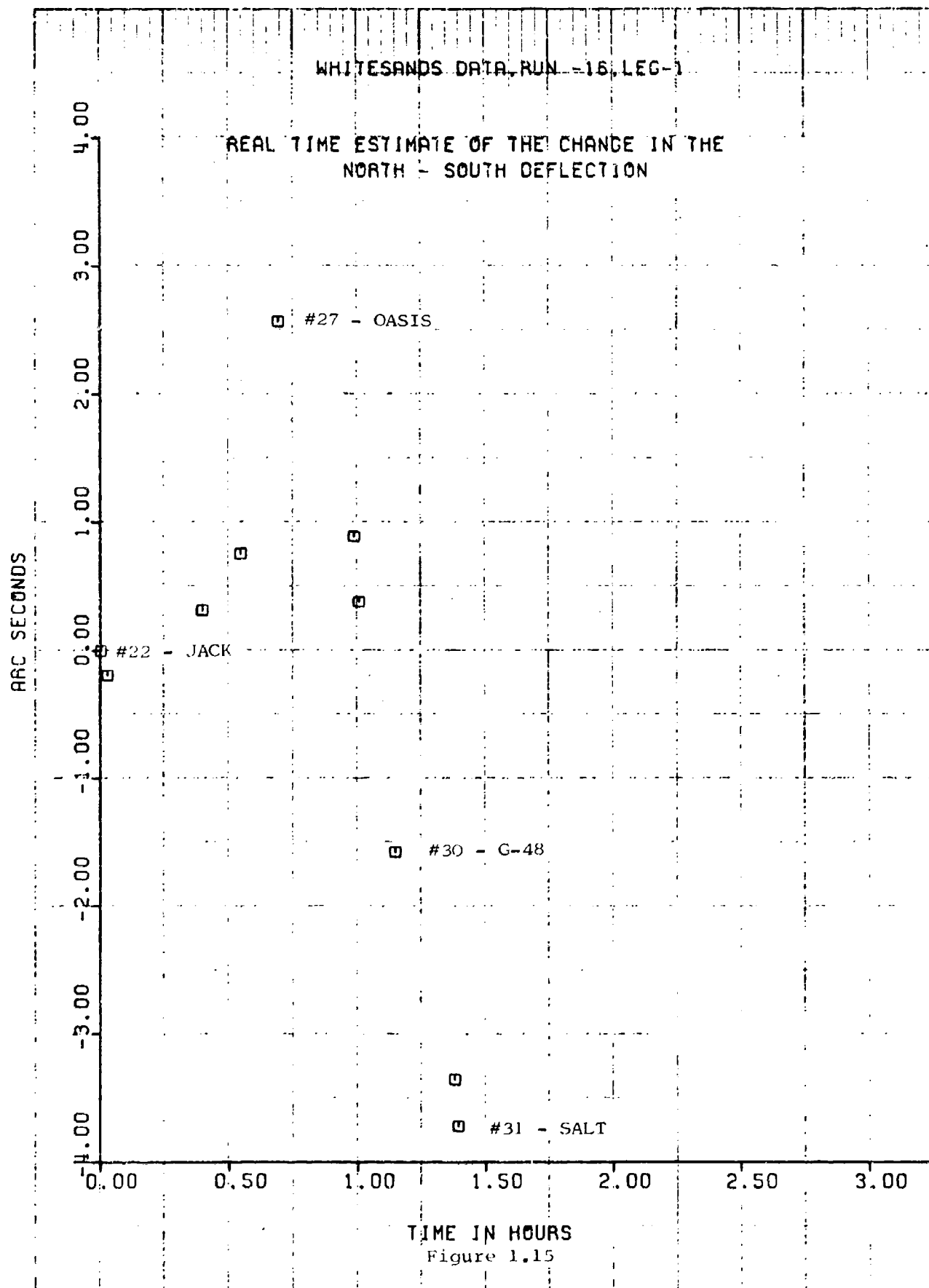


TIME IN HOURS

Figure 1.13

WHITESANDS DATA, RUN -14, LEG-1





WHITESANDS DATA RUN -16, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00

#31 - SALT

□

#29 - VALLEY ASTRO

□

#27 - OASIS

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS
Figure 1.16

WHITESANDS DATA, RUN -16, LEG-B

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00

#27 - OASIS

□

□ #26 - MONUMENT 14

□□ #22 - JACK

0.00

0.20

0.40

0.60

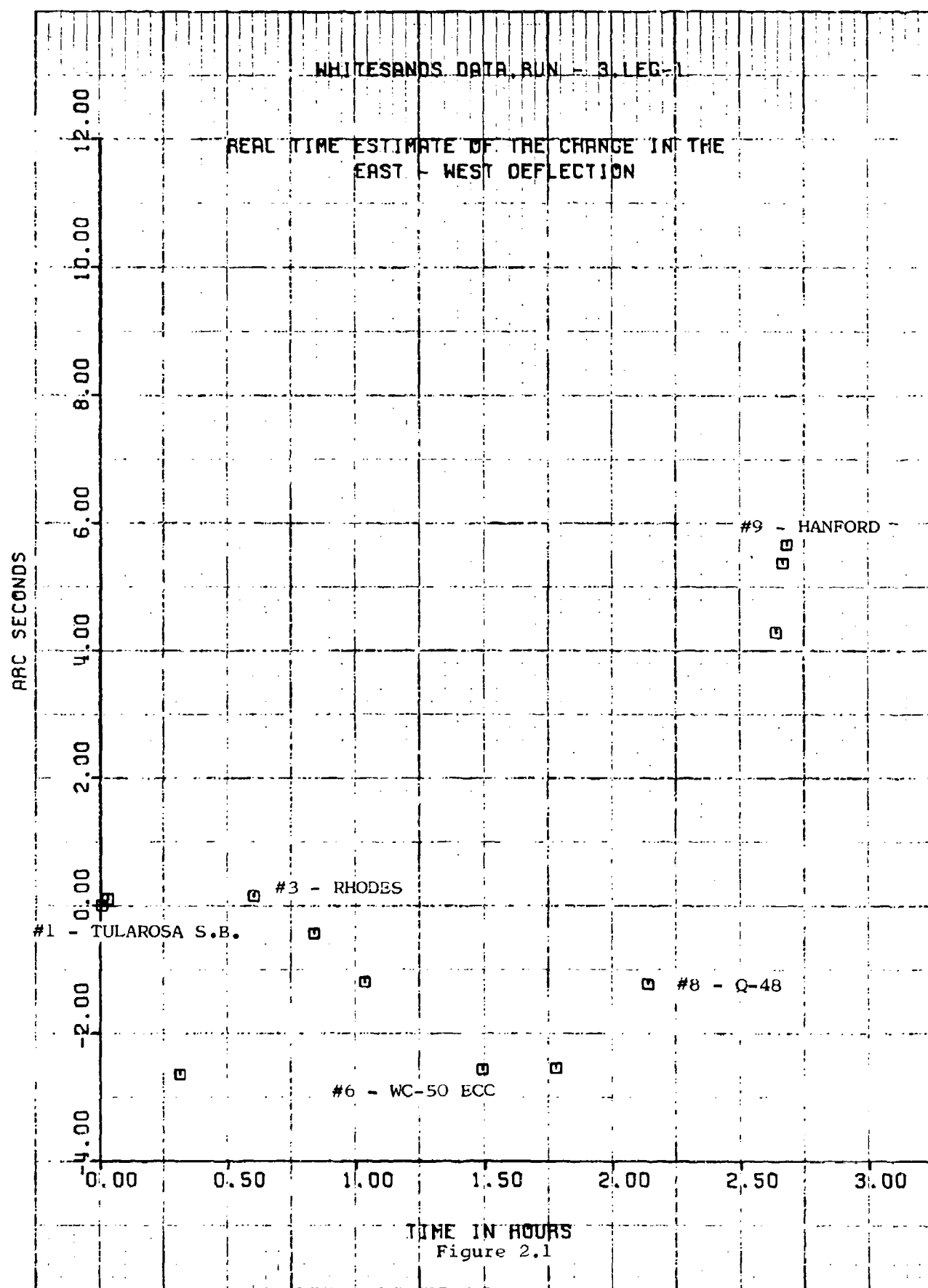
0.80

1.00

1.20

TIME IN HOURS

Figure 1.17



WHITESANDS DATA RUN - 4, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00

#9 - HANFORD

#7 - 4P953

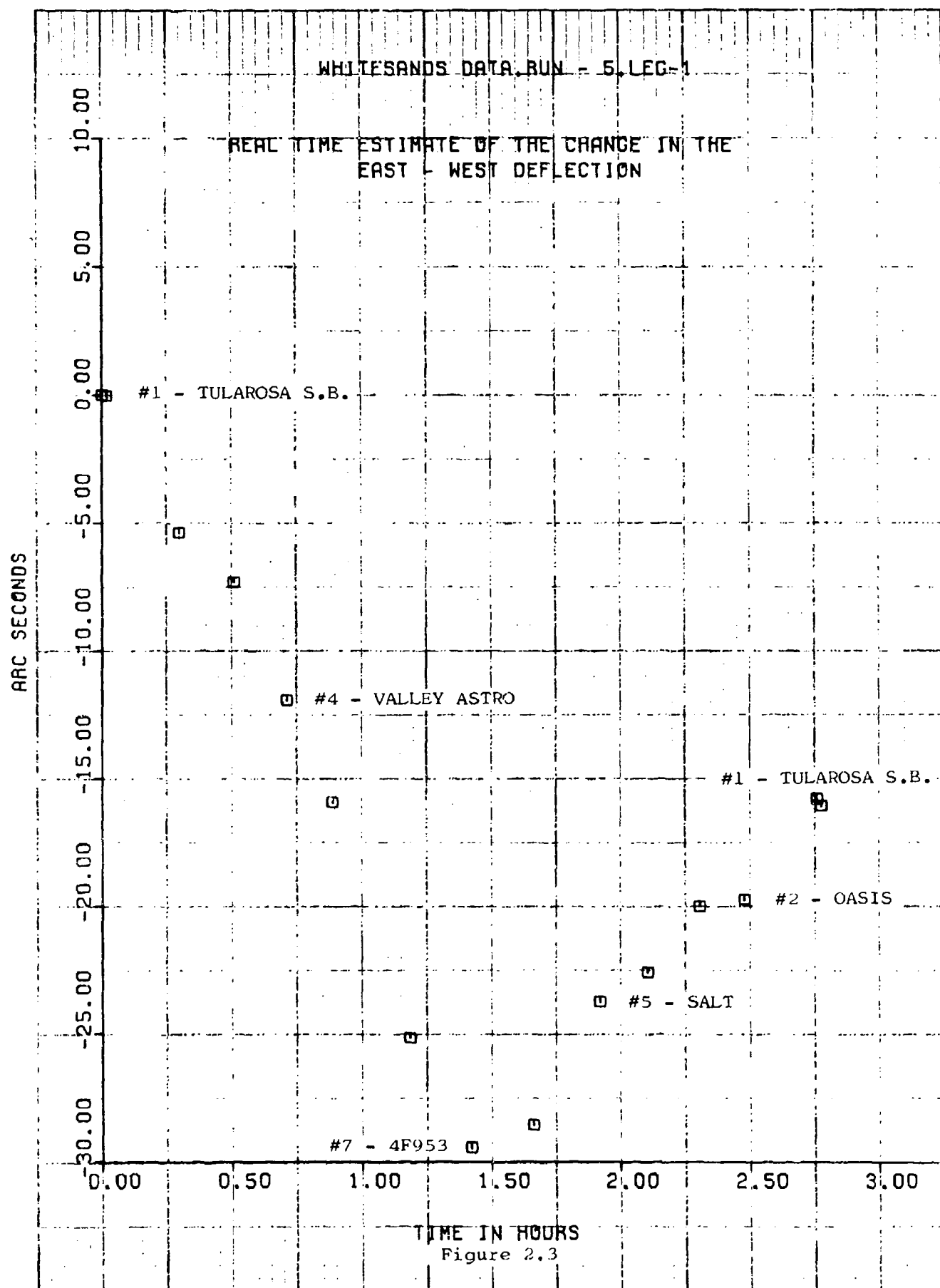
#5 - SALT

#2 - OASIS

#1 - TULAROSA S.B.

TIME IN HOURS
Figure 2.2

0.00 0.50 1.00 1.50 2.00 2.50 3.00



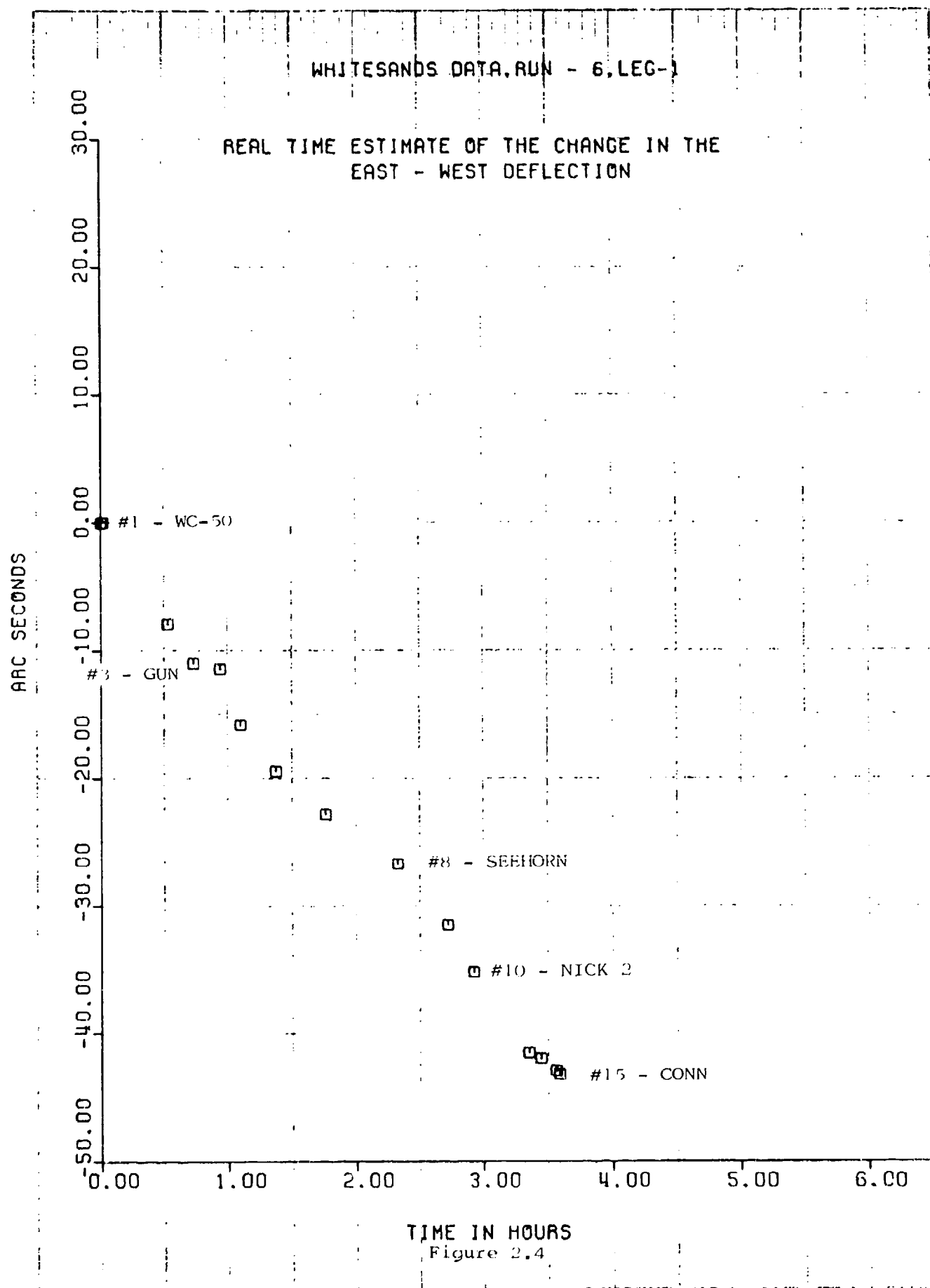
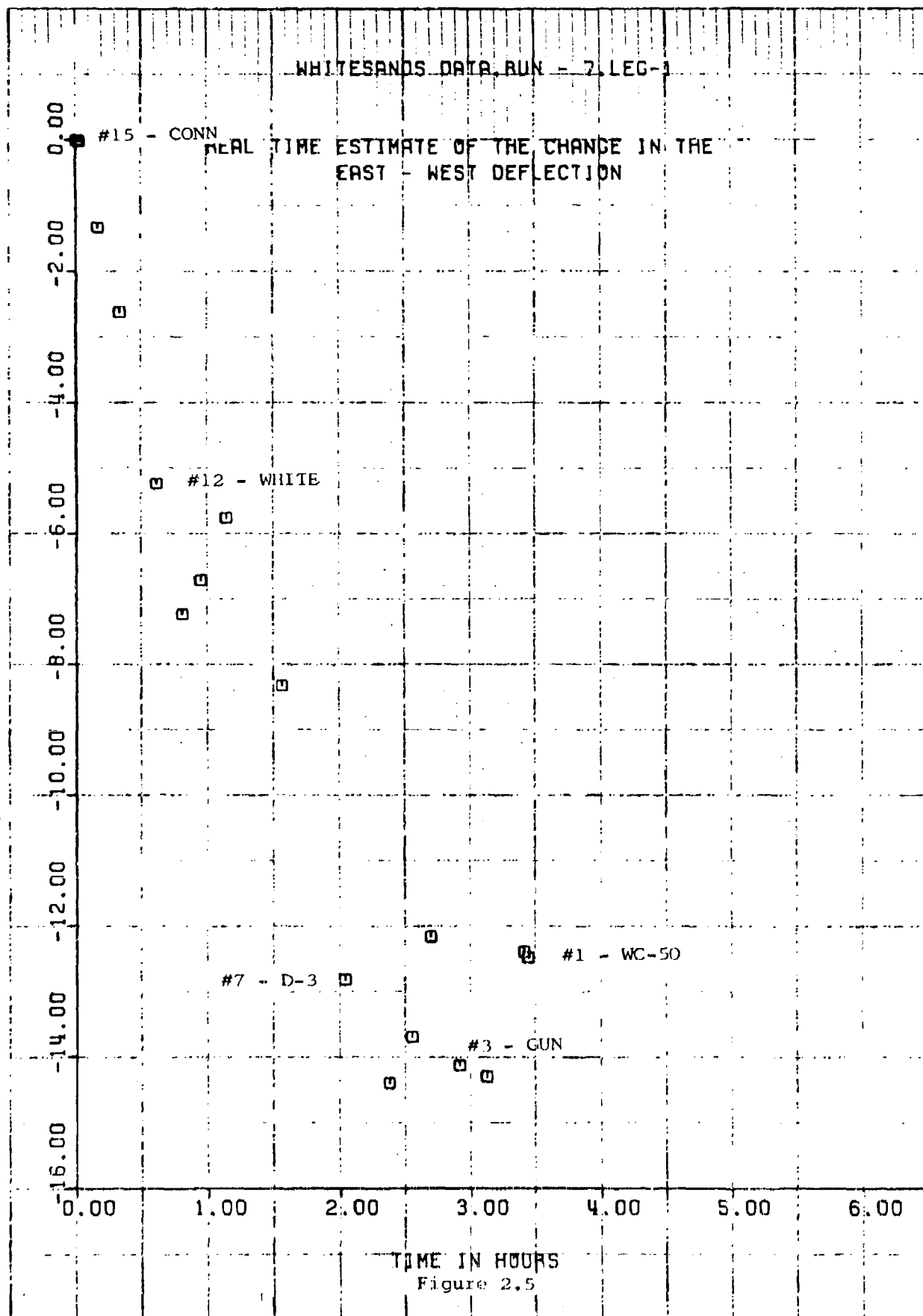
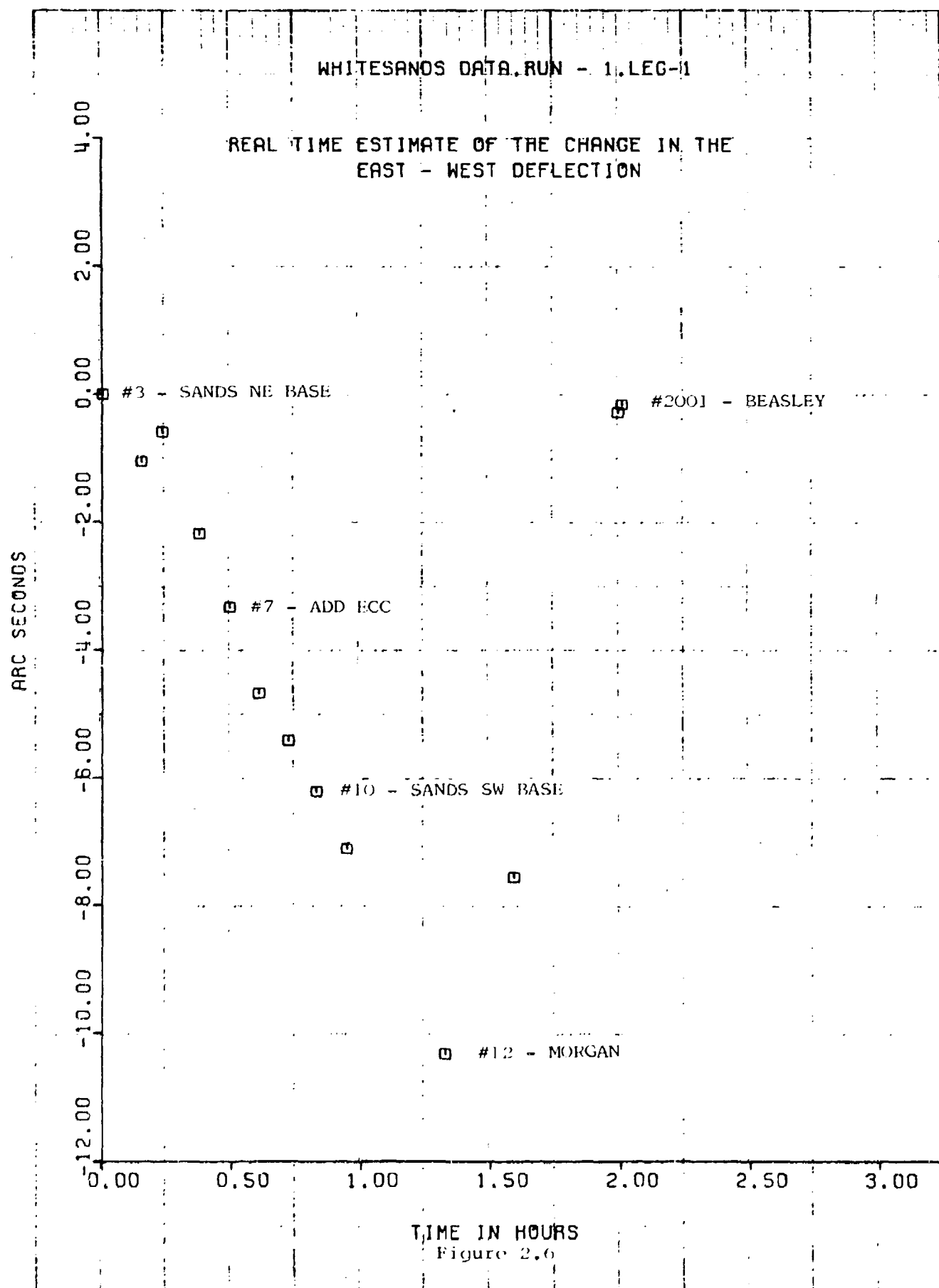
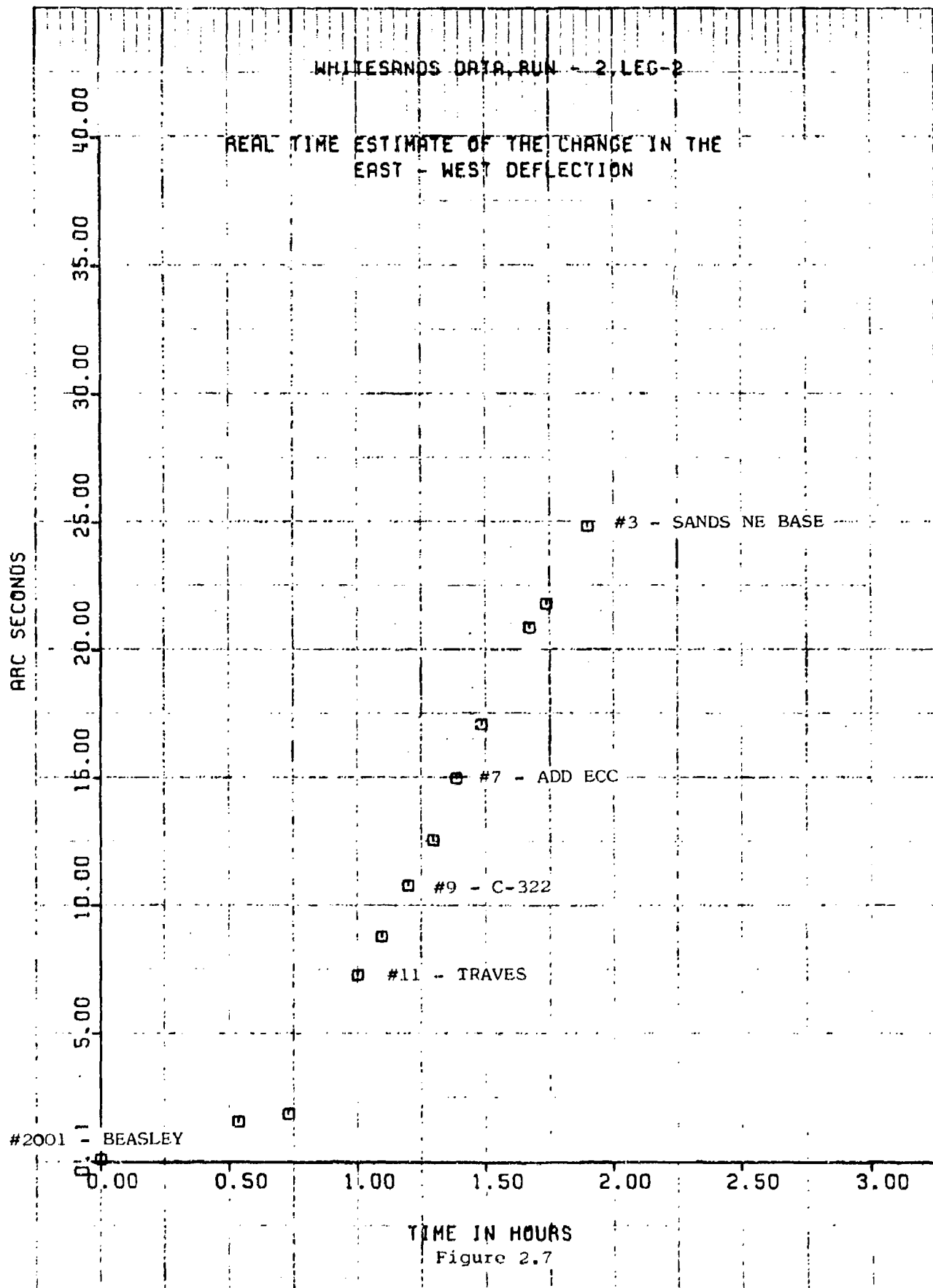


Figure 2.4

ARC SECONDS







ARC SECONDS

WHITESANDS DATA, RUN - 9, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

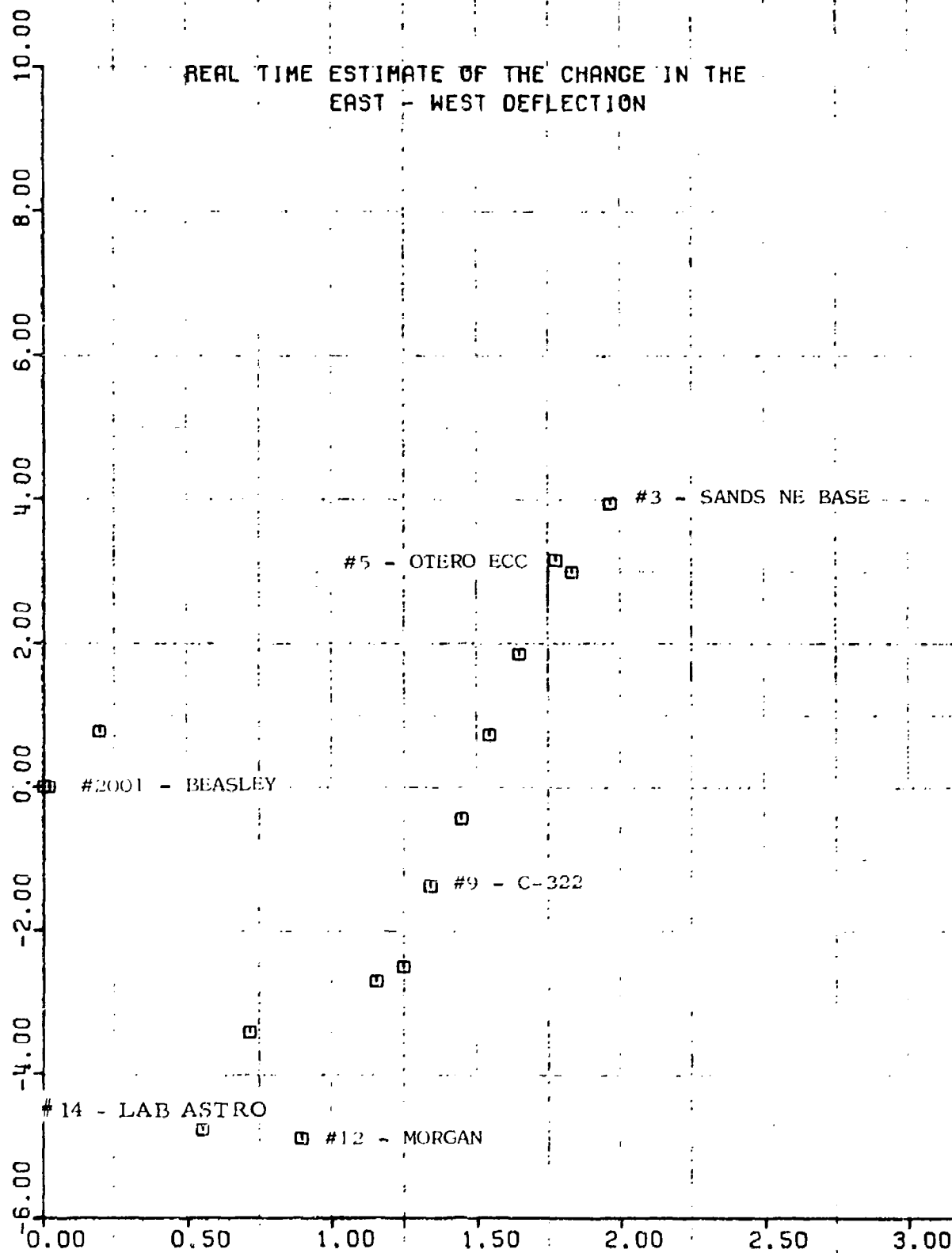
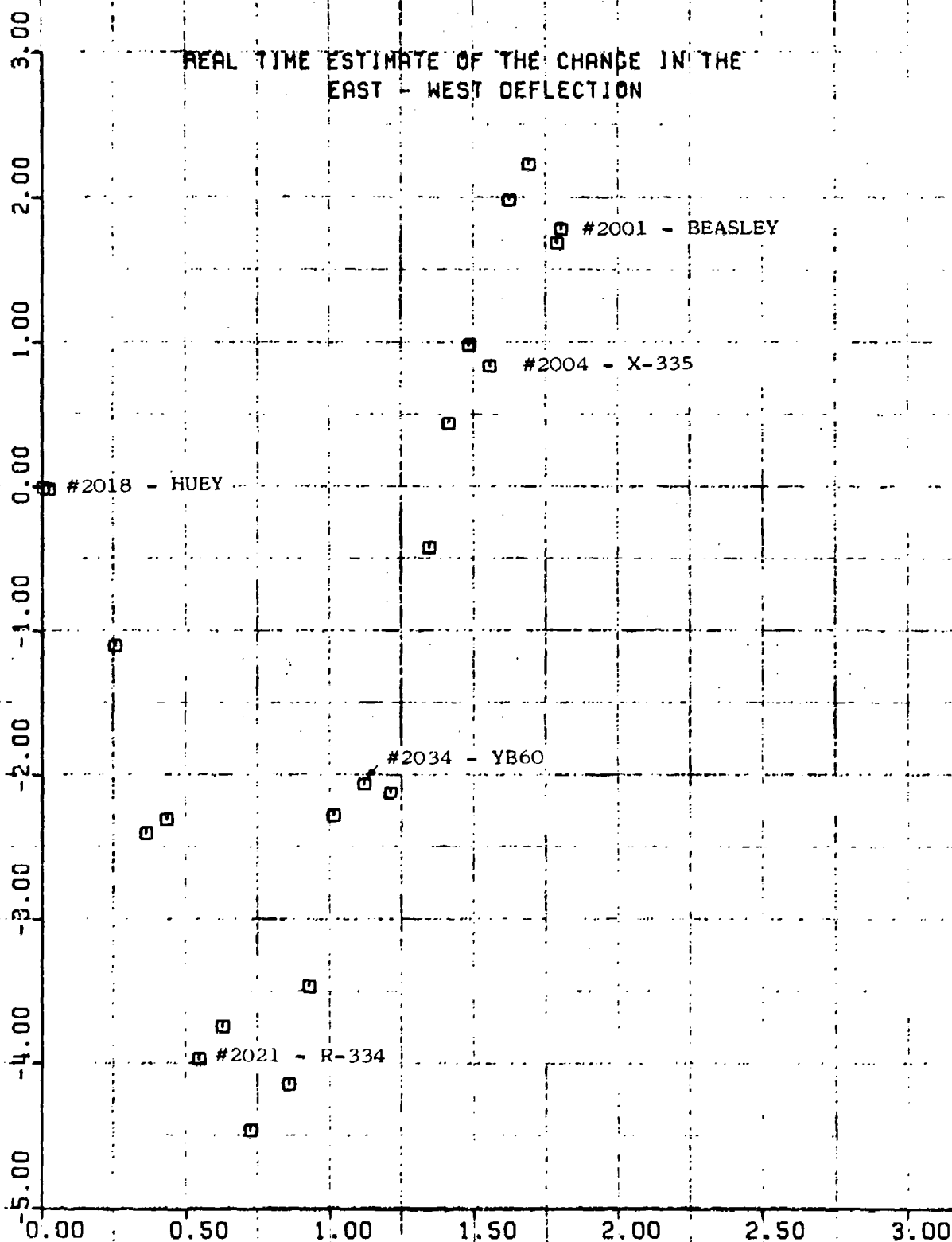


Figure 2.8

ARC SECONDS

WHITESANDS DATA, RUN - 2, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure 2.9

WHITESANDS DATA RUN - 8, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00

#2001 - BEASLEY

#2018 - HUEY

#2023 - M-334

#2022 - L-334

#2005 - W-2

#2001 - BEASL

TIME IN HOURS

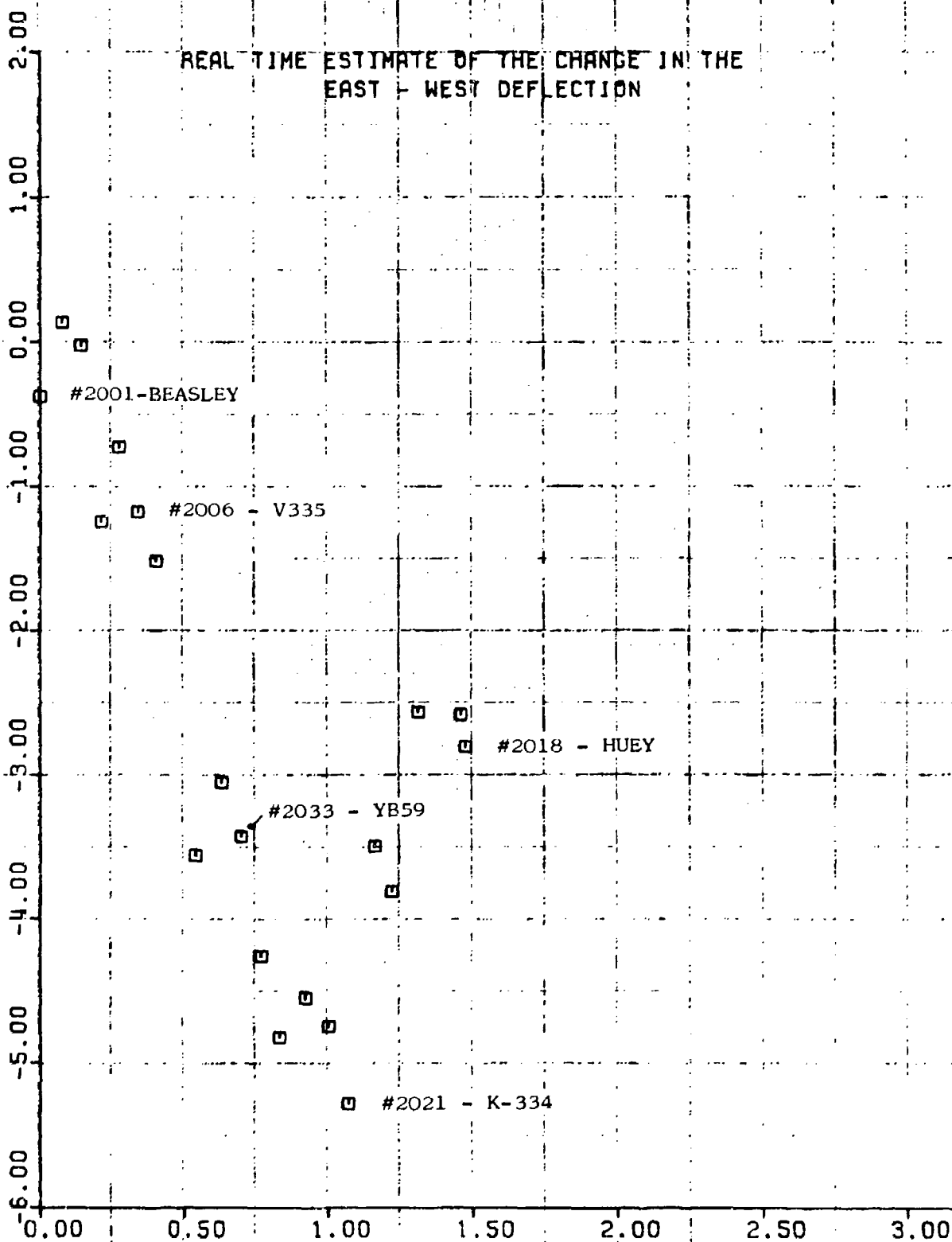
Figure 2.10

0.00 0.50 1.00 1.50 2.00 2.50 3.00

WHITESANDS DATA, RUN -10, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure 2.11

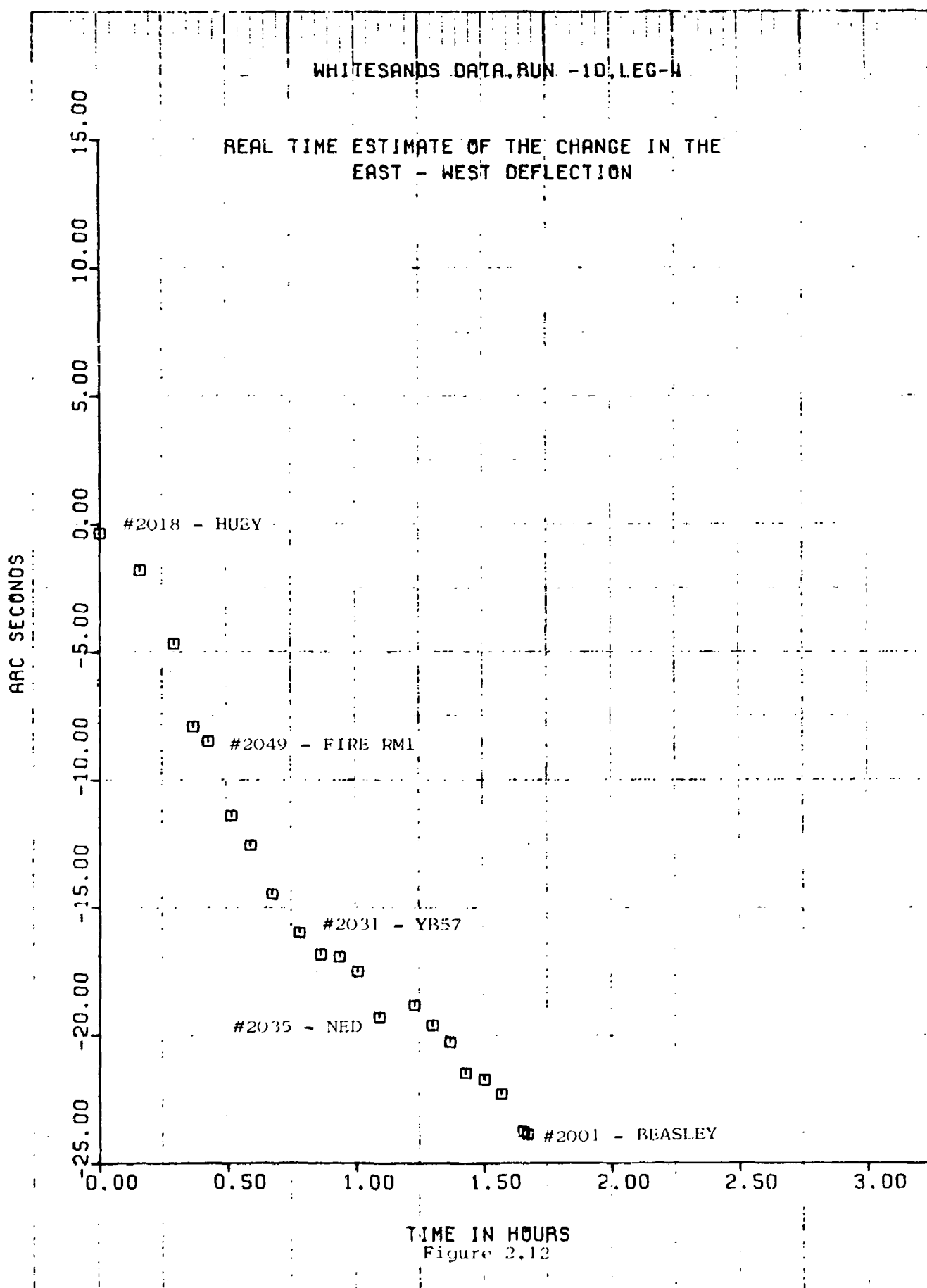


Figure 2.12

WHITESANDS DATA RUN -13, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00

#27 - OASIS

#210 - TS-857

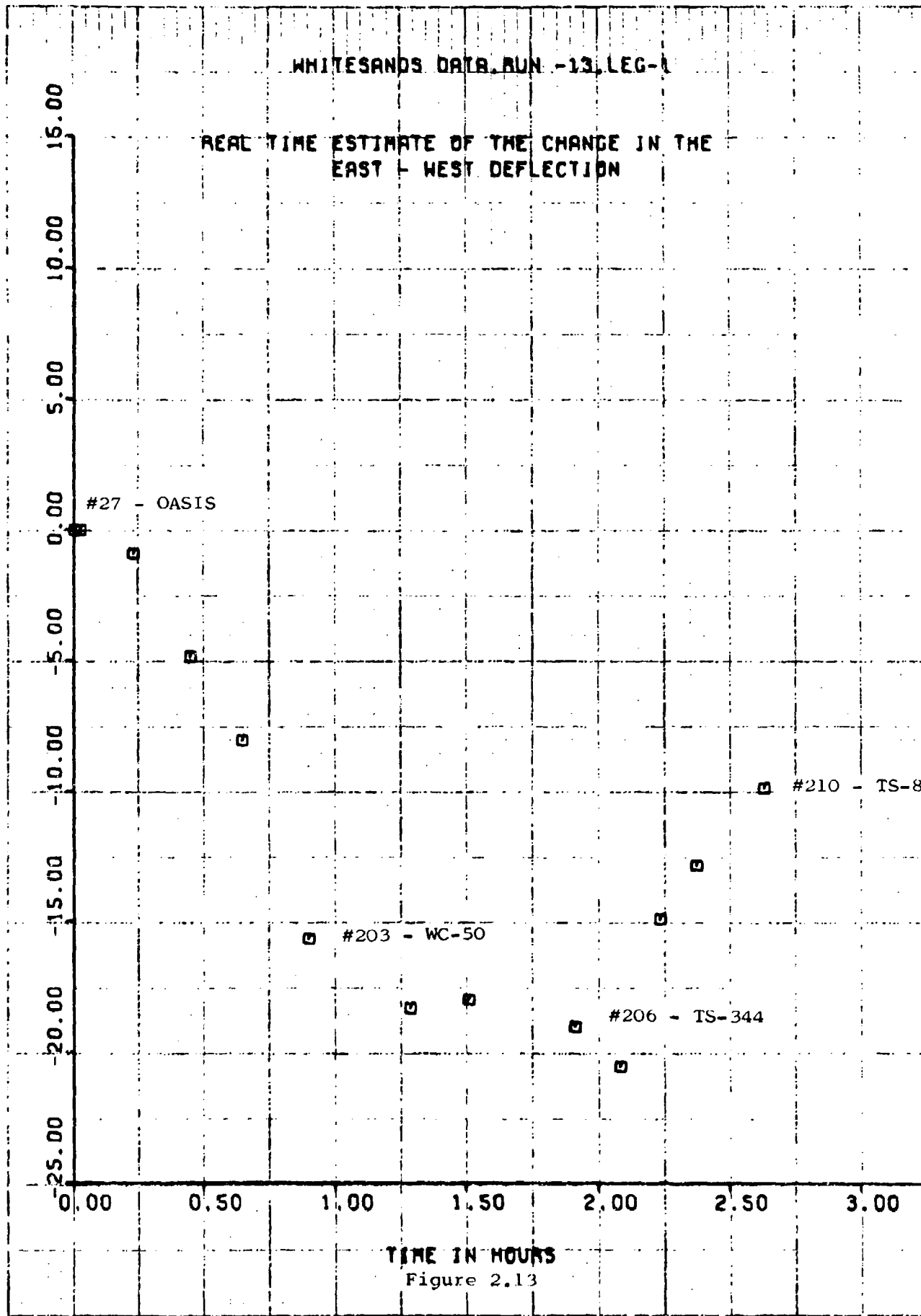
#203 - WC-50

#206 - TS-344

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS

Figure 2.13



WHITESANDS DATA, RUN -14, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

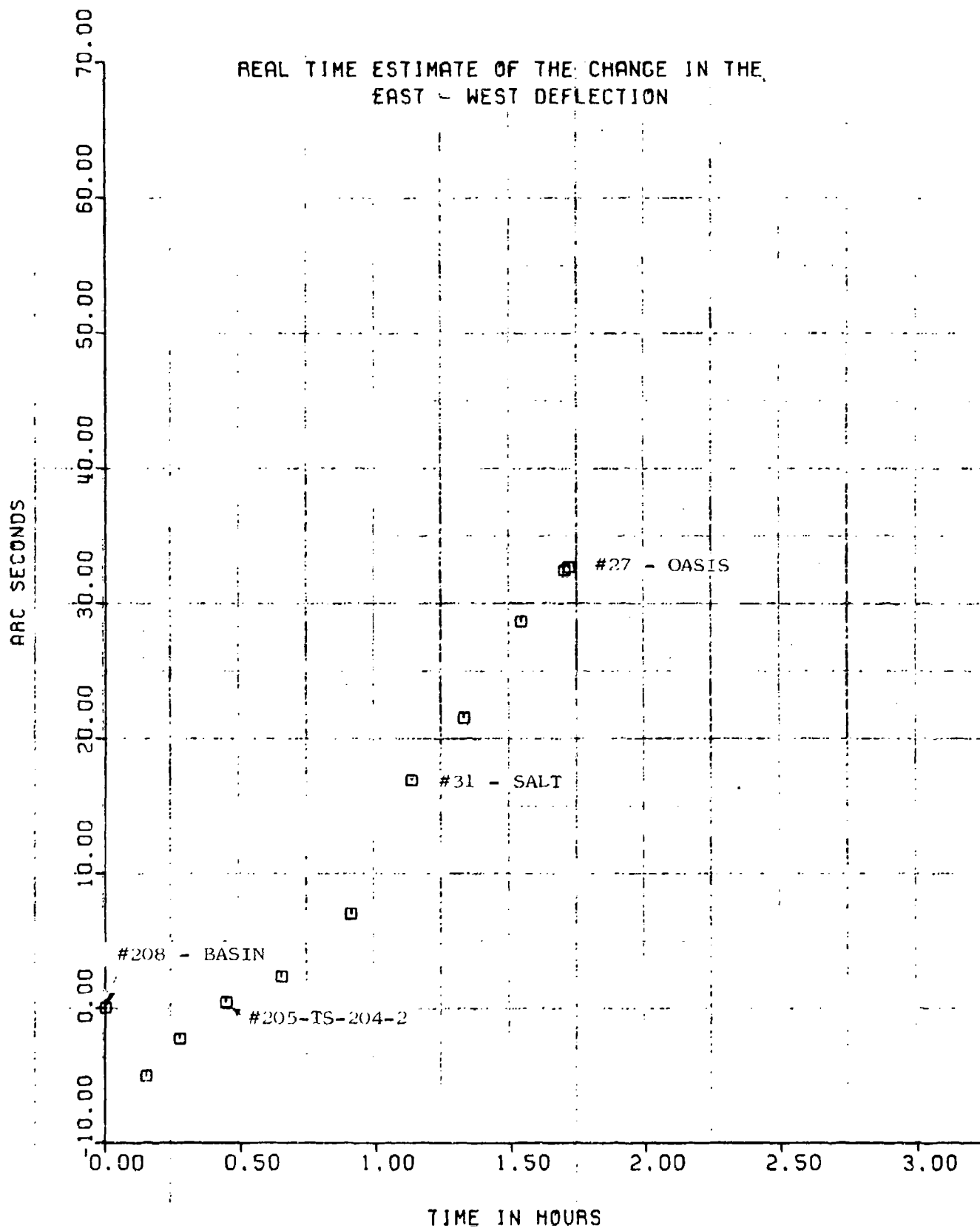
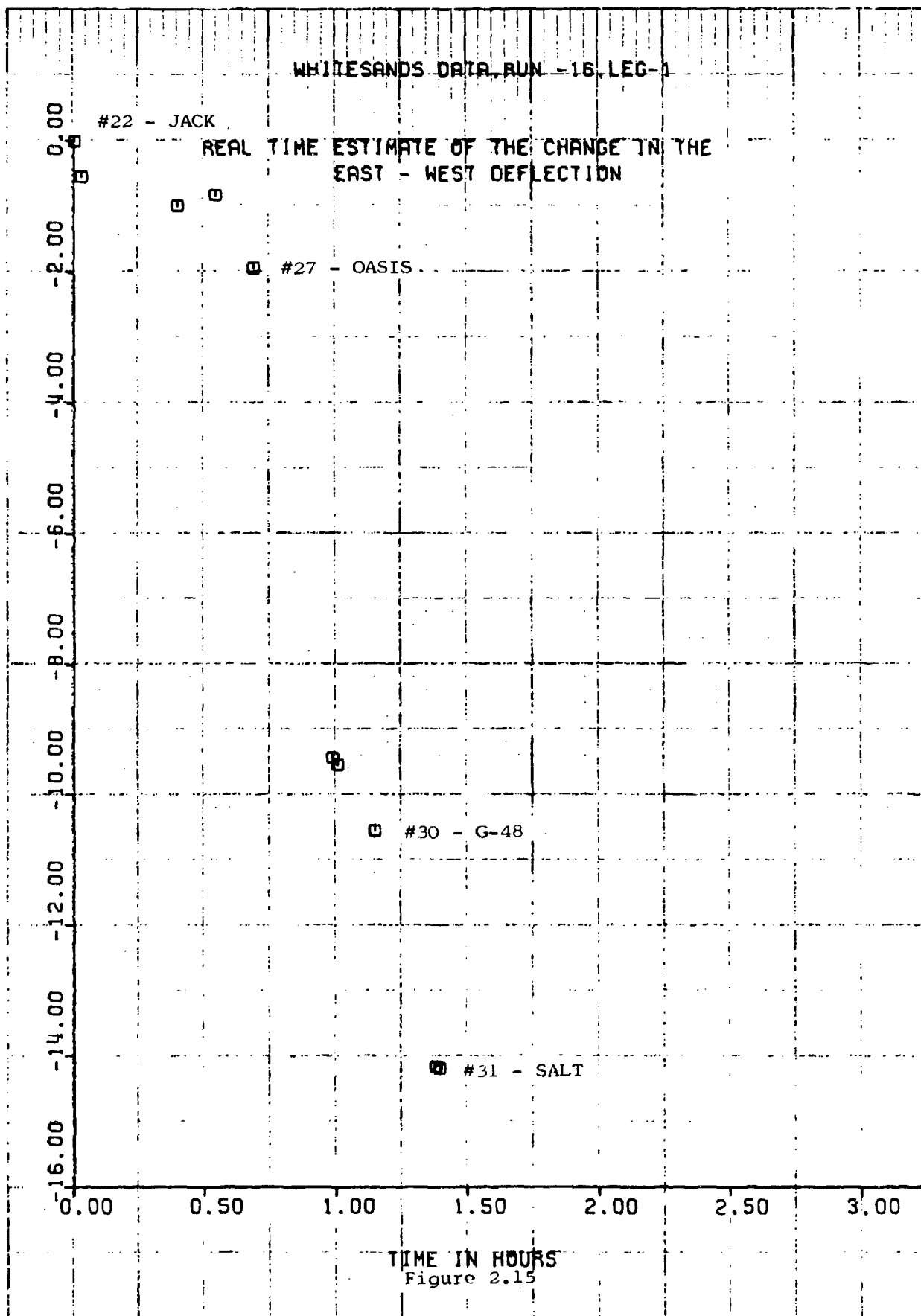


Figure 2.14

ARC SECONDS



WHITESANDS DATA, RUN -16, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

7.00

6.00

5.00

4.00

3.00

2.00

1.00

0.00

-1.00

0.00

0.20

0.40

0.60

0.80

1.00

1.20

TIME IN HOURS

Figure 2.16

#27 - OASIS

#29 - VALLEY ASTRO

#31 - SALT

B

B

B

B

WHITESANDS DATA RUN -16, LEG-B

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50

#27 - OASIS

#26 - MONUMENT 14

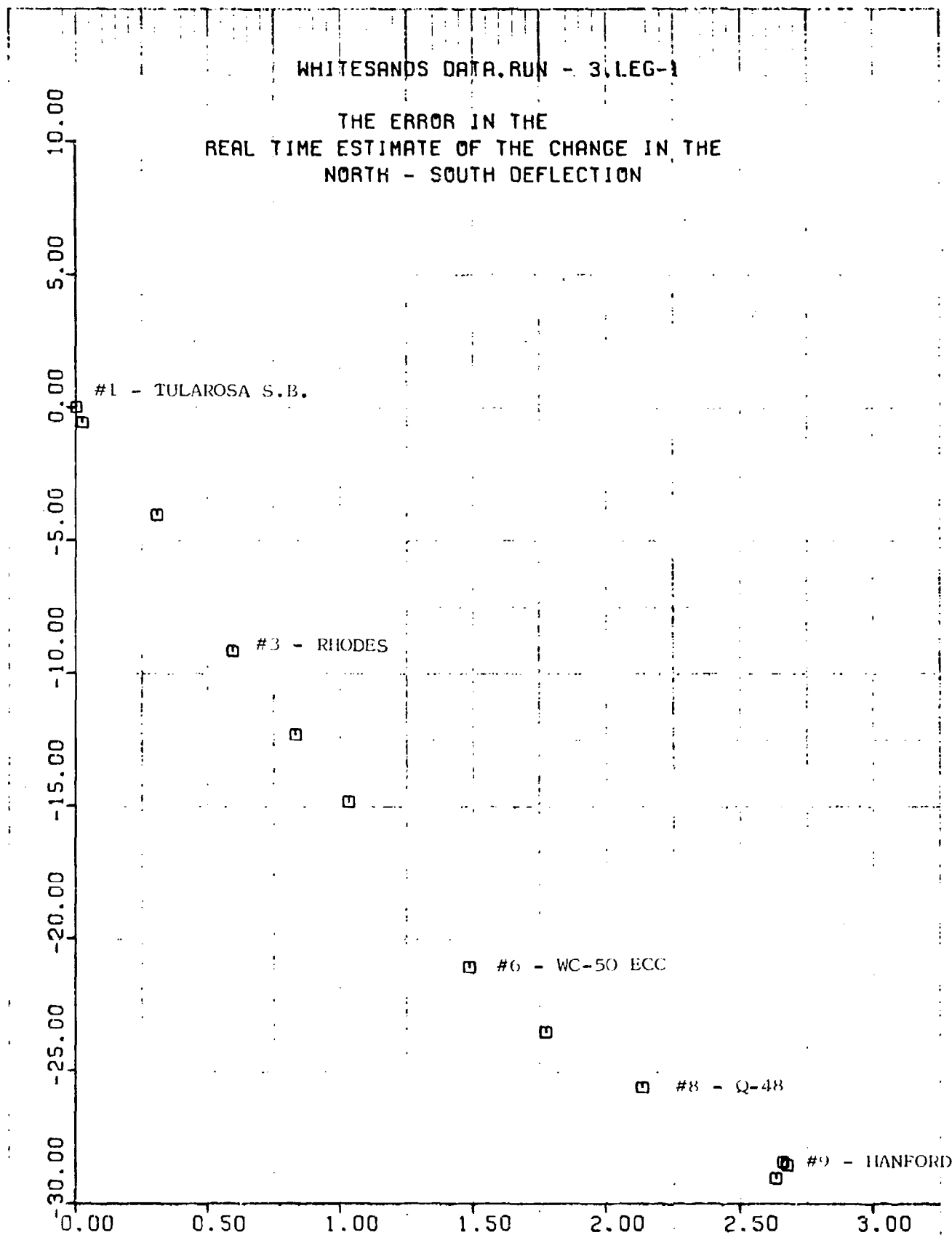
#22 - JACK

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS

Figure 2.17

ARC SECONDS



TIME IN HOURS
Figure 3.1

WHITESANDS DATA RUN - W. LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

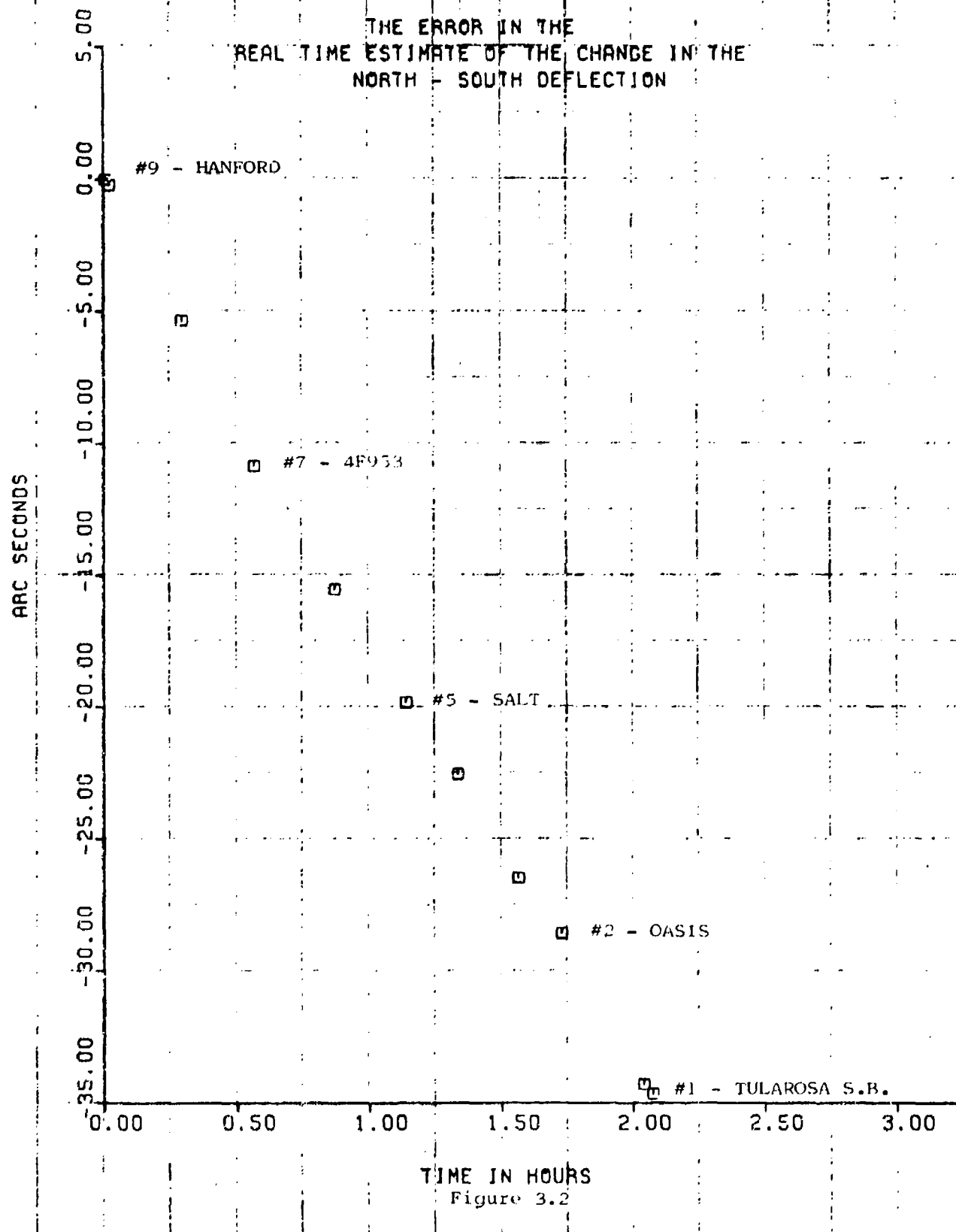


Figure 3.2

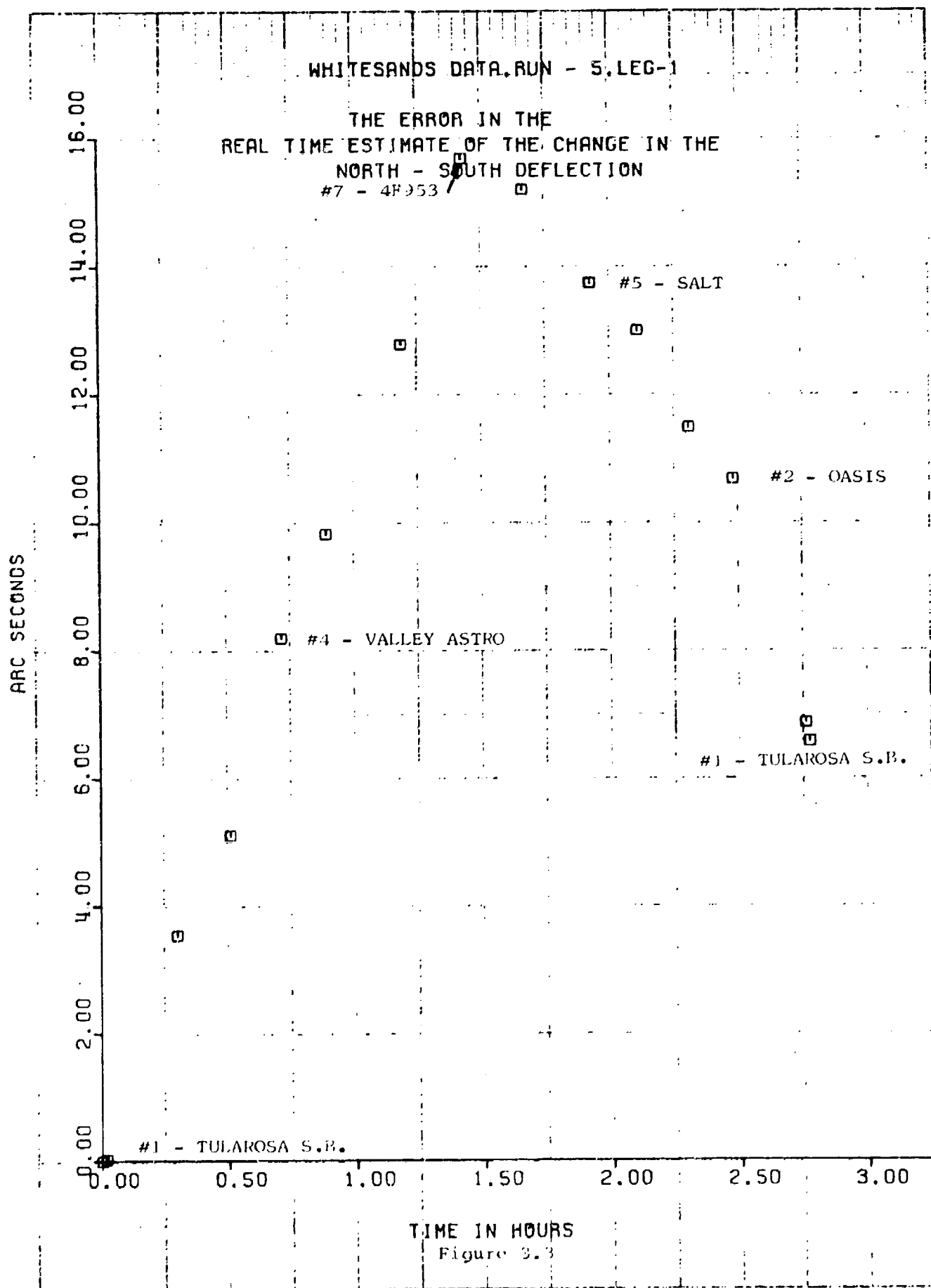
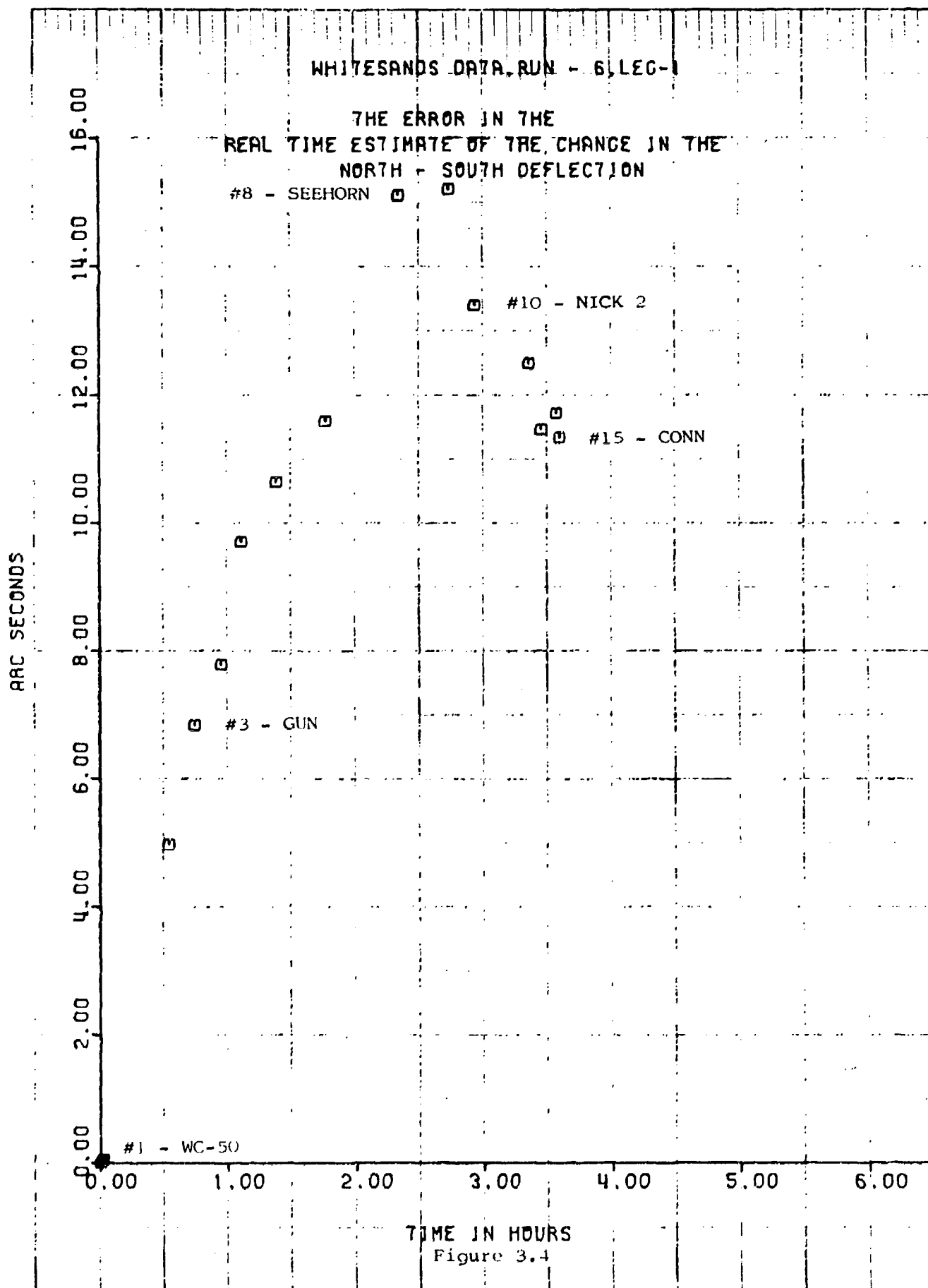
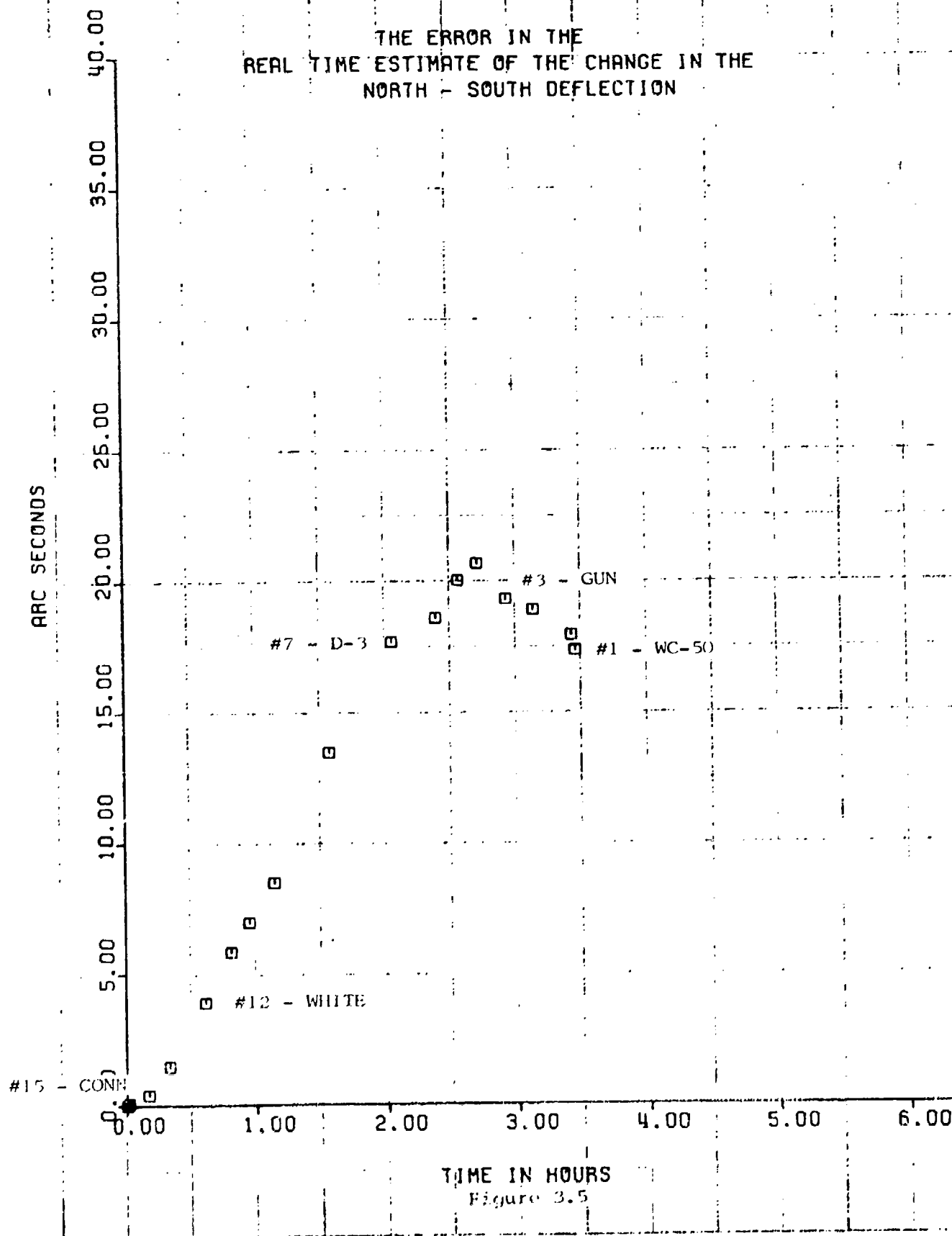


Figure 3.3



WHITESANDS DATA RUN - 7, LEG=1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure 3.5

WHITESANDS DATA RUN - 3, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00

0.00

0.50

1.00

1.50

2.00

2.50

3.00

TIME IN HOURS
Figure 4.1

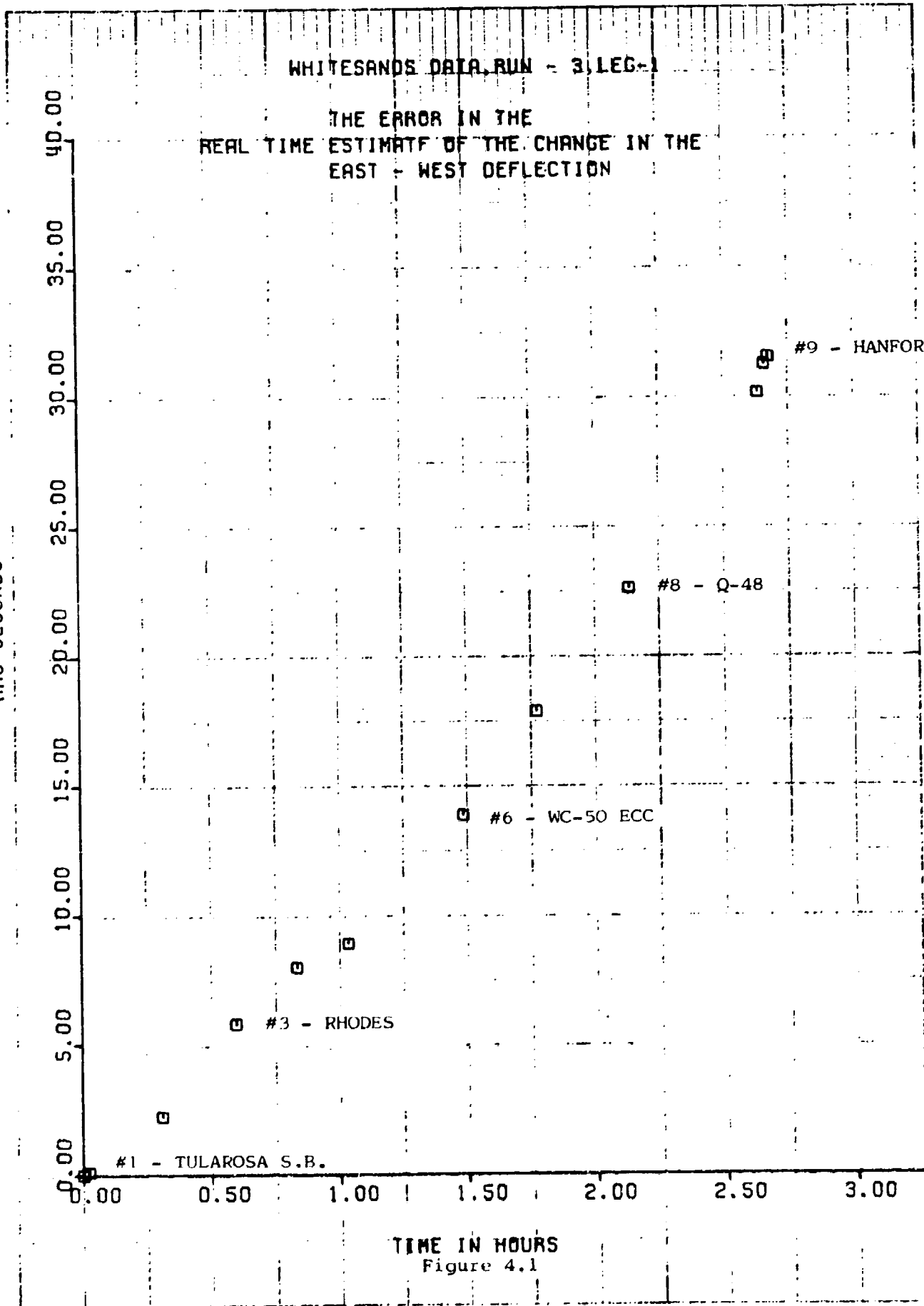
#9 - HANFORD

#8 - Q-48

#6 - WC-50 ECC

#3 - RHODES

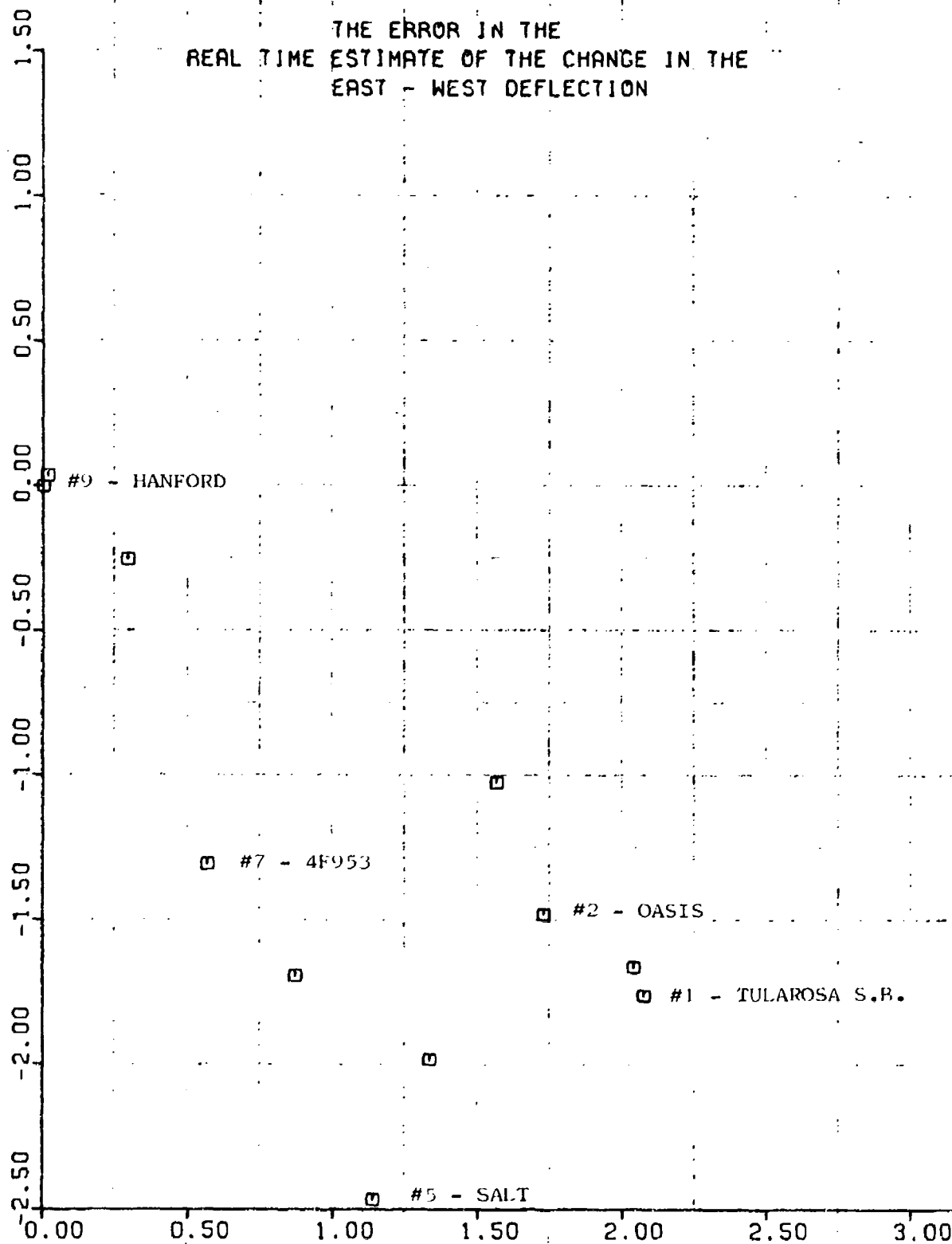
#1 - TULAROSA S.B.



WHITESANDS DATA, RUN - 4, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure 4.2

WHITESANDS DATA RUN - 5. LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00

#1 - TULAROSA S.B.

#4 - VALLEY ASTRO

#7 - 4F953

#5 - SALT

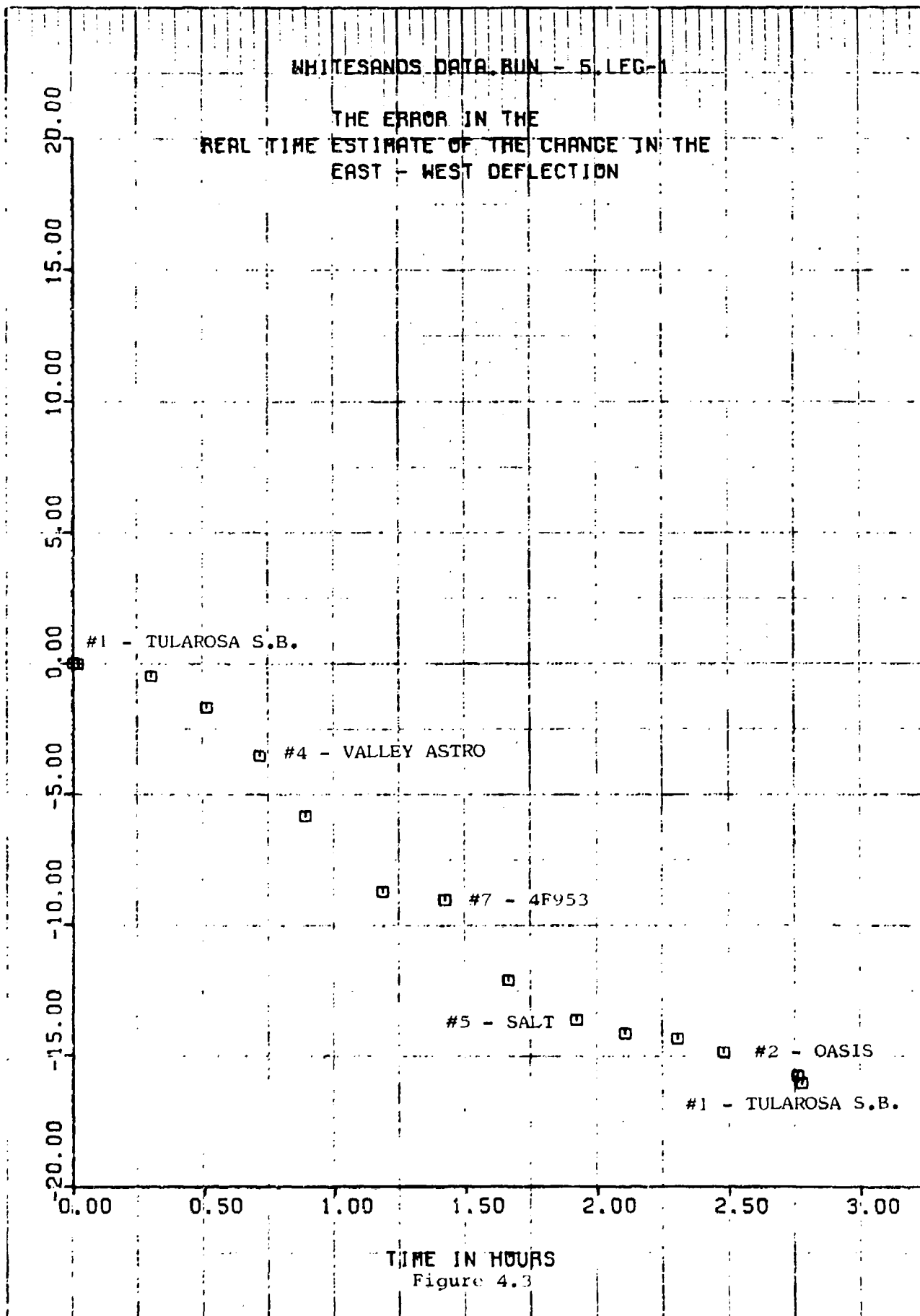
#2 - OASIS

#1 - TULAROSA S.B.

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS

Figure 4.3



WHITESANDS DATA RUN - 6. LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00

#1 - WC-50

#3 - GUN

#8 - SEEHORN

#10 - NICK 2

#15 - CONN

TIME IN HOURS

Figure 4.4

0.00

1.00

2.00

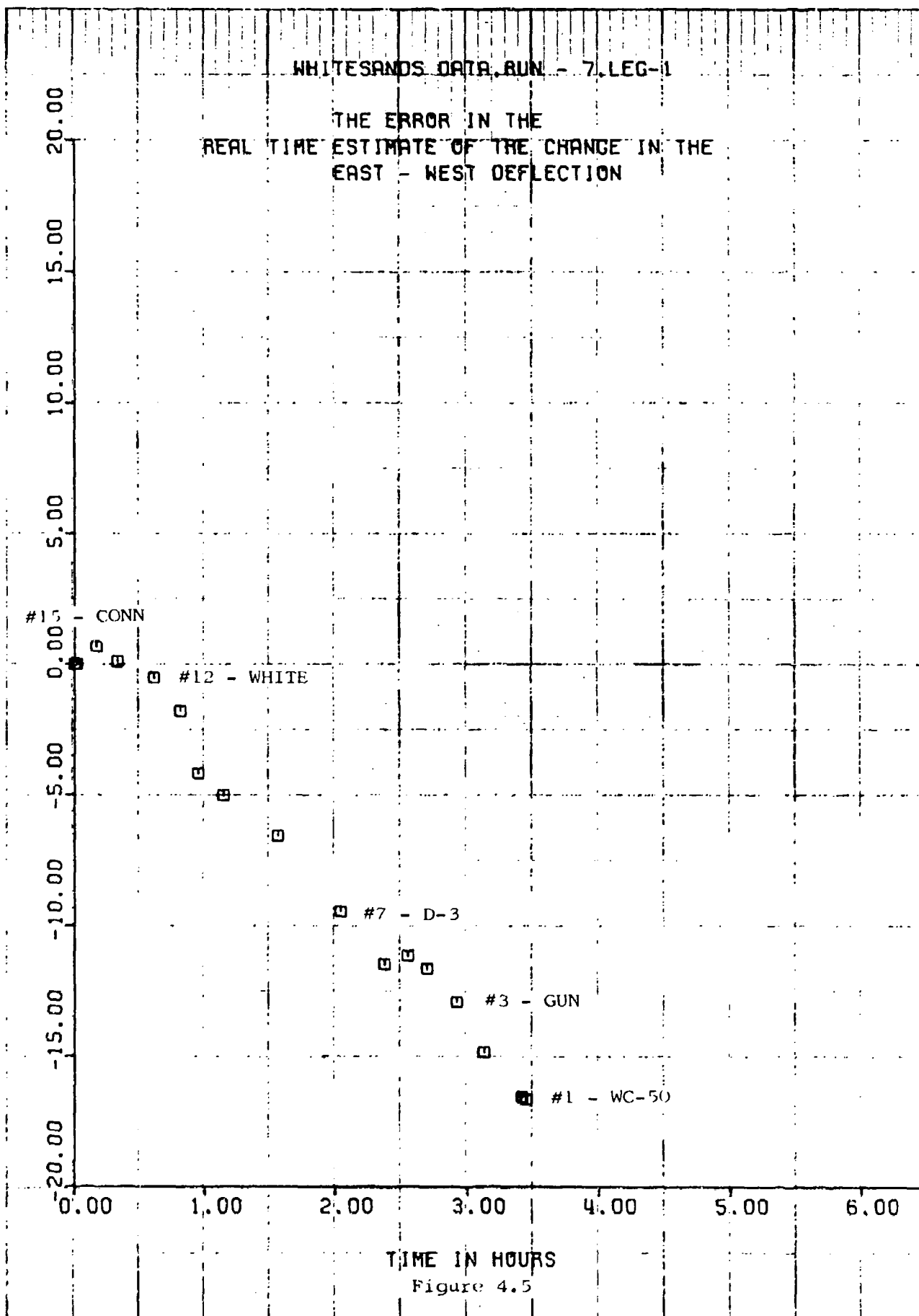
3.00

4.00

5.00

6.00

ARC SECONDS



WHITESANDS DATA, RUN - 3, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00

#1 - TULAROSA S.B.

#3 - RHODES

#9 - HANFORD

#6 - WC-30 ECC

#8 - Q-48

TIME IN HOURS
Figure 5.1

0.00

0.50

1.00

1.50

2.00

2.50

3.00

WHITESANDS DATA.RUN - 4.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#9 - HANFORD

#7 - 4F953

#5 - SALT

#2 - OASIS

#1 - TULAROSA S.B.

TIME IN HOURS
Figure 5.2

0.00 0.50 1.00 1.50 2.00 2.50 3.00

WHITESANDS DATA RUN - S, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#1 - TULAROSA S.B.

#1 - TULAROSA S.B.

#4 - VALLEY ASTRO

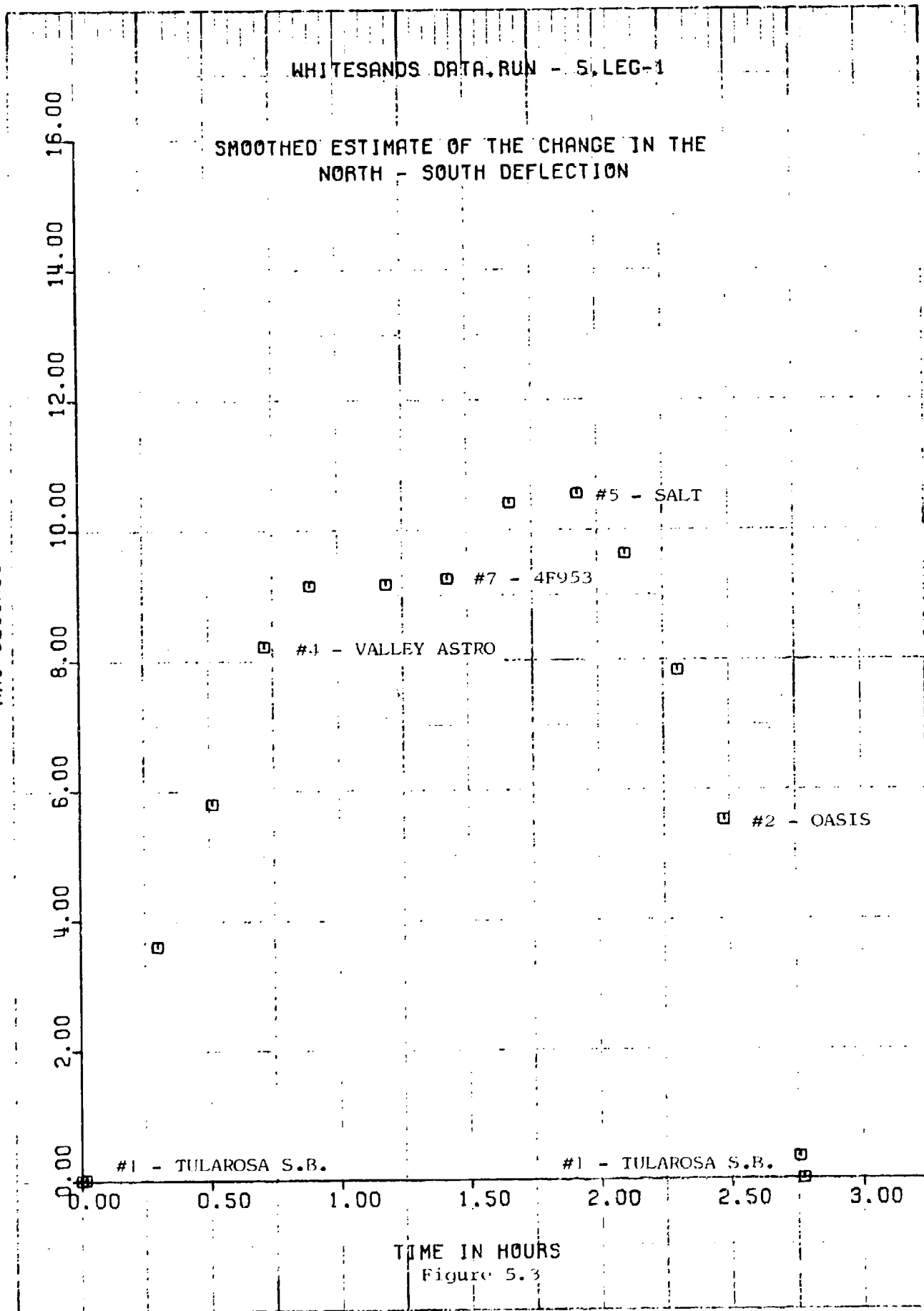
#7 - 4F953

#5 - SALT

#2 - OASIS

TIME IN HOURS

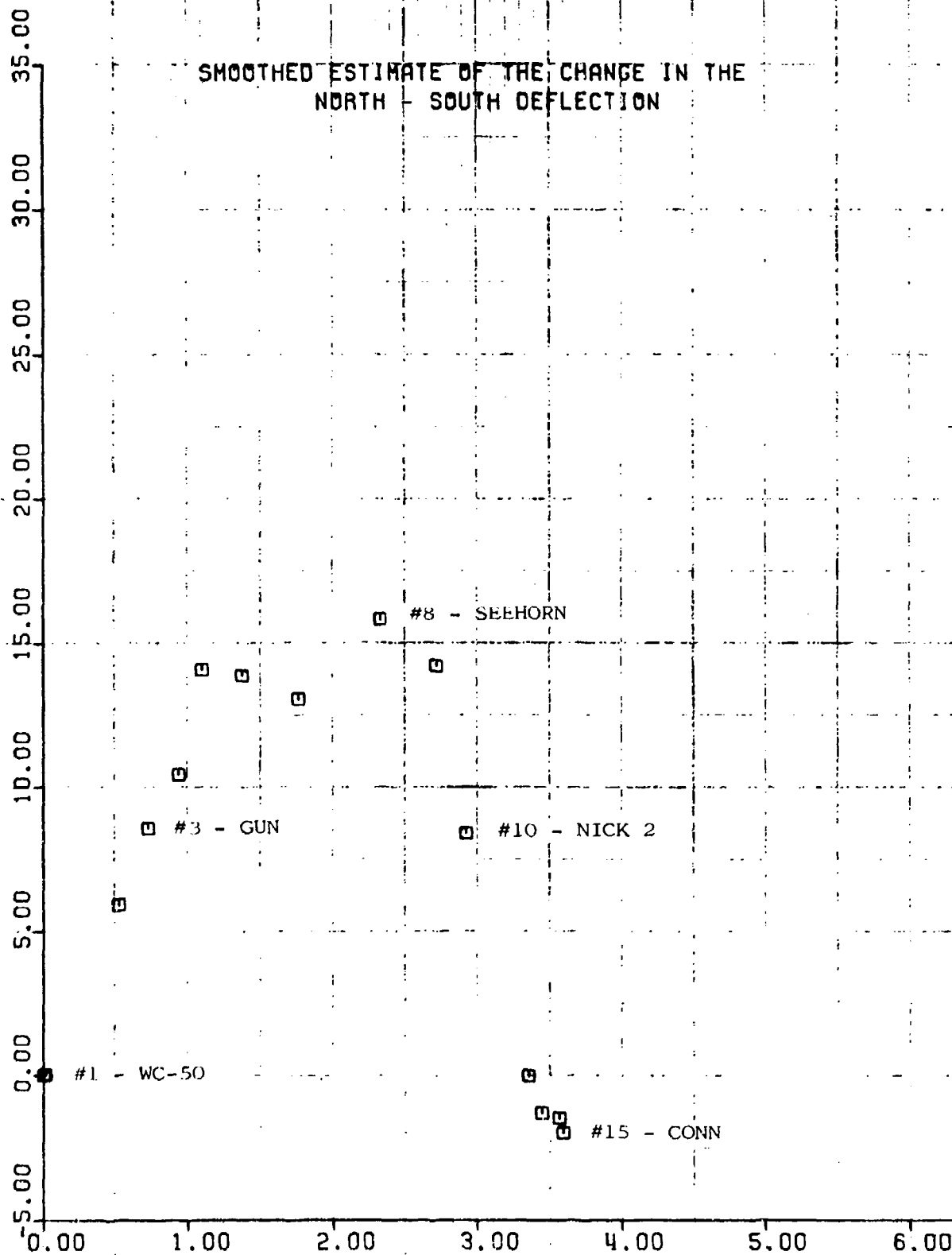
Figure 5.3



ARC SECONDS

WHITESANDS DATA RUN - 6 LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure 5.4

ARC SECONDS

WHITESANDS DATA RUN - 7, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH SOUTH DEFLECTION

#7 - D-3

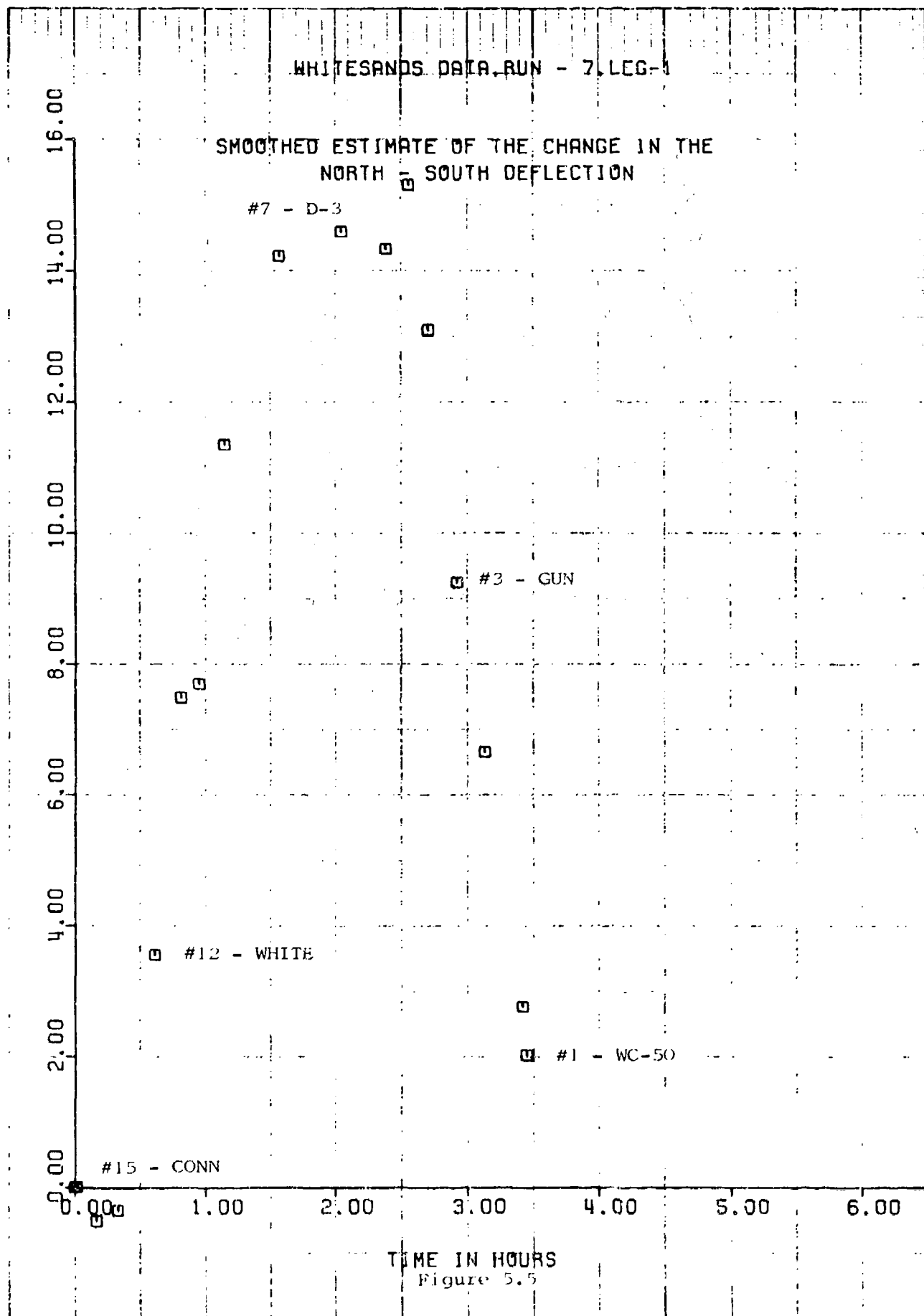
#3 - GUN

#12 - WHITE

#1 - WC-50

#15 - CONN

TIME IN HOURS
Figure 5.5



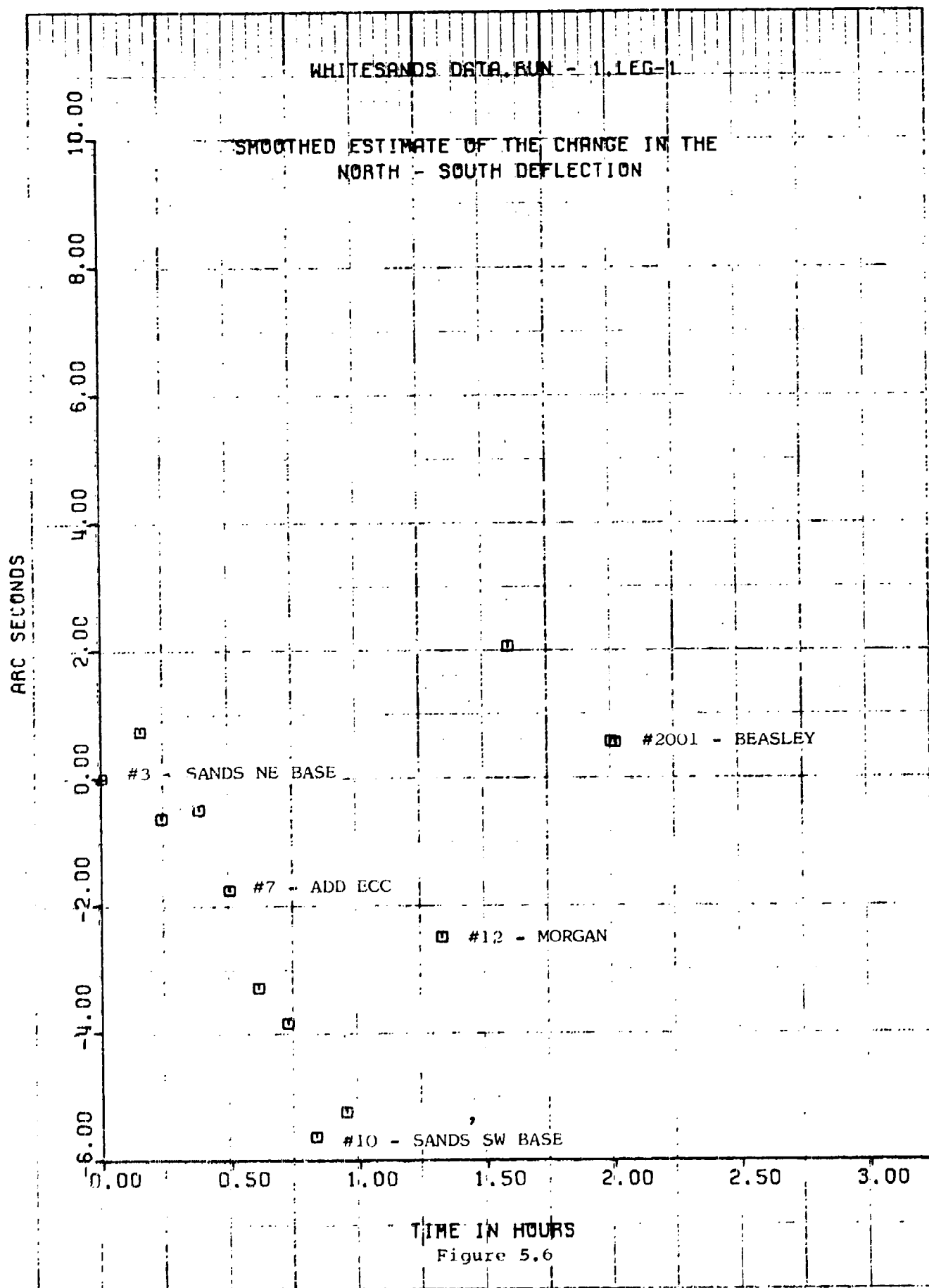


Figure 5.6

WHITESANDS DATA, RUN - 2, LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

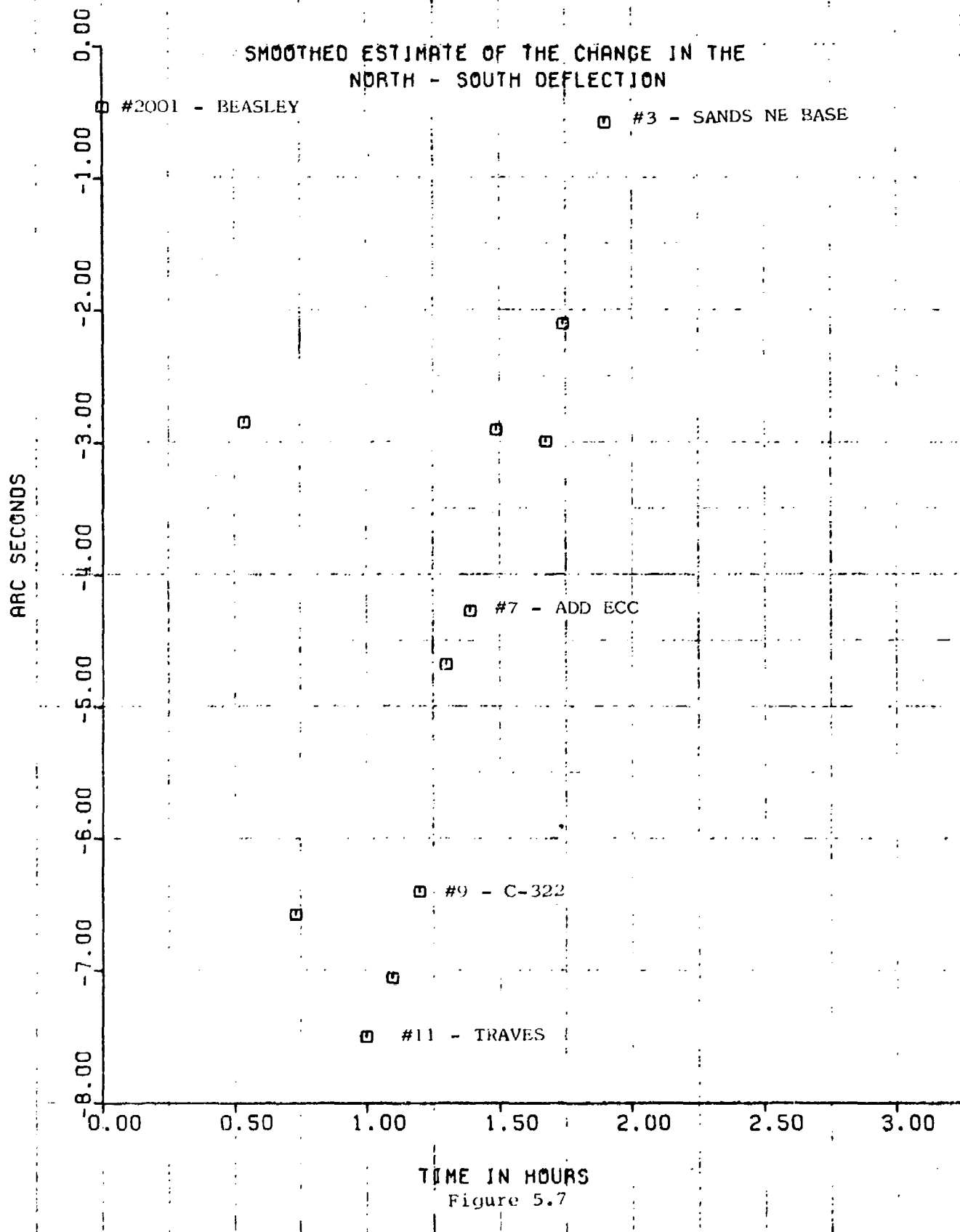
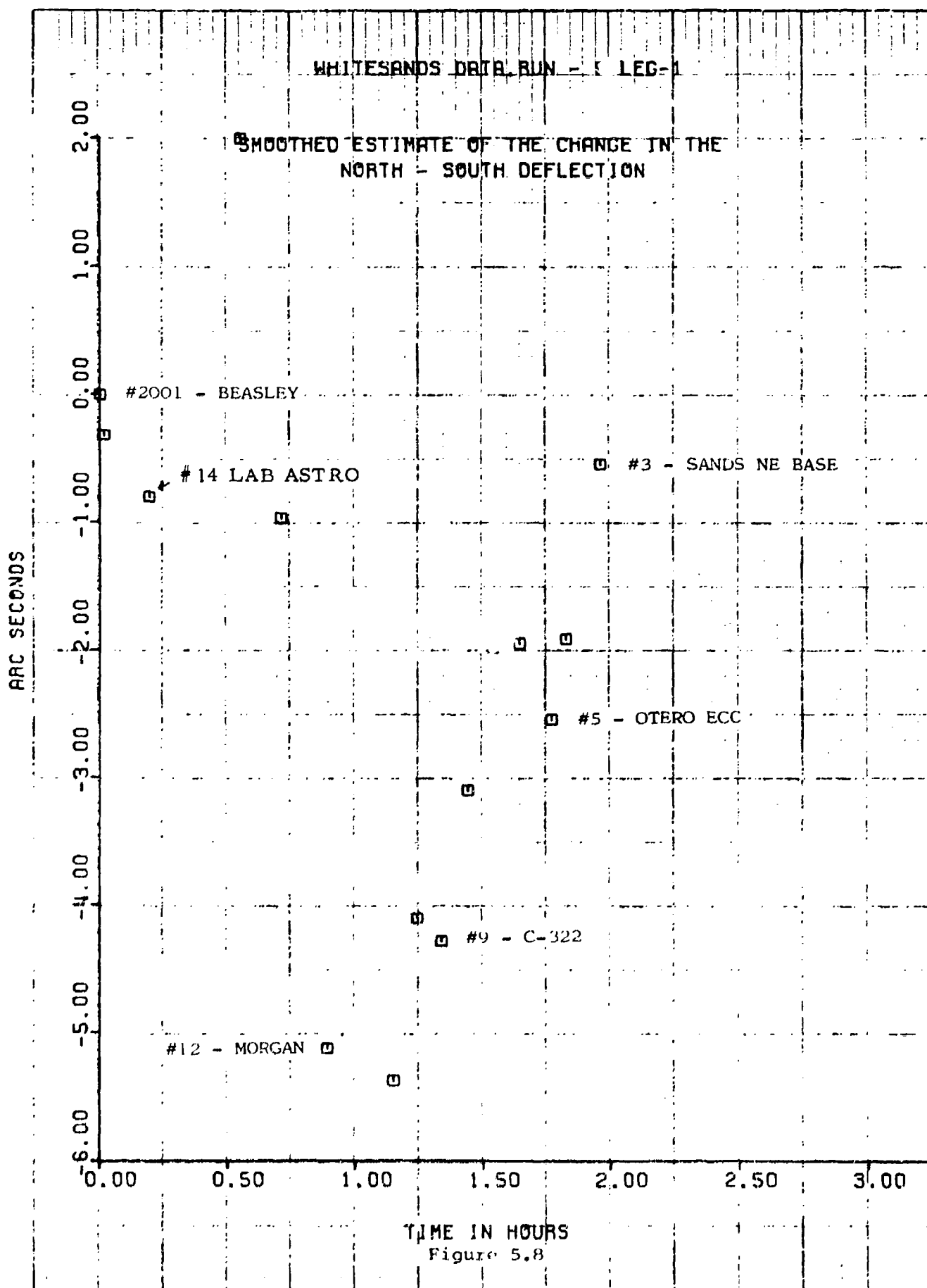
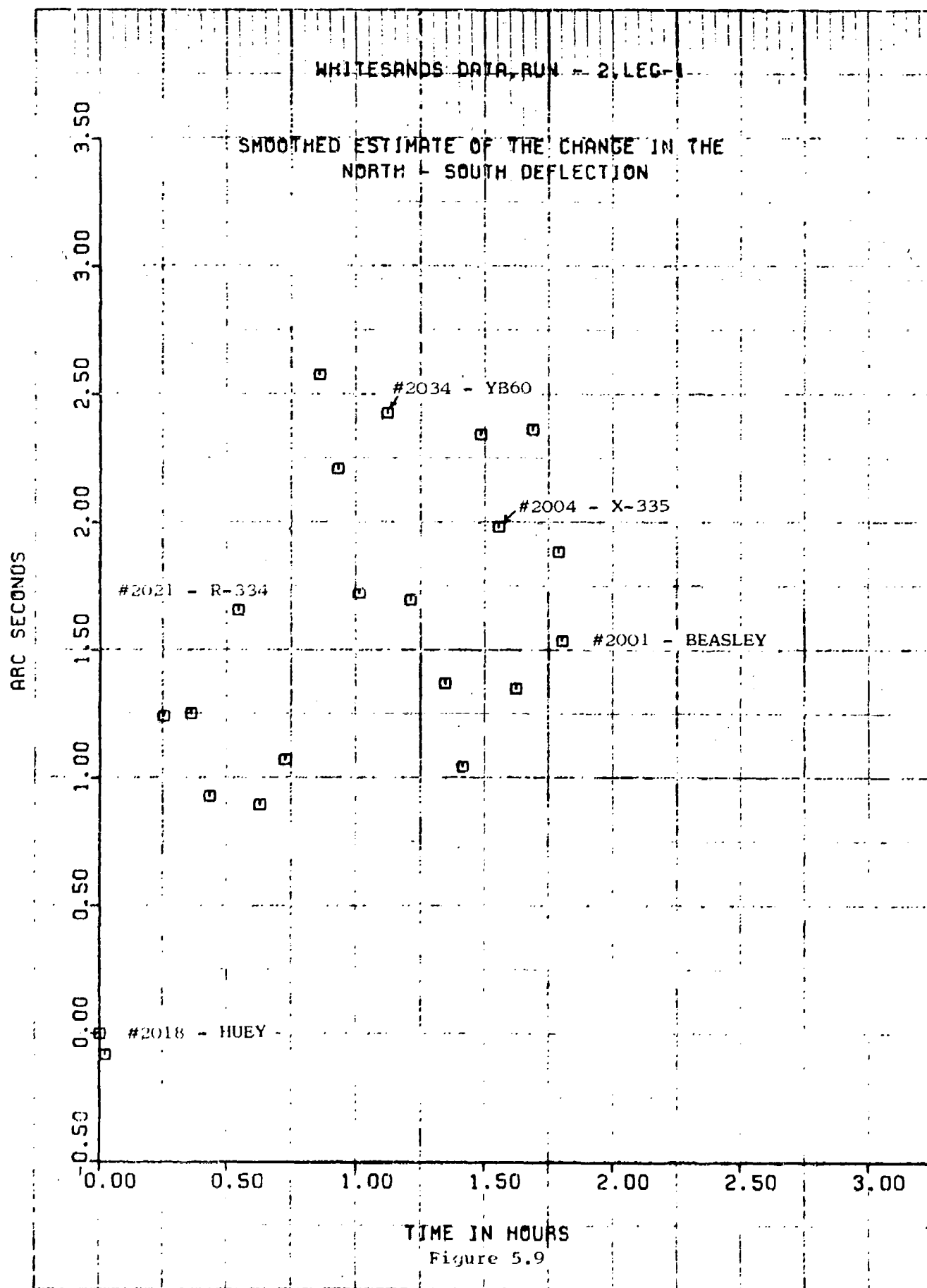


Figure 5.7





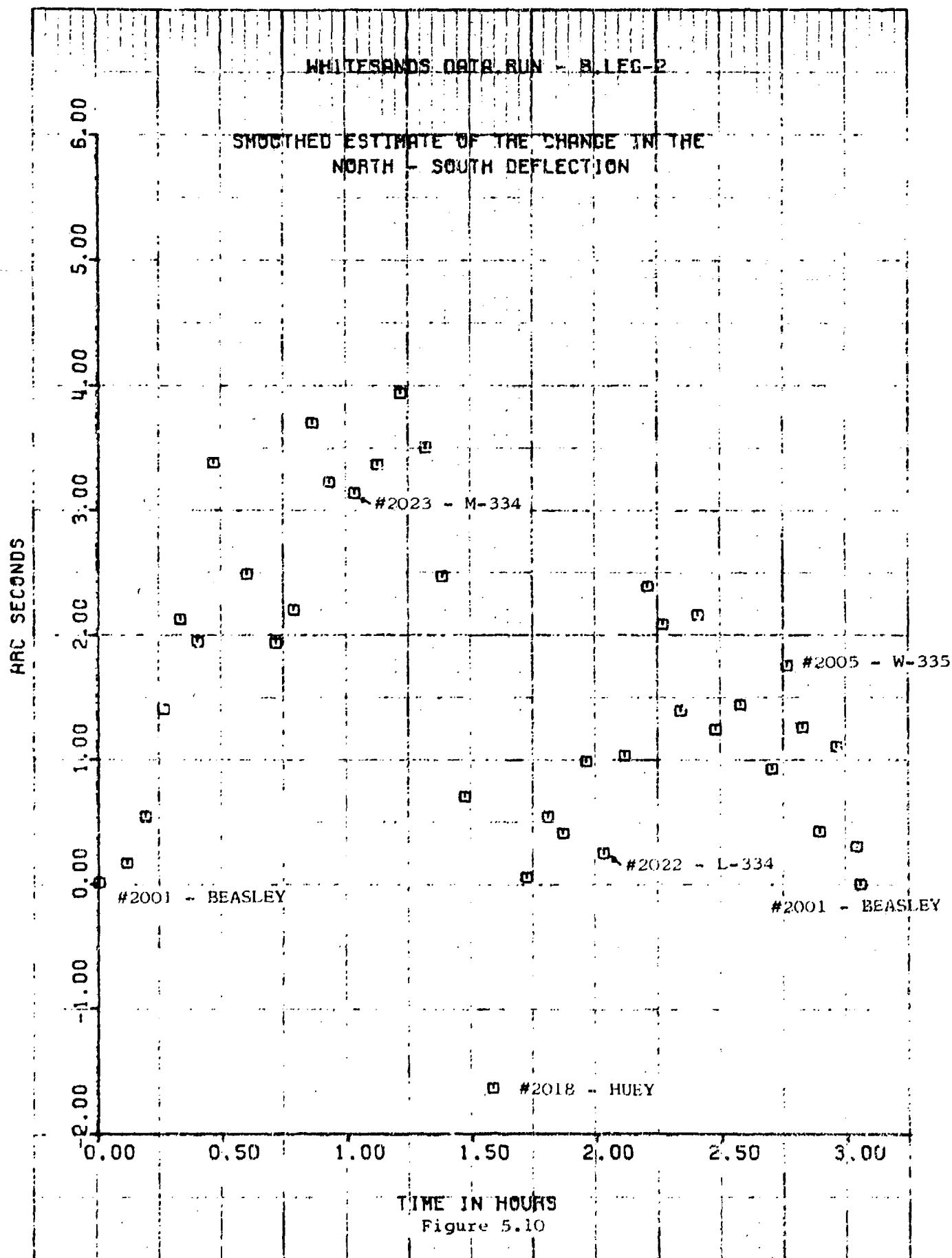
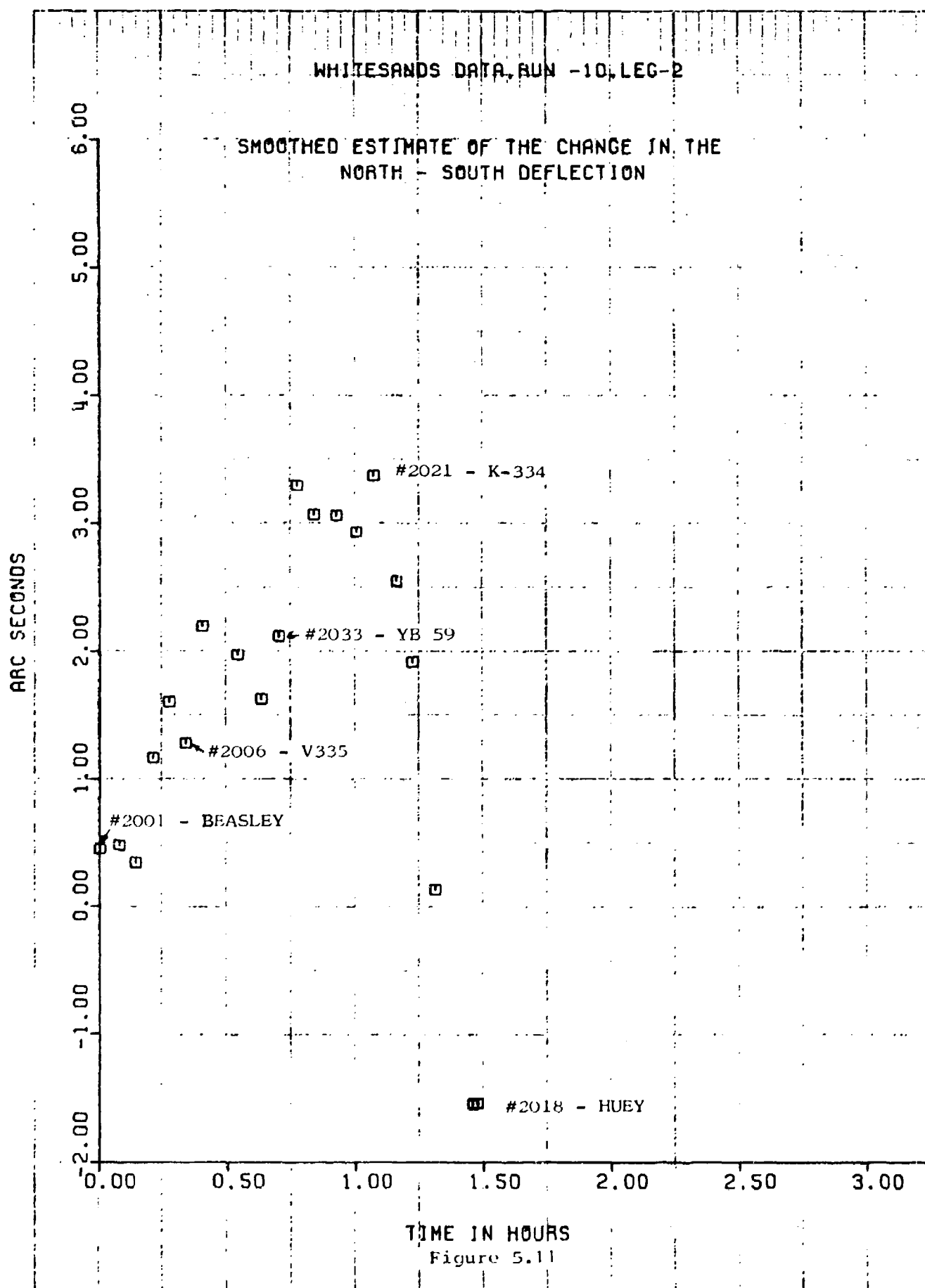
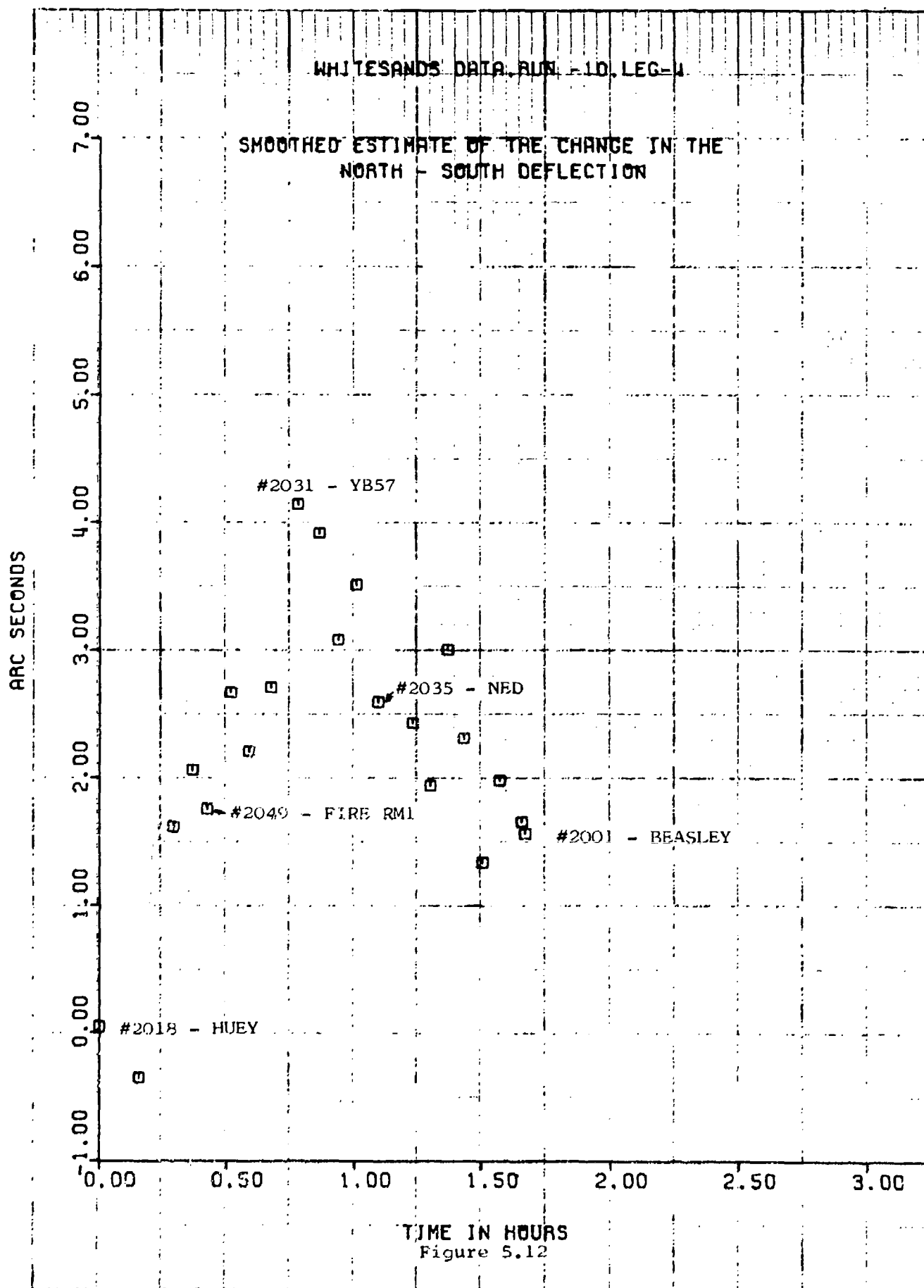


Figure 5.10





WHITESANDS DATA, RUN -13, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

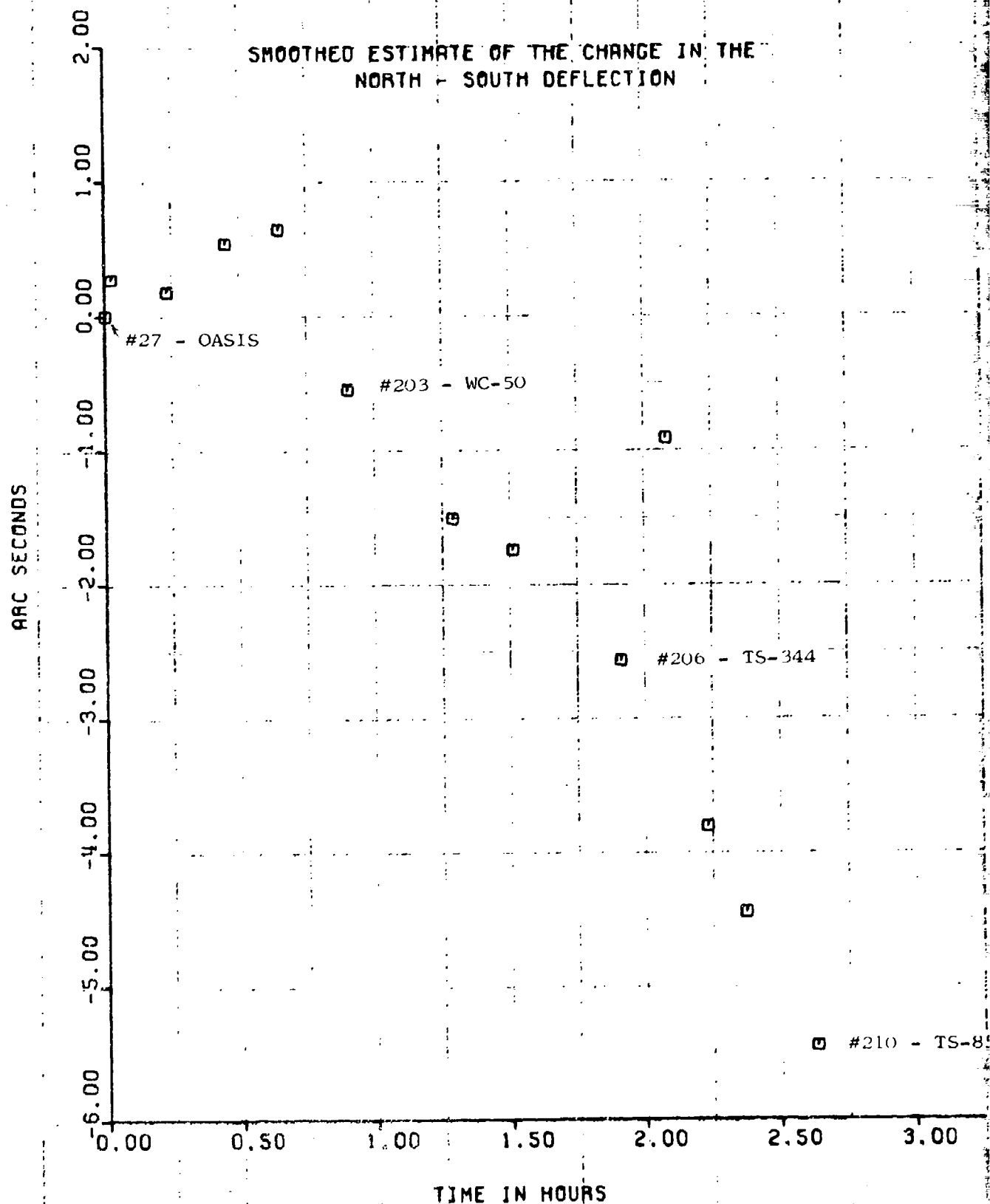
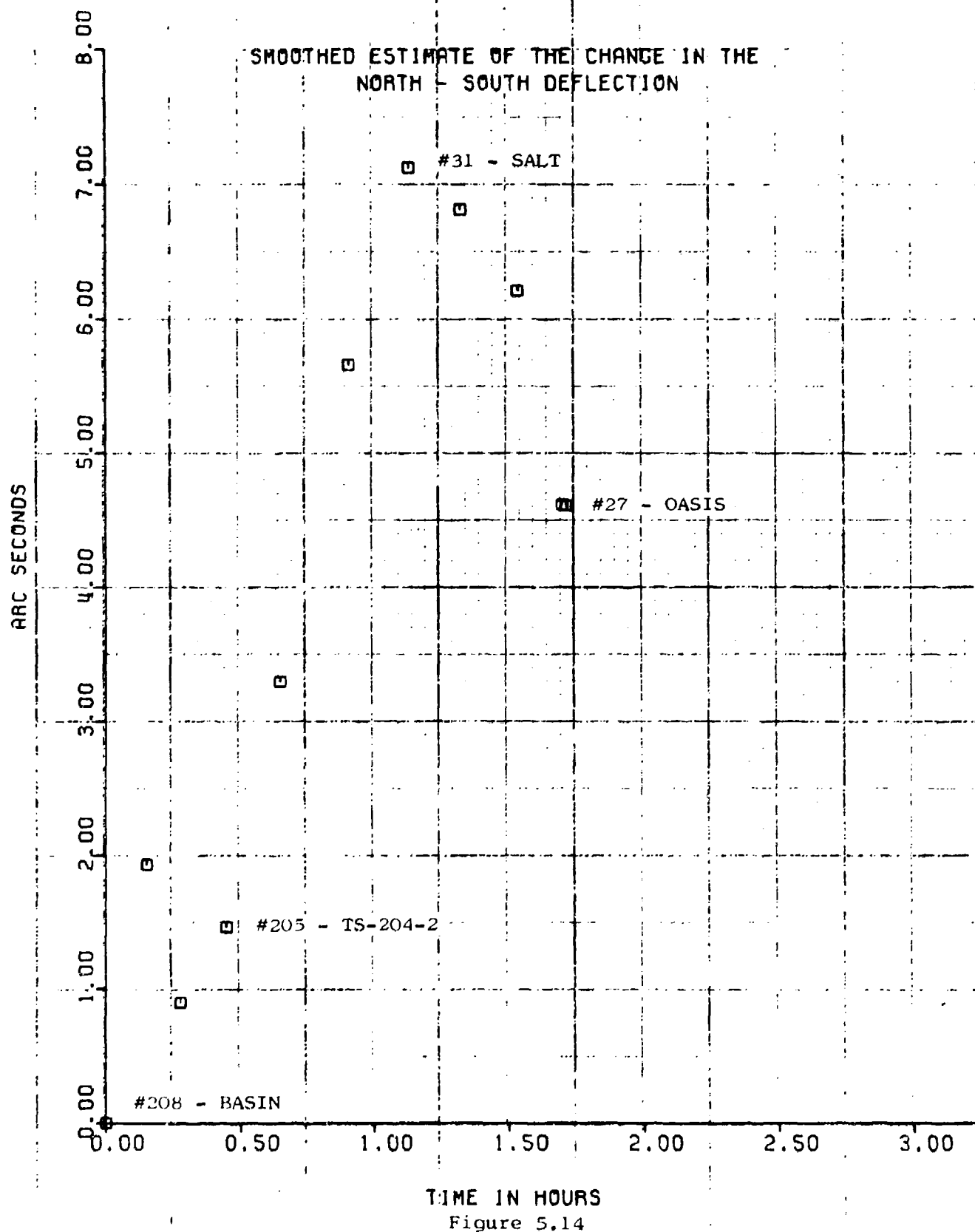


Figure 5.13

WHITESANDS DATA, RUN -14, LEG-1



WHITESANDS DATA, RUN -16, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00

#22 - JACK

#27 - OASIS

#30 - G-48

#31 - SALT

TIME IN HOURS
Figure 5.15

0.00 0.50 1.00 1.50 2.00 2.50 3.00

WHITESANDS DATA RUN -16, LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50

□ #29 - VALLEY ASTRO

□ #31 - SALT

□ #27 - OASIS

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS
Figure 5.16

WHITESANDS DATA, RUN -16, LEG-3

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

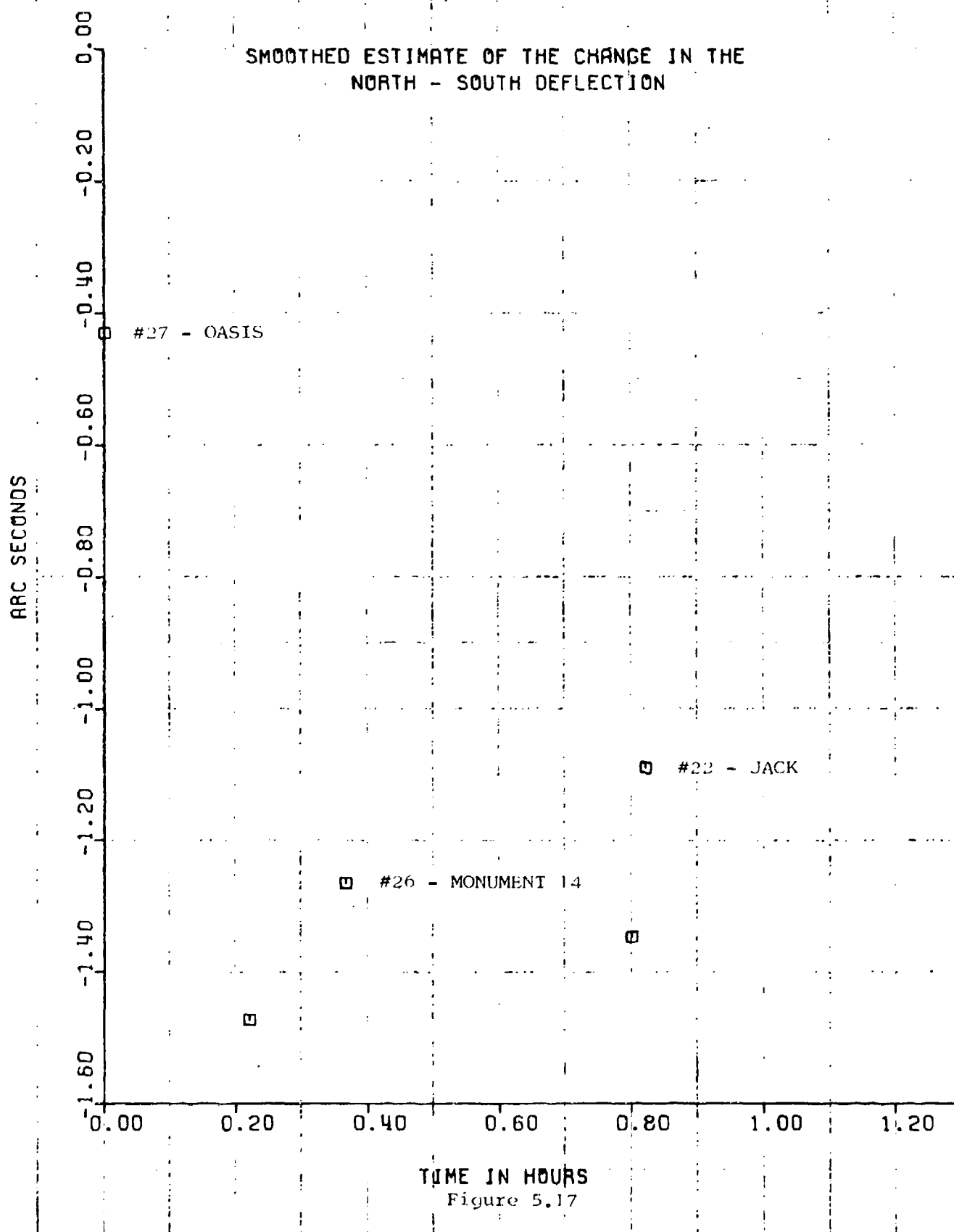


Figure 5.17

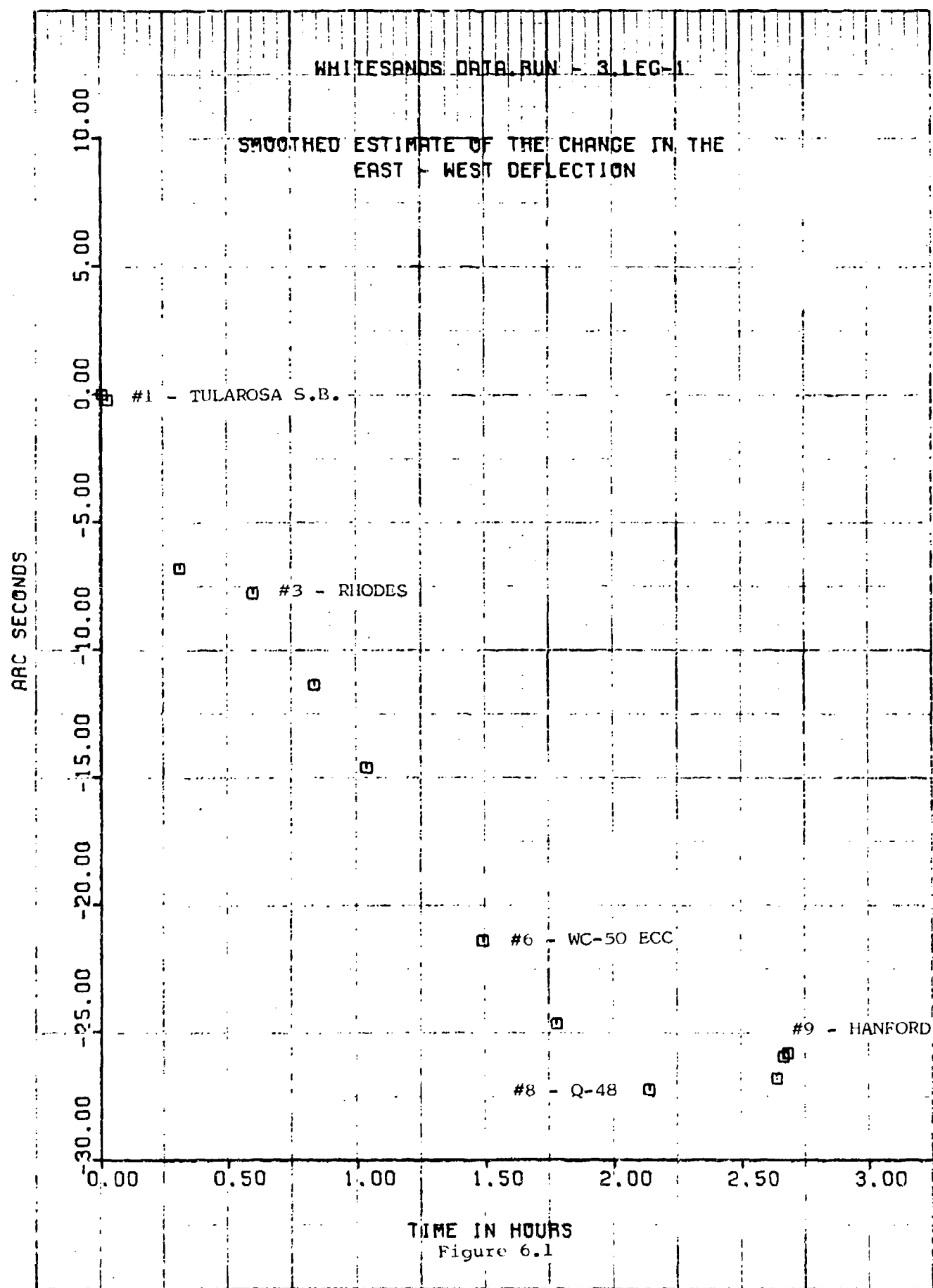


Figure 6.1

WHITESANDS DATA RUN - 4. LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00

#9 - HANFORD

#7 - 4F953

#5 - SALT

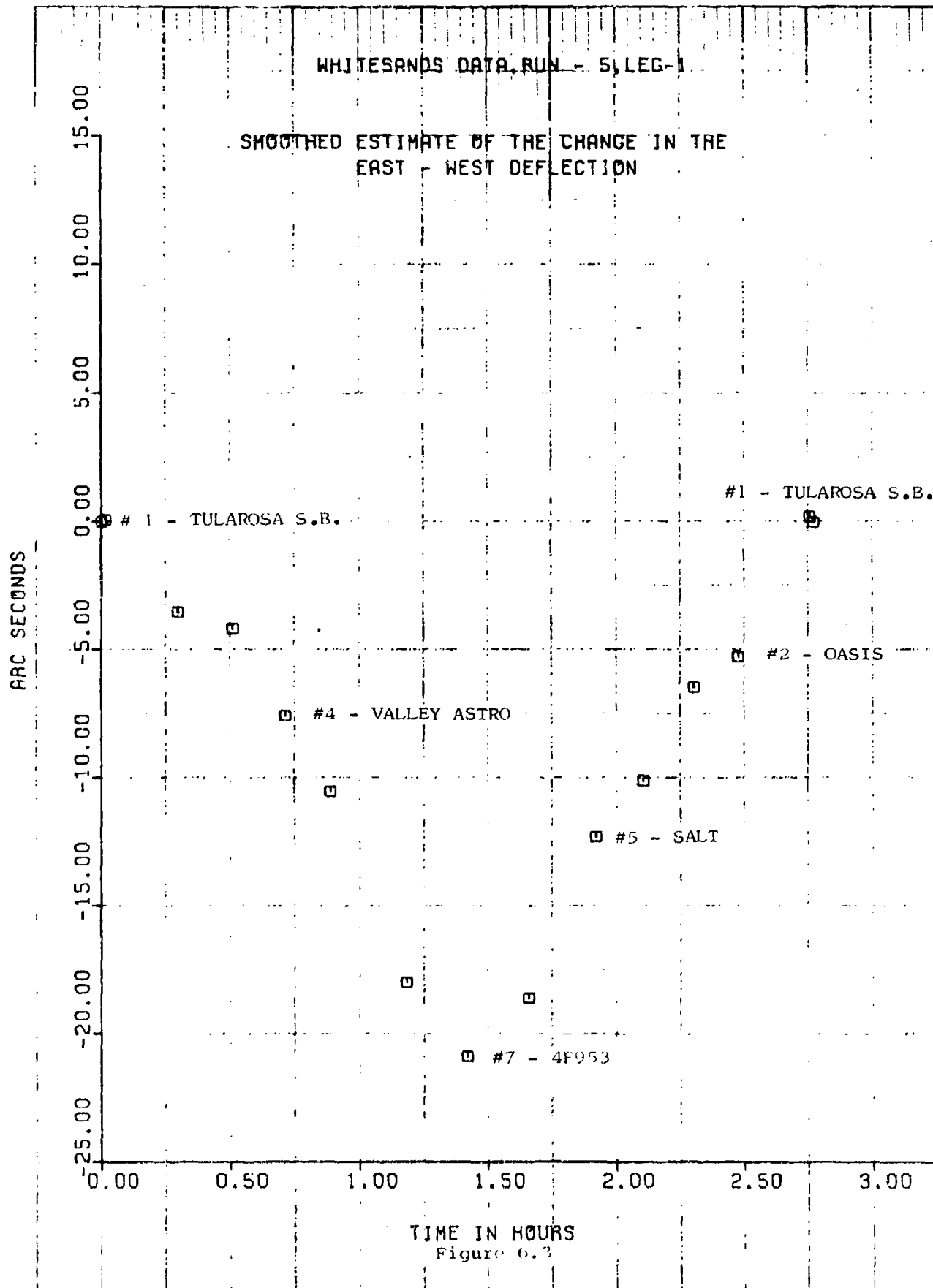
#2 - OASIS

#1 - TULAROSA S.B.

TIME IN HOURS

Figure 6.2

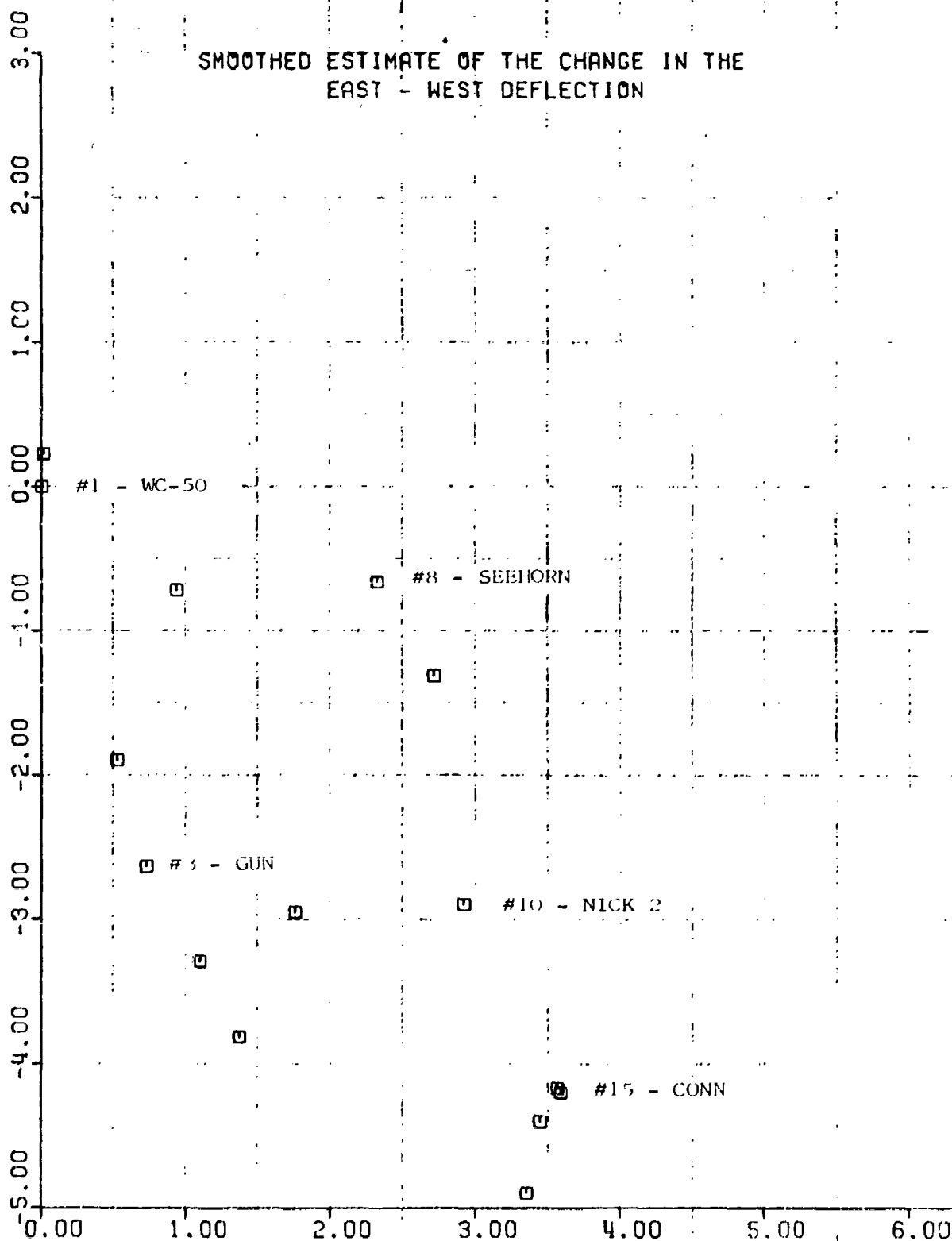
0.00 0.50 1.00 1.50 2.00 2.50 3.00



WHITESANDS DATA.RUN - 6.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

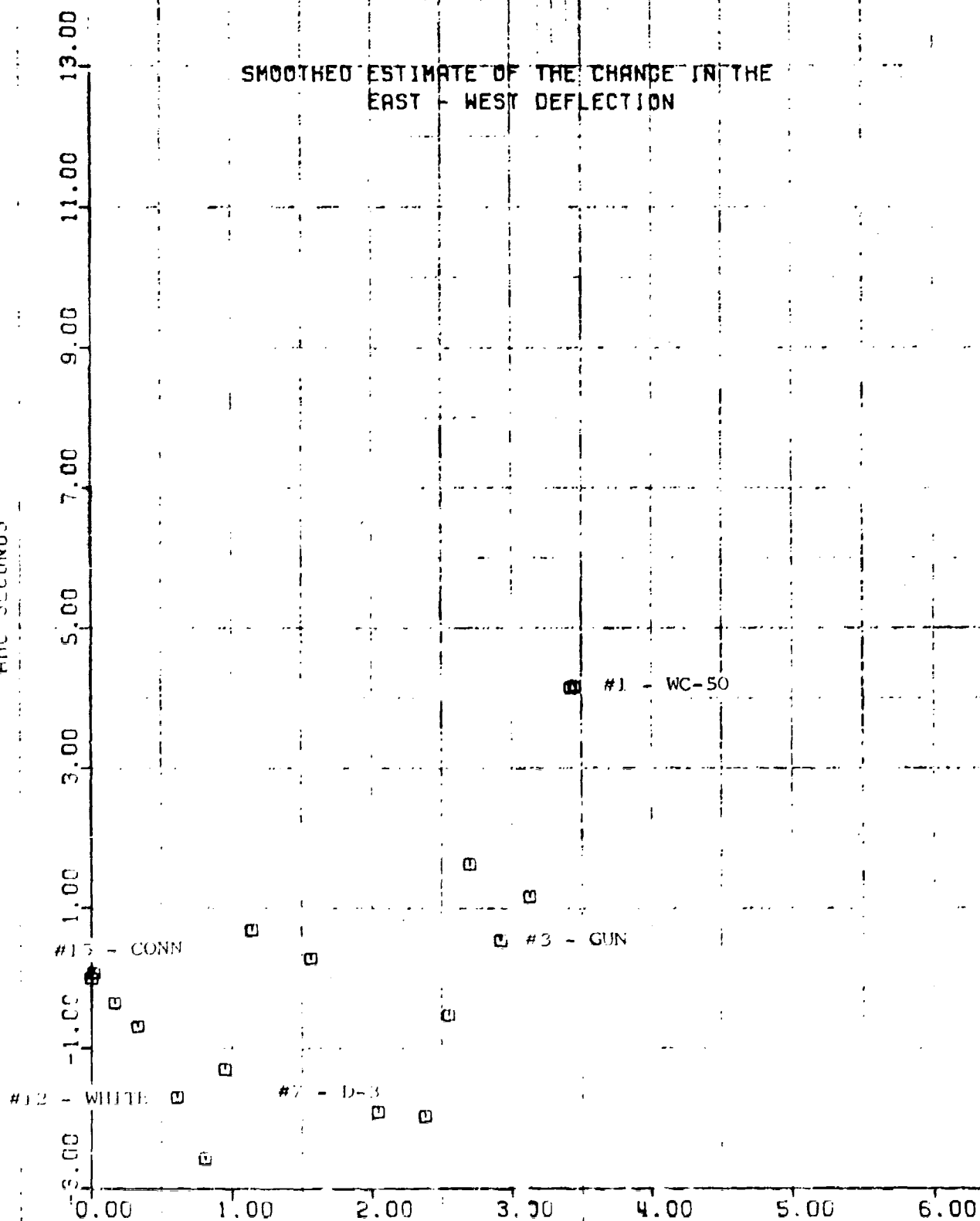


TIME IN HOURS
Figure 6.4

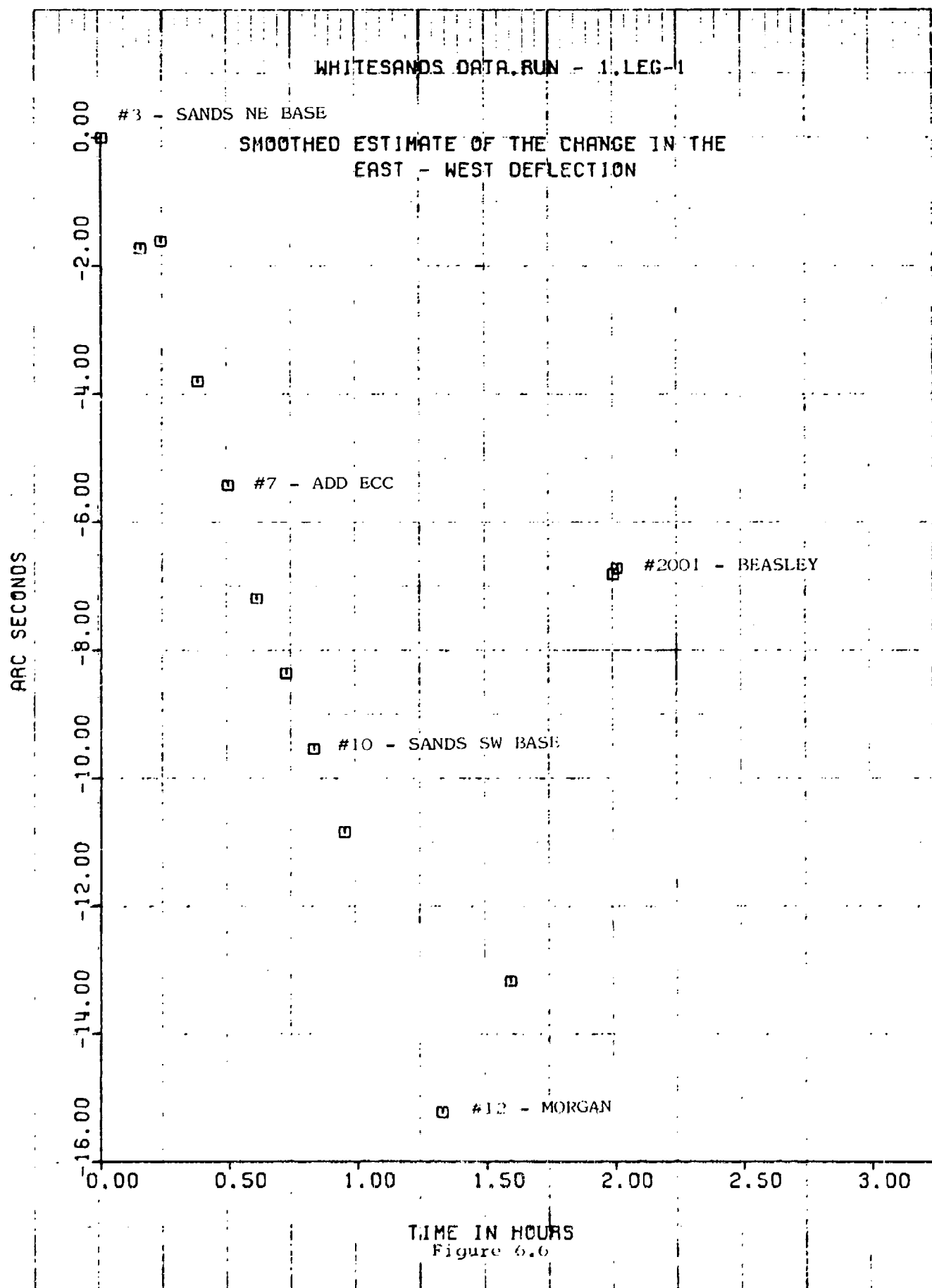
WHITESANDS DATA RUN - 2, LEG-1

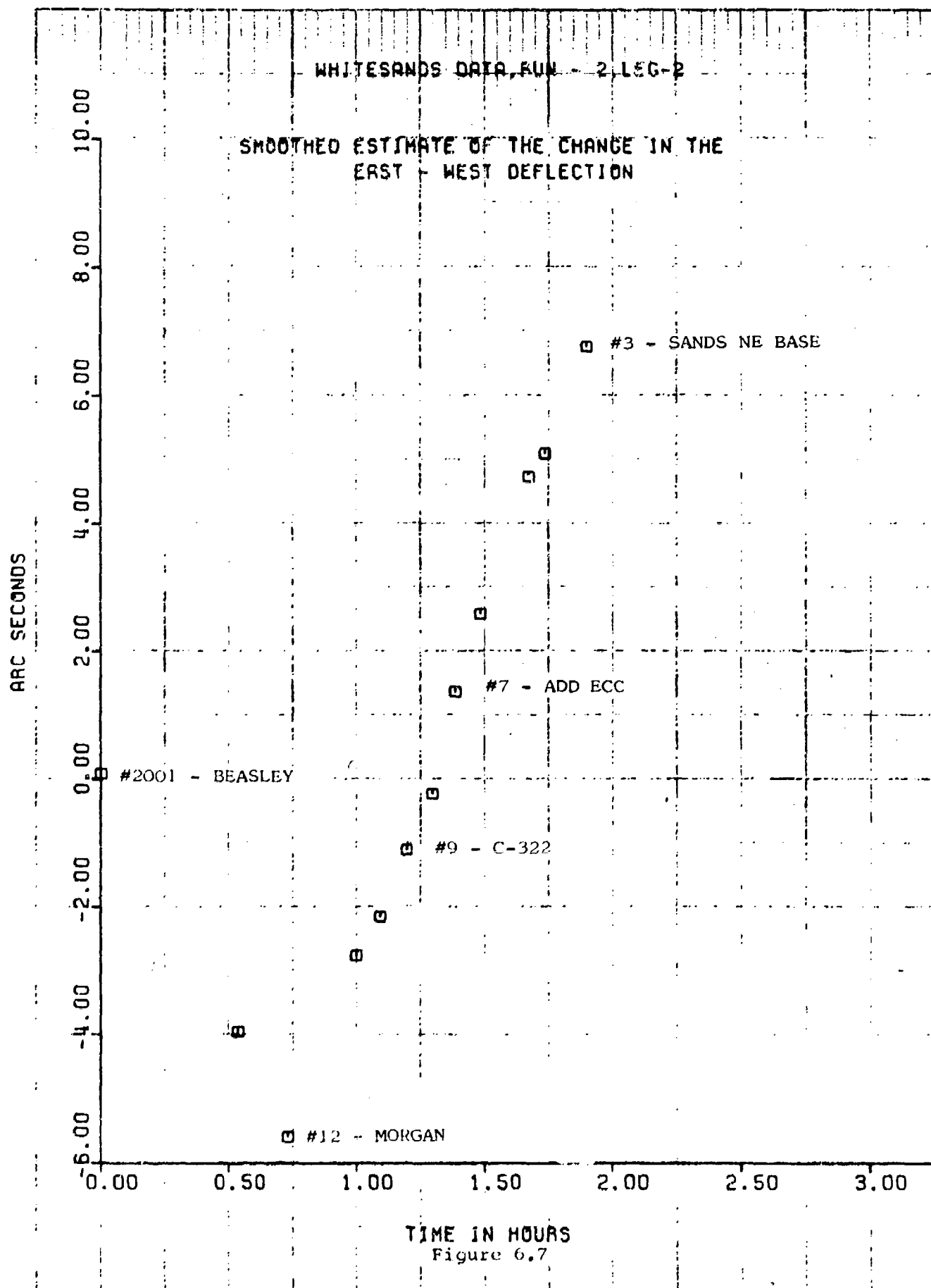
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure 6.7





WHITESANDS DATA.RUN - 9.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00

#3 - SANDS NE BASE
#5 - OTERO ECC
#9 - C-322
#12 - MORGAN
#14 - LAB ASTRO
#2001 - BEASLEY

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS
Figure 6.8

WHITESANDS DATA RUN - 2, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

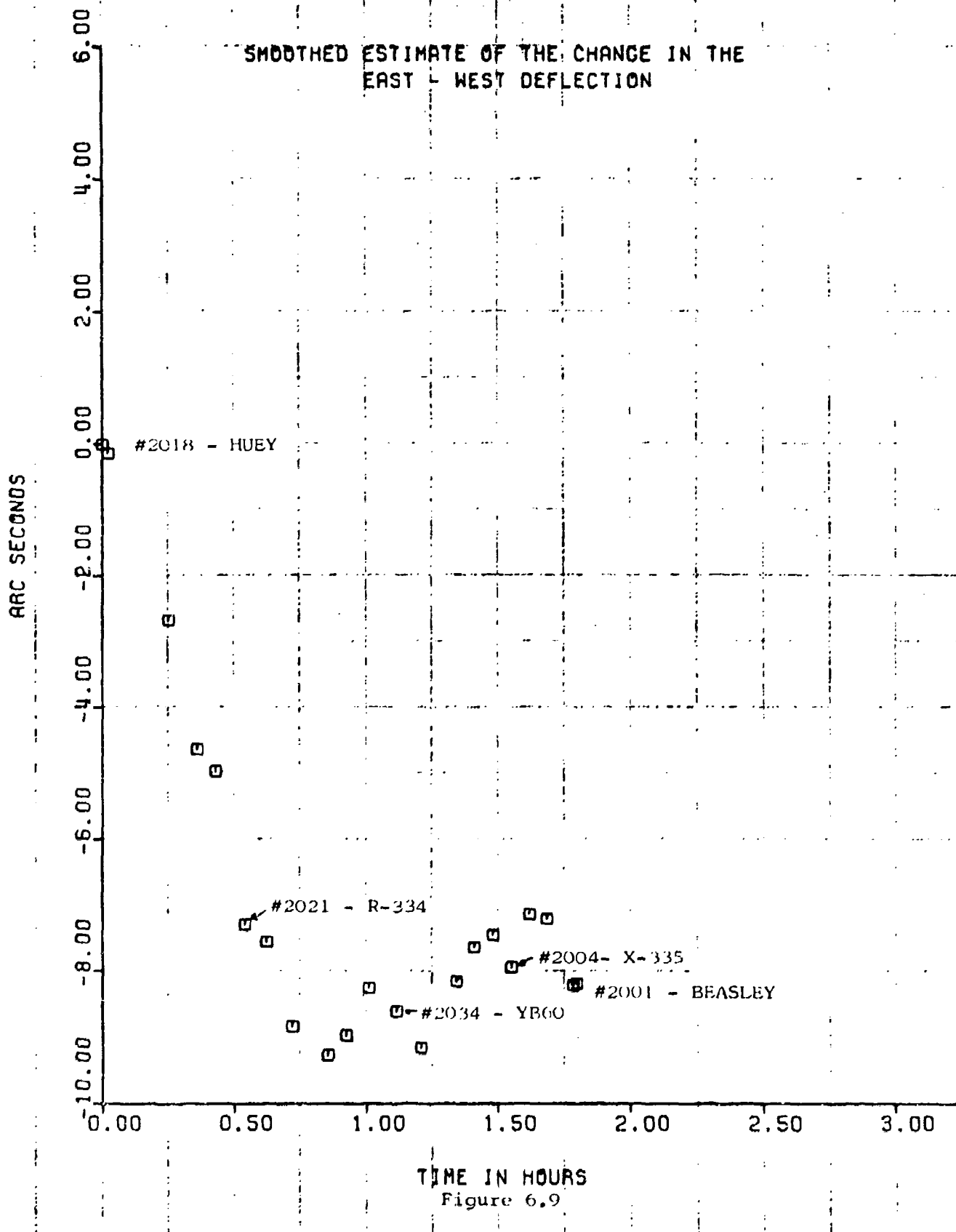


Figure 6.9

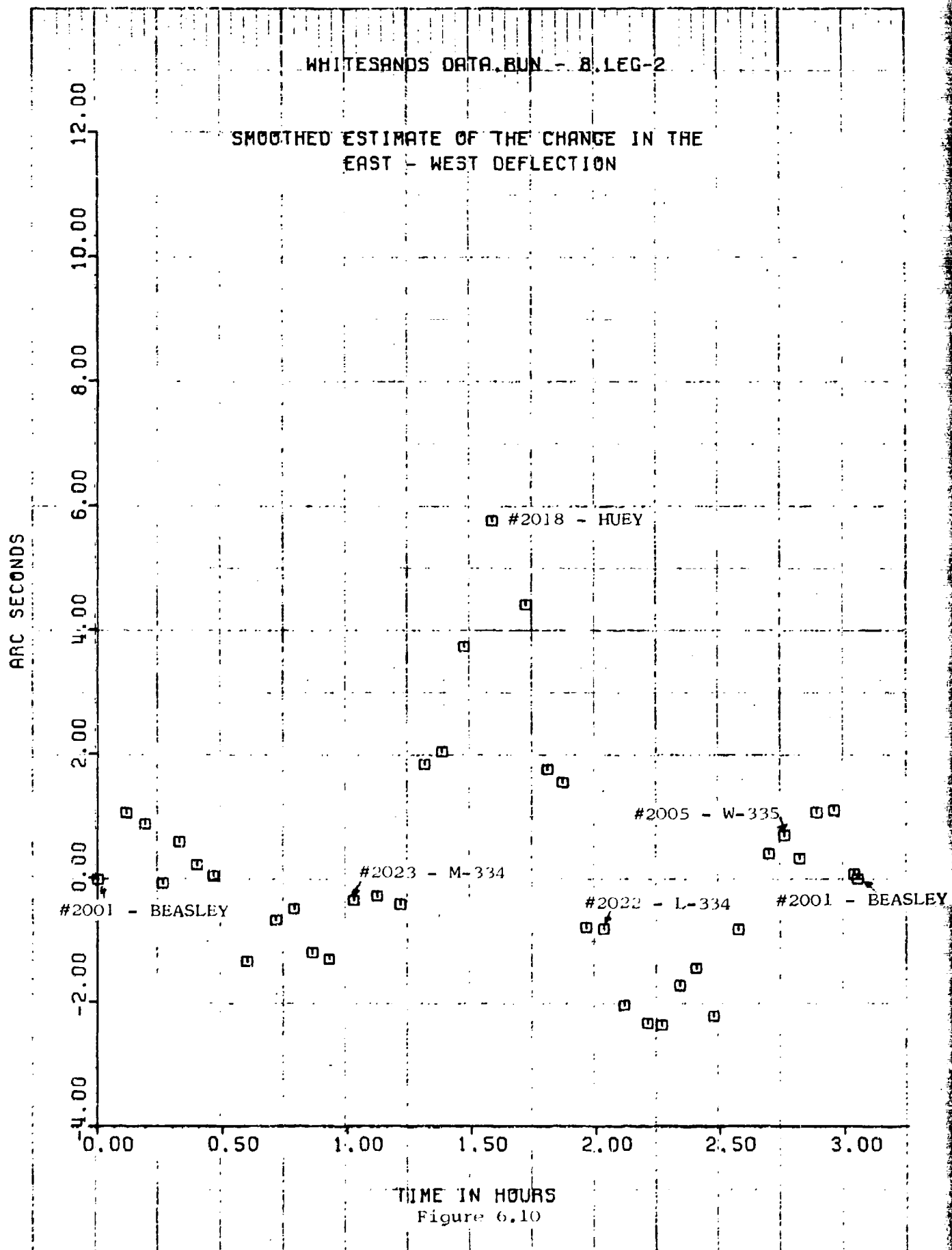


Figure 6.10

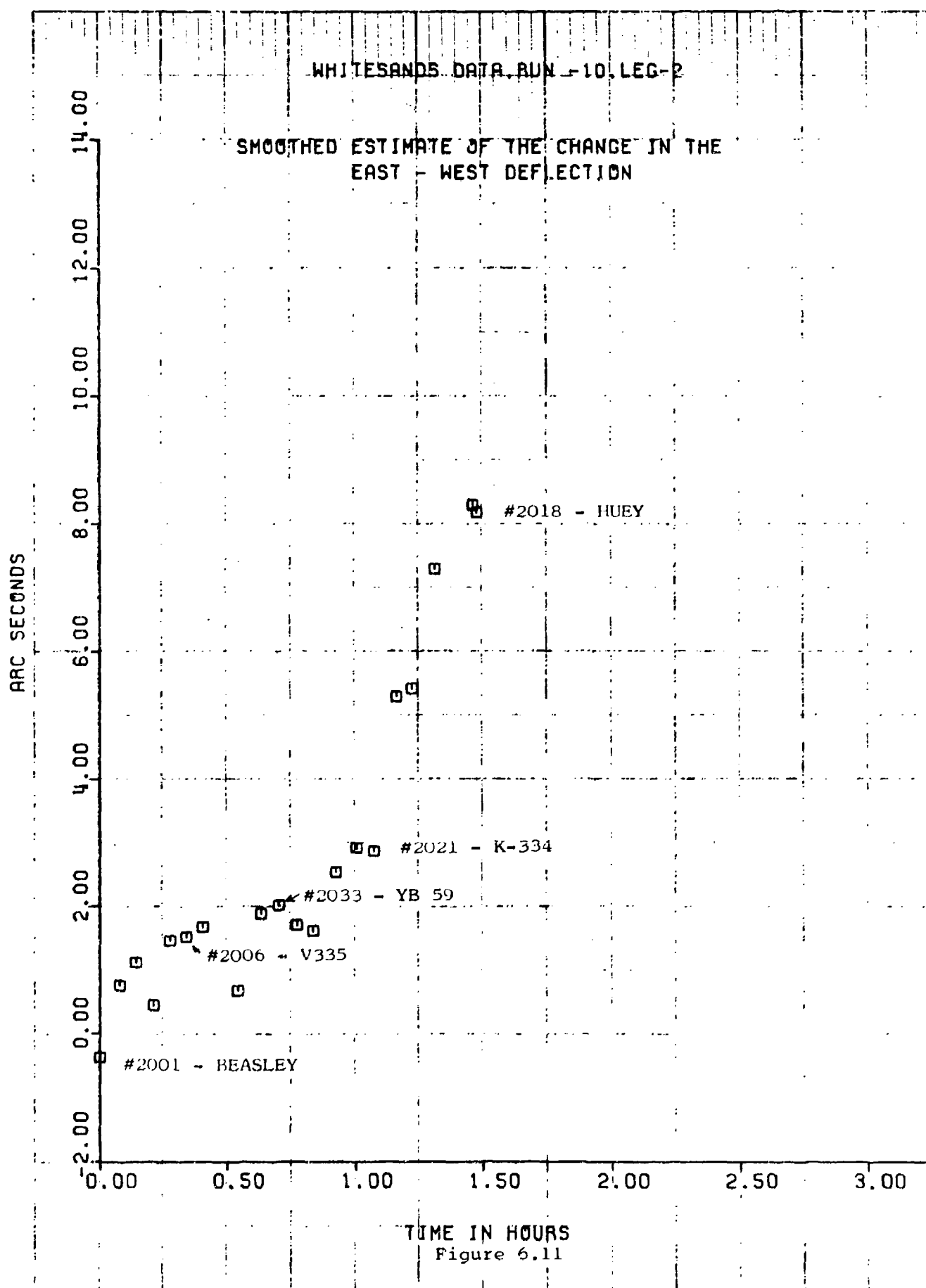


Figure 6.11

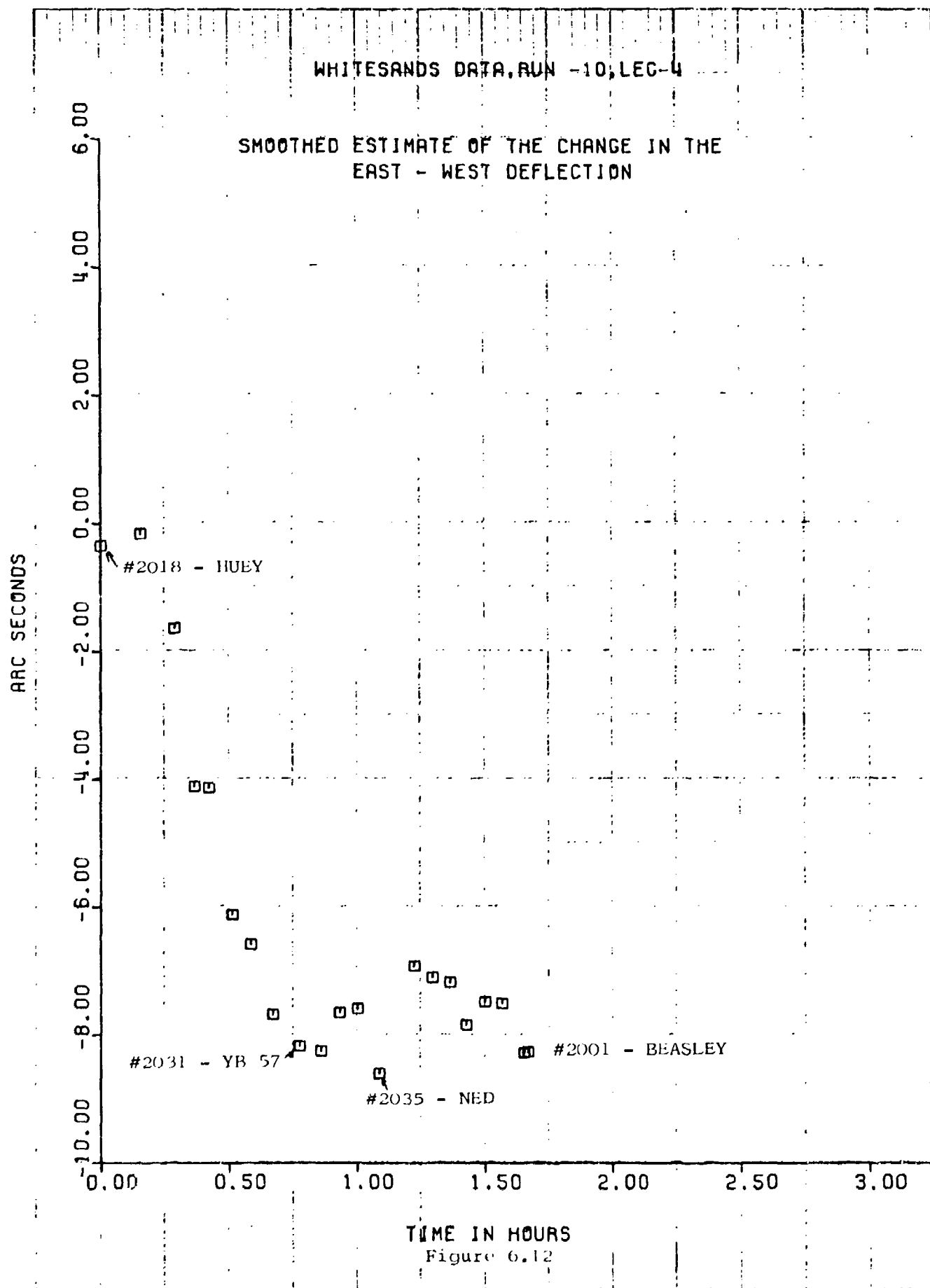


Figure 6.12

WHITESANDS DATA.RUN -13.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

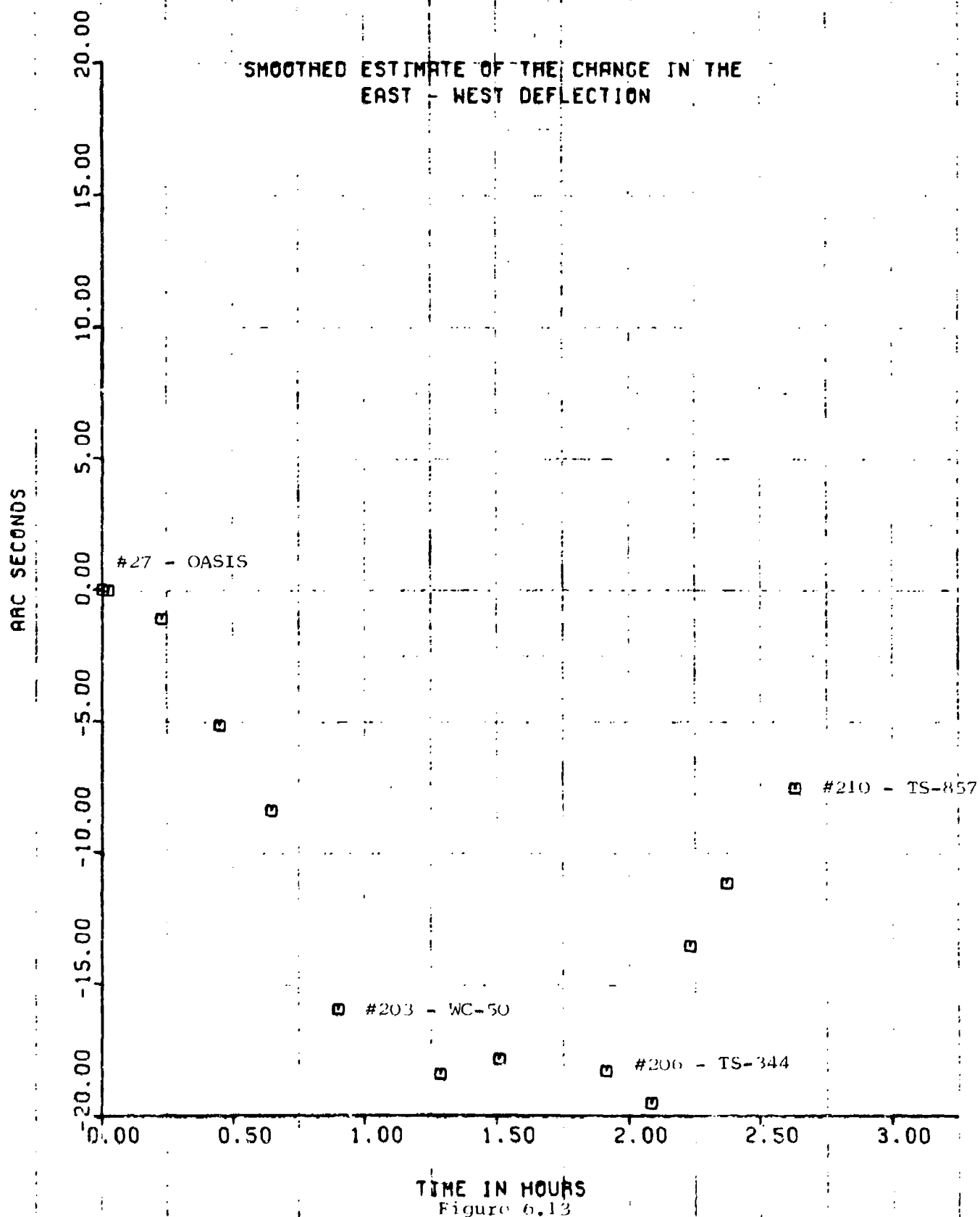
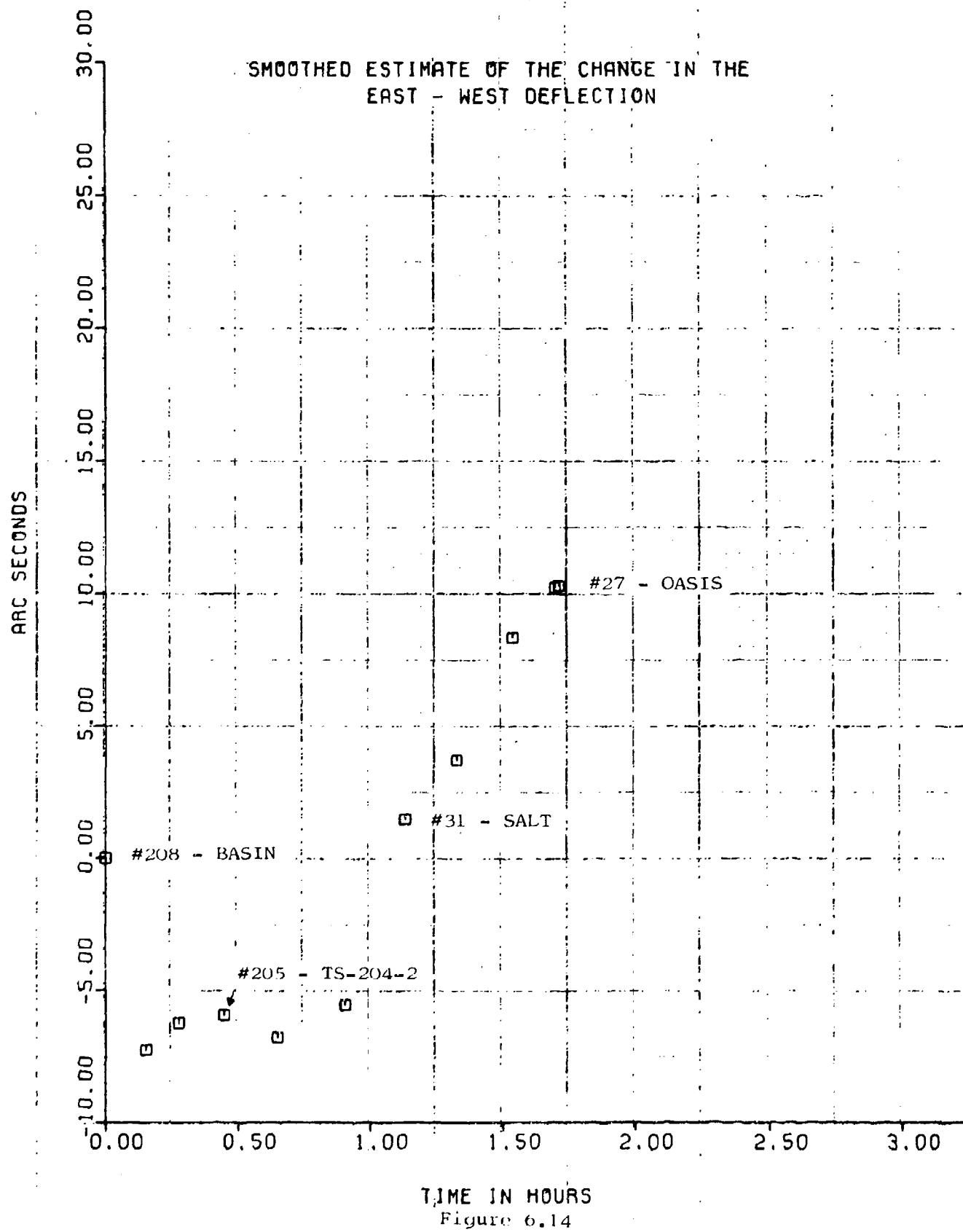


Figure 6.13

WHITESANDS DATA, RUN -14, LEG-1



WHITESANDS DATA, RUN. -16, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

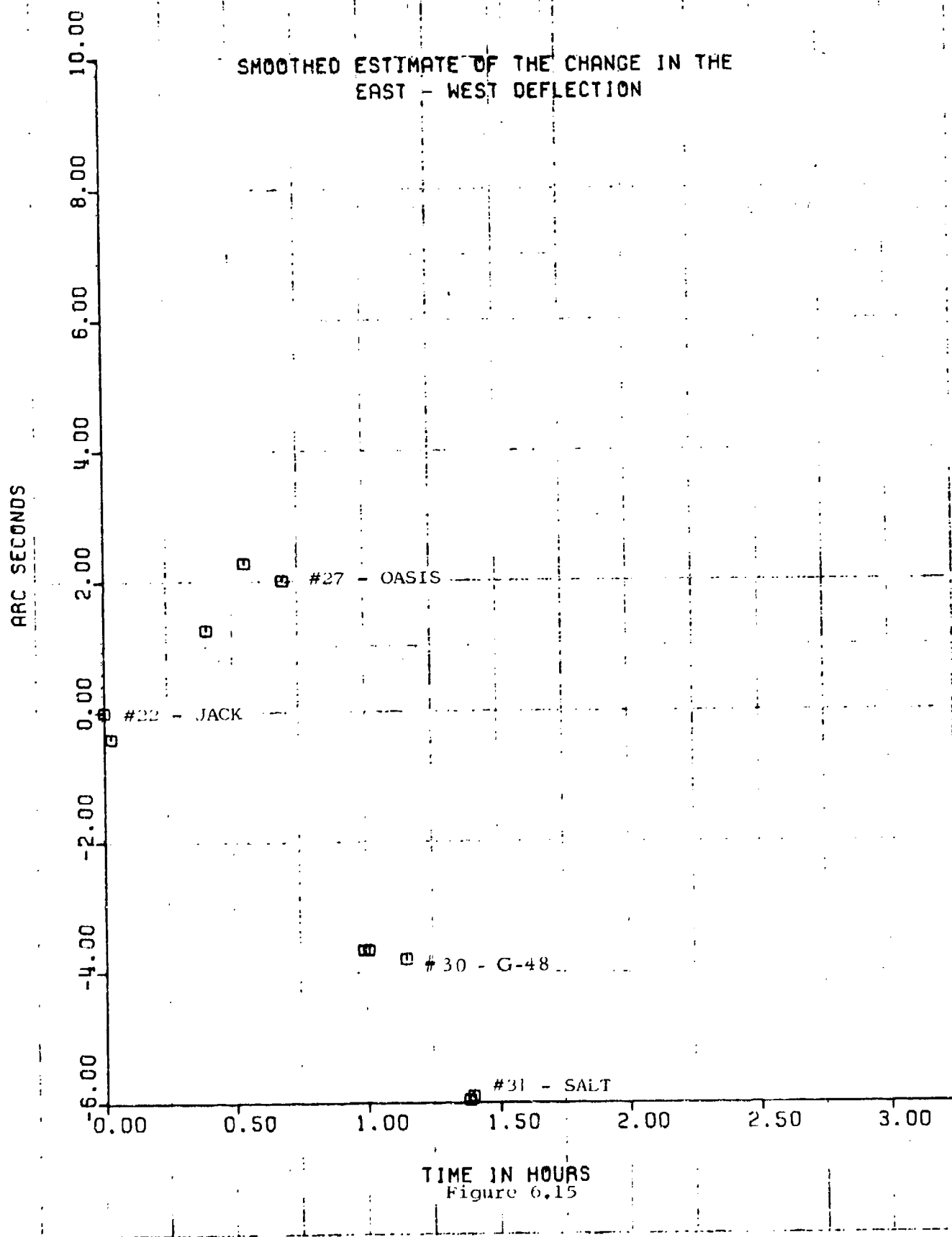


Figure 6.15

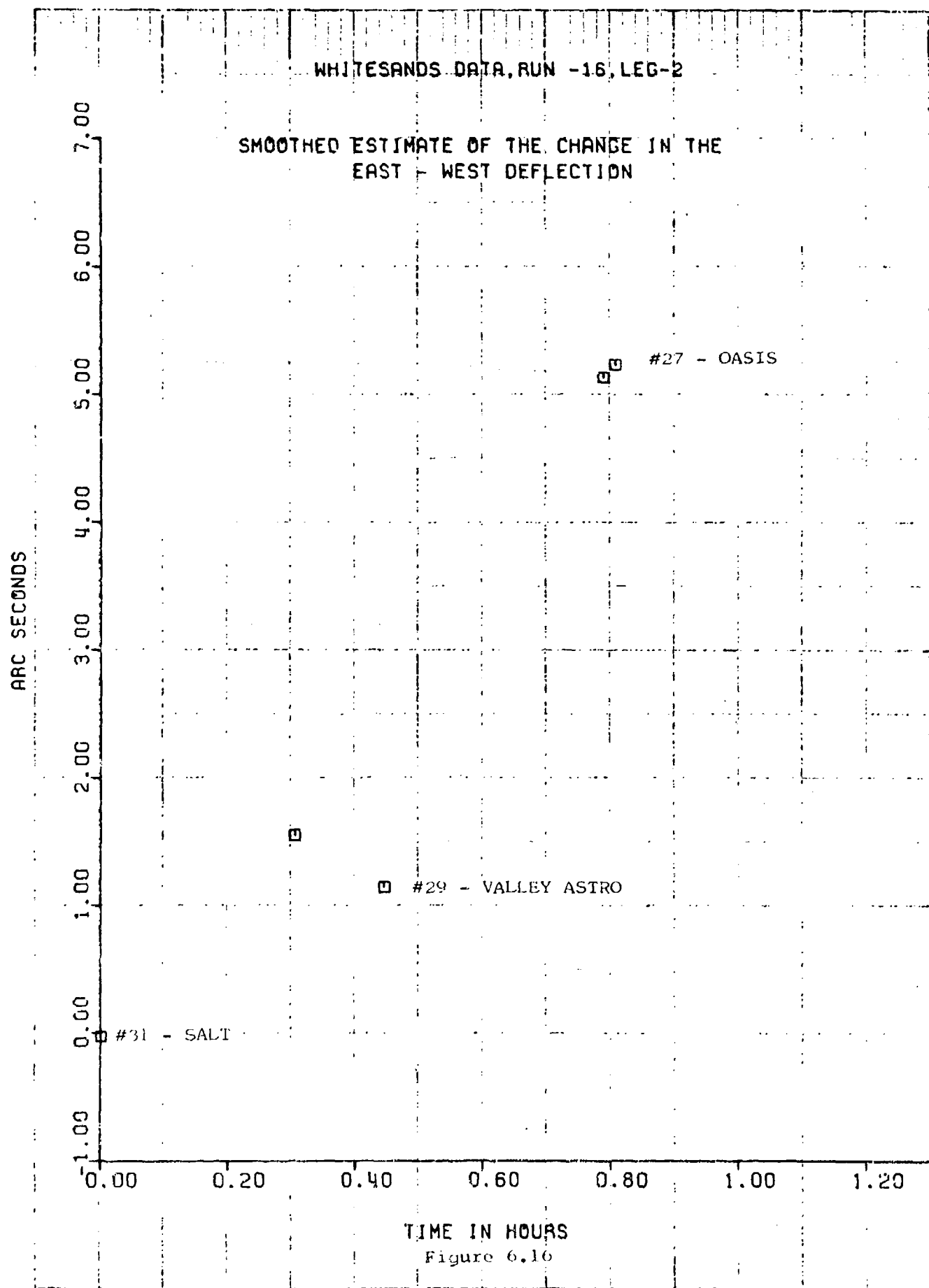


Figure 6.16

WHITESANDS DATA, RUN -16, LEG-3

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

□ #26 - MONUMENT 14

ARC SECONDS

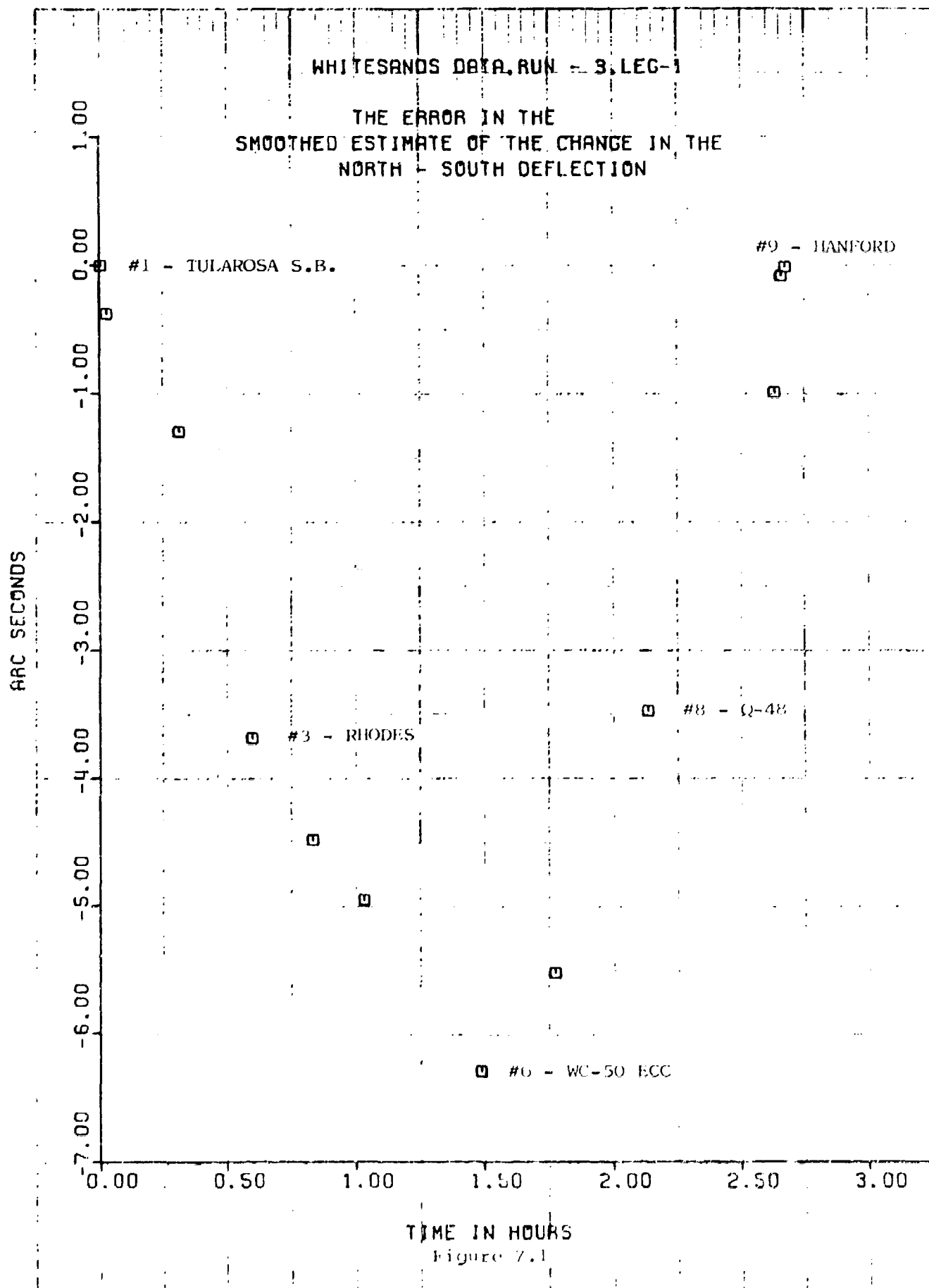
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00

□ #22 - JACK

□ #27 - OASIS

0.00 0.20 0.40 0.60 0.80 1.00 1.20

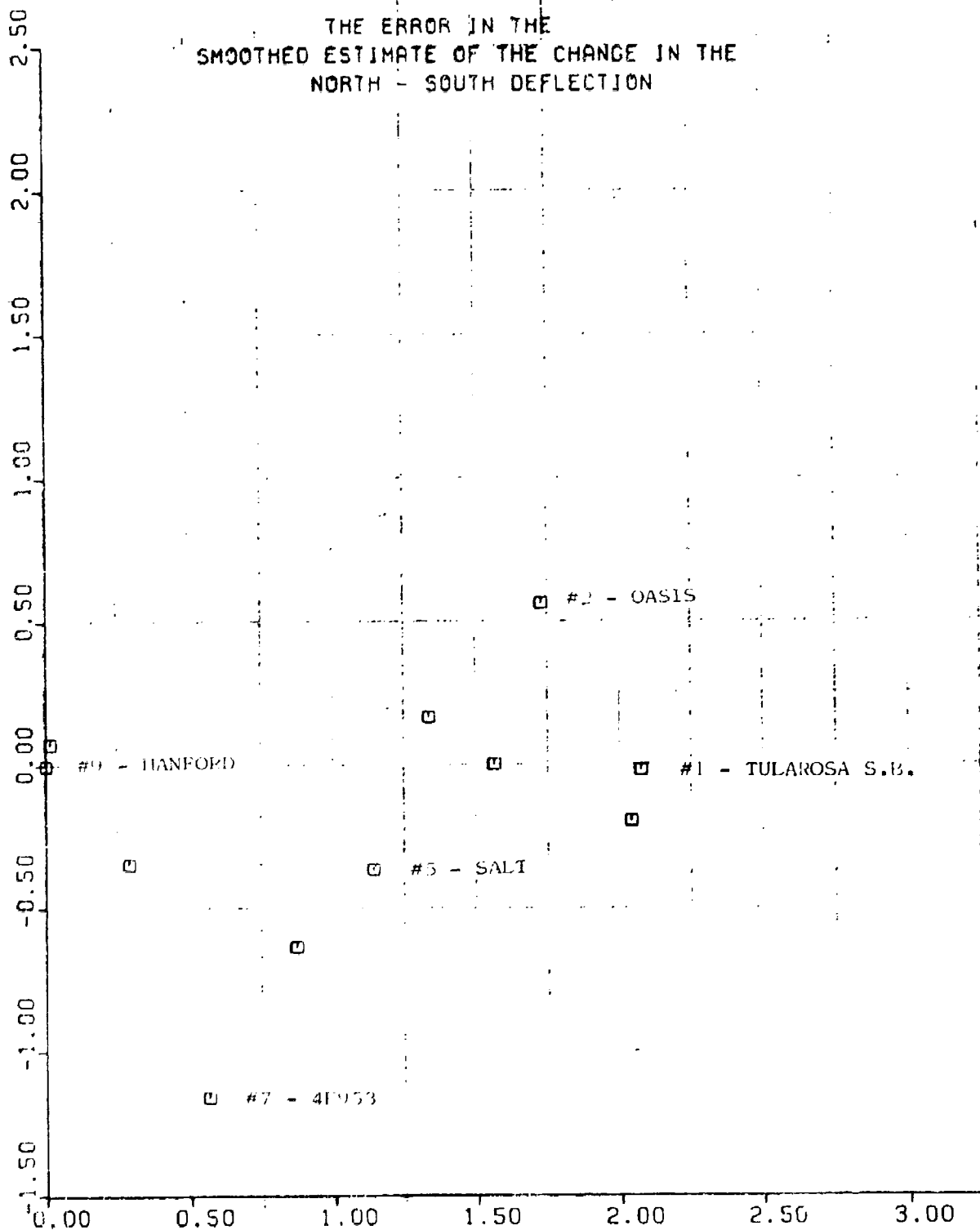
TIME IN HOURS
Figure 6.17



WHITESANDS DATA, RUN - 4, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure 7.2

ARC SECONDS

WHITESANDS DATA RUN - 5. LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#1 - TULAROSA S. P.

#1 - TULAROSA S. P.

#4 - VALLEY ACTPO

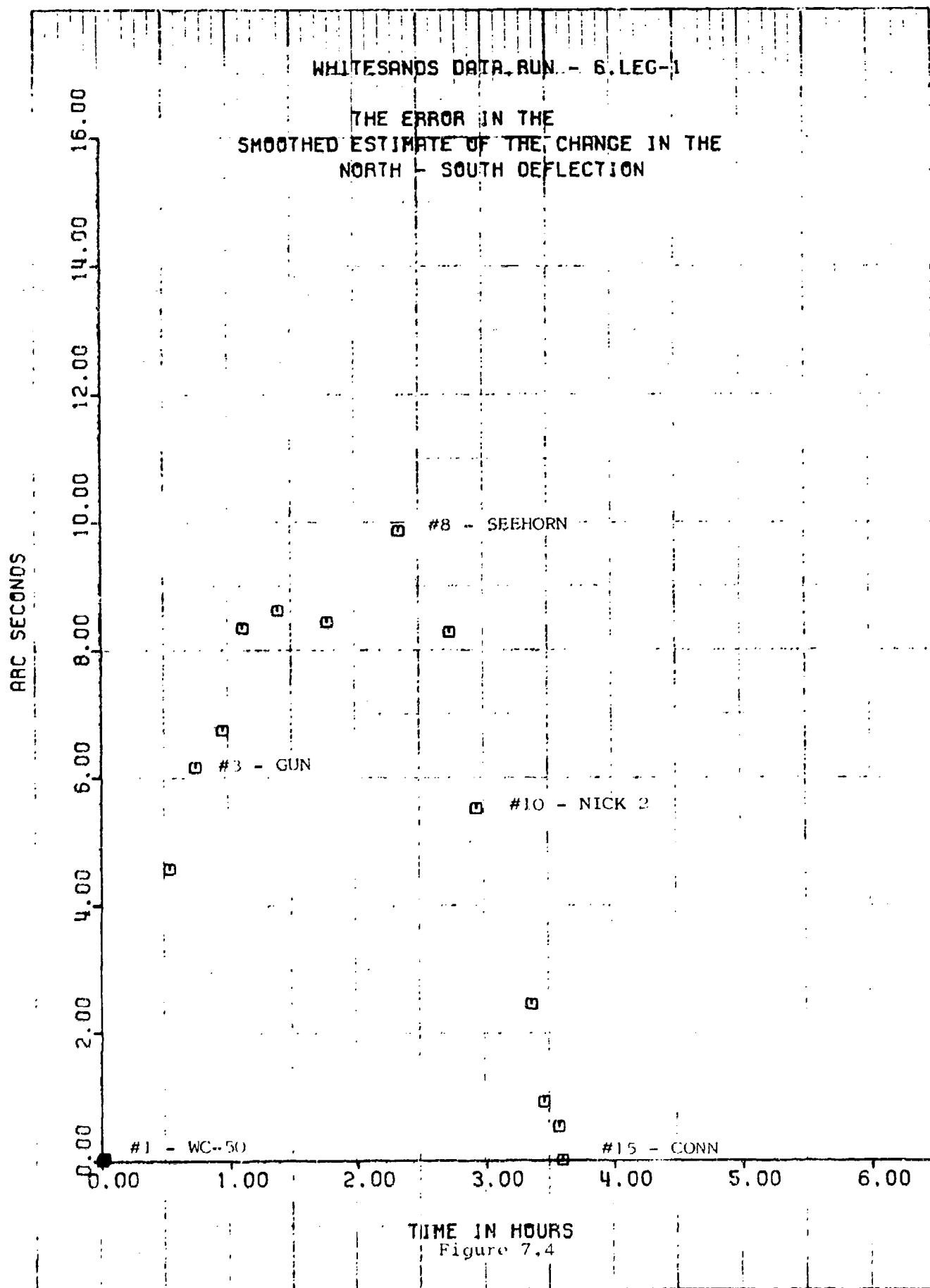
#5 - SALT

#7 - 4F953

#2 - OASIS

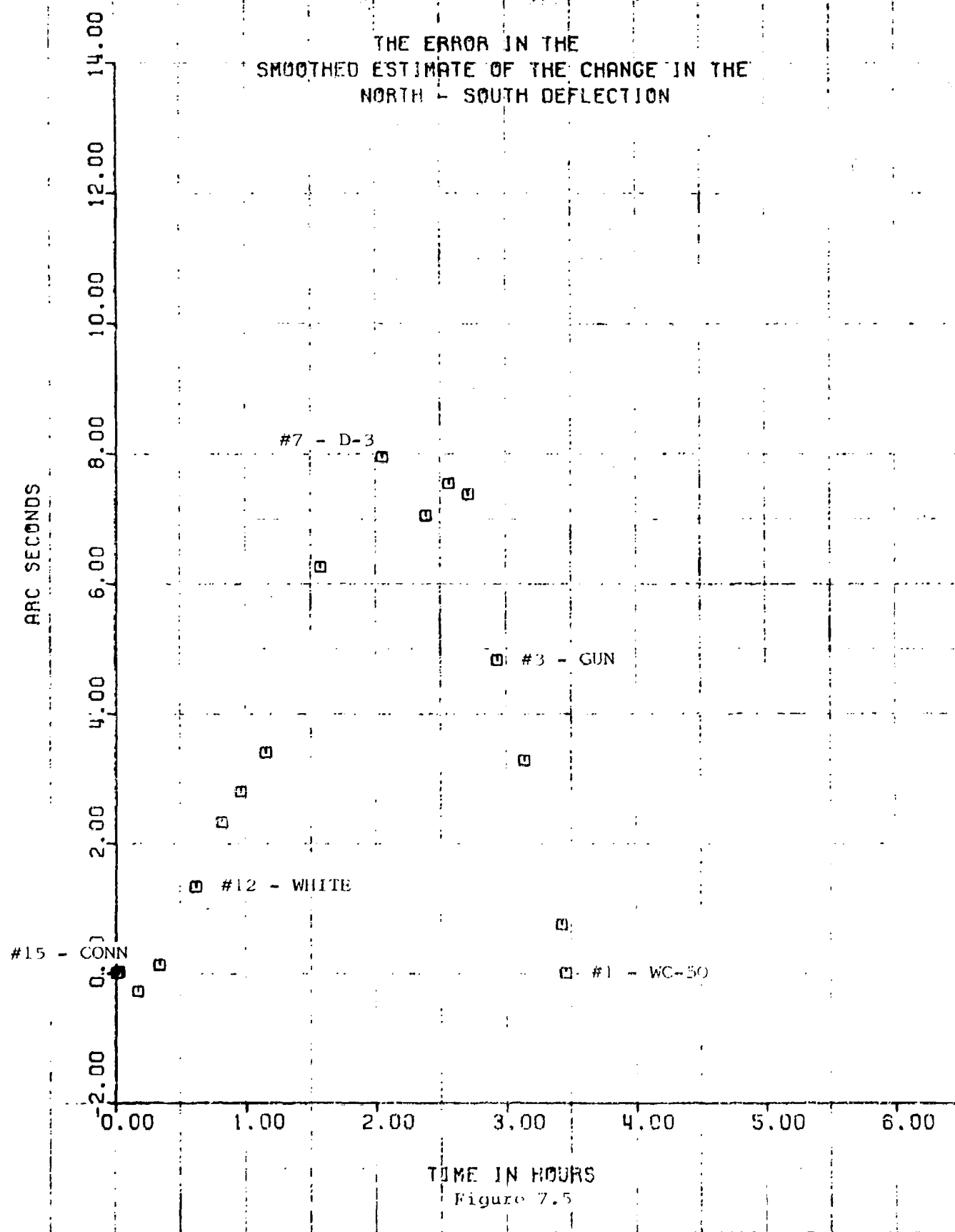
TIME IN HOURS
Figure 7.3

0.00 0.50 1.00 1.50 2.00 2.50 3.00



WHITESANDS DATA, RUN - 7, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



WHITESANDS DATA, RUN - 3, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00

#1 - TULAROSA S.B.

#9 - HANFORD

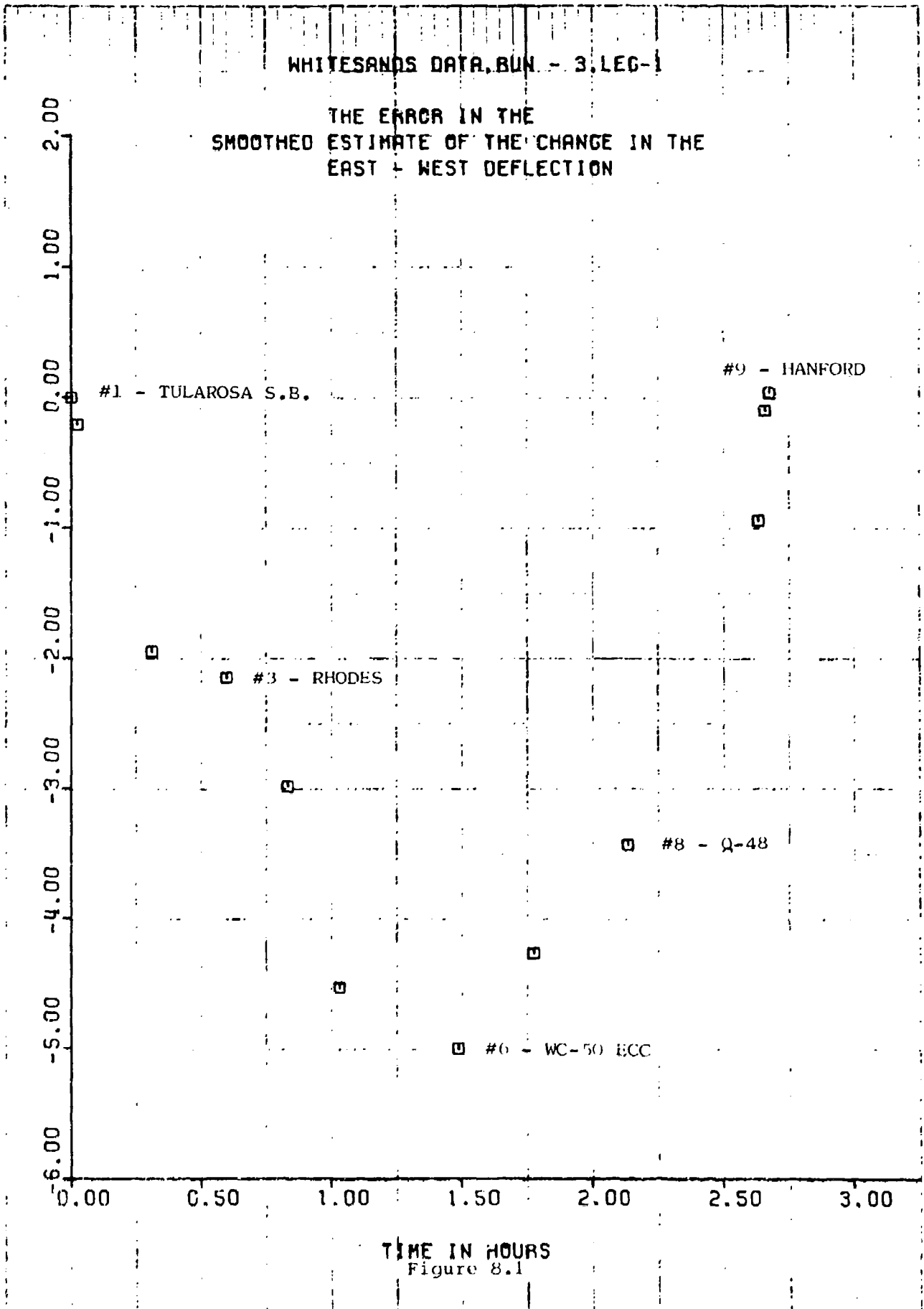
#3 - RHODES

#8 - Q-48

#6 - WC-50 ECC

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS
Figure 8.1



ARC SECONDS

WHITESANDS DATA, RUN - 4, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

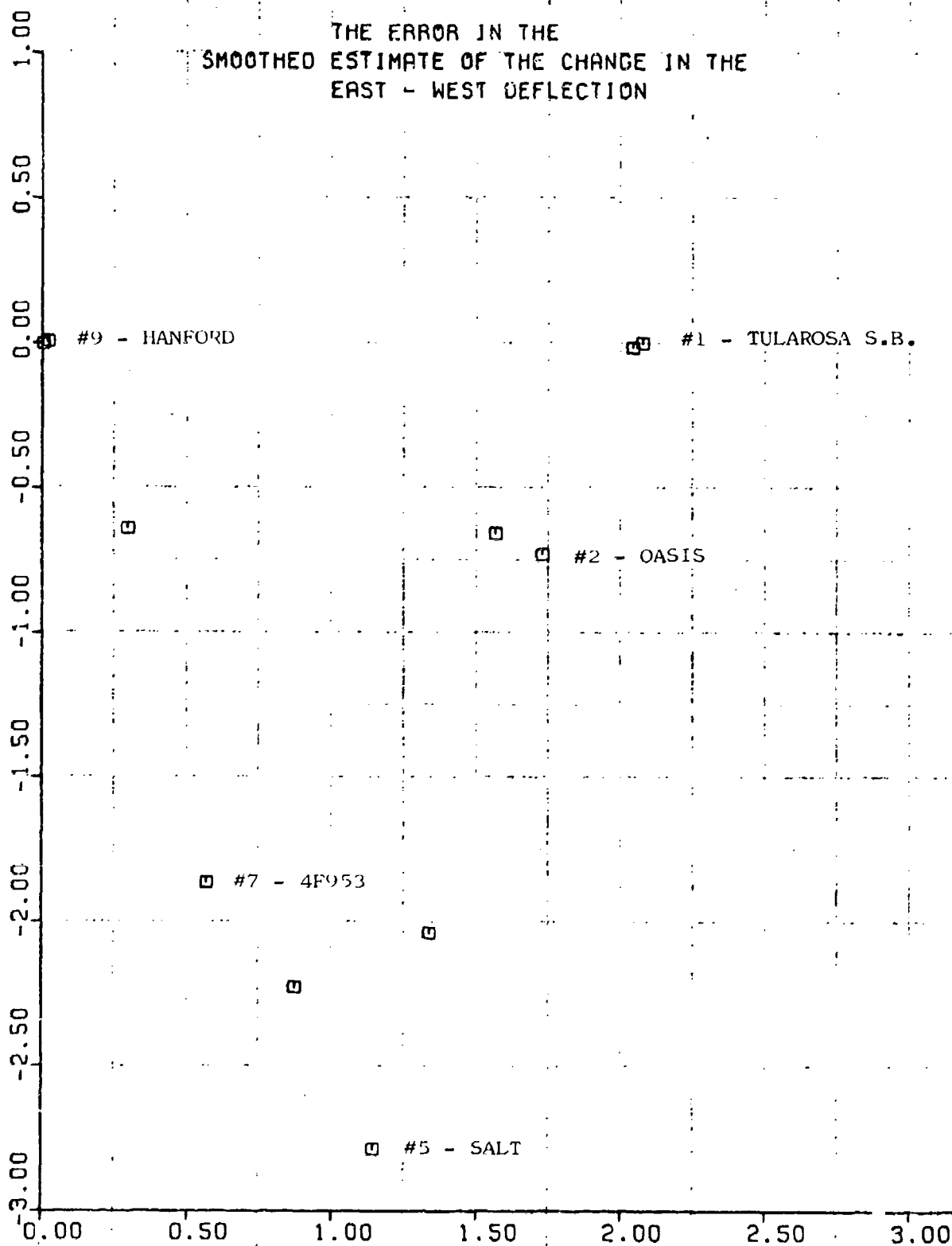
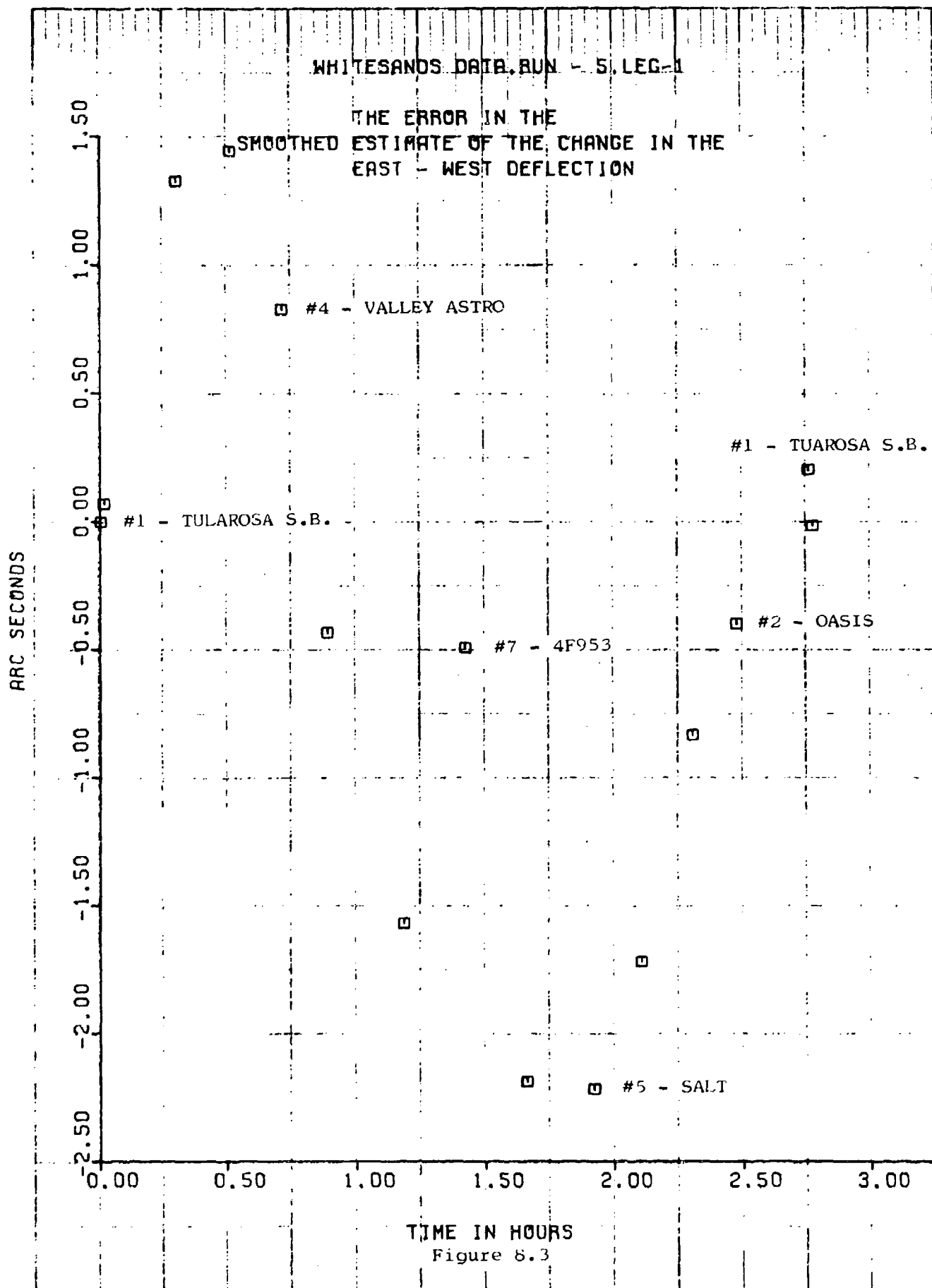
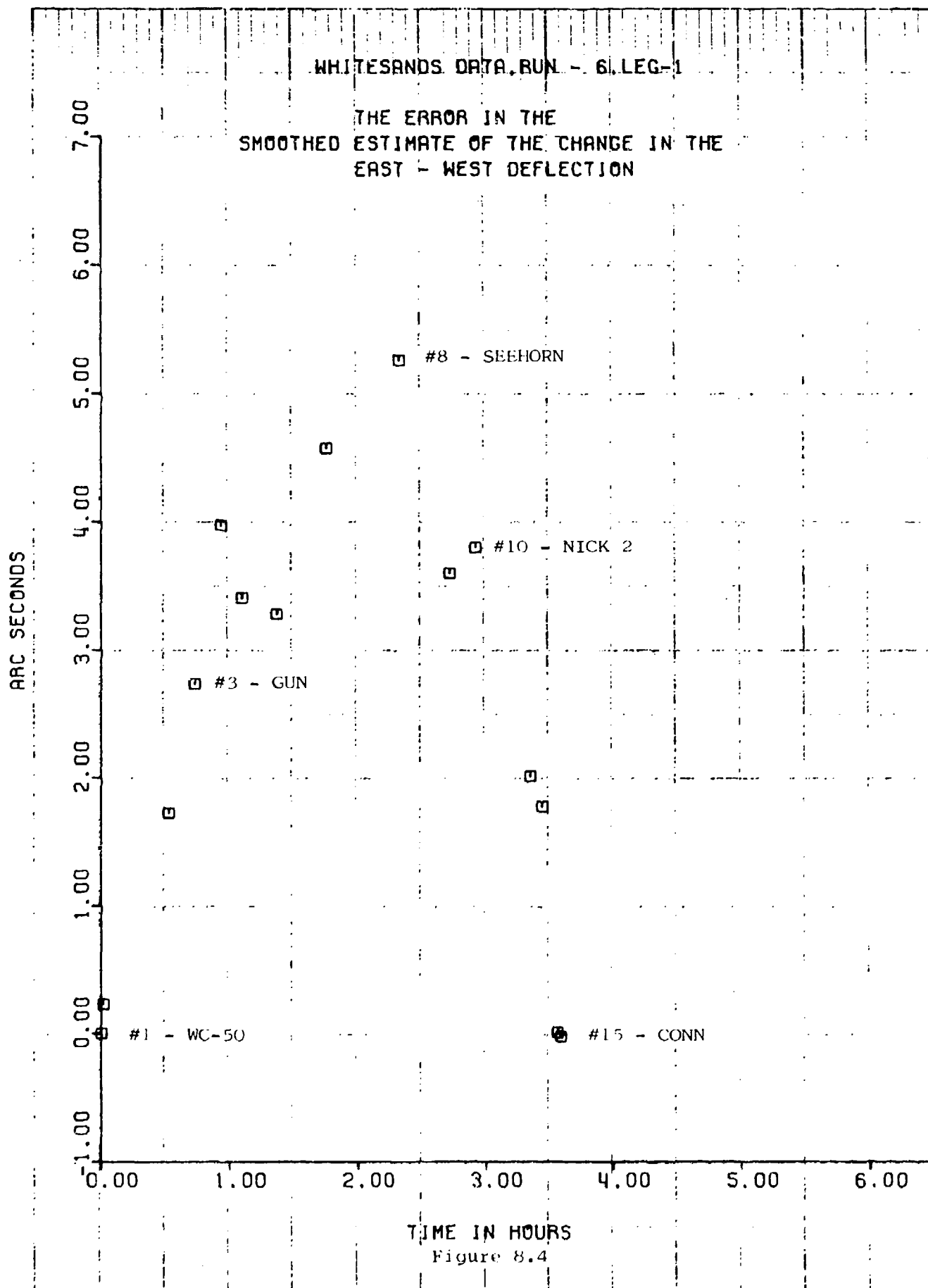


Figure 8.2





WHITESANDS DATA RUN - 7.LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50

0.00 1.00 2.00 3.00 4.00 5.00 6.00

TIME IN HOURS

Figure 8.5

#12 - WHITE

#3 - GUN

#7 - D-3

#15 - CONN

#1 - WC-50

APPENDIX E

REAL TIME ESTIMATES, SMOOTHED ESTIMATE AND ERRORS IN THE ESTIMATES OF THE DEFLECTION OF THE VERTICAL CHANGE FOR THE RUNS WITH MAJOR HEADING CHANGES REMOVED

This appendix presents deflection of the vertical data associated with the three mission (Runs 5, 6, 7) where major heading changes were deleted. The data is divided into the same four groups as in Appendix D.

LIST OF ILLUSTRATIONS FOR MISSIONS WITH MAJOR HEADING CHANGES DELETED

I. Real Time Estimates of the Change in the Deflections

<u>N-S (ξ)</u>		<u>E-W (η)</u>
<u>Figure</u>	<u>Run Identification</u>	<u>Figure</u>
E1.1	5A	E2.1
E1.2	5B	E2.2
E1.3	6A	E2.3
E1.4	6B	E2.4
E1.5	7A	E2.5
E1.6	7B	E2.6

II. The Error in the Real Time Estimate of the Change in the Deflections

E3.1	5A	E4.1
E3.2	5B	E4.2
E3.3	6A	E4.3
E3.4	6B	E4.4
E3.5	7A	E4.5
E3.6	7B	E4.6

III. Smoothed Estimate of the Change in the Deflections

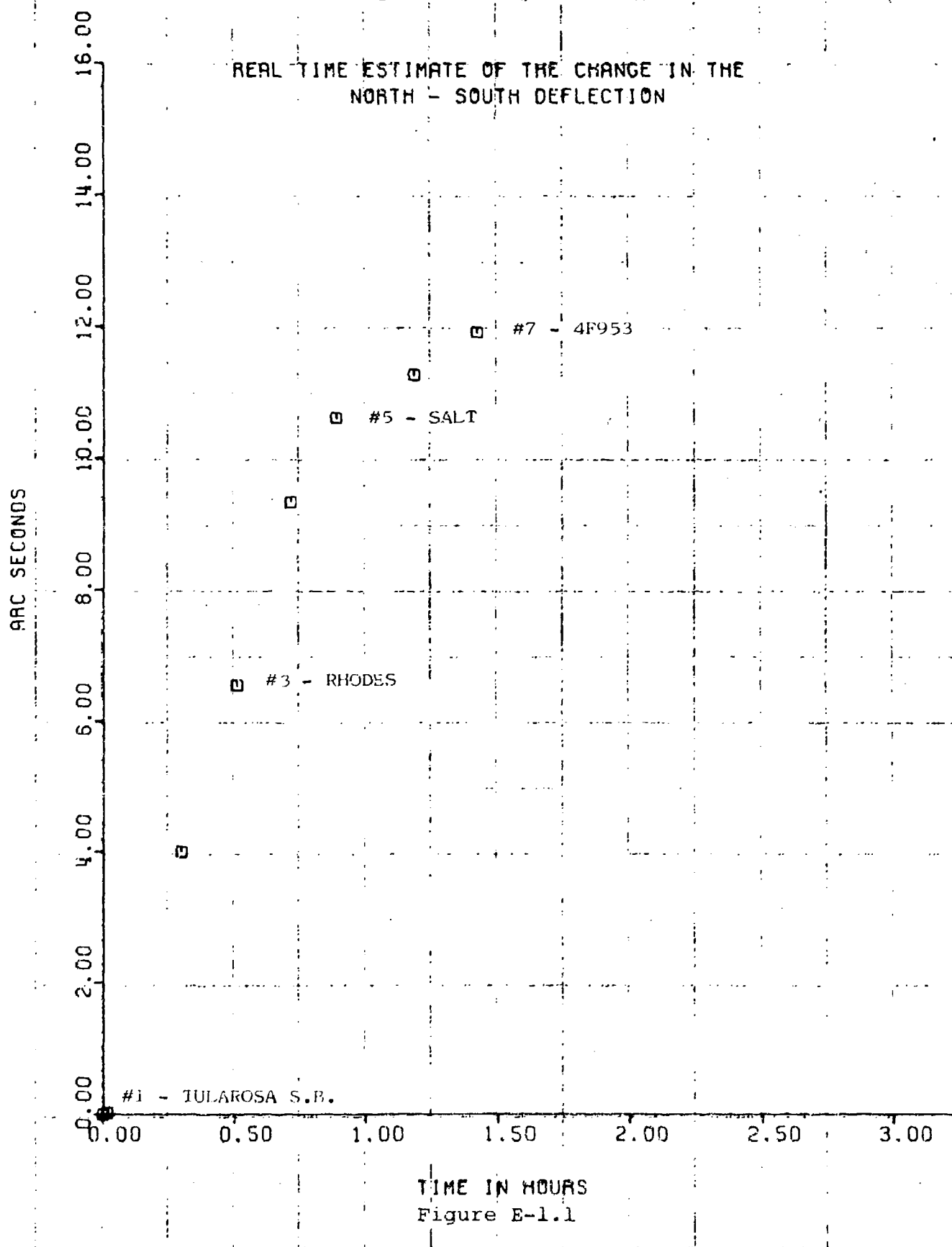
E5.1	5A	E6.1
E5.2	5B	E6.2
E5.3	6A	E6.3
E5.4	6B	E6.4
E5.5	7A	E6.5
E5.6	7B	E6.6

IV. The Error in the Smoothed Estimate of the Change in the Deflections

E7.1	5A	E8.1
E7.2	5B	E8.2
E7.3	6A	E8.3
E7.4	6B	E8.4
E7.5	7A	E8.5
E7.6	7B	E8.6

WHITESANDS DATA RUN - SA.LEG-1

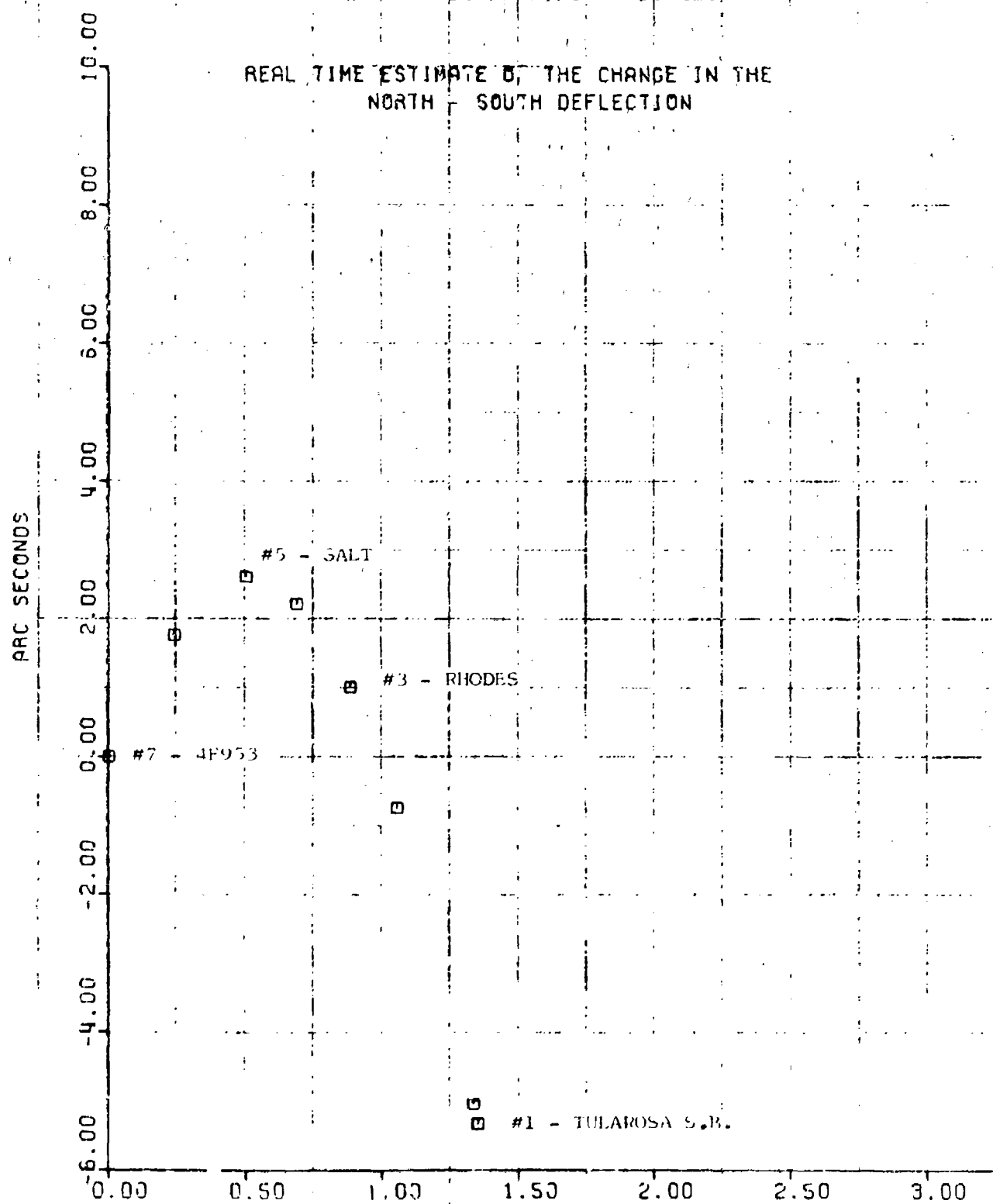
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



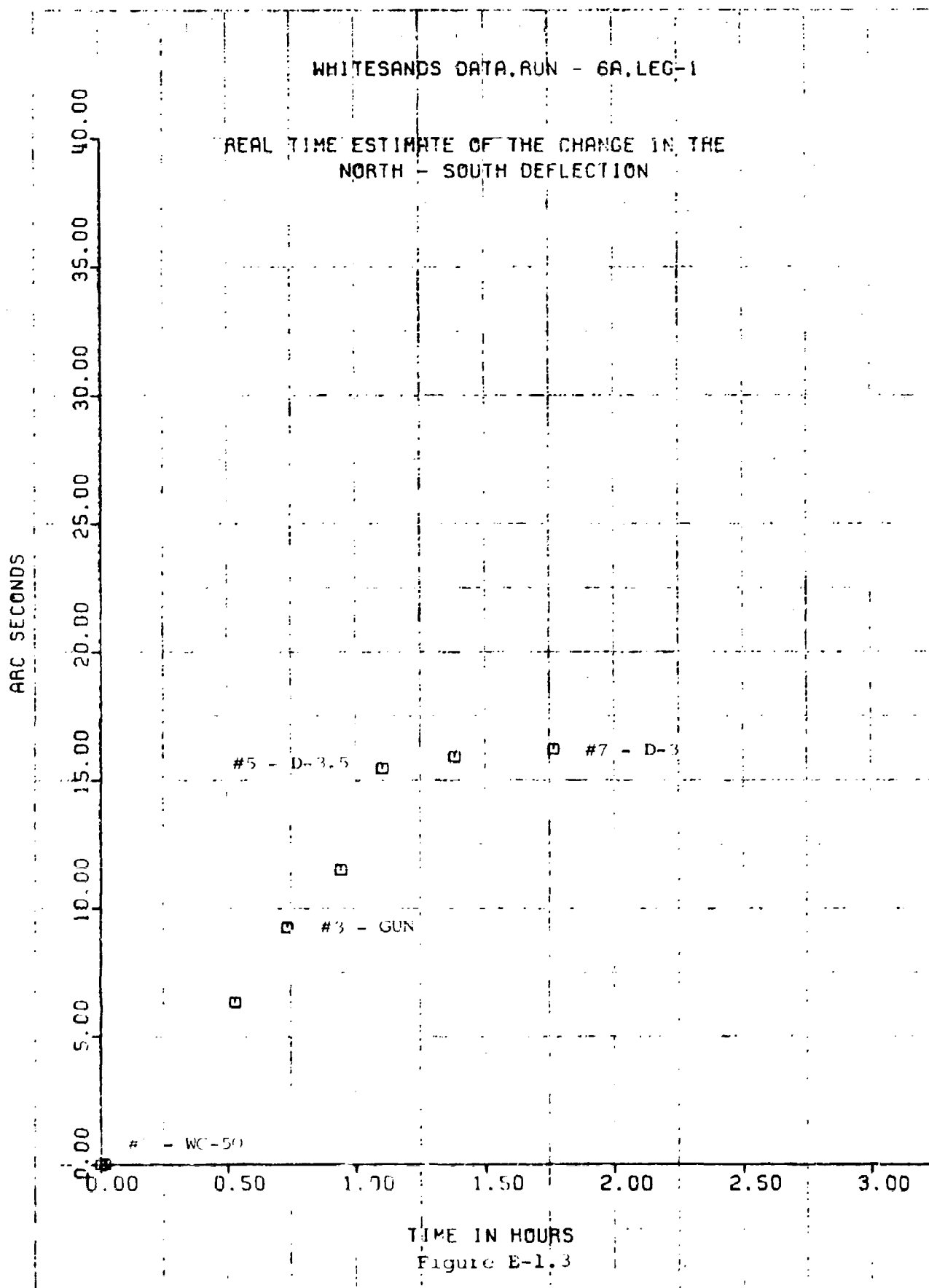
TIME IN HOURS
Figure E-1.1

WHITESANDS DATA, RUN - SB LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

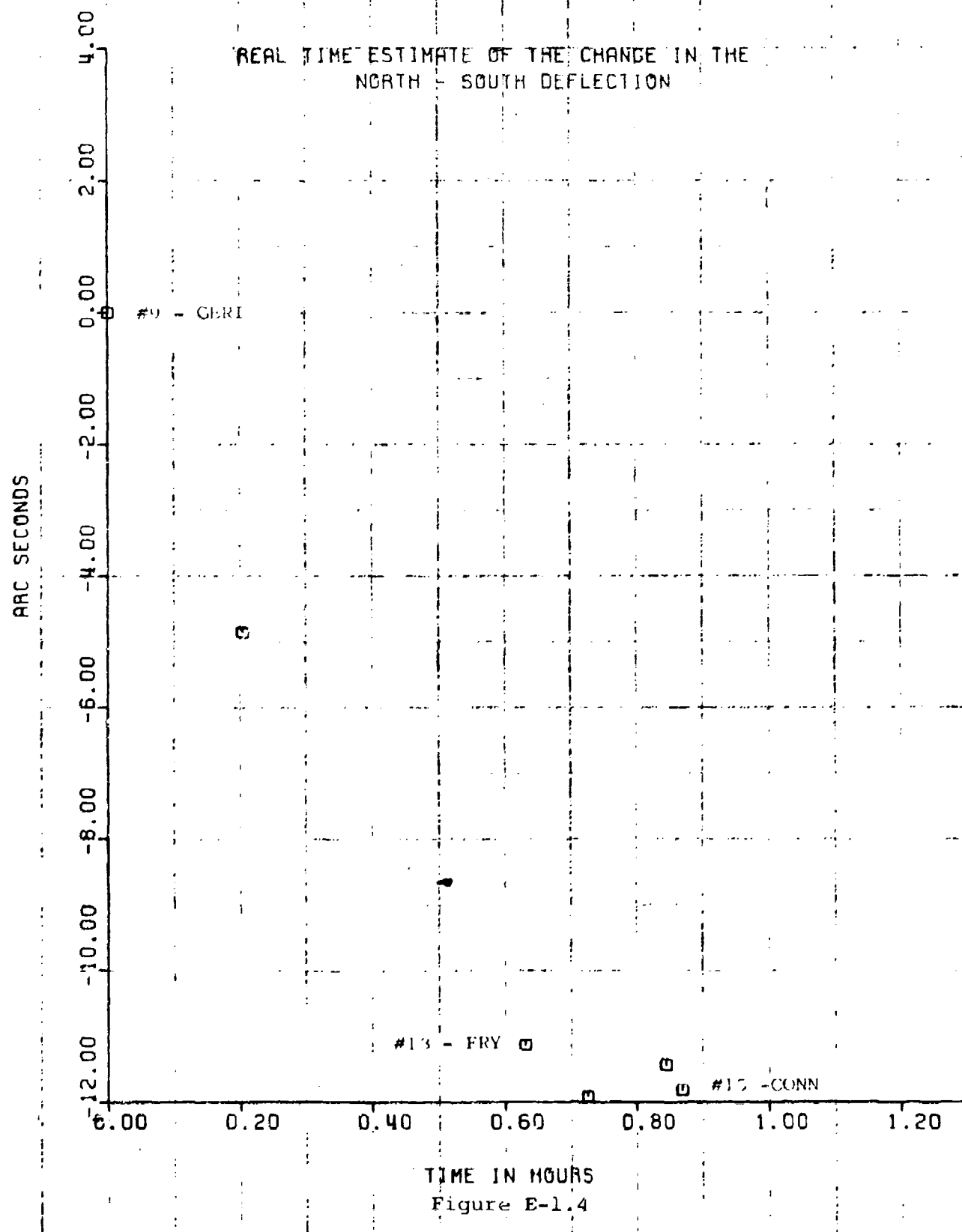


TIME IN HOURS
Figure E-1.2



WHITESANDS DATA RUN - 6B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



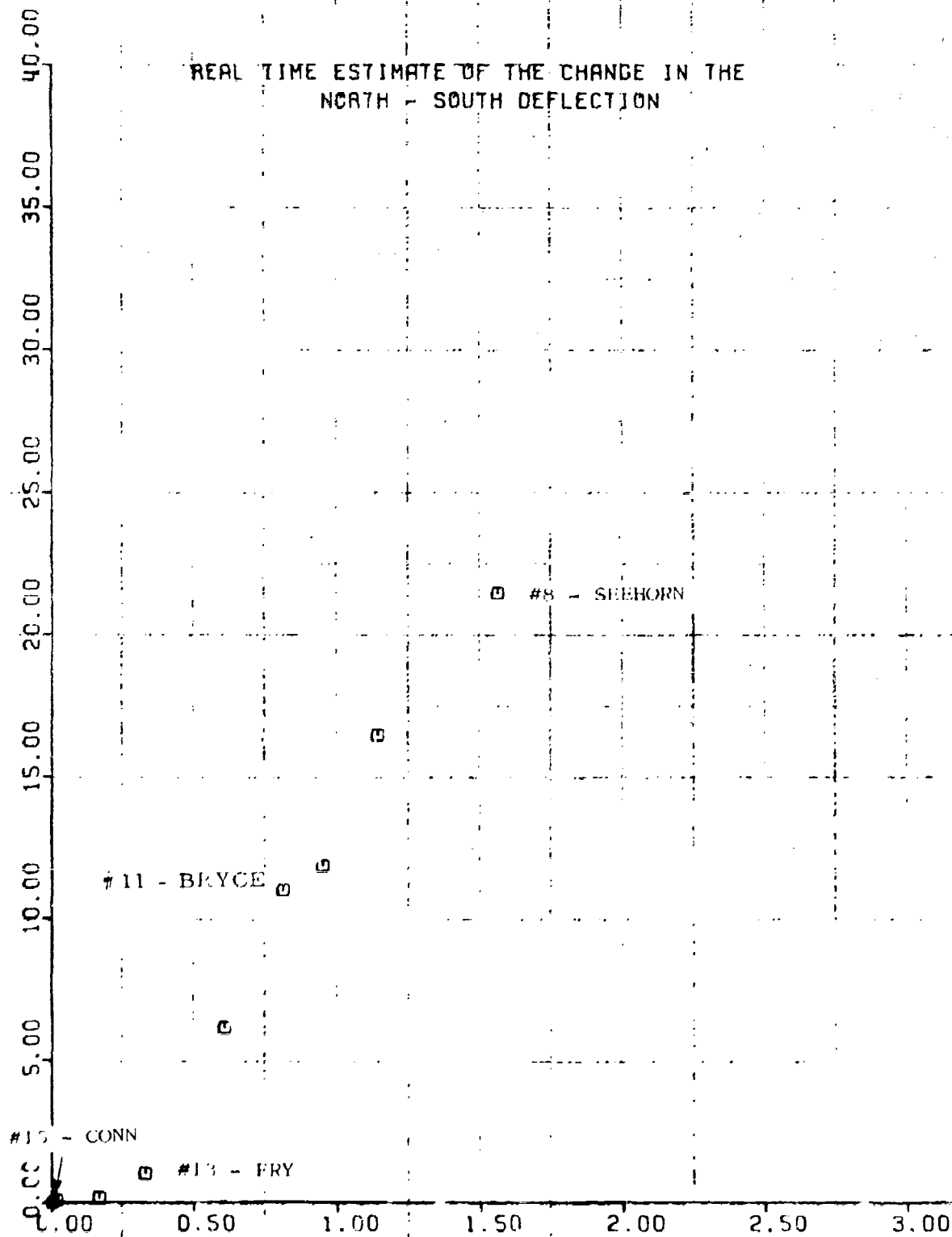
TIME IN HOURS

Figure E-1.4

WHITESANDS DATA, RUN - 7A, LEO-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

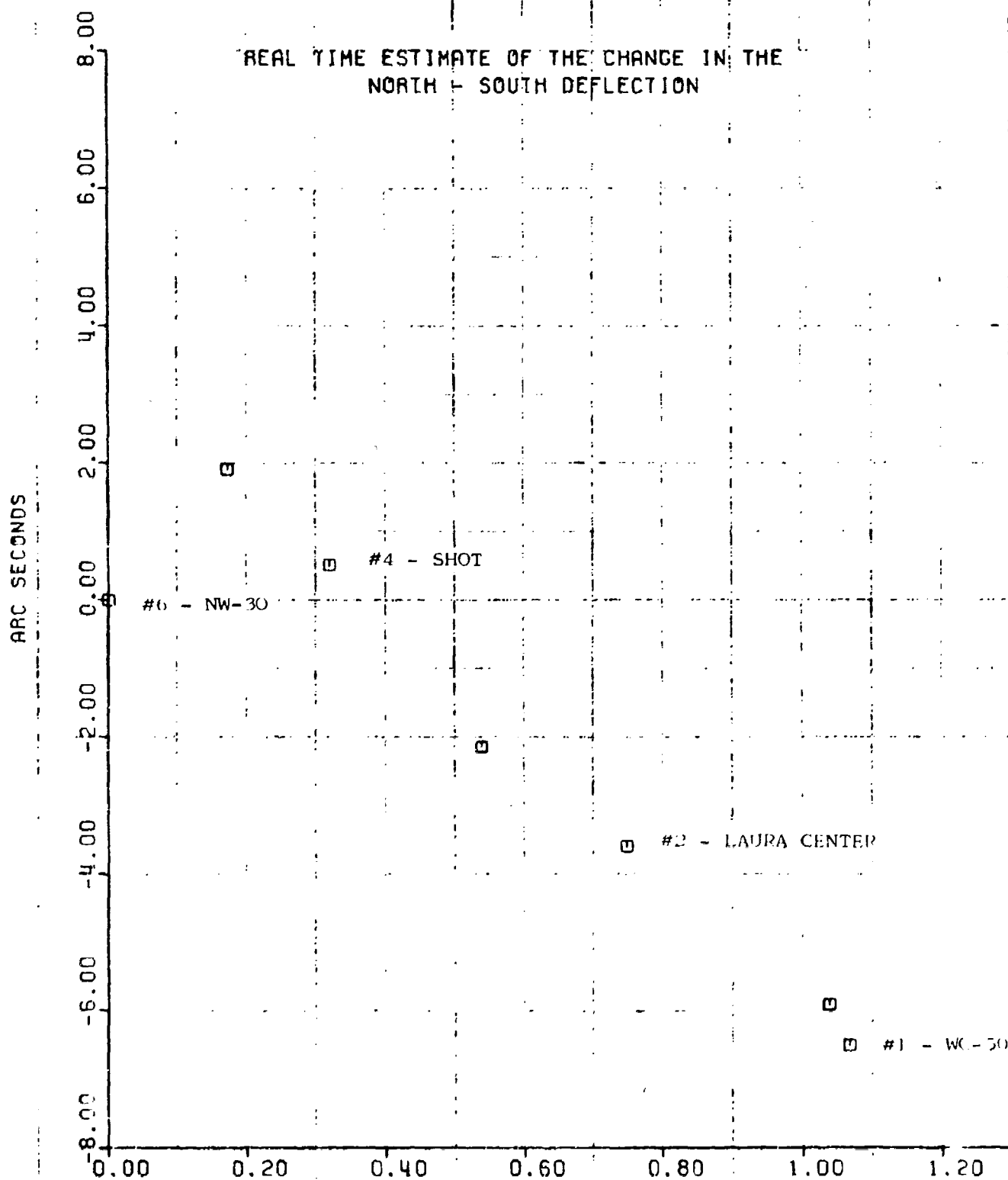
ARC SECONDS



TIME IN HOURS
Figure E-1.5

WHITESANDS DATA, RUN - 7B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

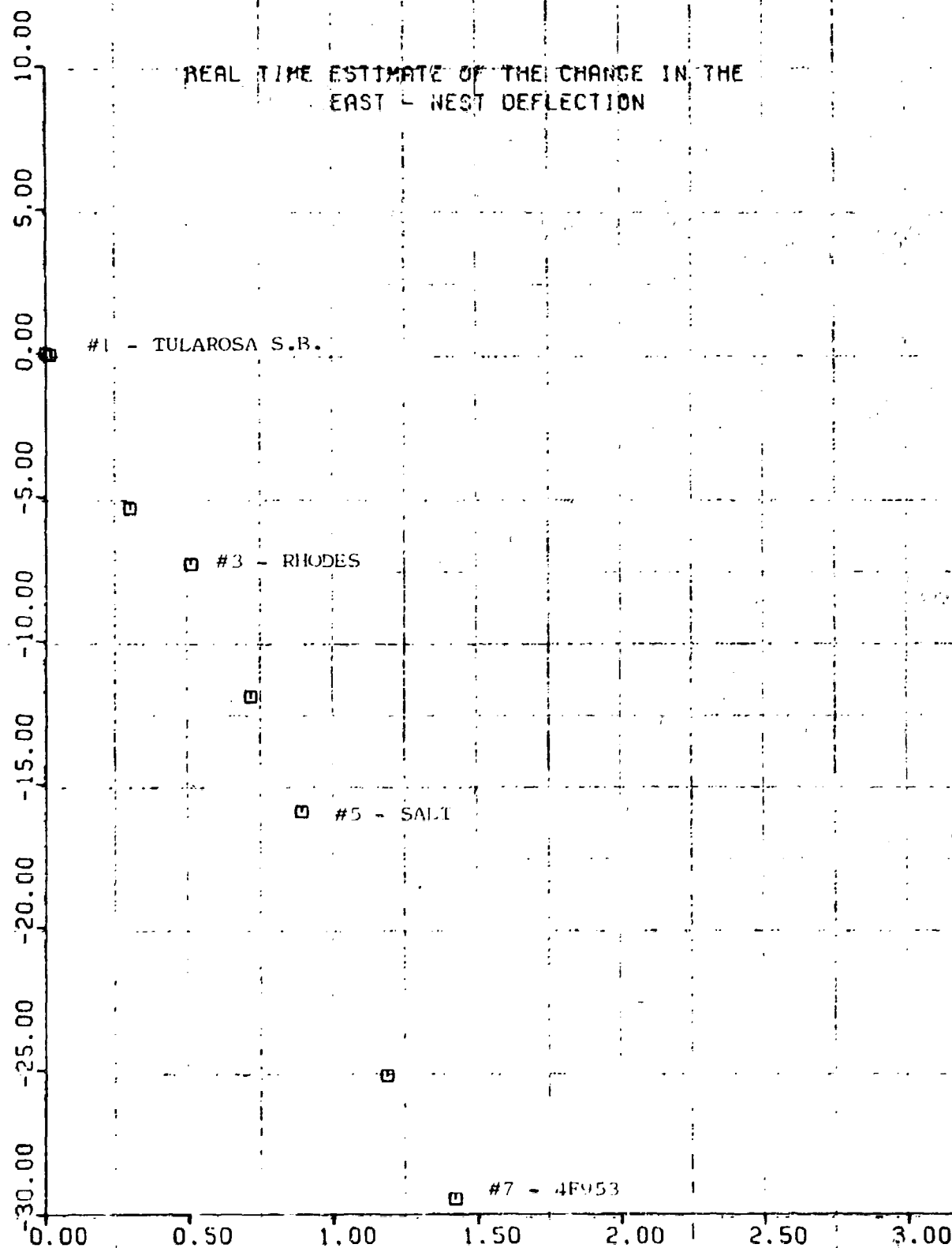


TIME IN HOURS
Figure E-1.6

ARC SECONDS

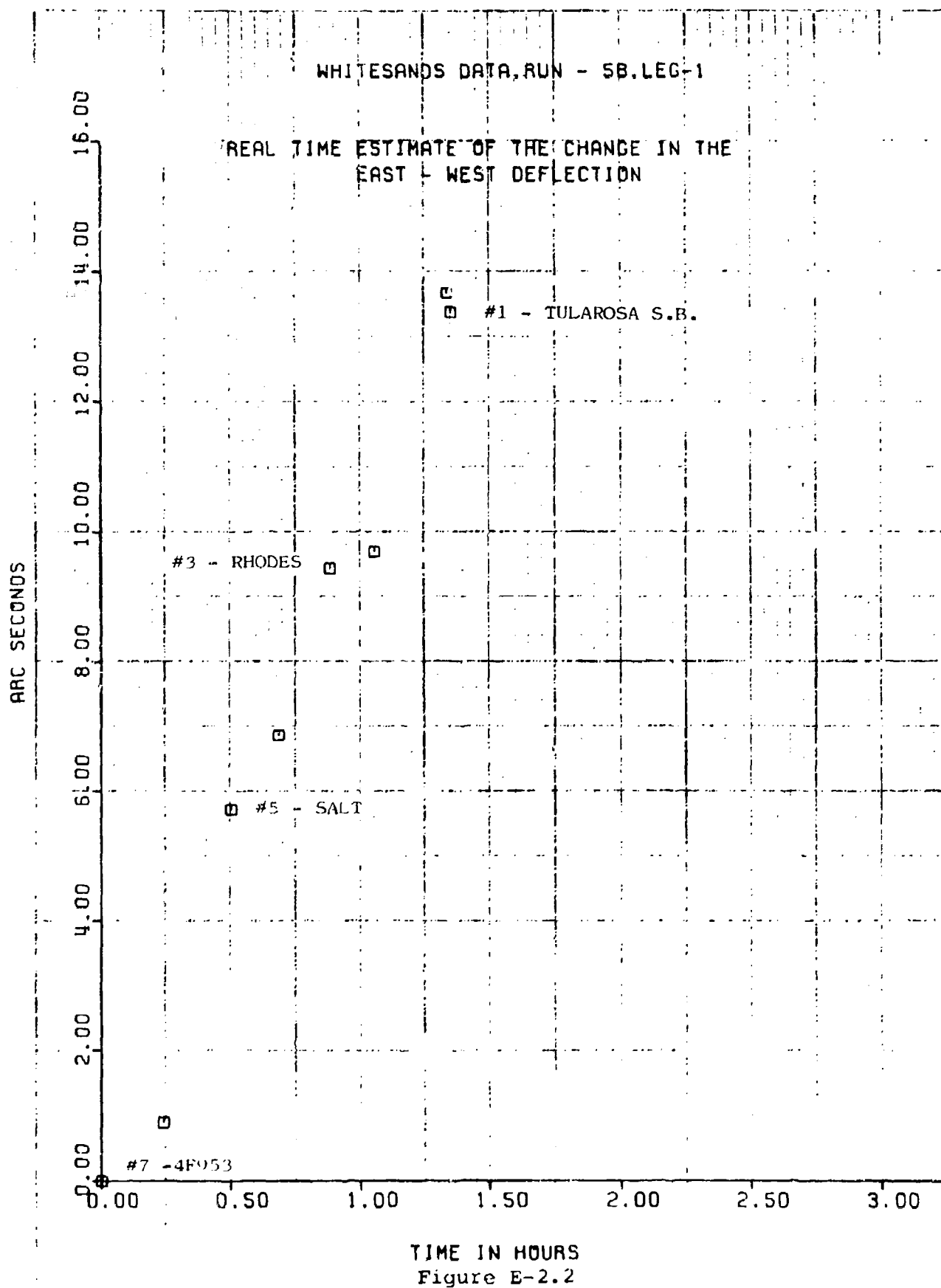
WHITESANDS DATA RUN - SA LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS

Figure E-2.1



WHITESANDS DATA RUN - 6A, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00

#1 - WC-50

#3 - GUN

#5 - D-3.5

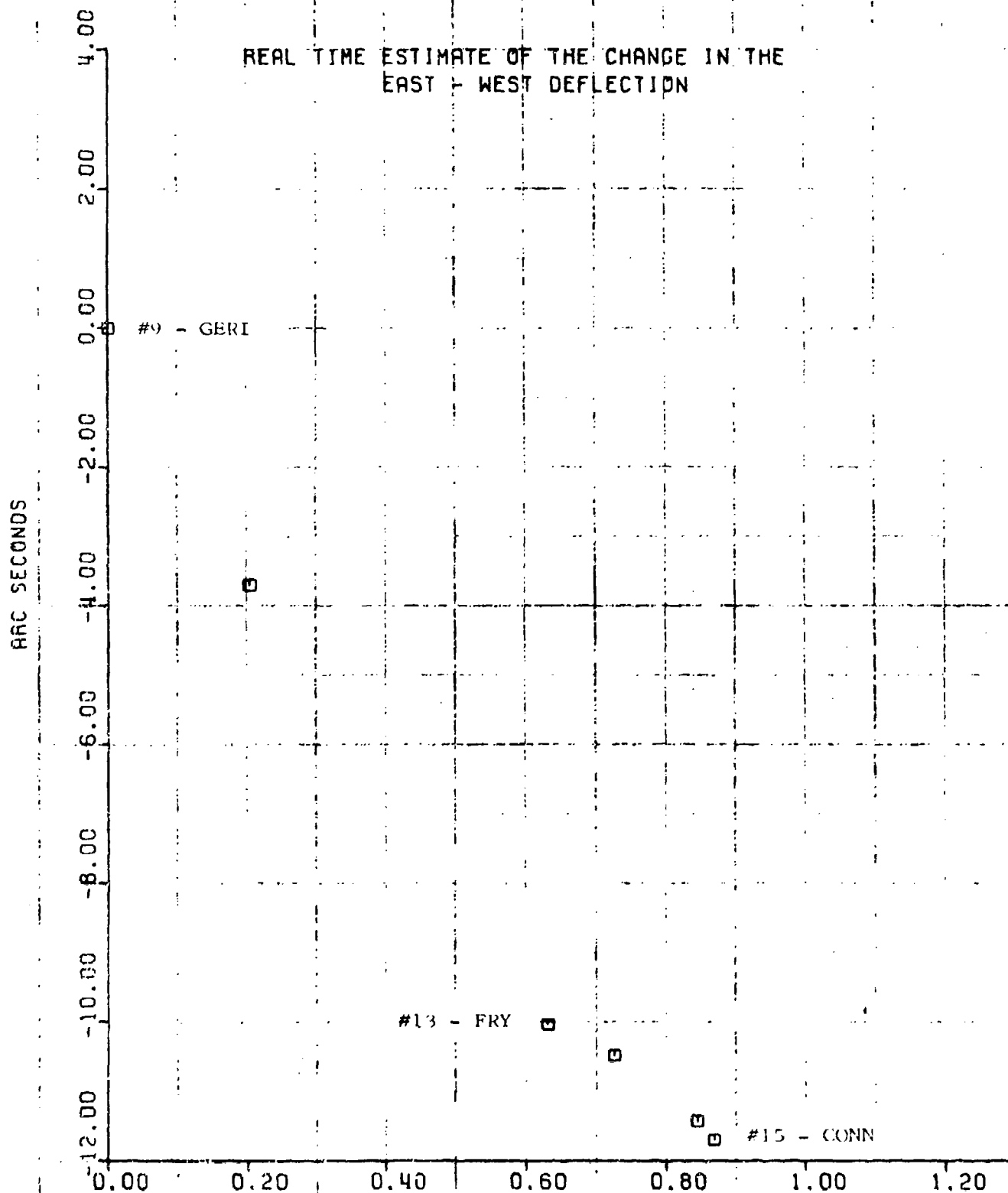
#7 - D-3

TIME IN HOURS

Figure E-2.3

WHITESANDS DATA, RUN - 6B, LEG-1

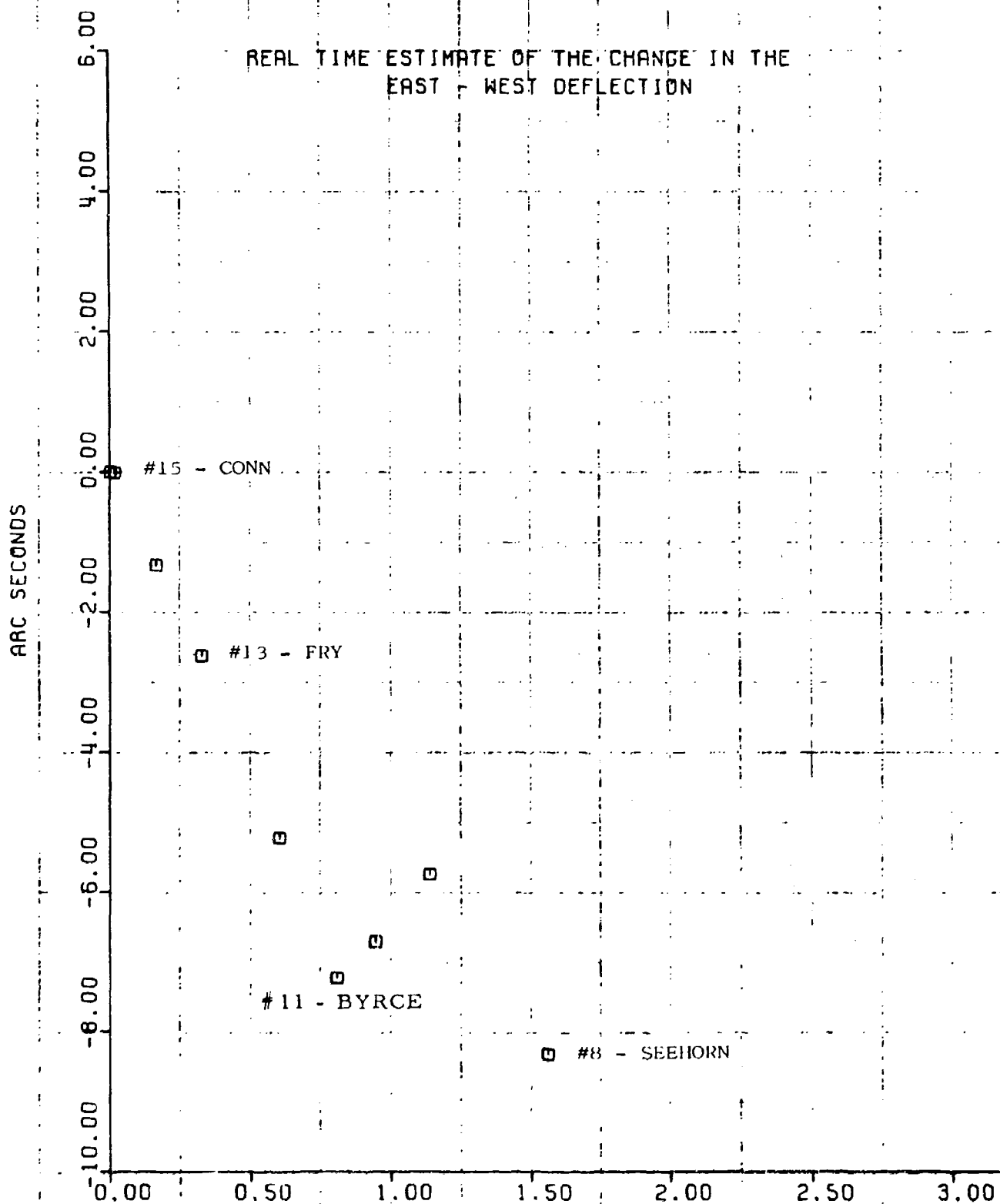
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure E-2.4

WHITESANDS DATA, RUN - 7A, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS

Figure E-2.5

WHITESANDS DATA RUN - 7B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00

#6 - NW-30

□

□ #4 - SHOT

□

□ #2 - LAURA CENTER

□

□ #1 - WC-50

1.00

1.20

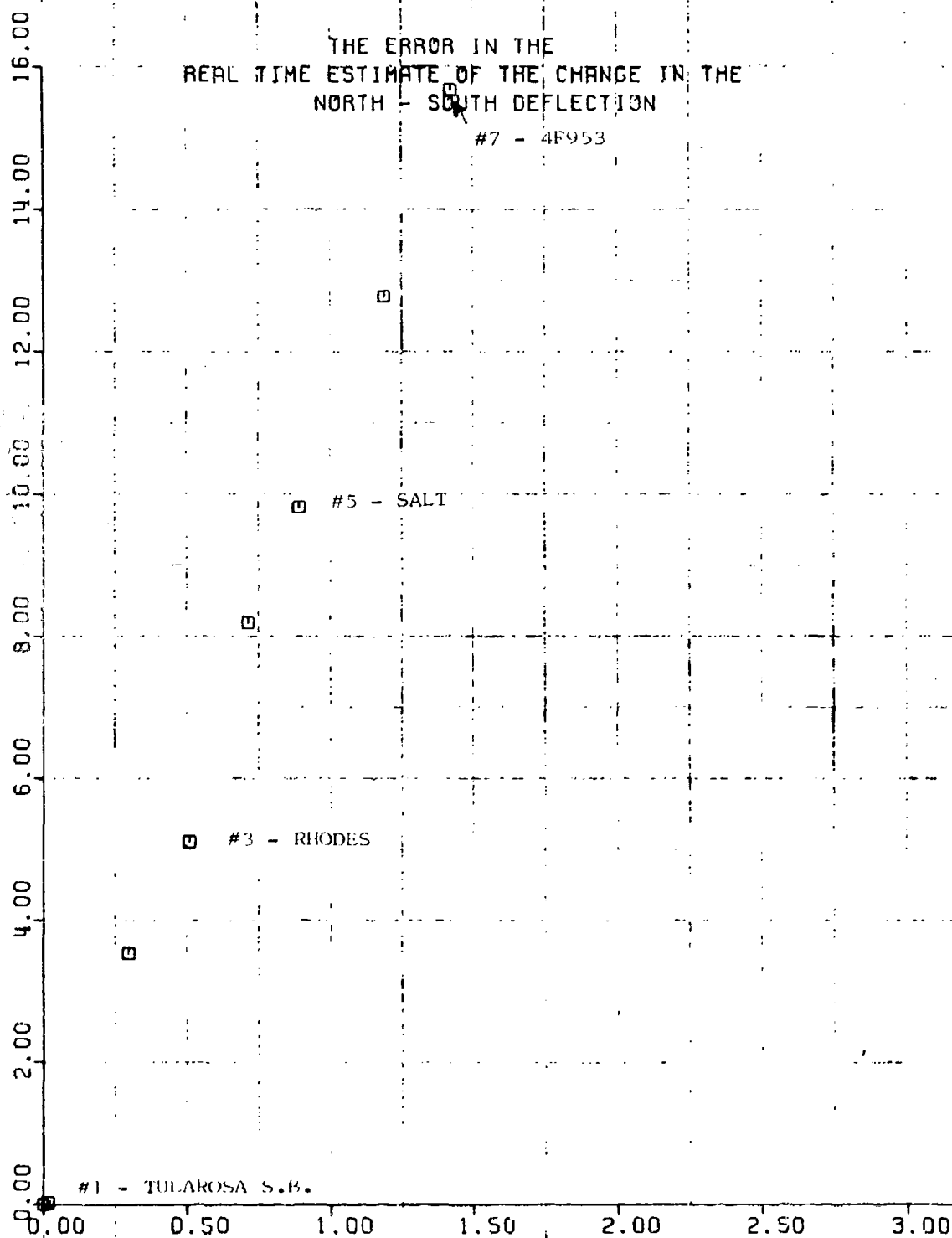
TIME IN HOURS
Figure E-2.6

WHITESANDS DATA, RUN - SA, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

#7 - 4F953

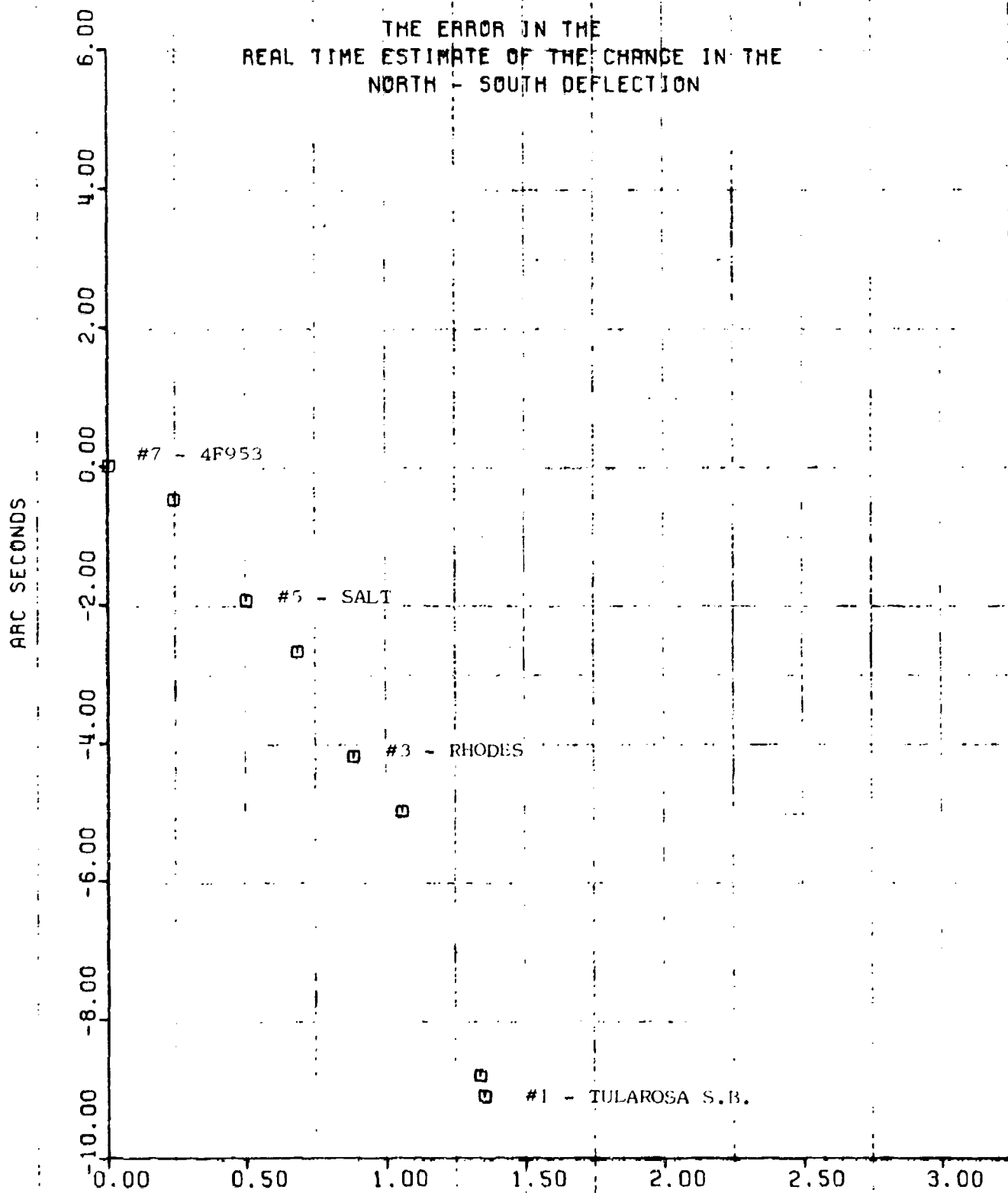
ARC SECONDS



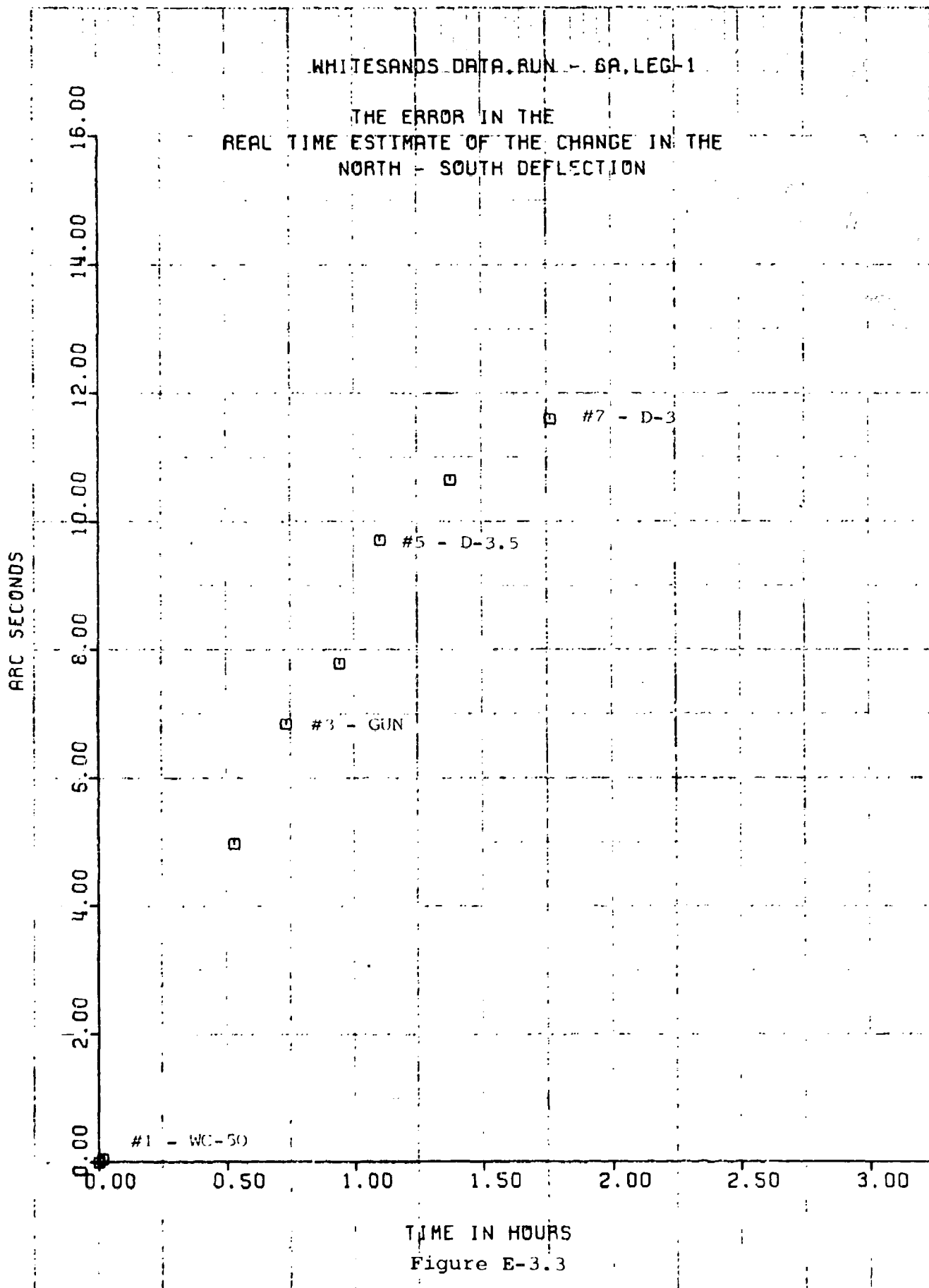
TIME IN HOURS
Figure E-3.1

WHITESANDS DATA RUN - SB, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure E-3.2



WHITESANDS DATA RUN - 6B.LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

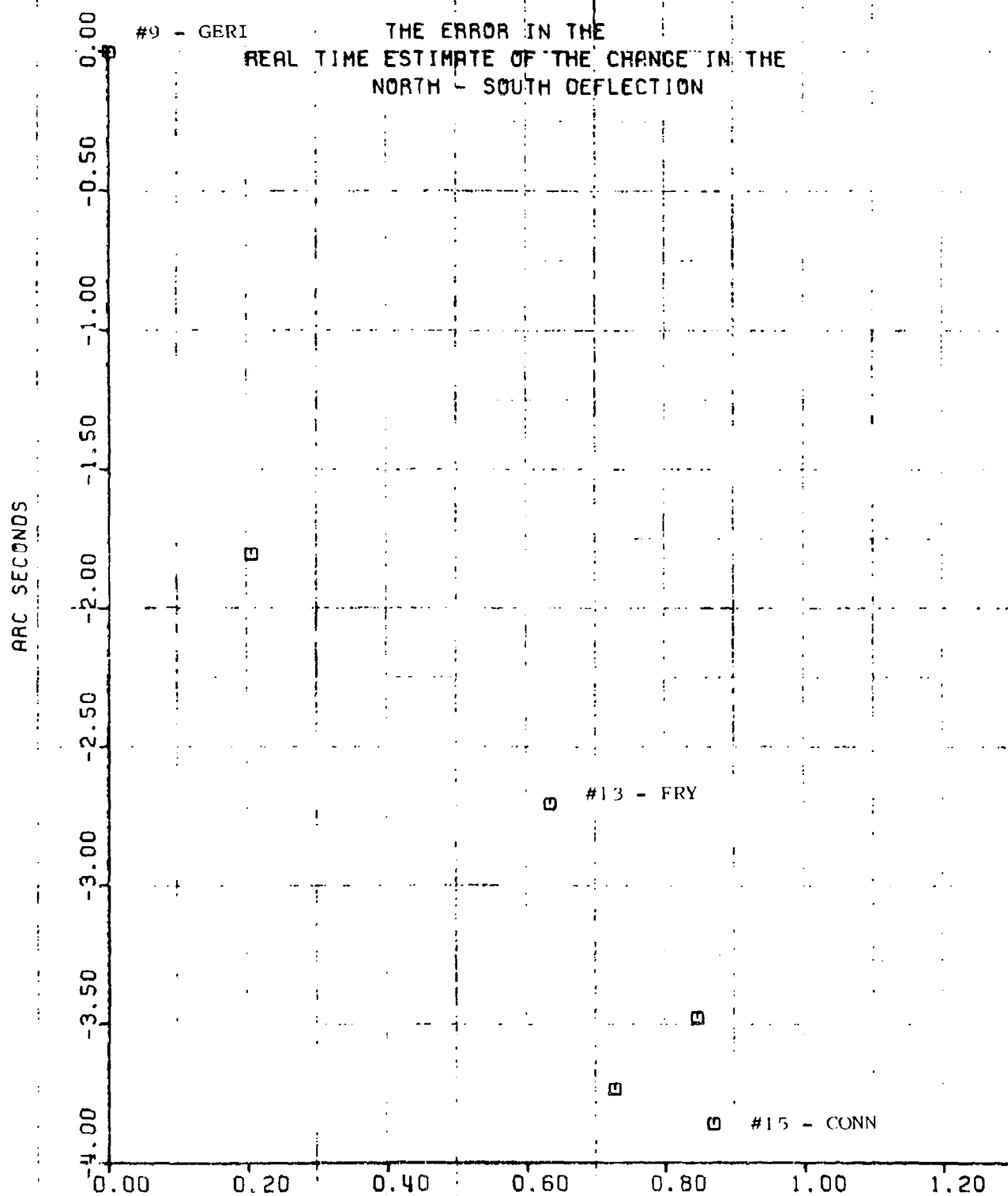


Figure E-3.4

WHITESANDS DATA.BUN - 7A.LEC-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#8 - SEBHORN

#11 - BRYCE

#13 - FRY

#15 - CONN

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS
Figure E-3.5

WHITESANDS DATA.RUN - 78.LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50

□ #4 - SHOT

□

□

□ #2 - LAURA CENTER

□ #6 - NW-30

□

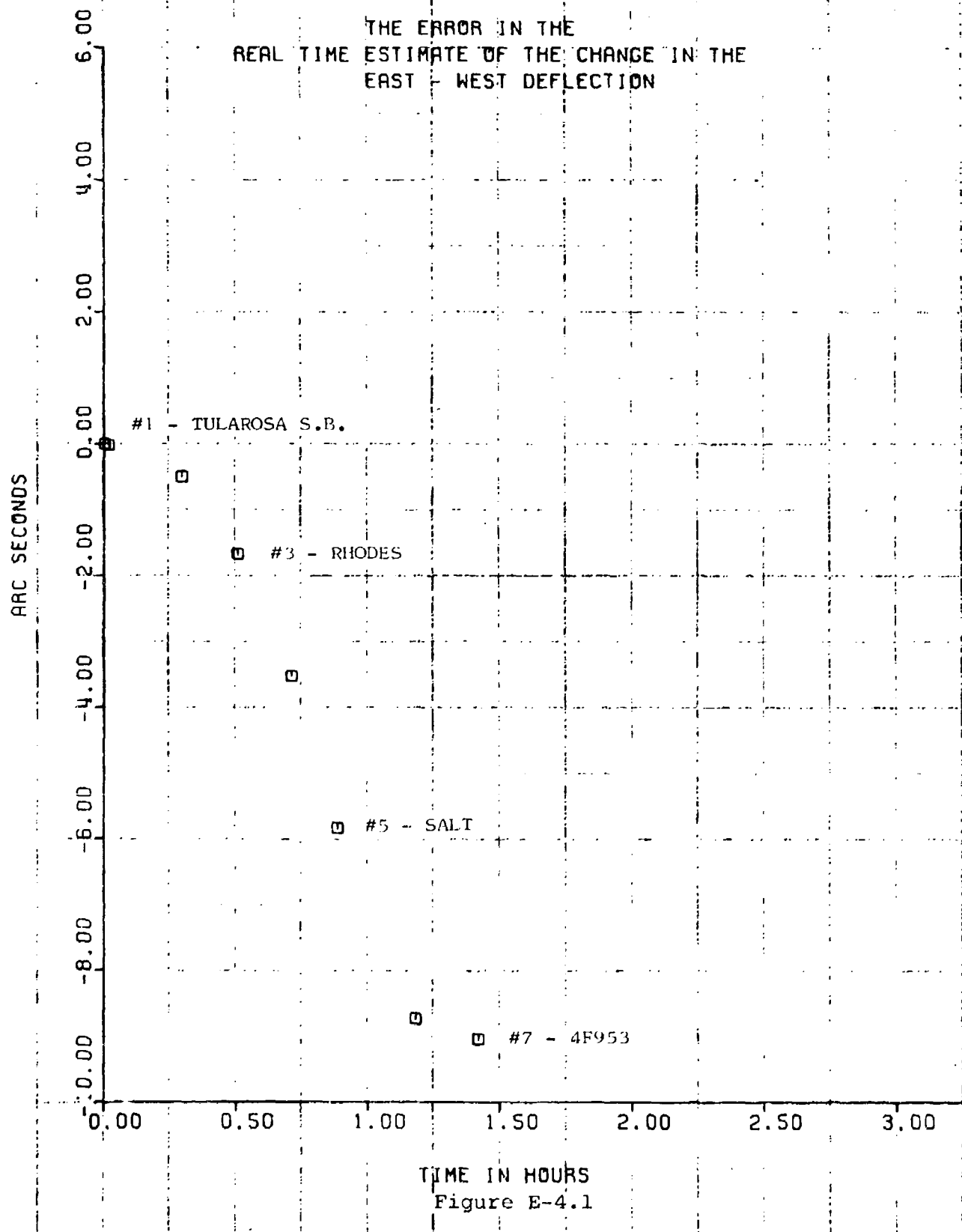
□ #1 - WC-50

0.00 0.20 0.40 0.60 0.80 1.00 1.20

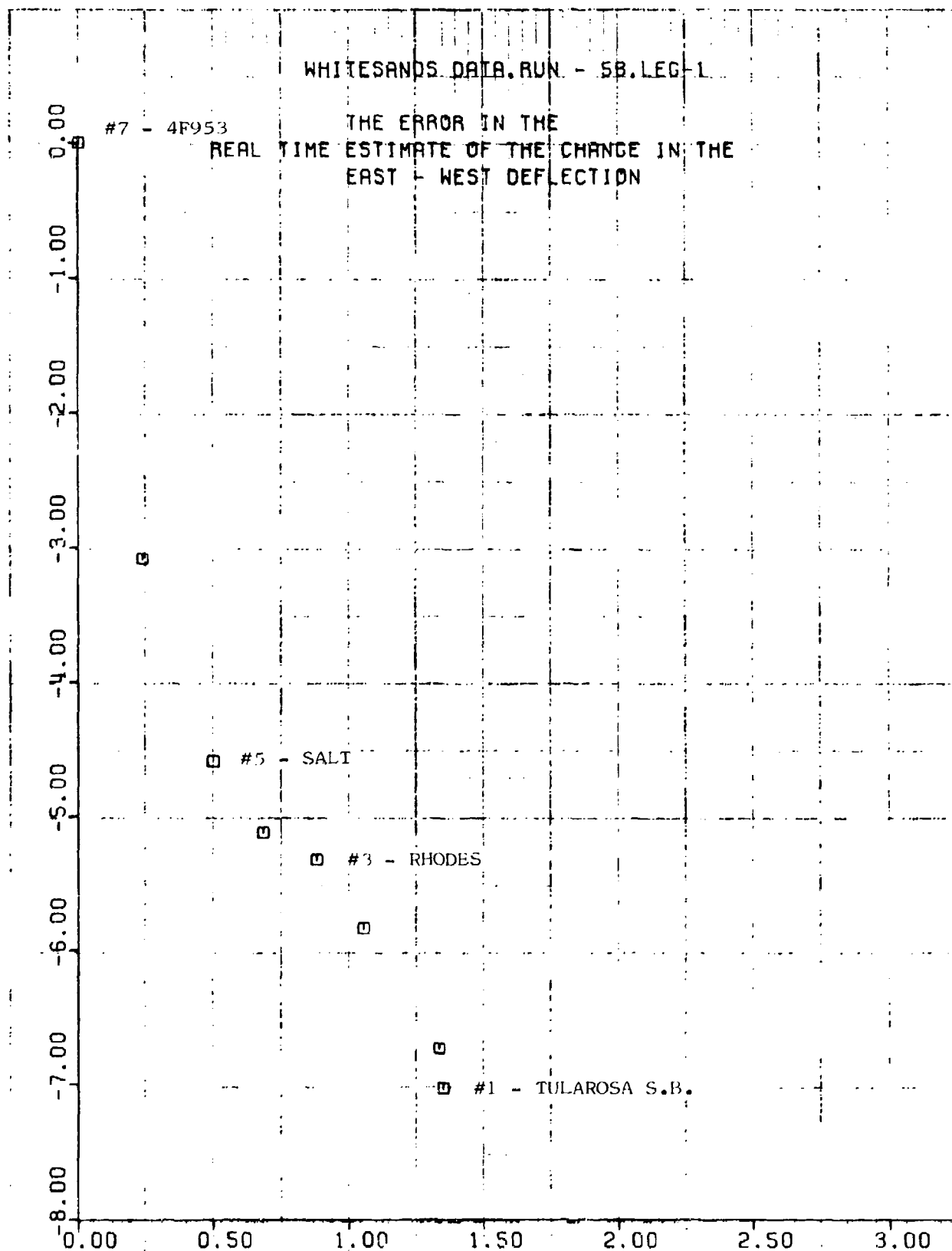
TIME IN HOURS
Figure E-3.6

WHITESANDS DATA, RUN - 5A, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



ARC SECONDS



TIME IN HOURS

Figure E-4.2

WHITESANDS DATA, RUN - 6A, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00

#1 - WC-50

#3 - GUN

#5 - D-3.5

#7 - D-3

0.00

0.50

1.00

1.50

2.00

2.50

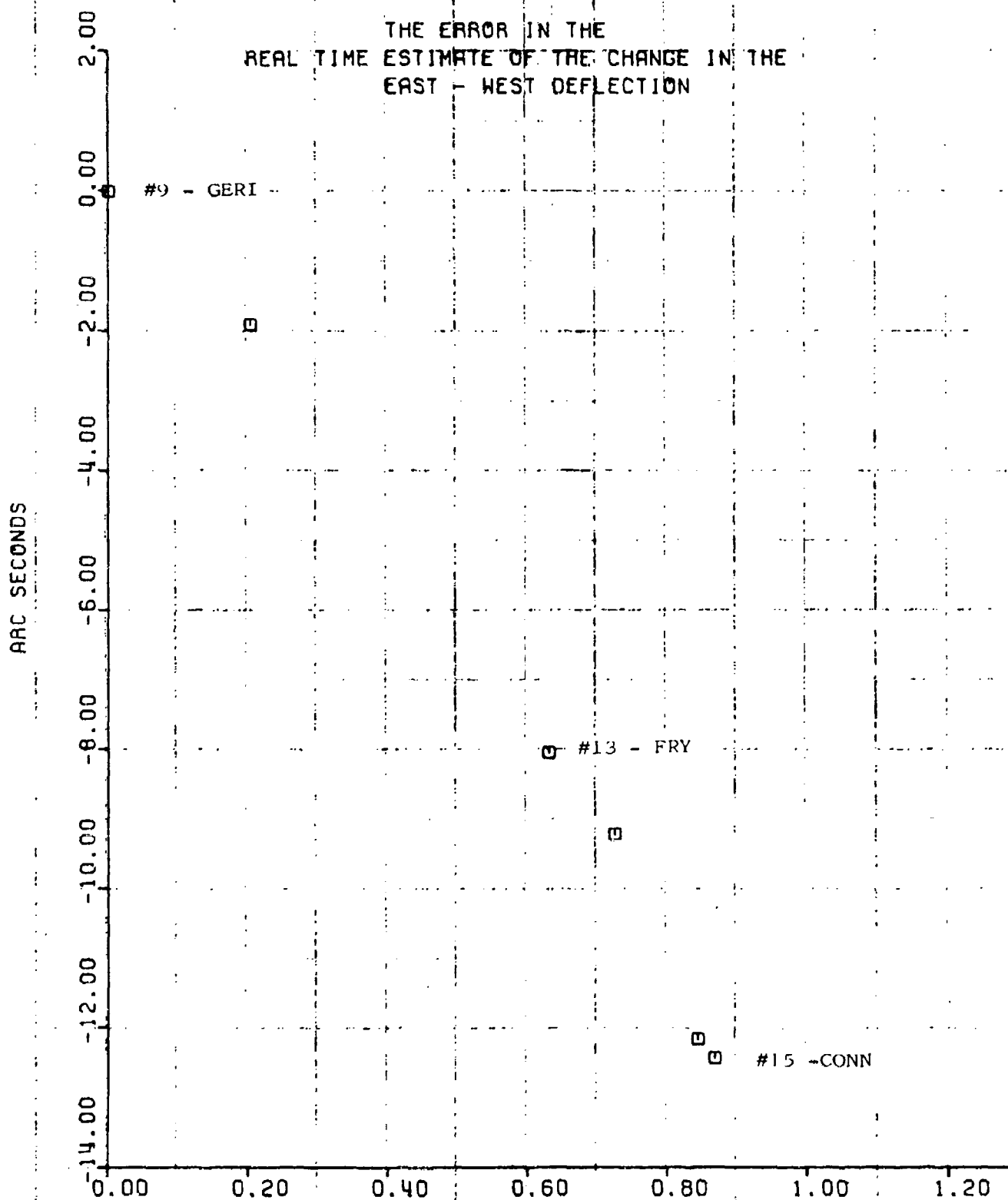
3.00

TIME IN HOURS

Figure E-4.3

WHITESANDS DATA, RUN - 6B, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

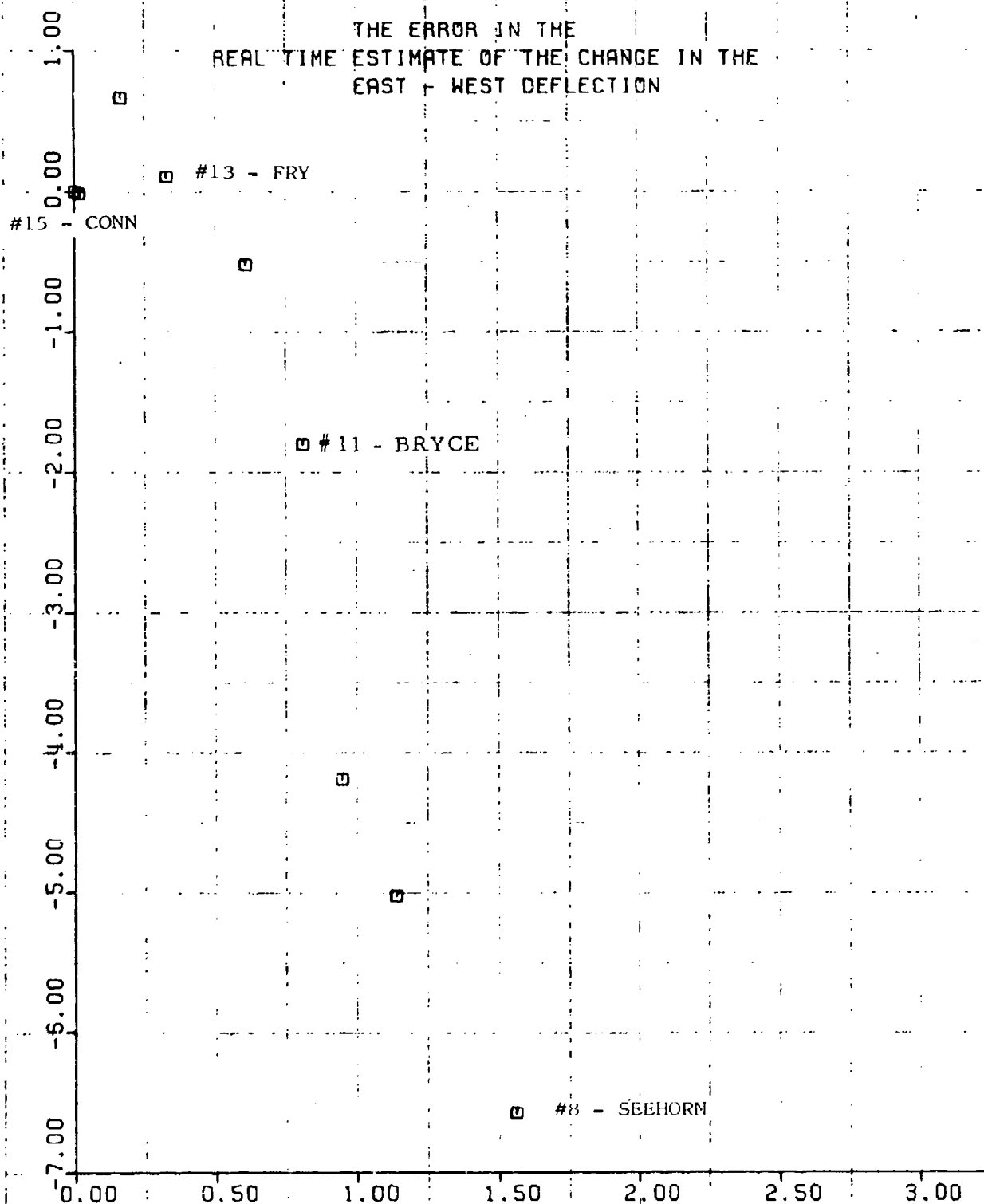


TIME IN HOURS
Figure E-4.4

WHITESANDS DATA RUN - 7A, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

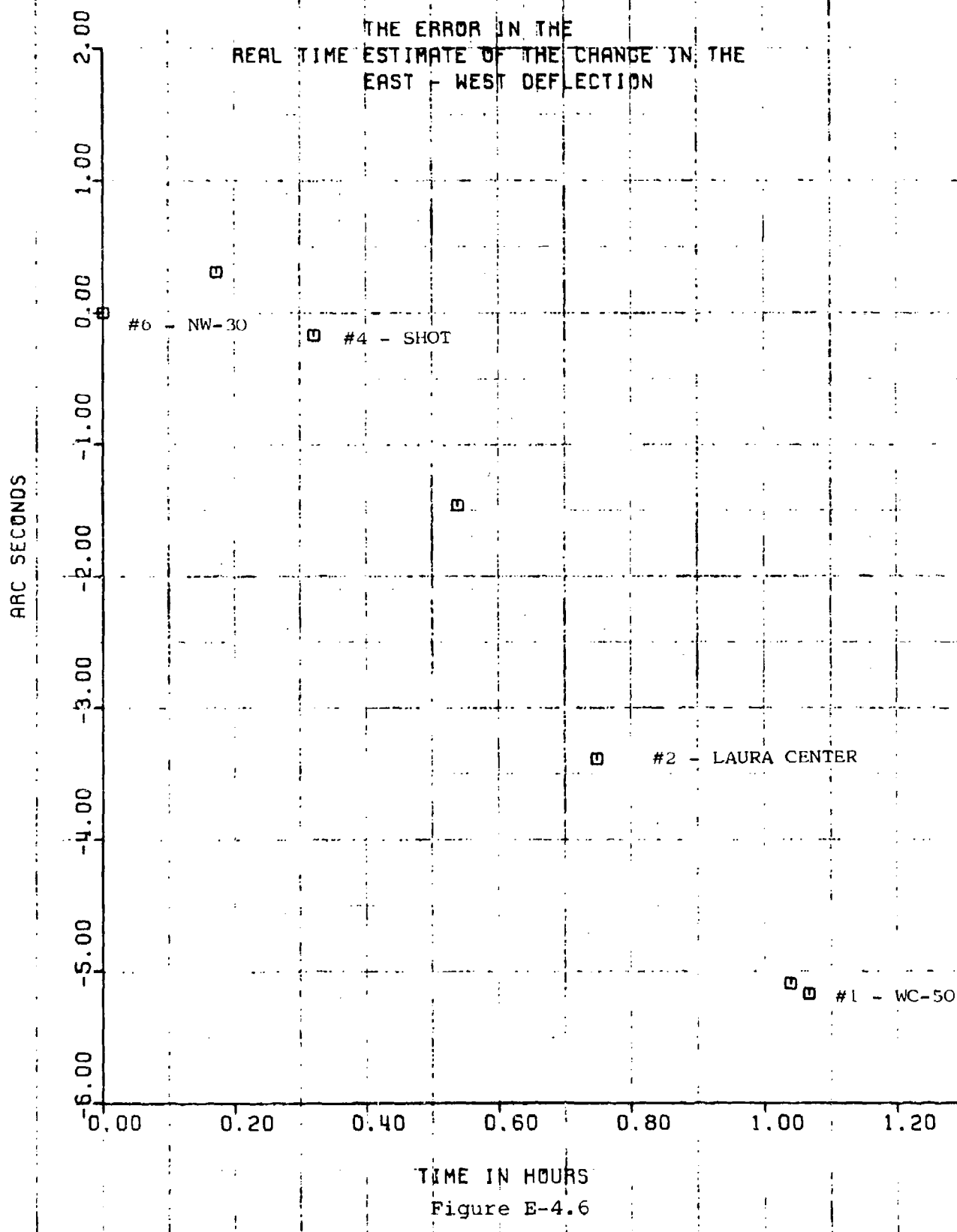
ARC SECONDS



TIME IN HOURS
Figure E-4.5

WHITESANDS DATA RUN - 7B, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

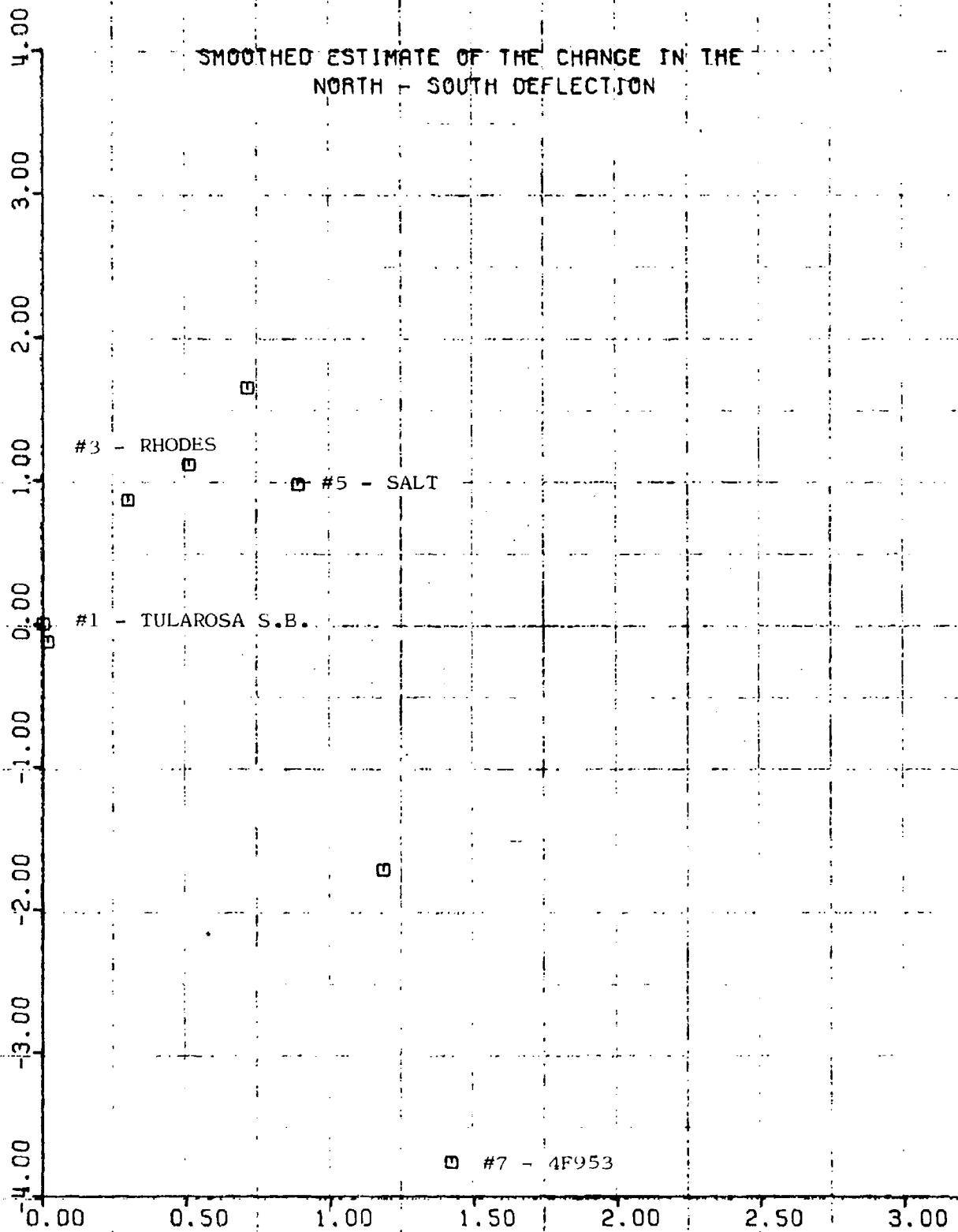


TIME IN HOURS
Figure E-4.6

WHITESANDS DATA RUN - SA, LEG-1

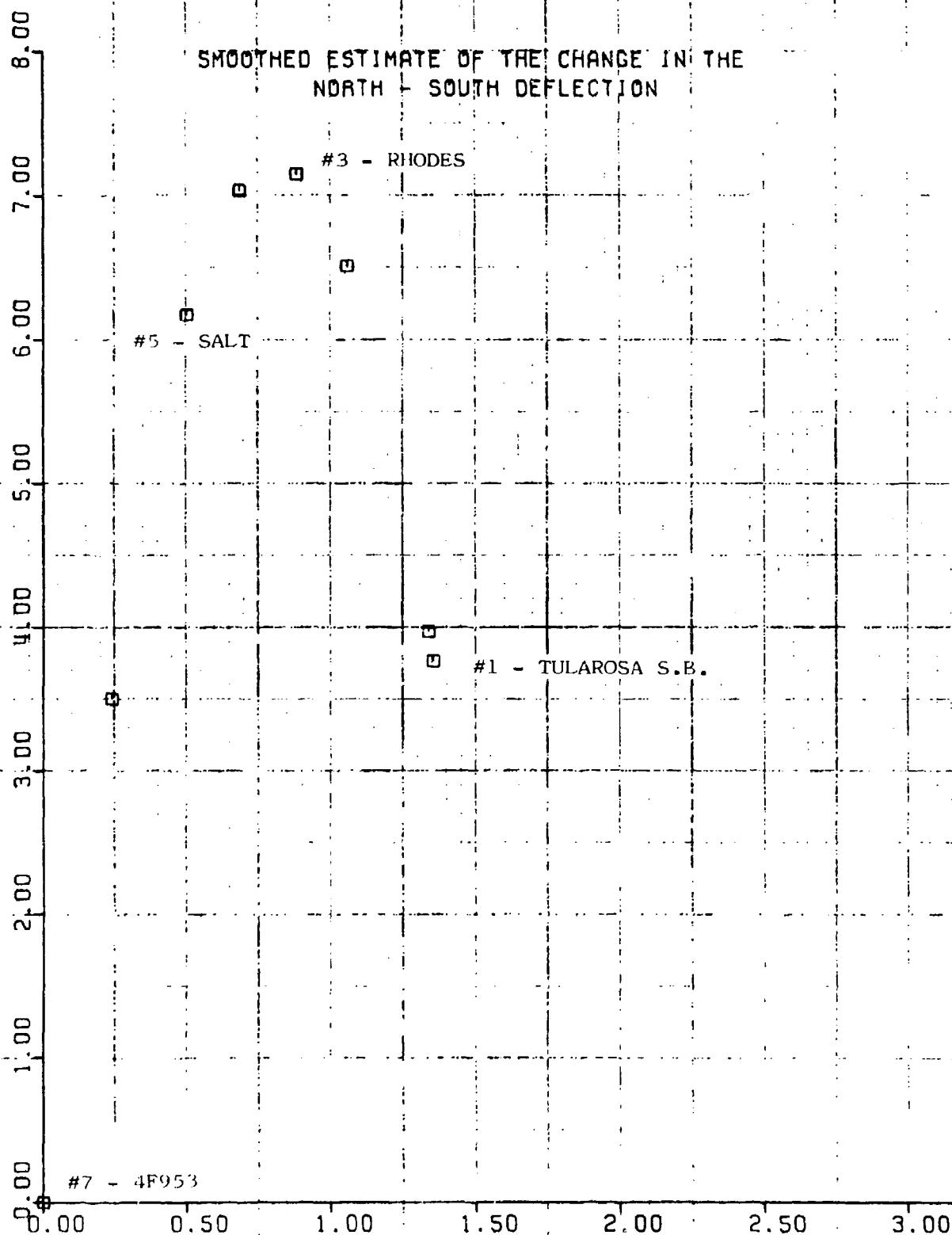
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

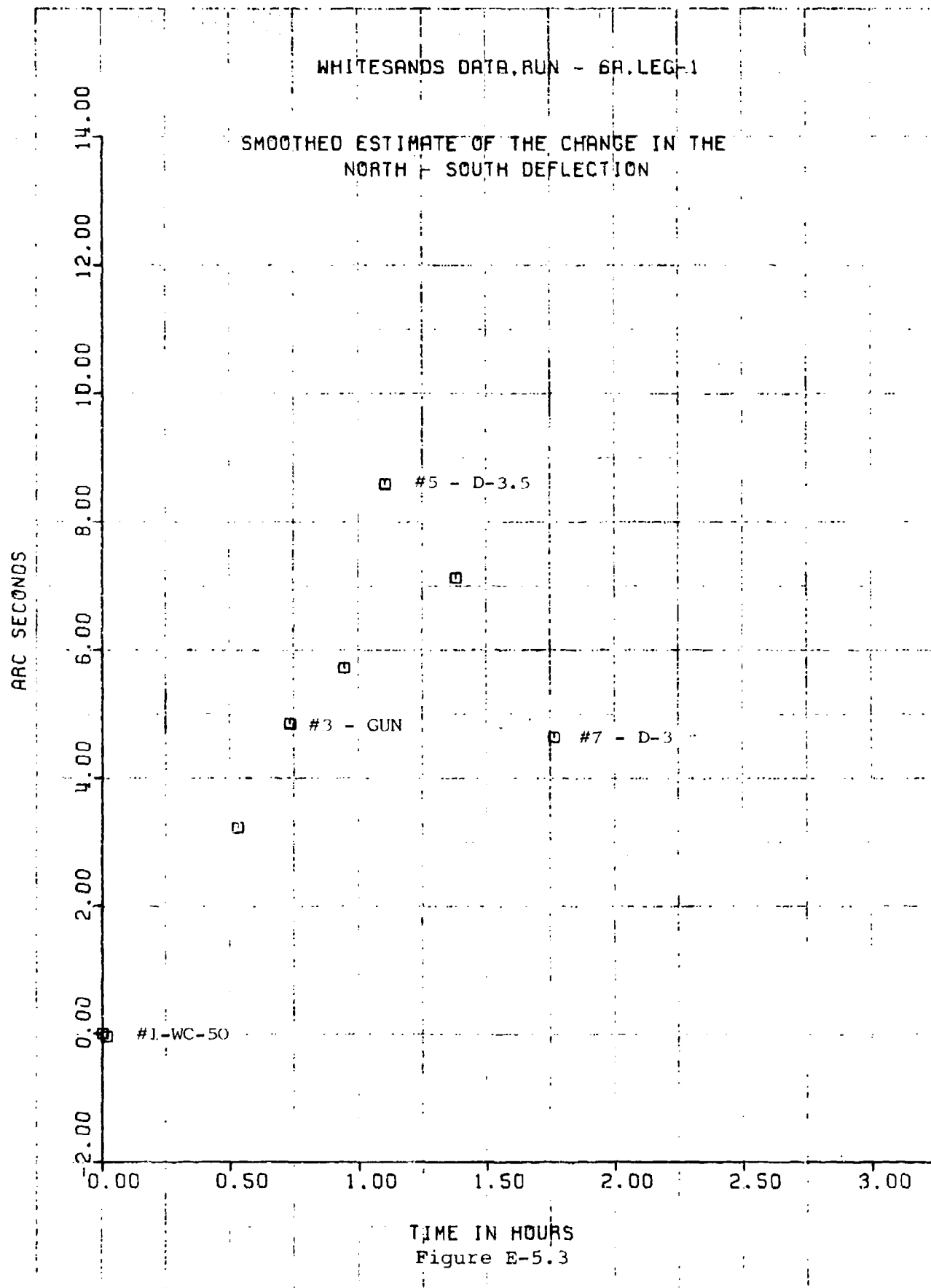


TIME IN HOURS
Figure E-5.1

ARC SECONDS



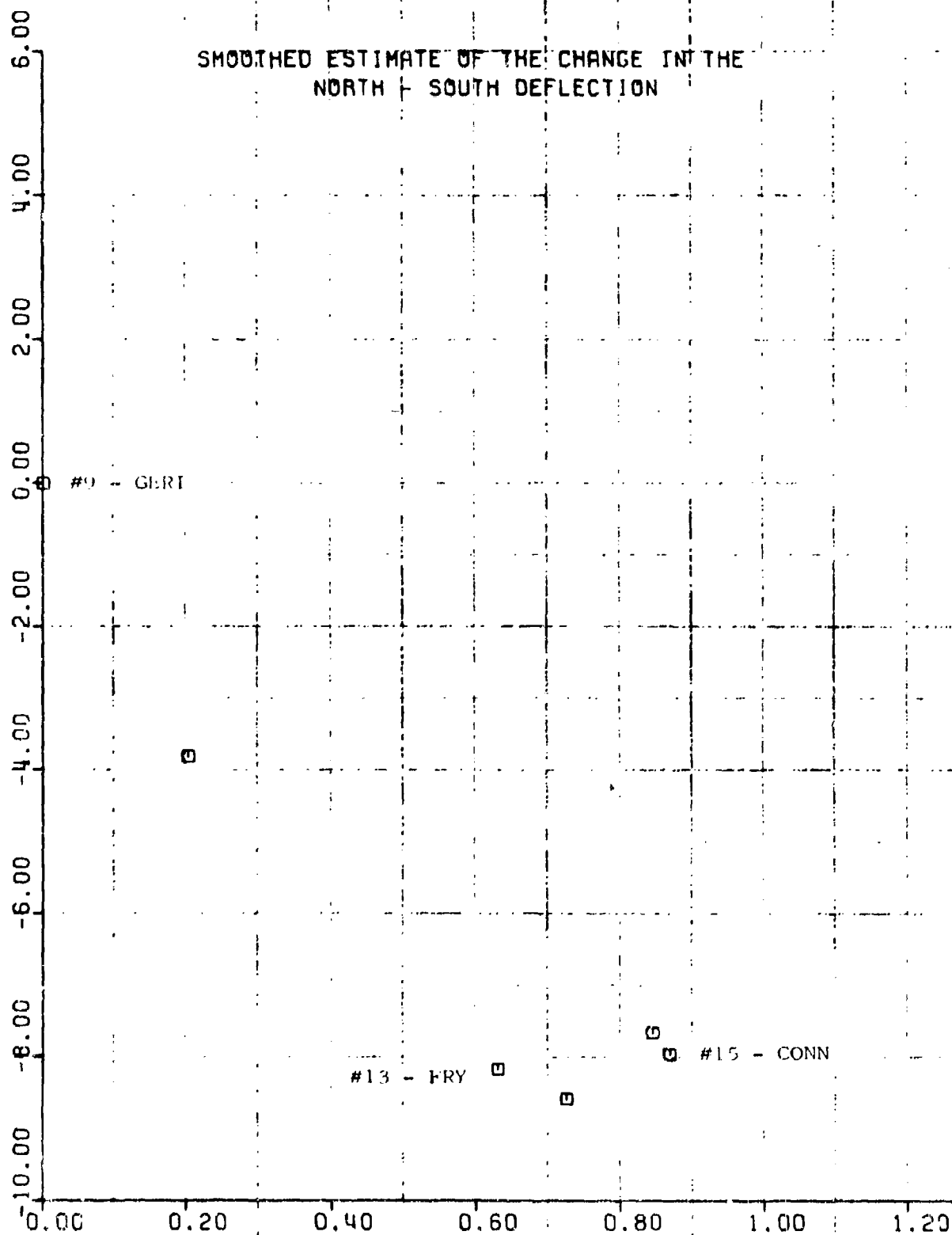
TIME IN HOURS
Figure E-5.2



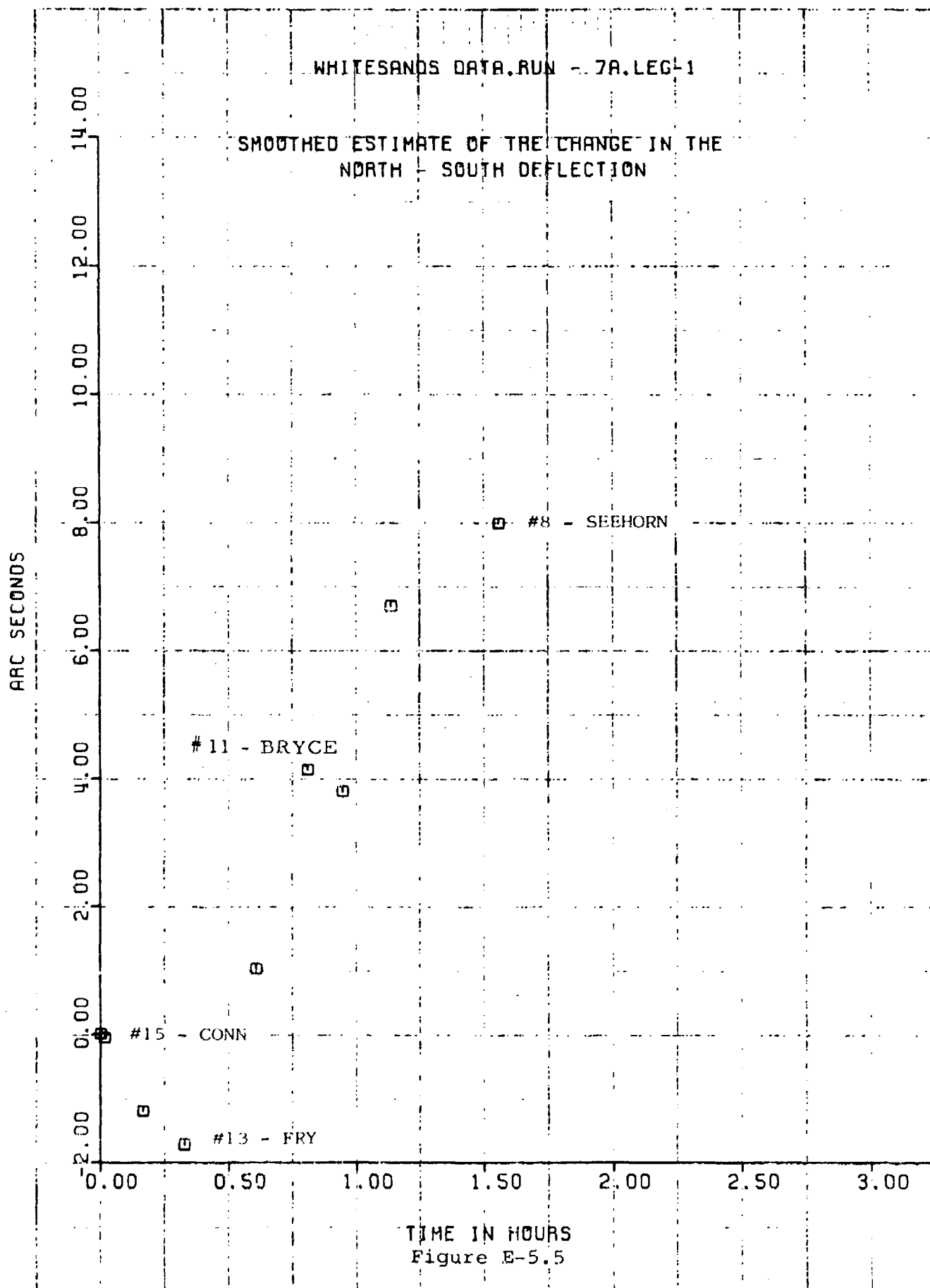
WHITESANDS DATA, RUN - 6B, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

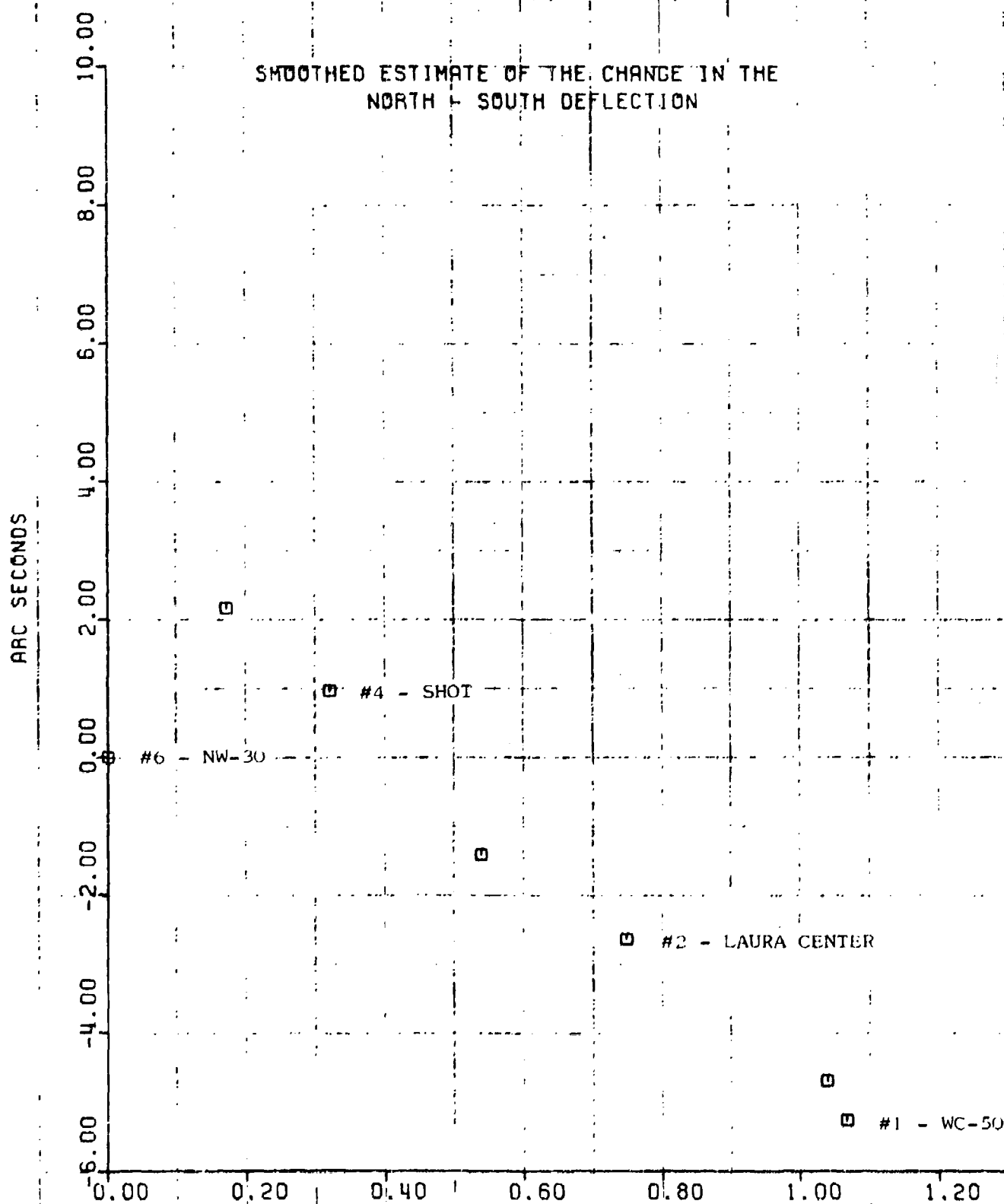


TIME IN HOURS
Figure E-5.4

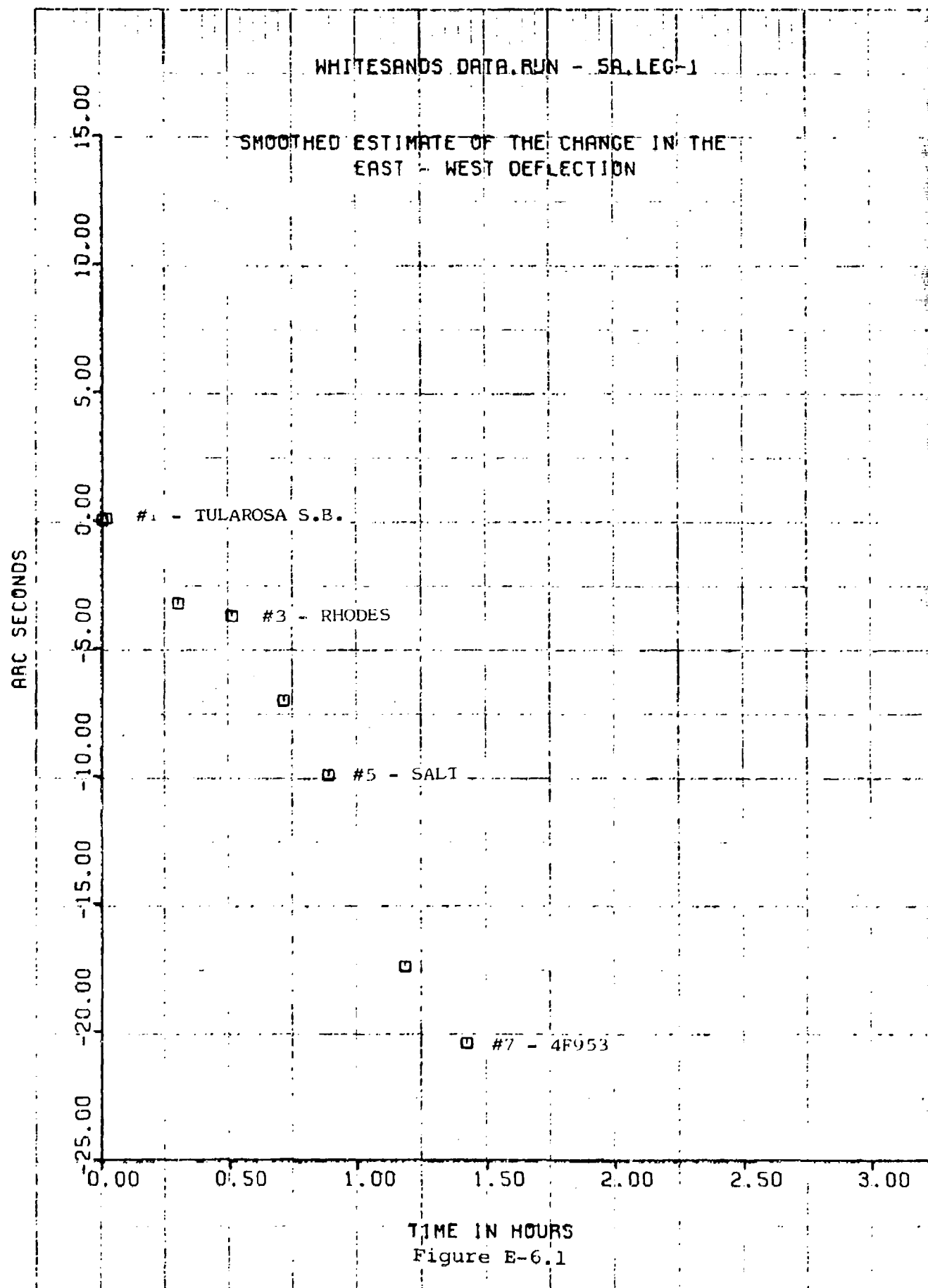


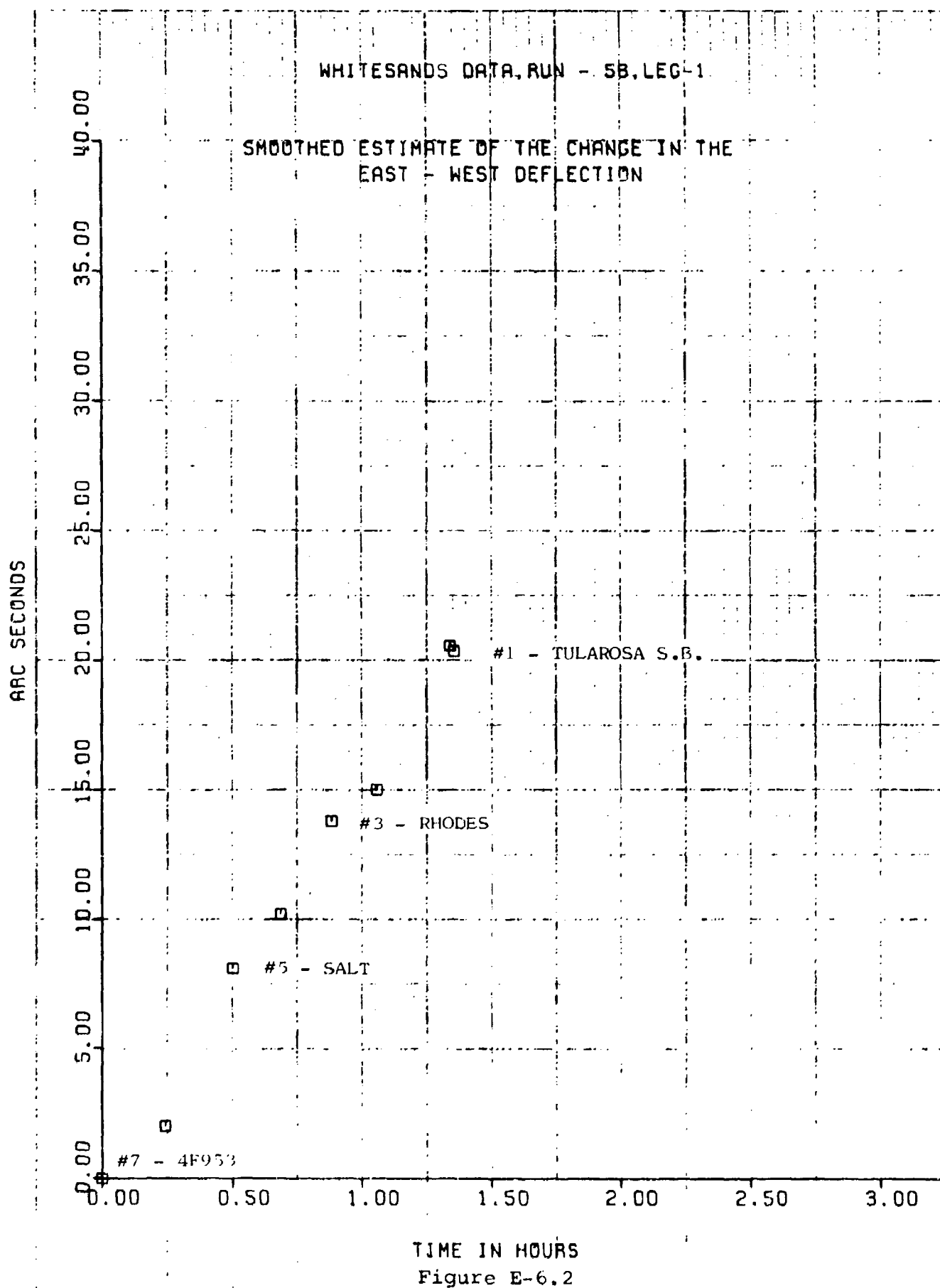
WHITESANDS DATA RUN - 7B.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

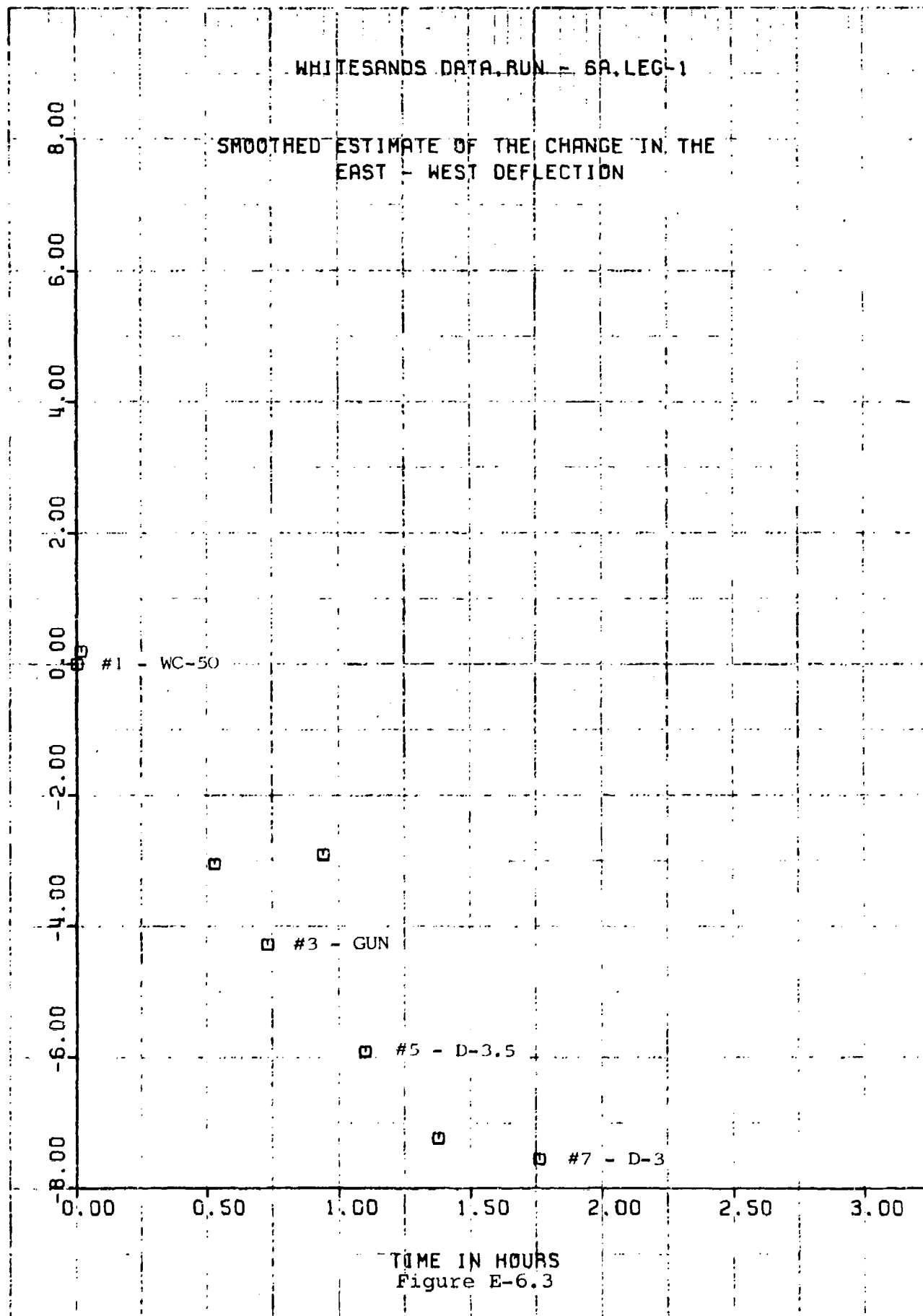


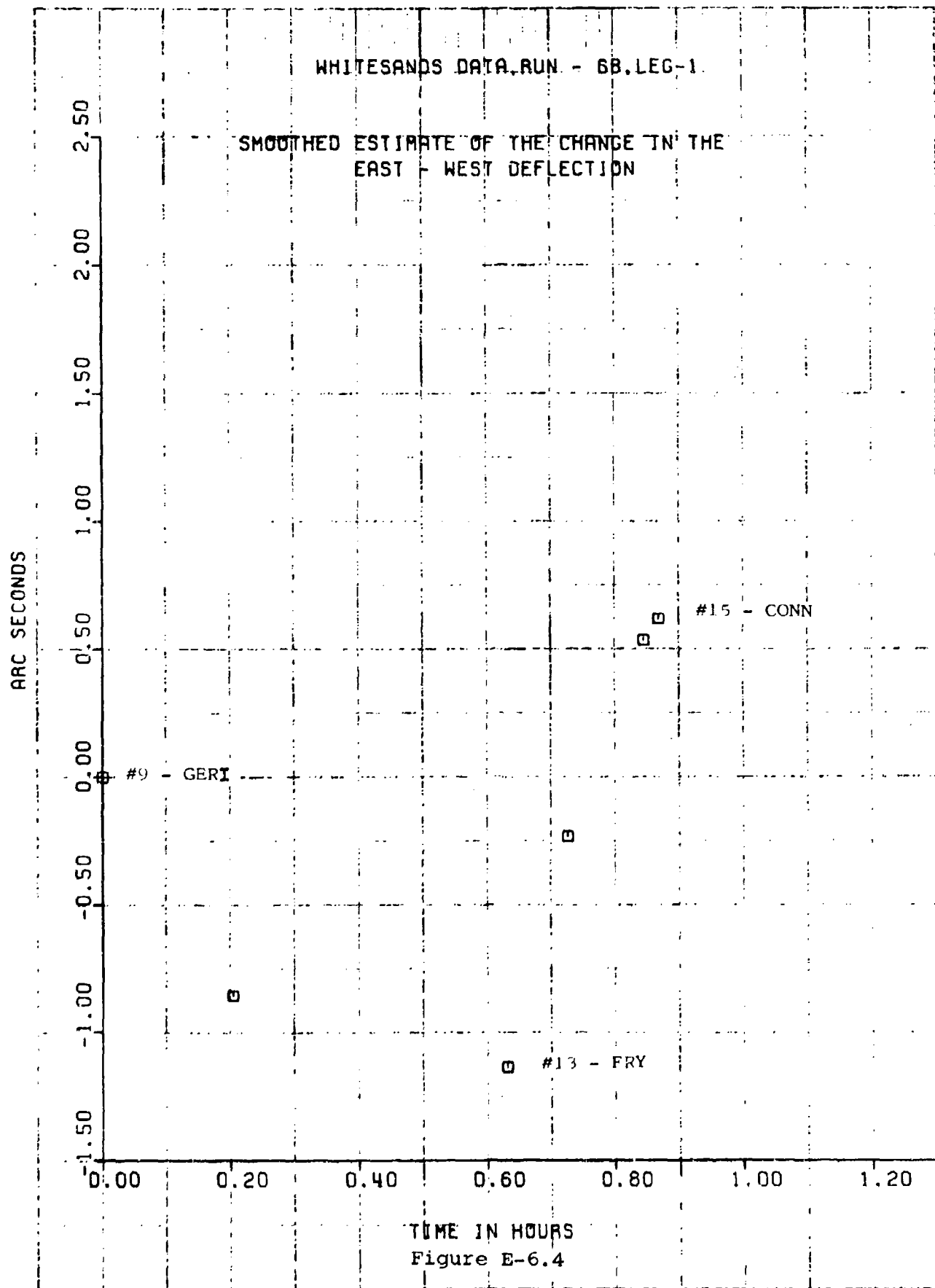
TIME IN HOURS
Figure E-5.6





ARC SECONDS



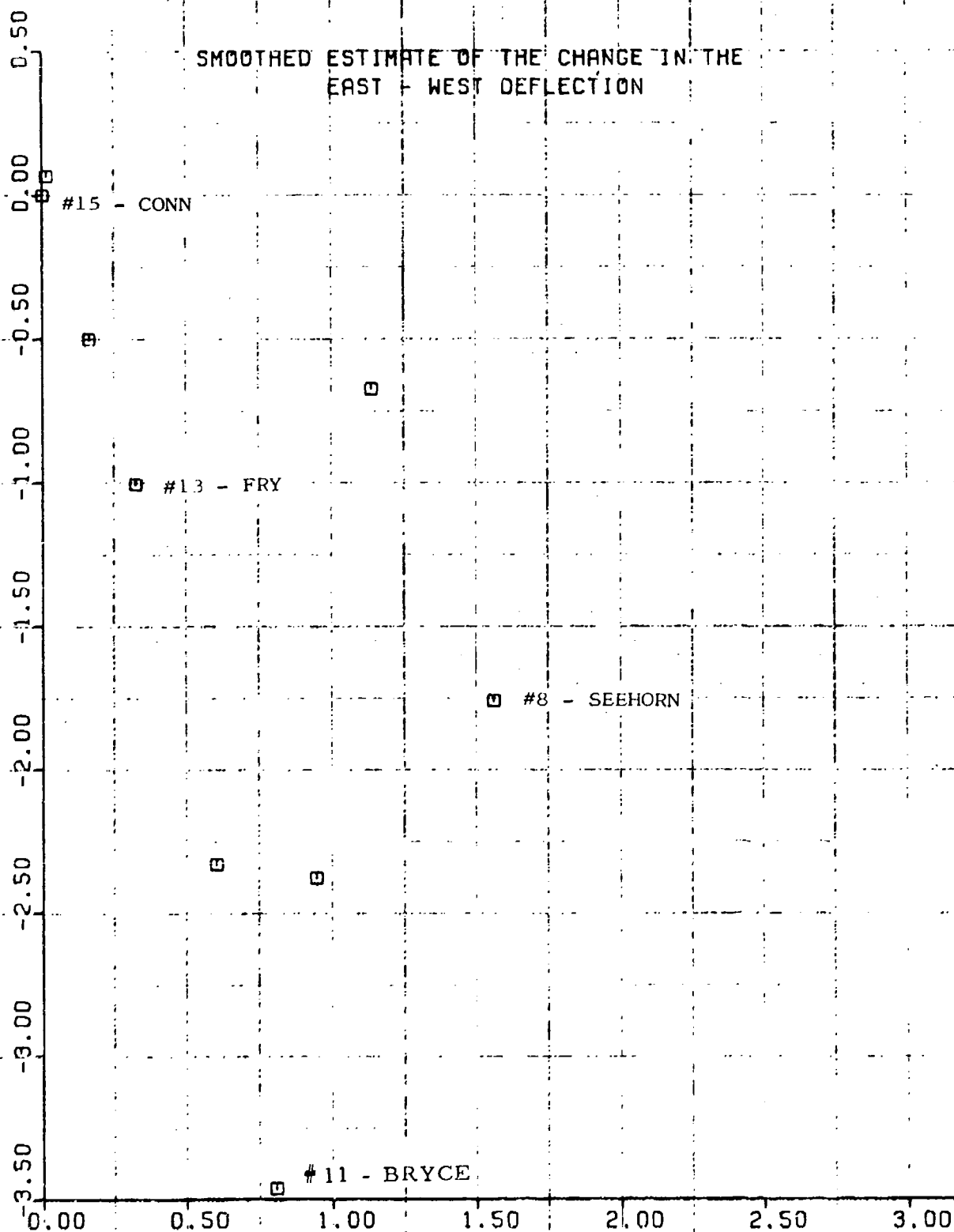


TIME IN HOURS
Figure E-6.4

WHITESANDS DATA, RUN - 7A, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

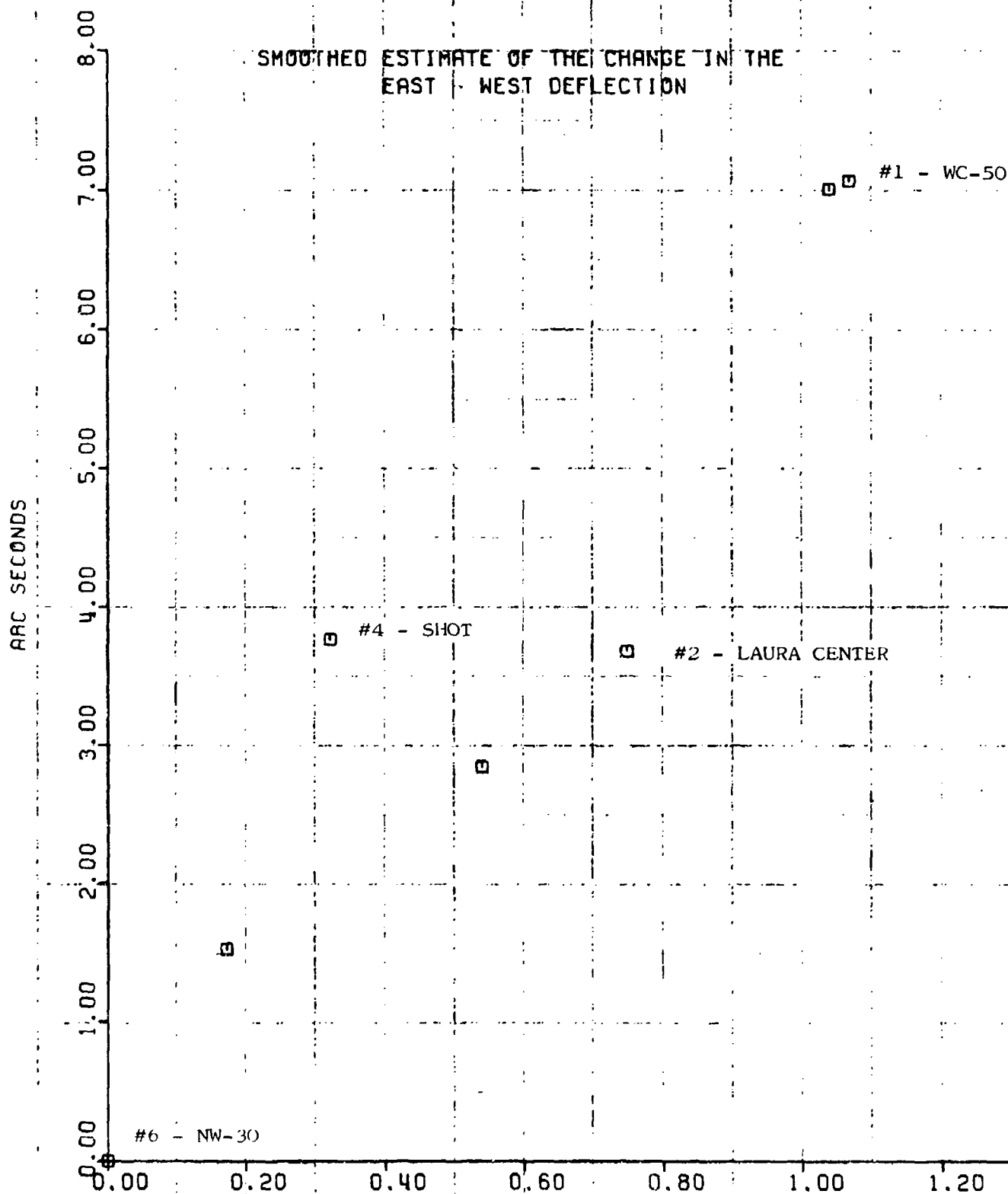
ARC SECONDS



TIME IN HOURS
Figure E-6.5

WHITESANDS DATA RUN - 7B, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

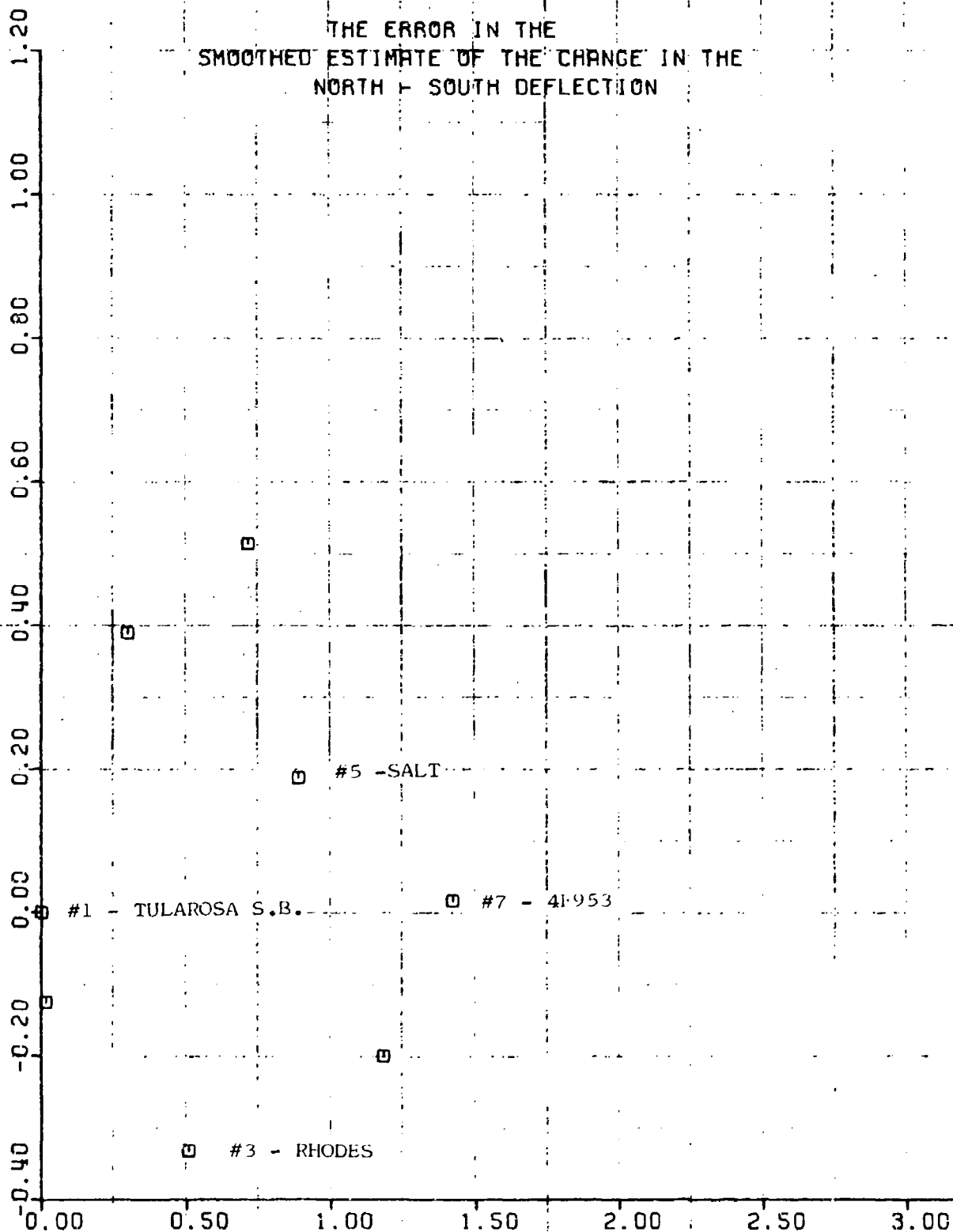


TIME IN HOURS
Figure E-6.6

ARC SECONDS

WHITESANDS DATA RUN - SA, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

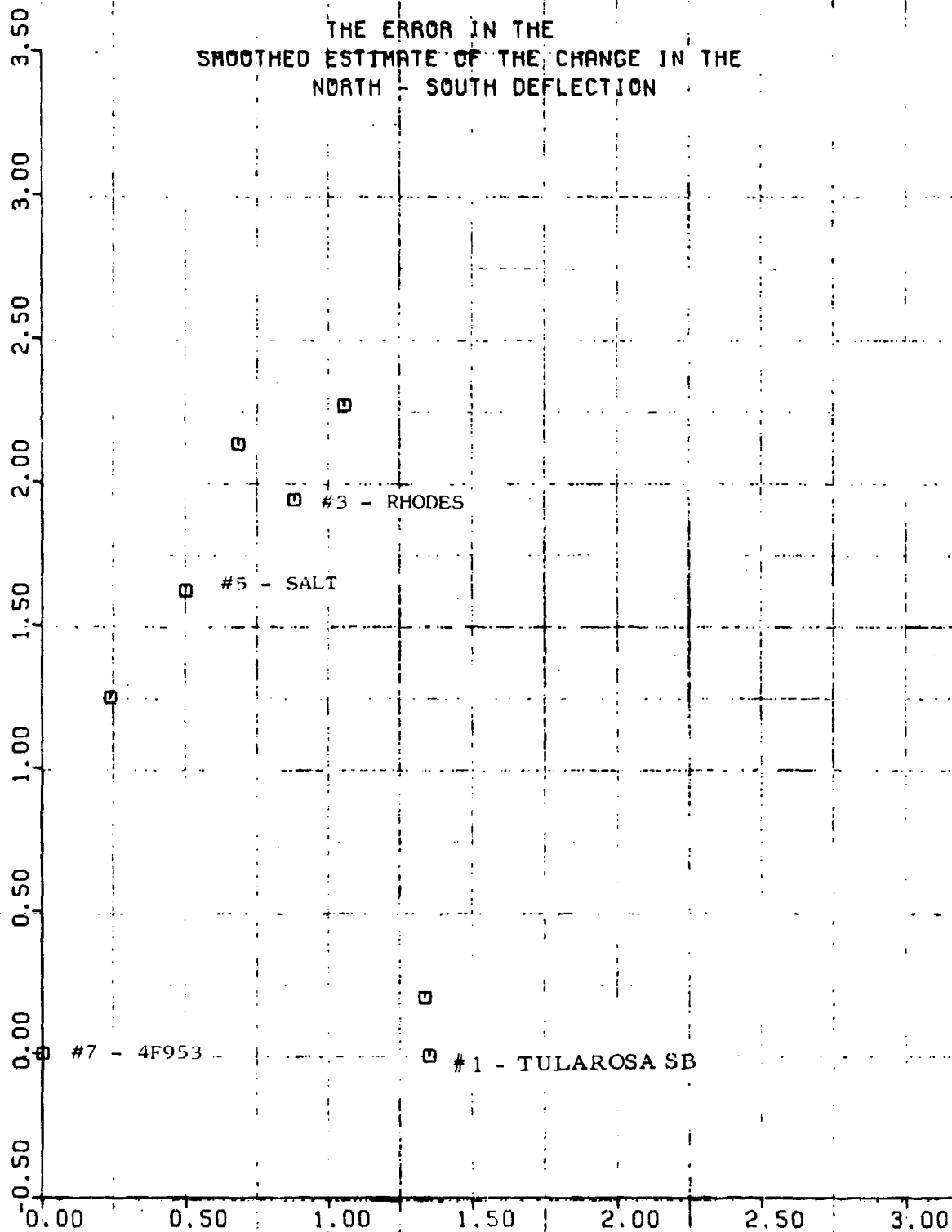


TIME IN HOURS
Figure E-7.1

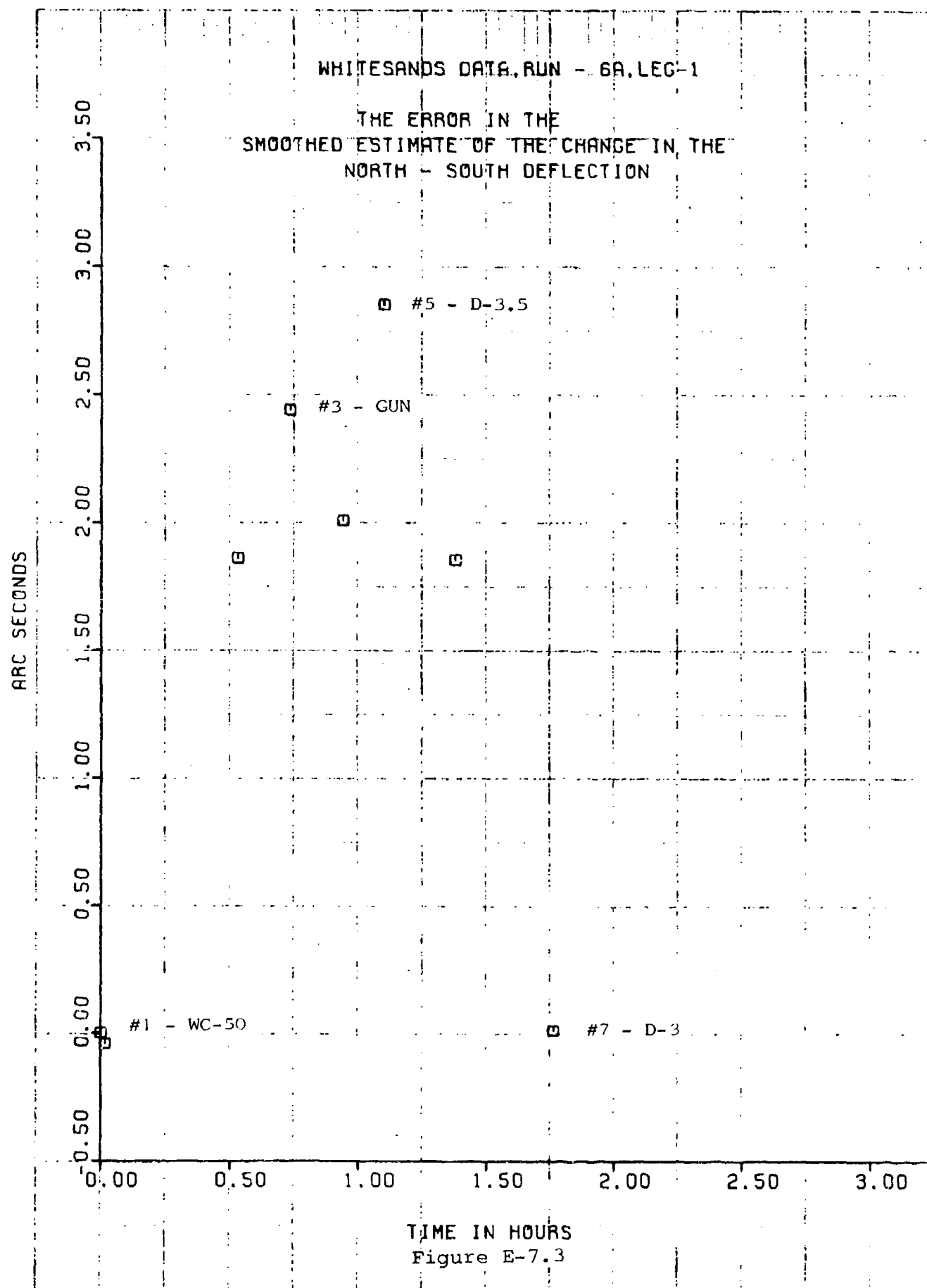
WHITESANDS DATA.RUN - SB.LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



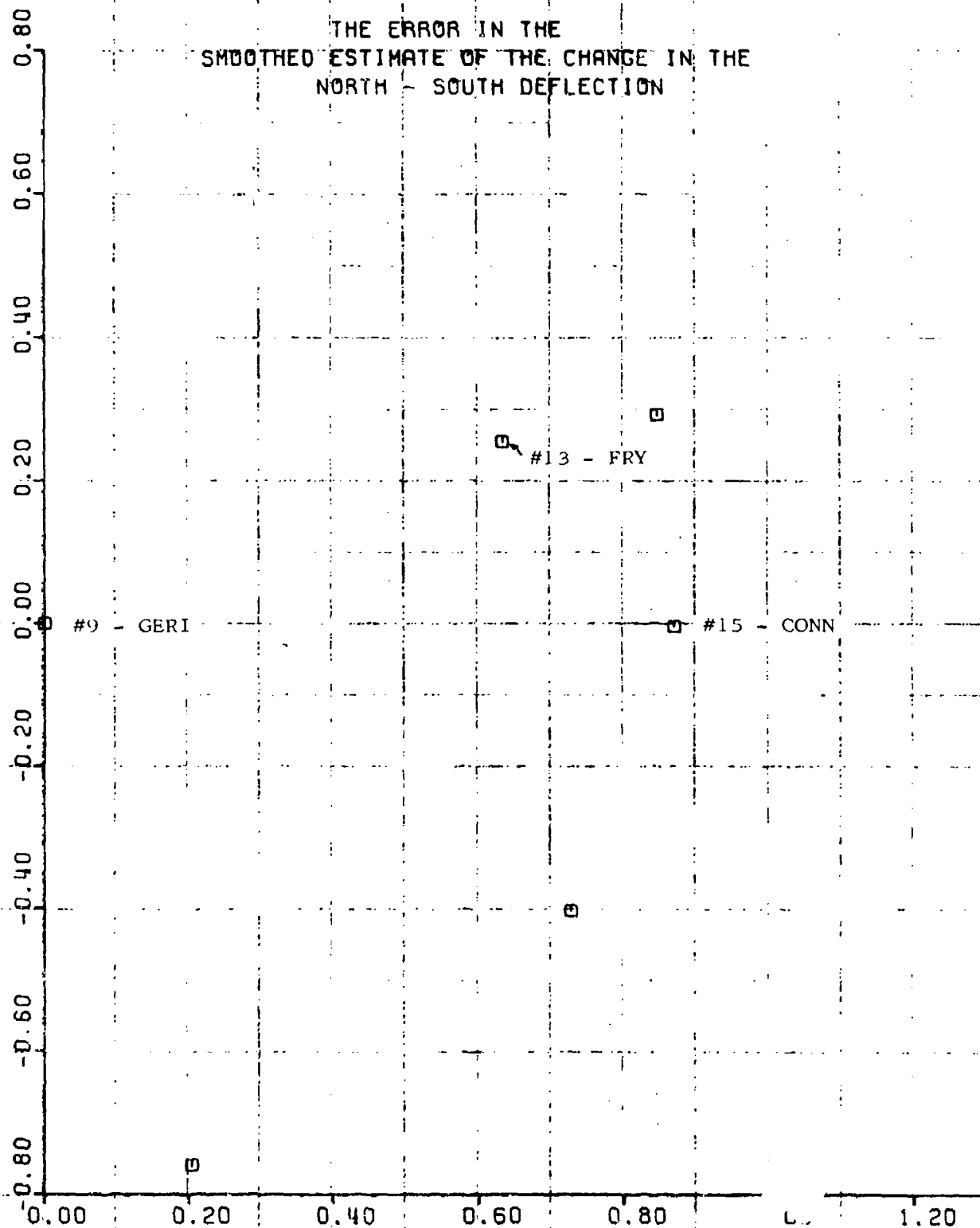
TIME IN HOURS
Figure E-7.2



WHITESANDS DATA, RUN - 6B, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure E-7.4

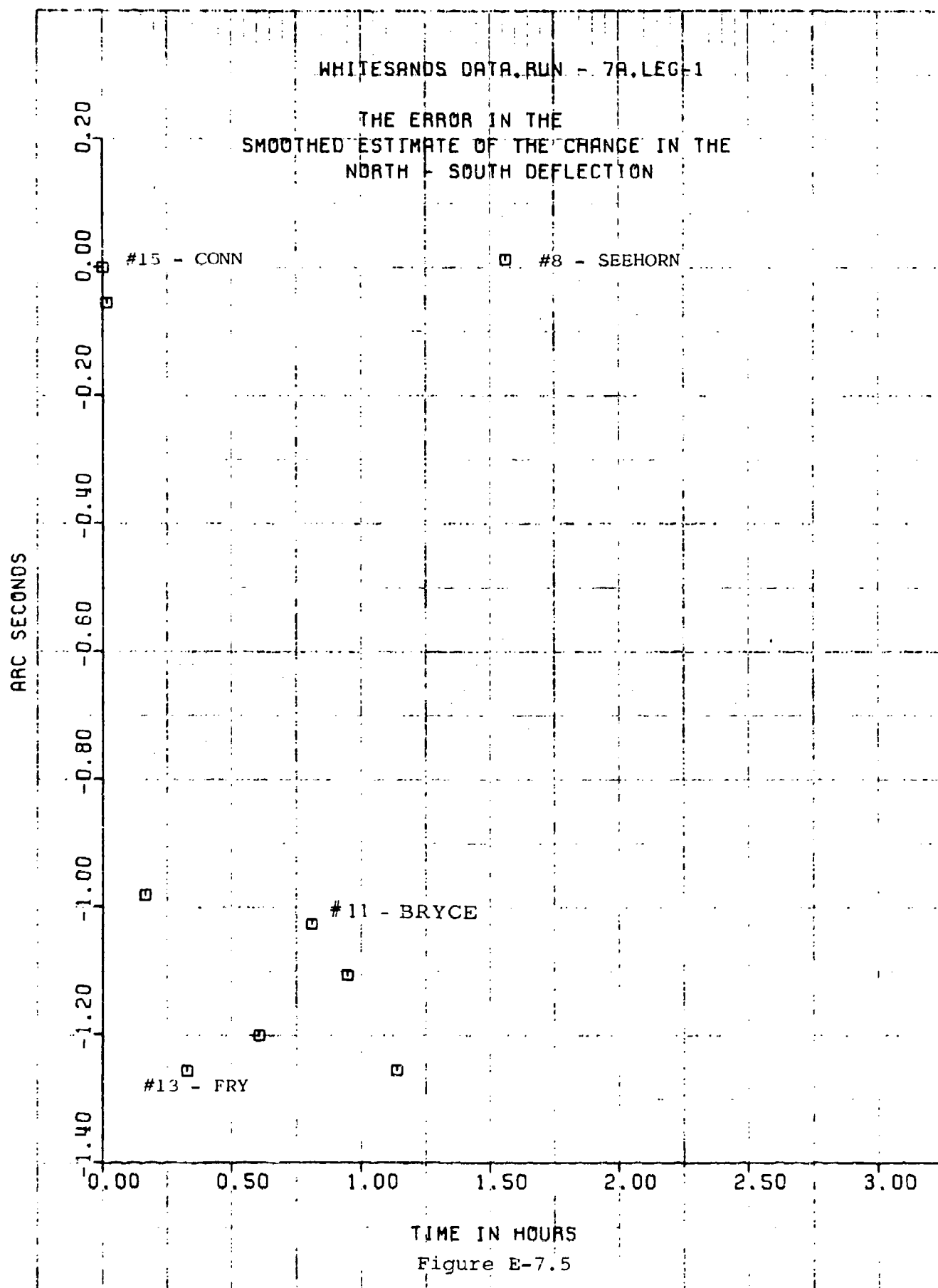
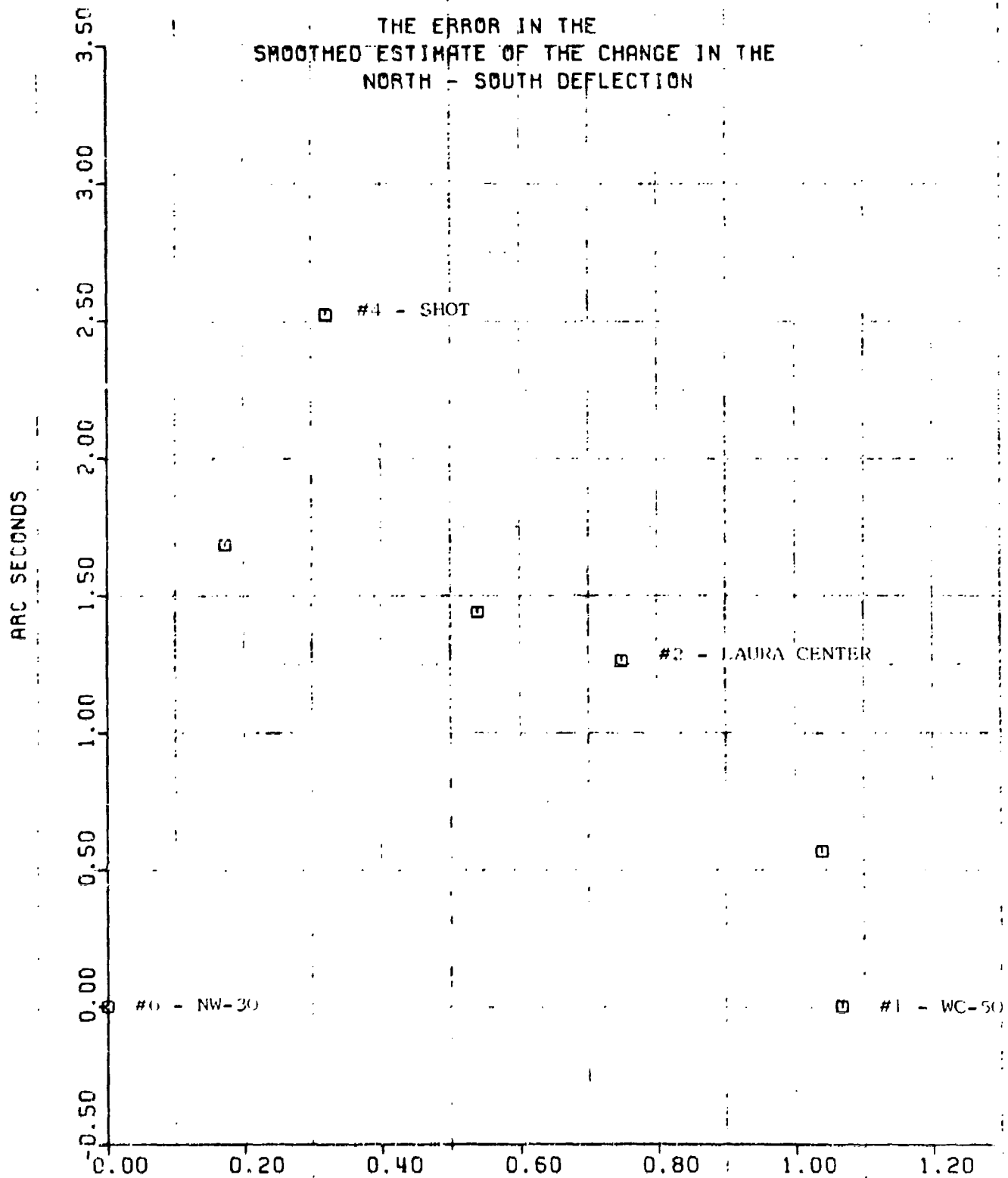


Figure E-7.5

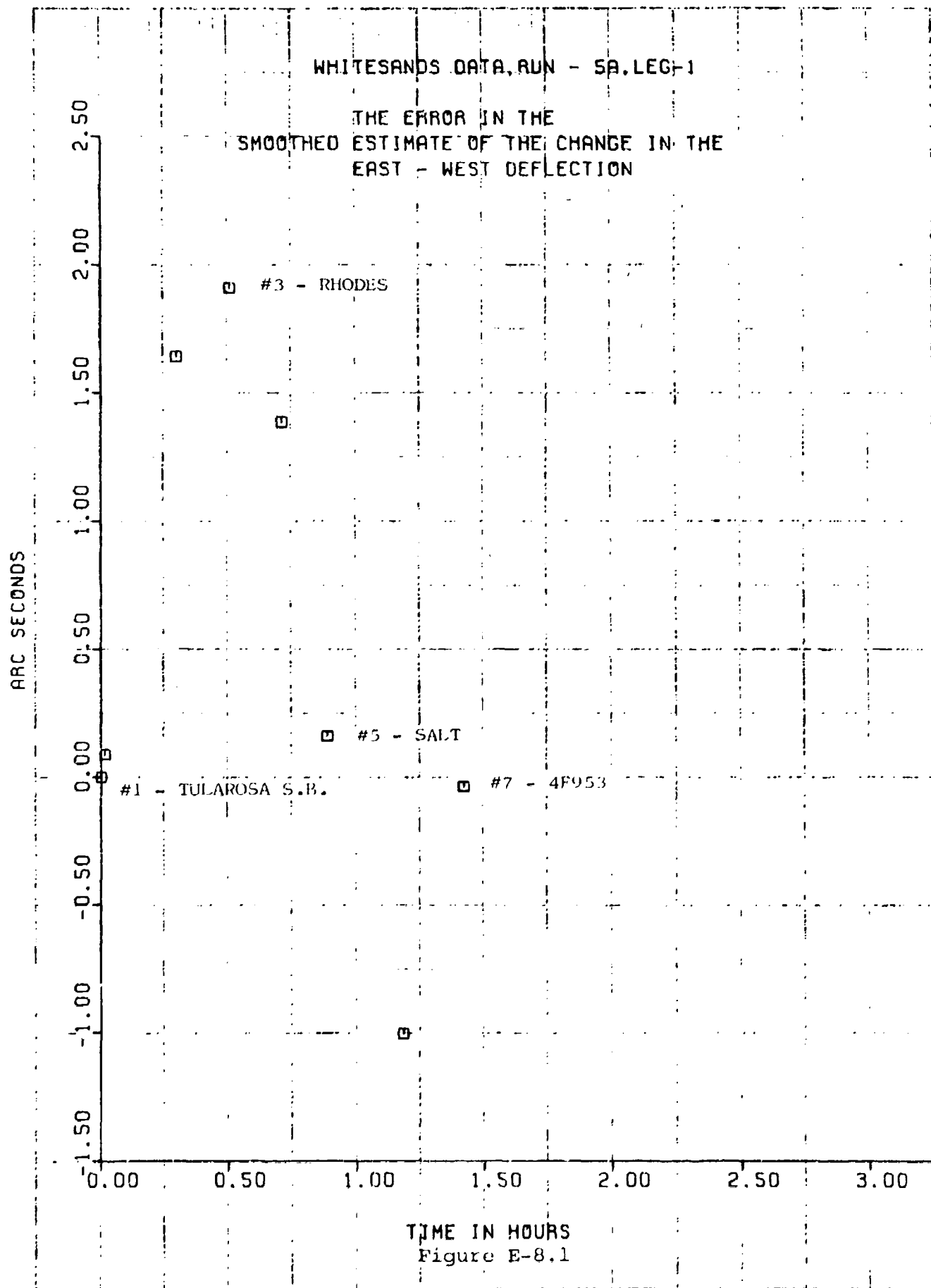
WHITESANDS DATA, RUN - 7B, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS

Figure E-7.6



WHITESANDS DATA RUN - SB.LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50

#7 - 4F953

#1 - TULATORSA SB

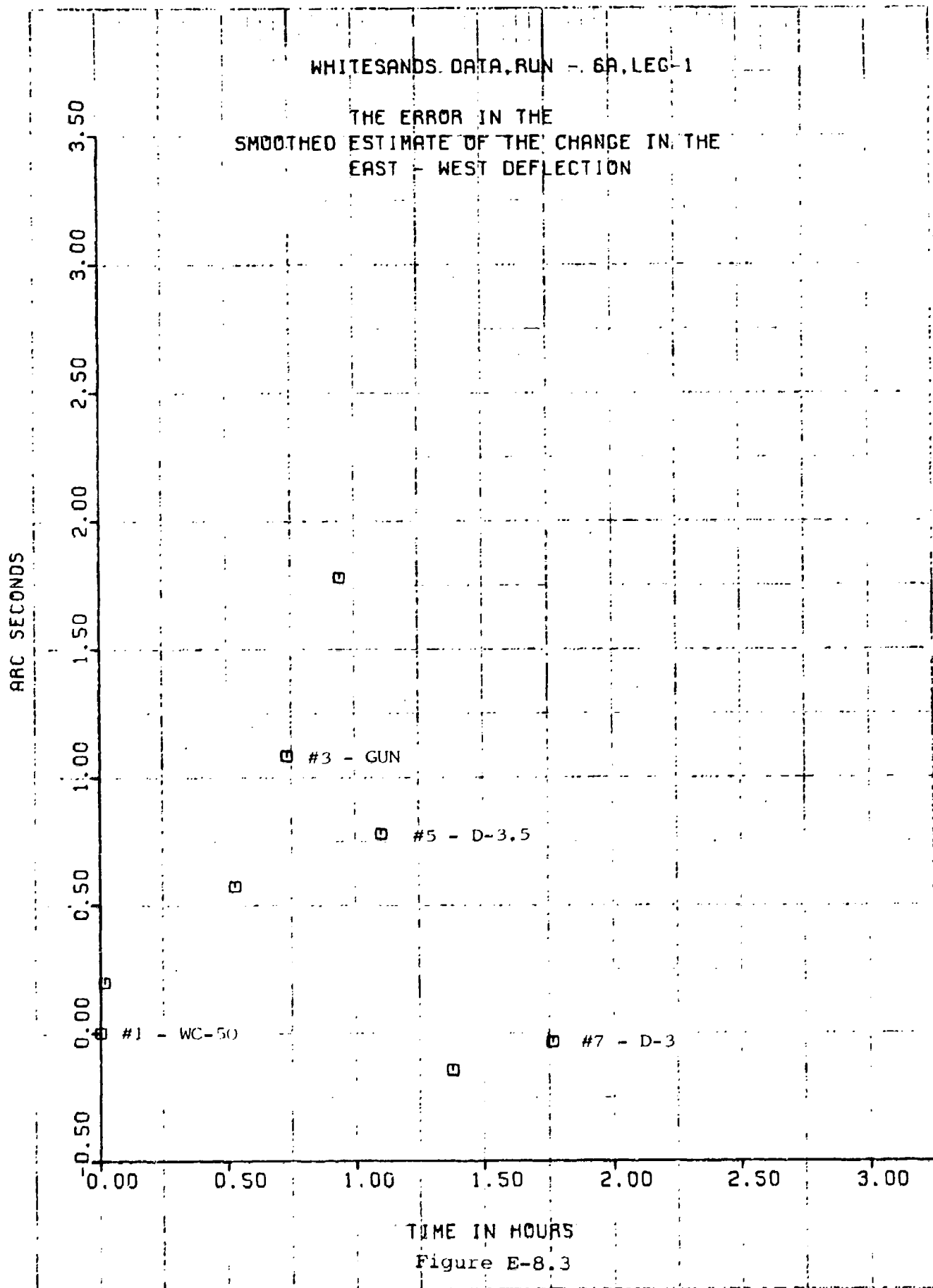
#3 - RHODES

#5 - SALT

0.00 0.50 1.00 1.50 2.00 2.50 3.00

TIME IN HOURS

Figure E-8.2



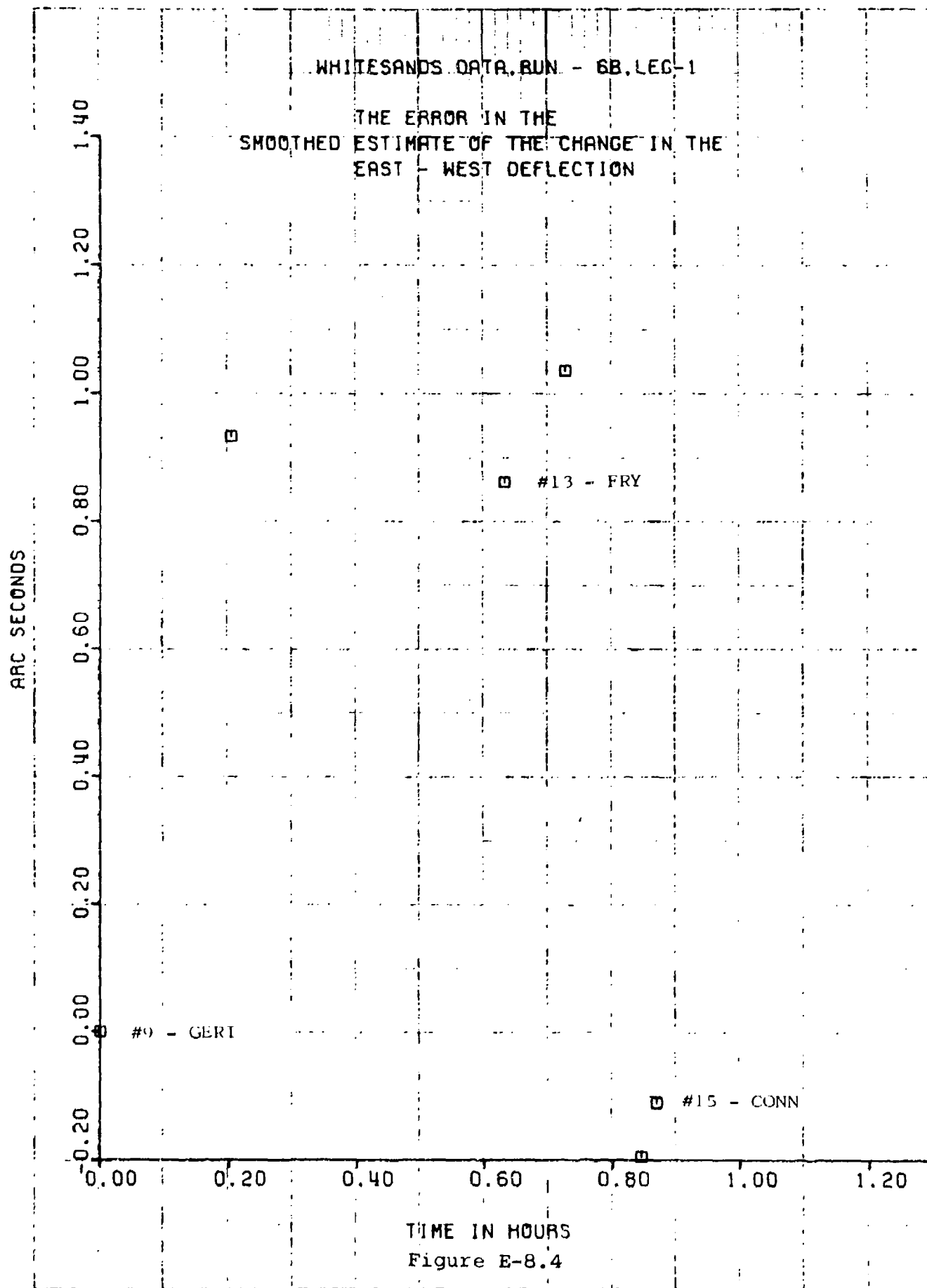
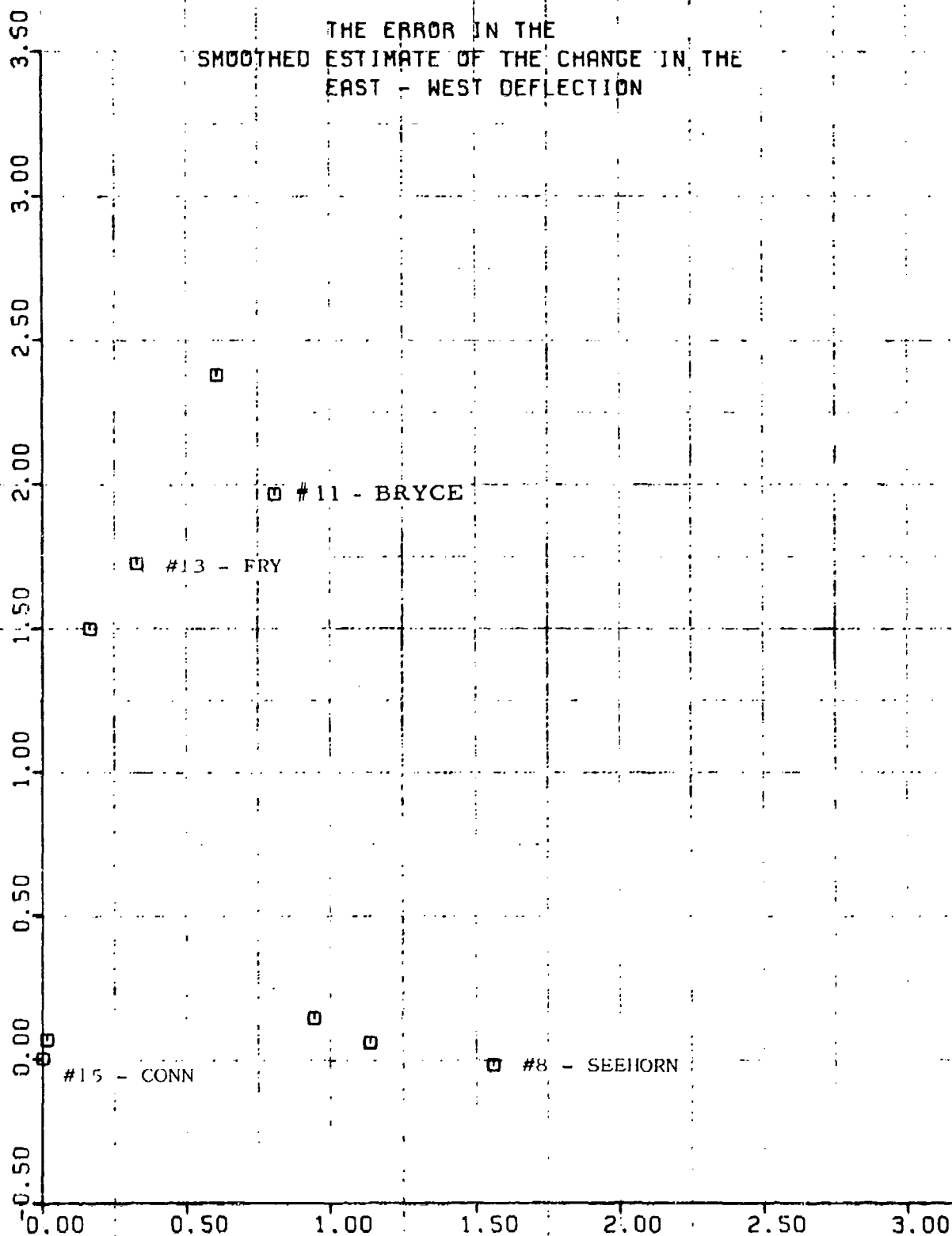


Figure E-8.4

WHITESANDS DATA RUN - 7A.LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS

Figure E-8.5

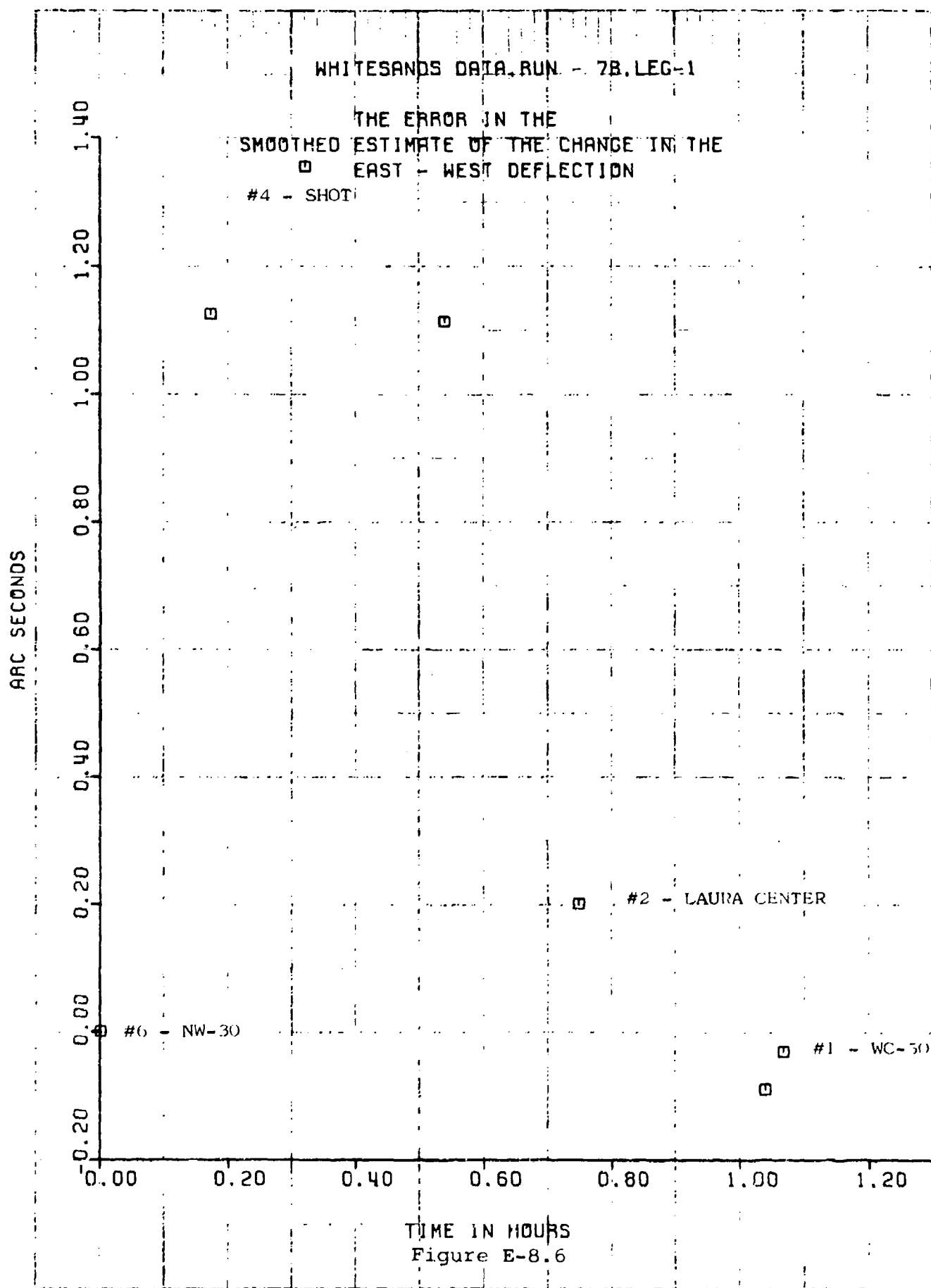


Figure E-8.6

APPENDIX I

REAL TIME ESTIMATES, SMOOTHED ESTIMATES, AND ERRORS IN THE ESTIMATES OF THE DEFLECTION OF THE VERTICAL CHANGE FOR THE RUNS DIVIDED INTO MULTIPLE LEGS

This appendix presents deflections of the vertical data associated with the 11 missions which were divided into shorter time segments. This includes Runs 3,4,1, 2(2), 9, 2(1), 8(2), 10(2), 10(4), 13, and 14. The data is divided into the same four groups as noted in Appendix D.

LIST OF ILLUSTRATIONS FOR RUNS DIVIDED FOR SHORTER TIME PERIODS

<u>N-S (ξ)</u>		<u>E-W (η)</u>
<u>Figure</u>	<u>Run Illustration</u>	<u>Figure</u>
<u>I. Real Time Estimate of the Change in the Deflections</u>		
F1.1	# 3A	F2.1
F1.2	# 3B	F2.2
F1.3	# 4A	F2.3
F1.4	# 4B	F2.4
F1.5	# 1A	F2.5
F1.6	# 1B	F2.6
F1.7	# 2(2)A	F2.7
F1.8	# 2(2)B	F2.8
F1.9	# 9A	F2.9
F1.10	# 9B	F2.10
F1.11	# 2(1)A	F2.11
F1.12	# 2(1)B	F2.12
F1.13	# 8(2)A	F2.13
F1.14	# 8(2)B	F2.14
F1.15	# 10(2)A	F2.15
F1.16	# 10(2)B	F2.16
F1.17	# 10(4)A	F2.17
F1.18	# 10(4)B	F2.18
F1.19	# 13A	F2.19
F1.20	# 13B	F2.20
F1.21	# 14A	F2.21
F1.22	# 14B	F2.22
<u>II. The Error in the Real Time Estimate of Change in the Deflections</u>		
F3.1	# 3A	F4.1
F3.2	# 3B	F4.2
F3.3	# 4A	F4.3
F3.4	# 4B	F4.4
<u>III. Smoothed Estimate of the Change in the Deflections</u>		
F5.1	# 3A	F6.1
F5.2	# 3B	F6.2
F5.3	# 4A	F6.3
F5.4	# 4B	F6.4
F5.5	# 1A	F6.5
F5.6	# 1B	F6.6
F5.7	# 2(2)A	F6.7
F5.8	# 2(2)B	F6.8
F5.9	# 9A	

LIST OF ILLUSTRATIONS FOR RUNS DIVIDED FOR SHORTER TIME PERIODS
(contd)

N-S (5)

E-W (7)

Figure

Run Illustration

Figure

III. Smoothed Estimate of the Change in the Deflections (cont)

F5.10	# 9B	F6.10
F5.11	# 2(1)A	F6.11
F5.12	# 2(1)B	F6.12
F5.13	# 8(2)A	F6.13
F5.14	# 8(2)B	F6.14
F5.15	# 10(2)A	F6.15
F5.16	# 10(2)B	F6.16
F5.17	# 10(4)A	F6.17
F5.18	# 10(4)B	F6.18
F5.19	# 13A	F6.19
F5.20	# 13B	F6.20
F5.21	# 14A	F6.21
F5.22	# 14B	F6.22

IV. The Error in the Smoothed Estimate of the Change in the Deflections

F7.1	# 3A	F8.1
F7.2	# 3B	F8.2
F7.3	# 4A	F8.3
F7.4	# 4B	F8.4

WHITESANDS DATA, RUN - 3A, LEG-1

#1-TULAROSA SB

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

0.00
-2.00
-4.00
-5.00
-8.00
-10.00
-12.00
-14.00
-16.00

□

□

□ #3-RHODES

□

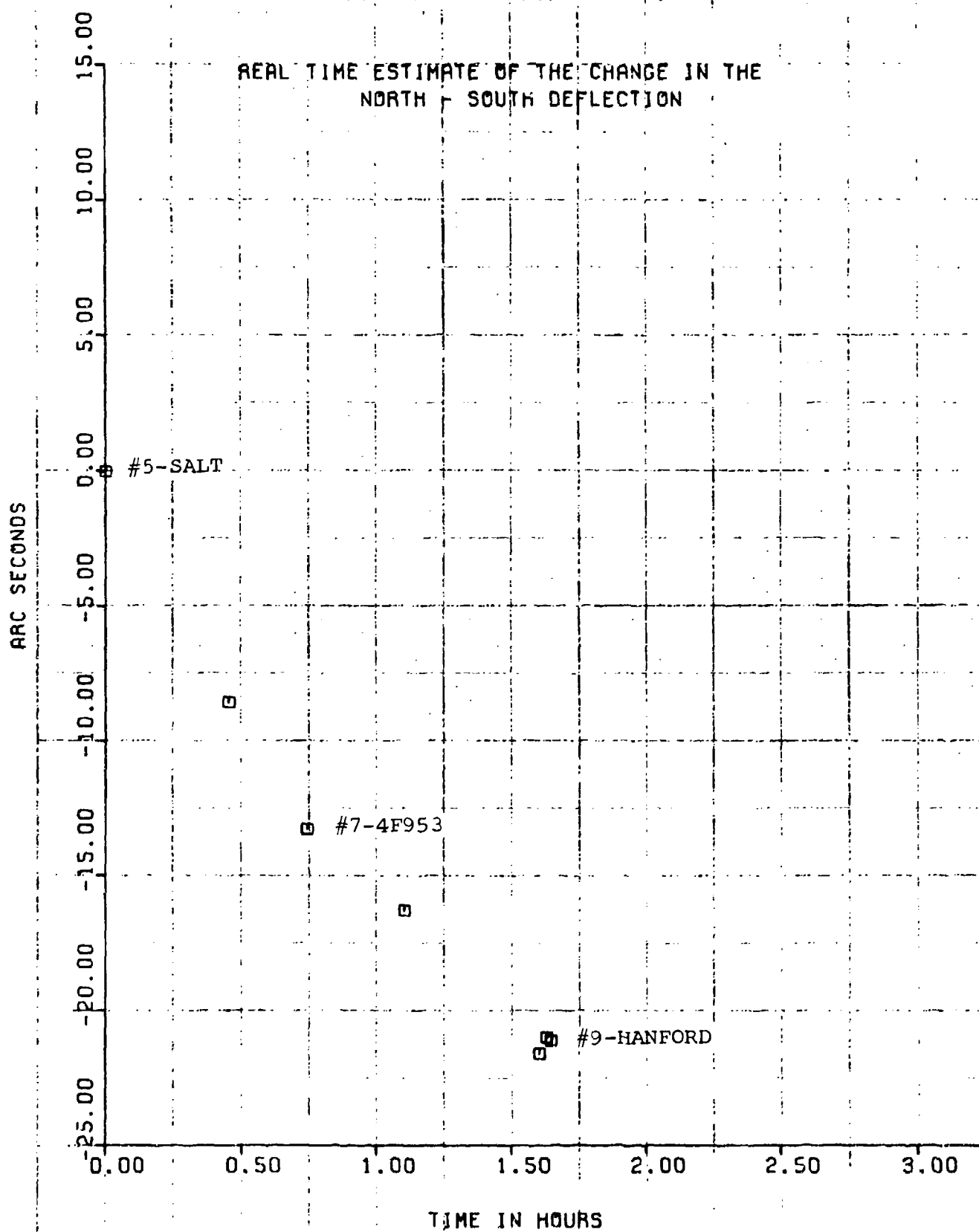
□ #5-SALT

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS
Figure F-1.1

WHITESANDS DATA.RUN - 3B.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

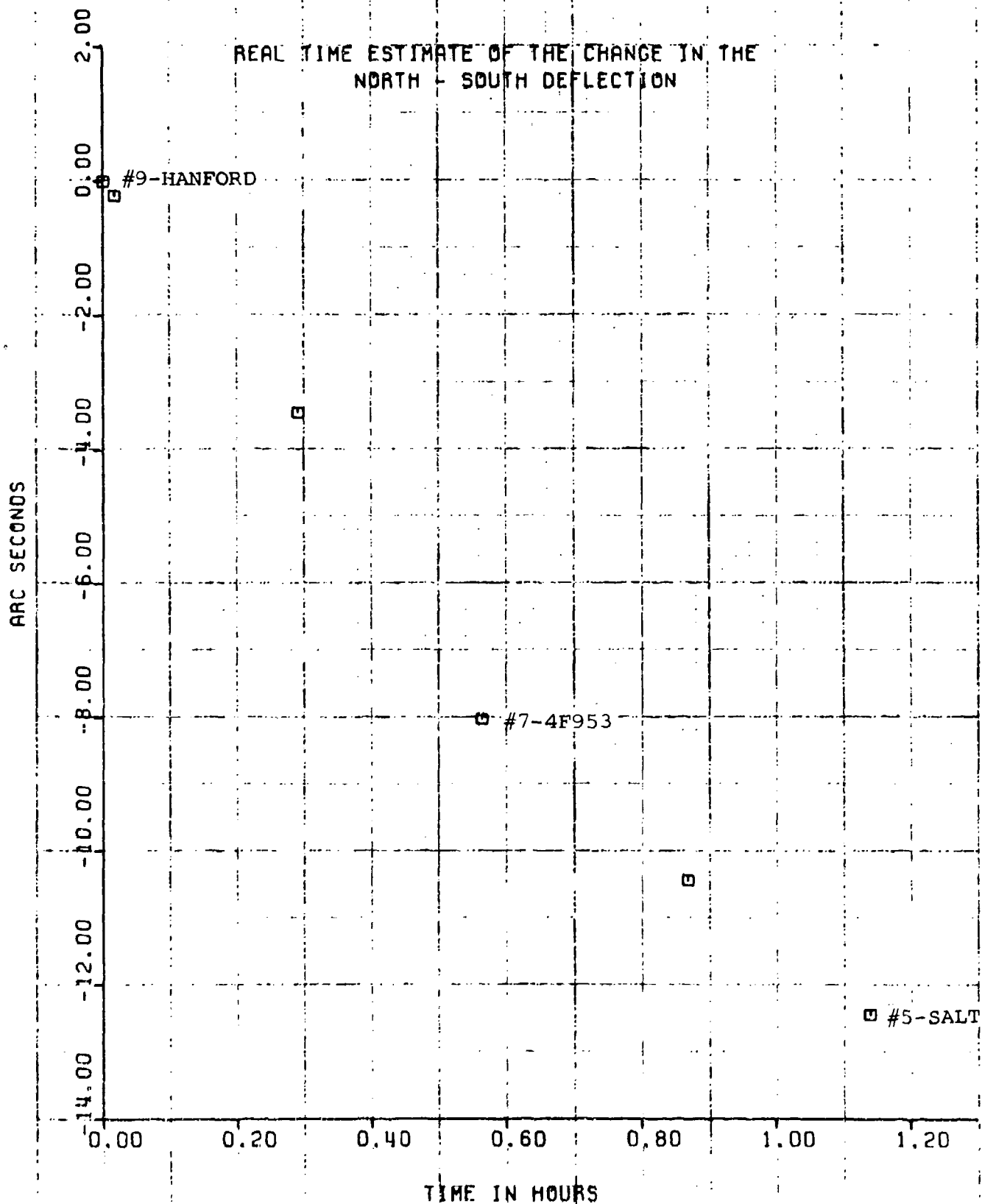


TIME IN HOURS

Figure F-1.2

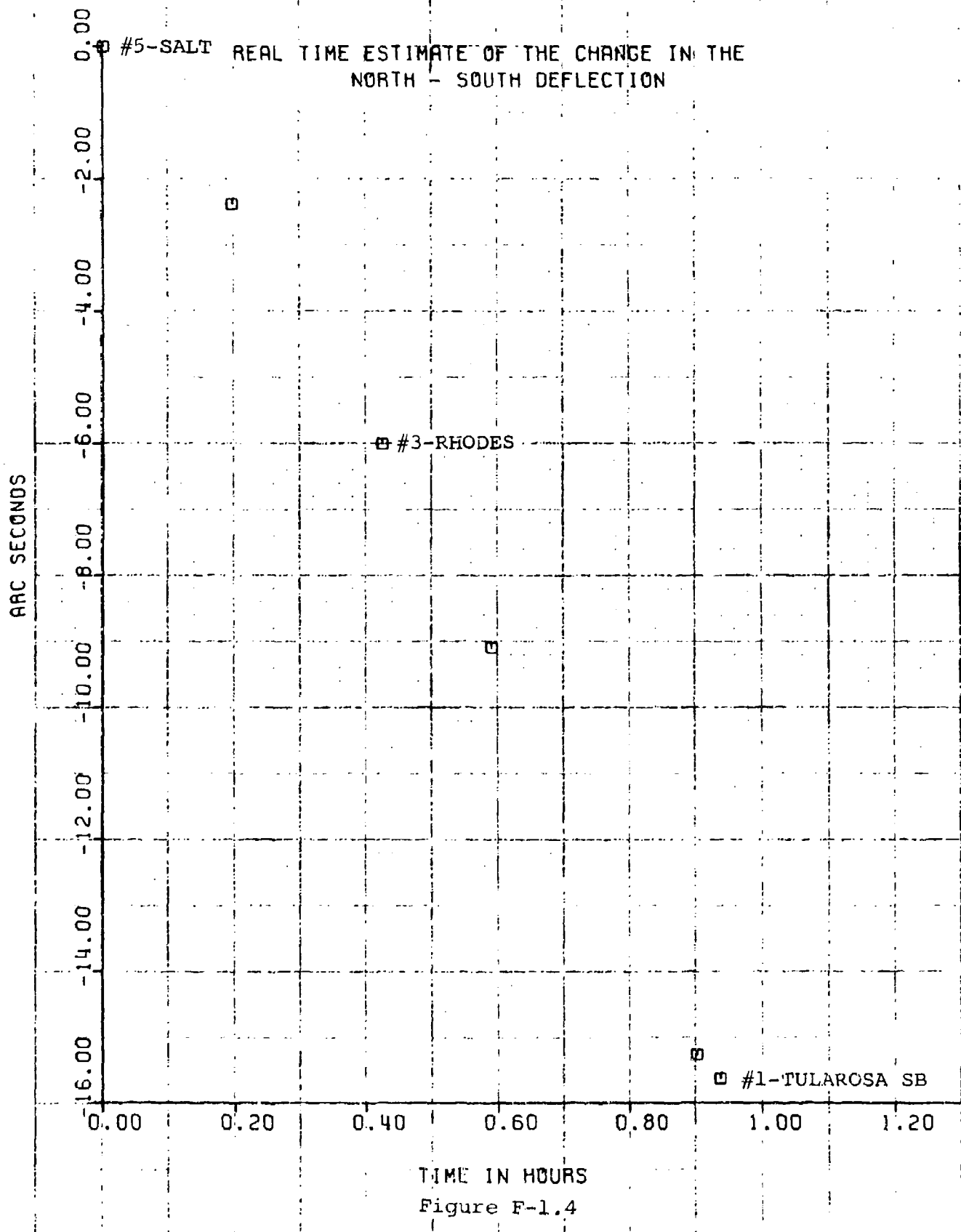
WHITESANDS DATA RUN - 4A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



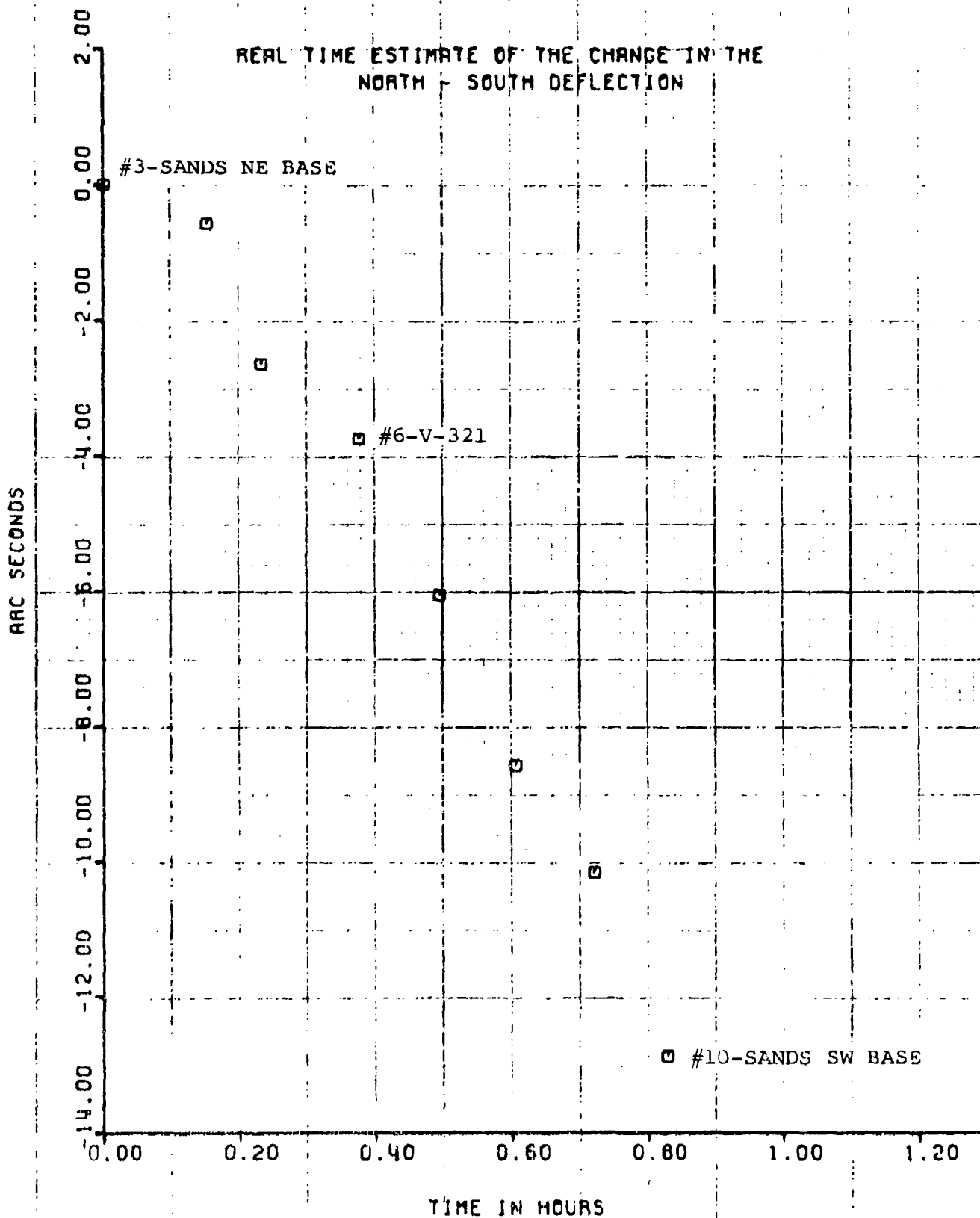
TIME IN HOURS
Figure F-1.3

WHITESANDS DATA, RUN - 4B, LEG-1



WHITESANDS DATA, RUN - 1A, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



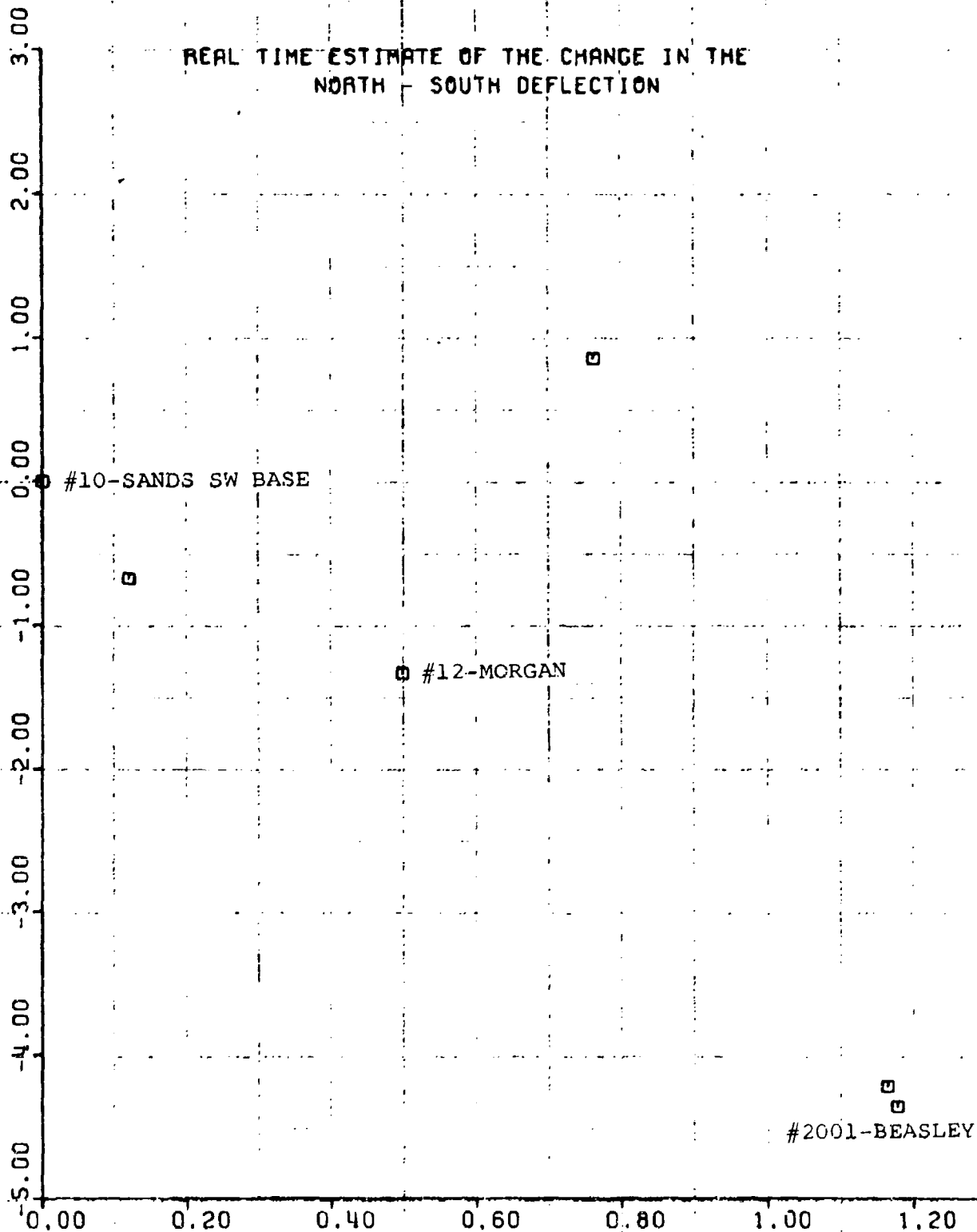
TIME IN HOURS

Figure F-1.5

WHITESANDS DATA RUN - 1B.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure F-1.6

WHITESANDS DATA RUN - 2A, LEG-2

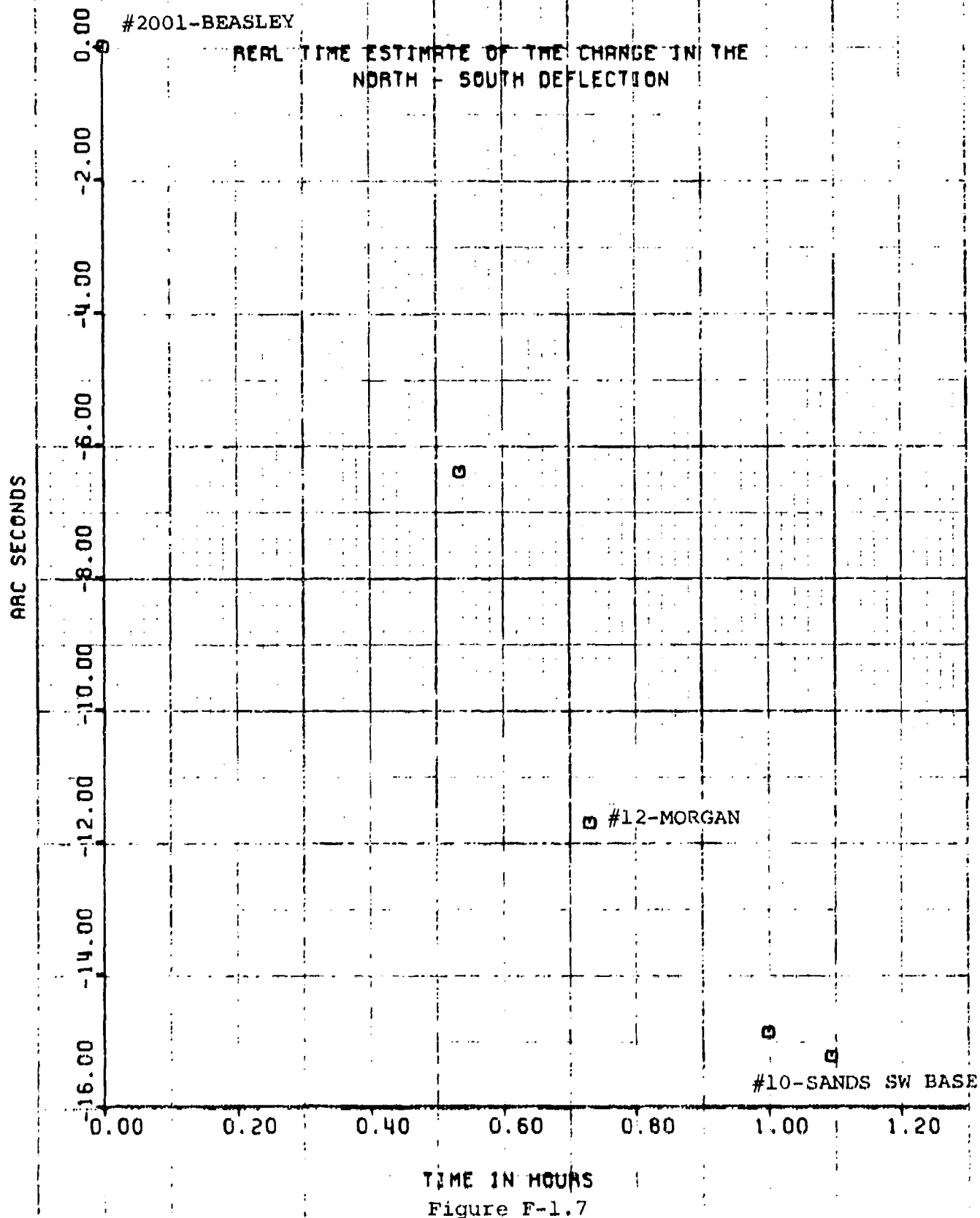
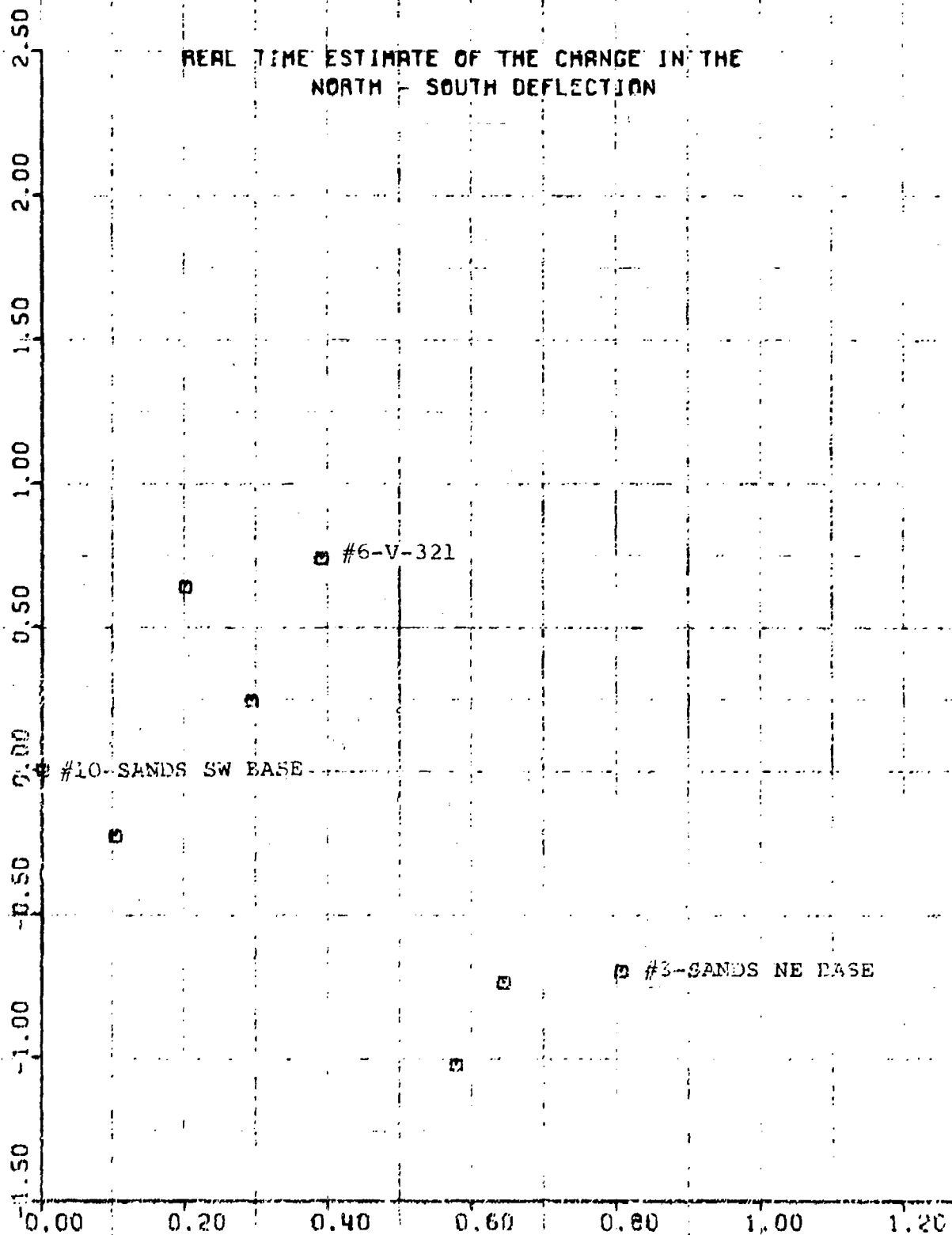


Figure F-1.7

WHITESANDS DATA, RUN - 2B, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure F-1.8

WHITESANDS DATA RUN - 9A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

RAC SECONDS

35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00

#2001-BEASLEY

8

8

#13-EASY

8

8

#10-SANDS SW BASE

8

8

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS

Figure F-1.9

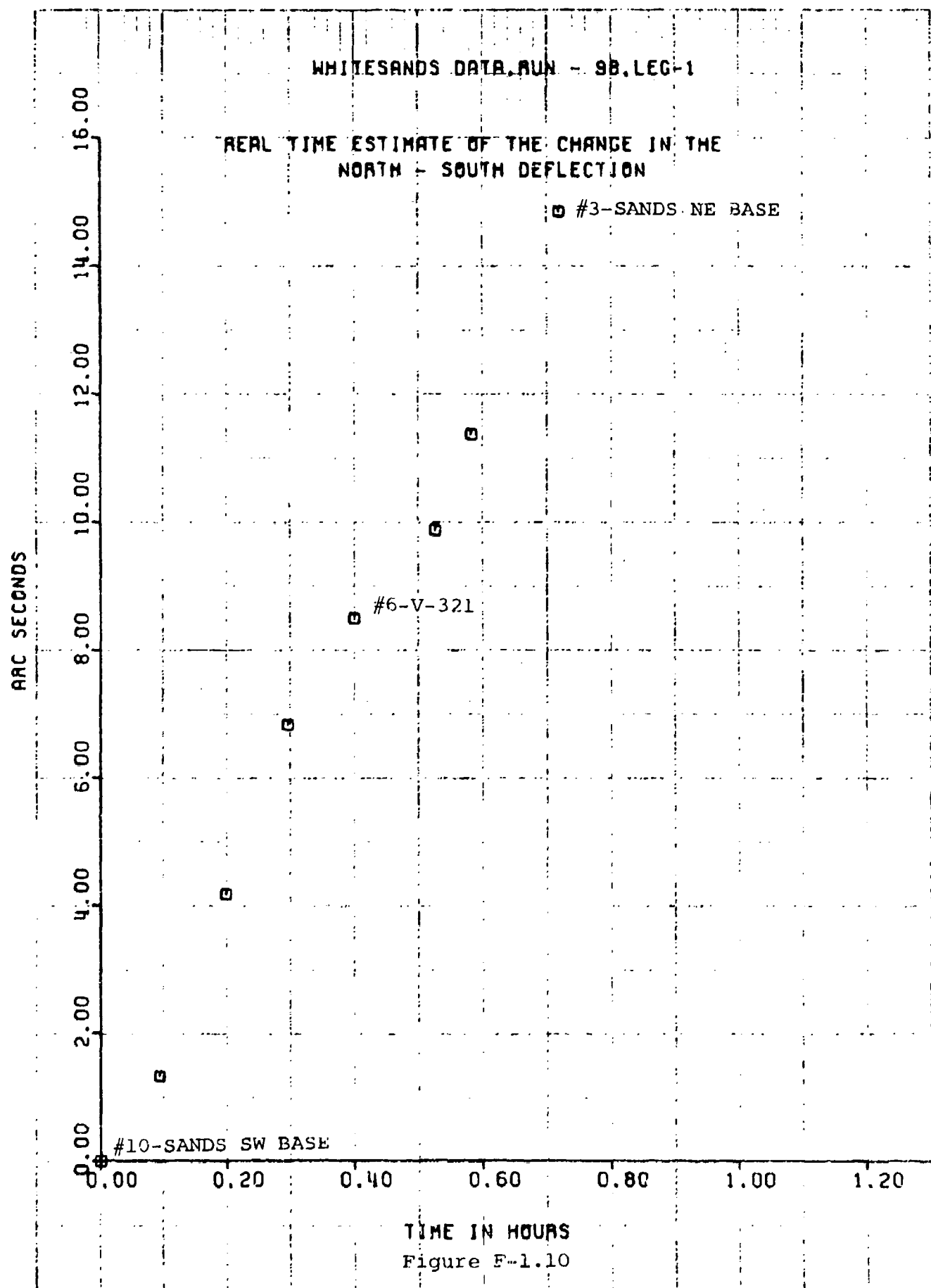
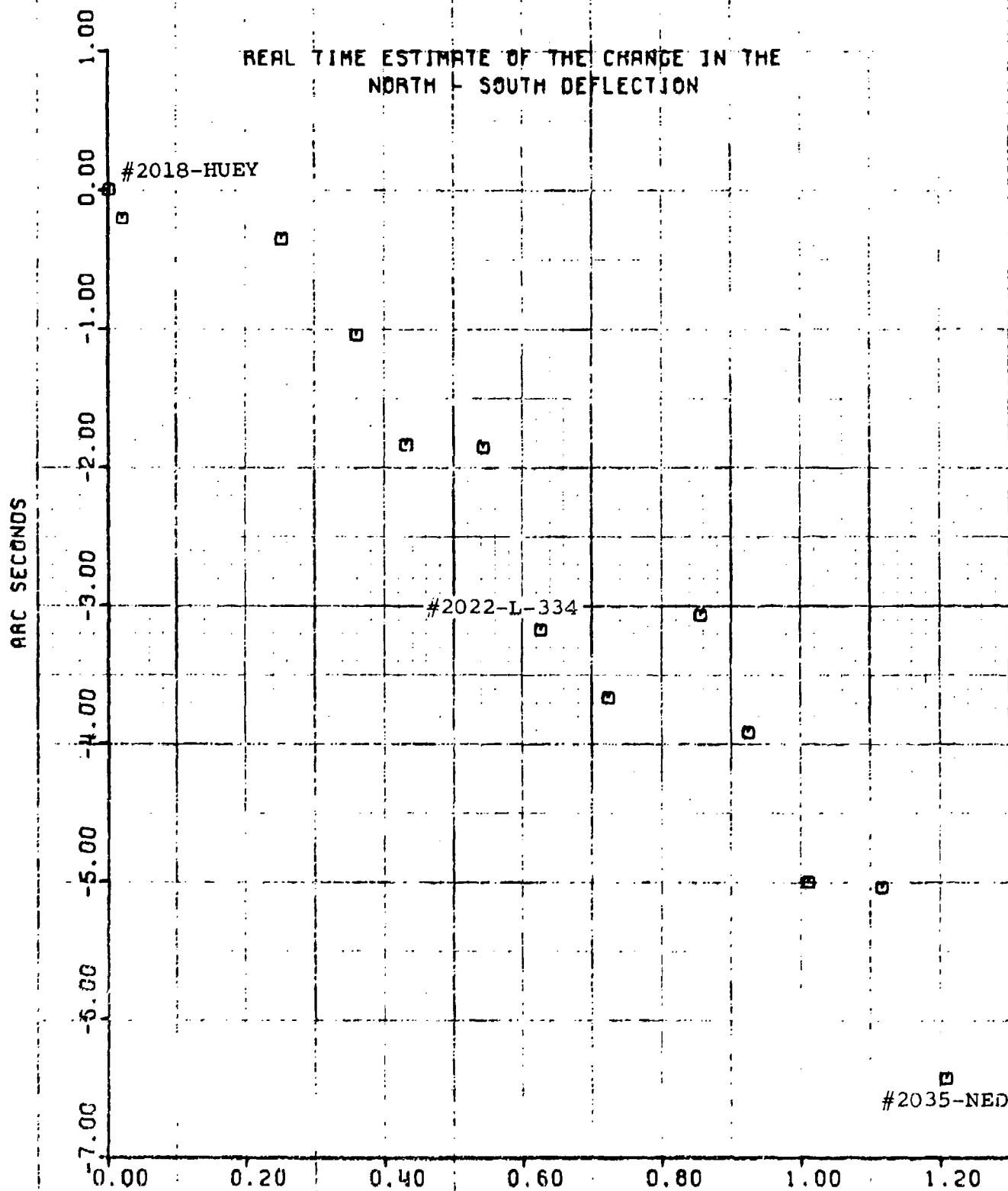


Figure F-1.10

WHITESANDS DATA.RUN - 2A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

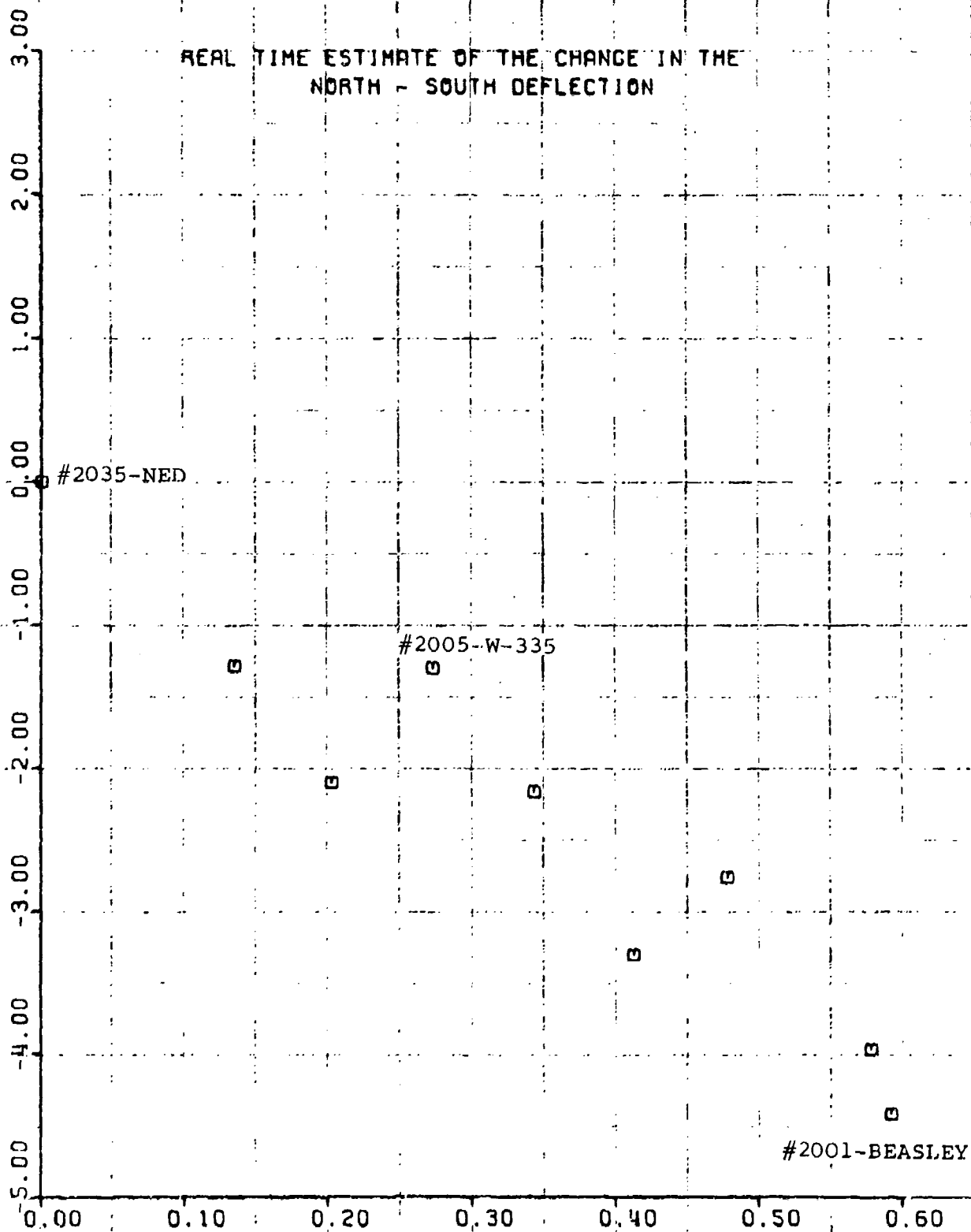


TIME IN HOURS
Figure F-1.11

WHITESANDS DATA RUN - 2B.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



#2001-BEASLEY

TIME IN HOURS
Figure F-1.12

WHITESANDS DATA, RUN - 8A, LEG-2

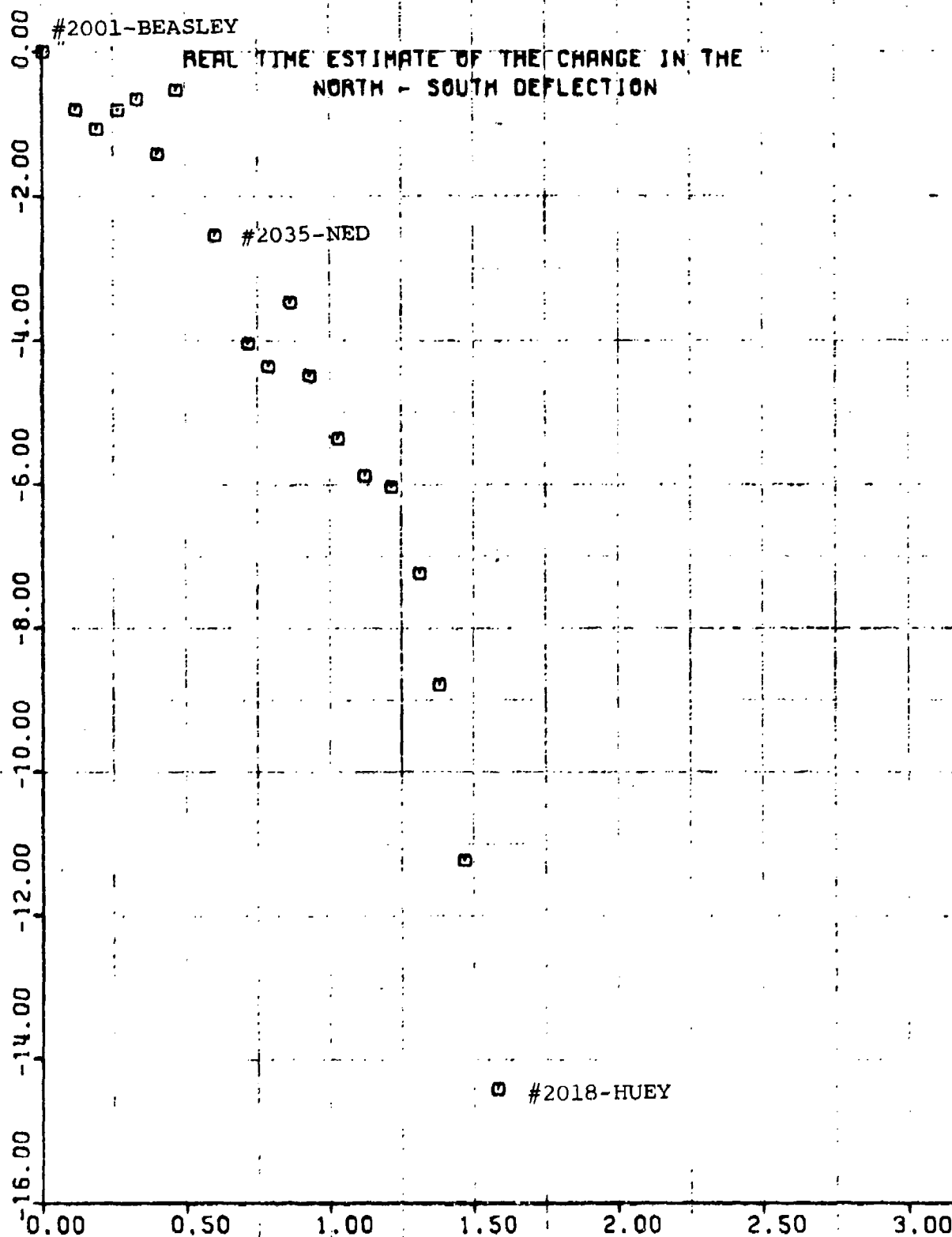
#2001-BEASLEY

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

#2035-NED

#2018-HUEY

ARC SECONDS

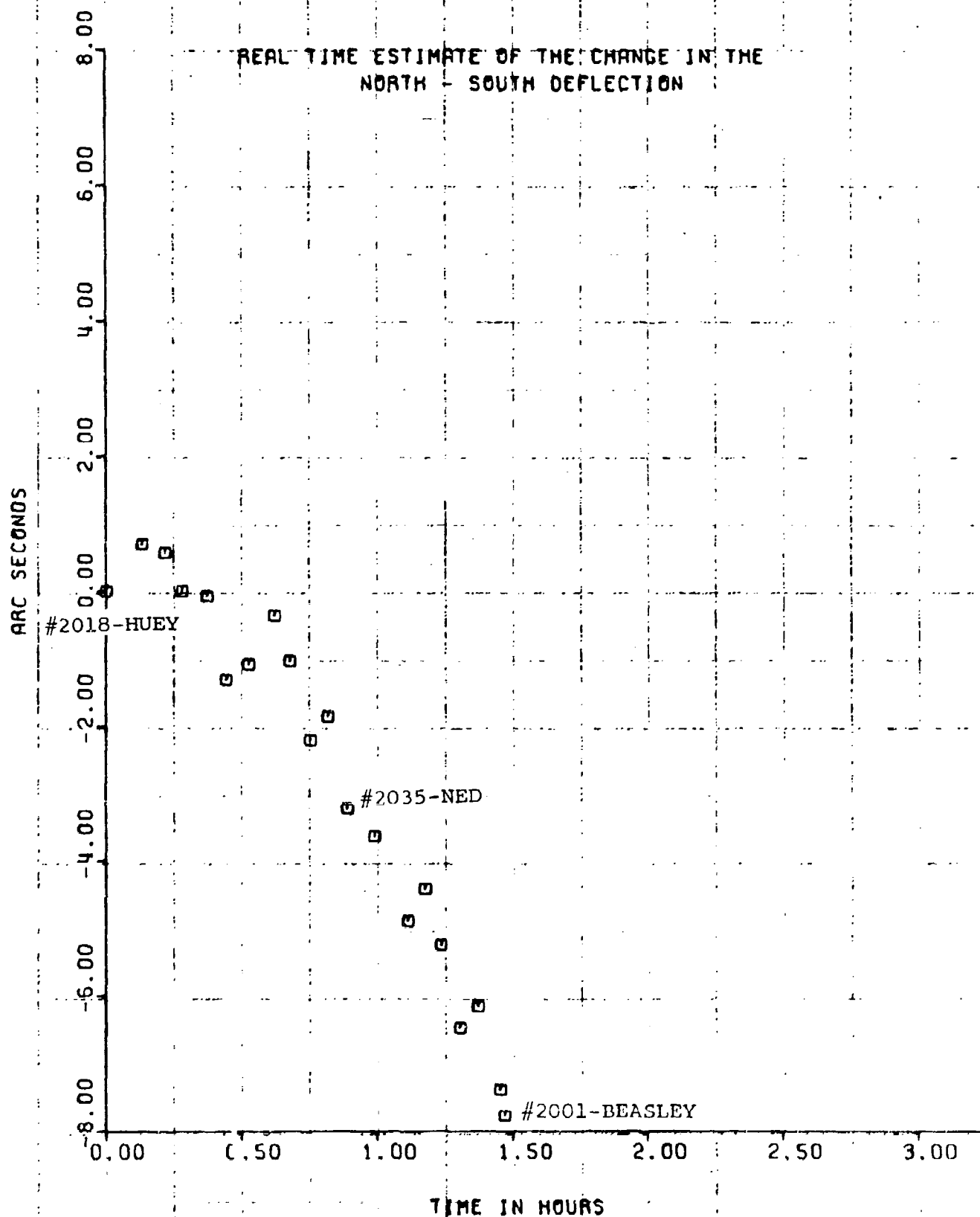


TIME IN HOURS

Figure F-1.13

WHITESANDS DATA.RUN - 88.LEG-2

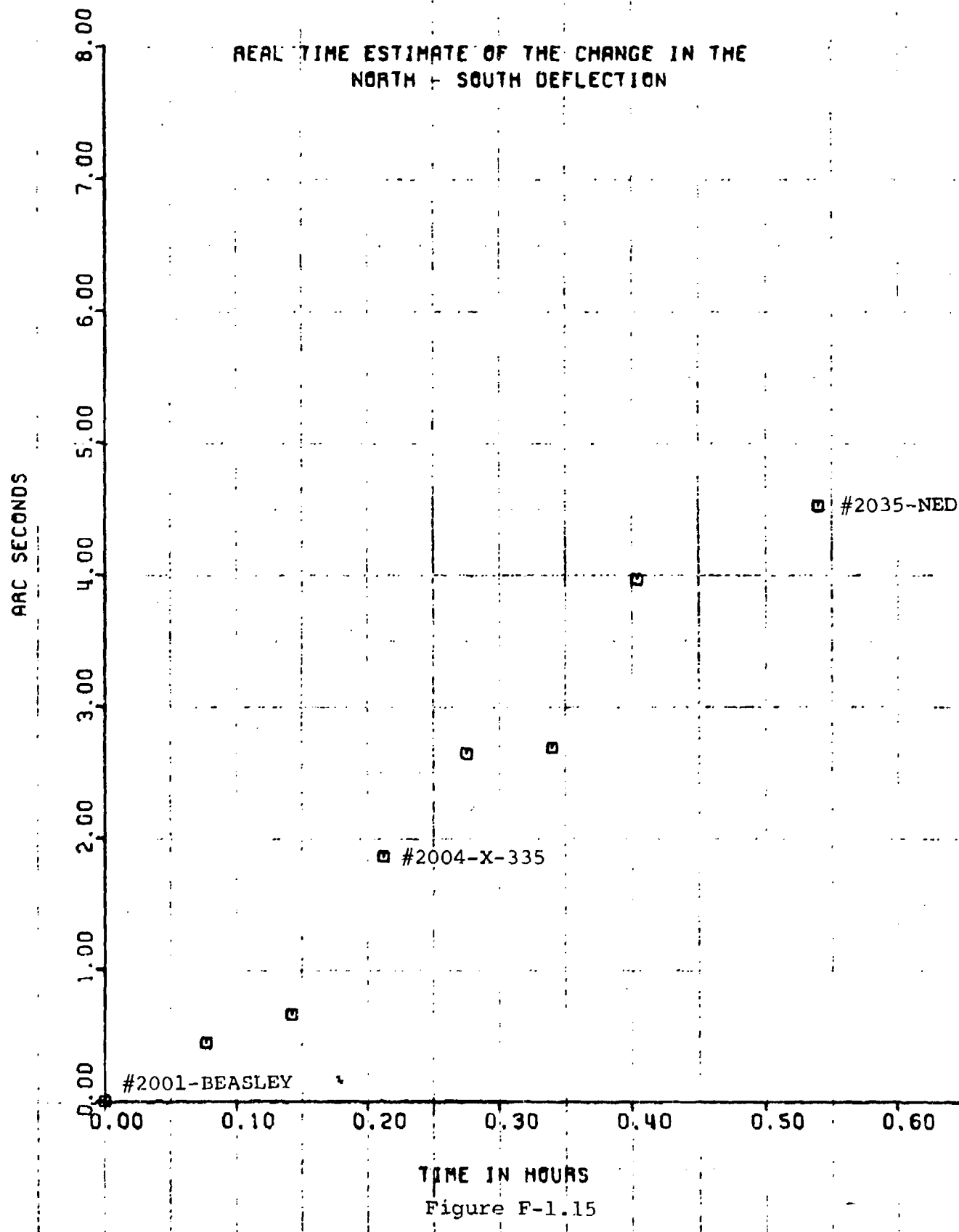
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-1.14

WHITESANDS DATA.BUN -10A.LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-1.15

WHITESANDS DATA.RUN -10B.LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00

0.00

#2035-NED

0.20

0.40

0.60

0.80

1.00

1.20

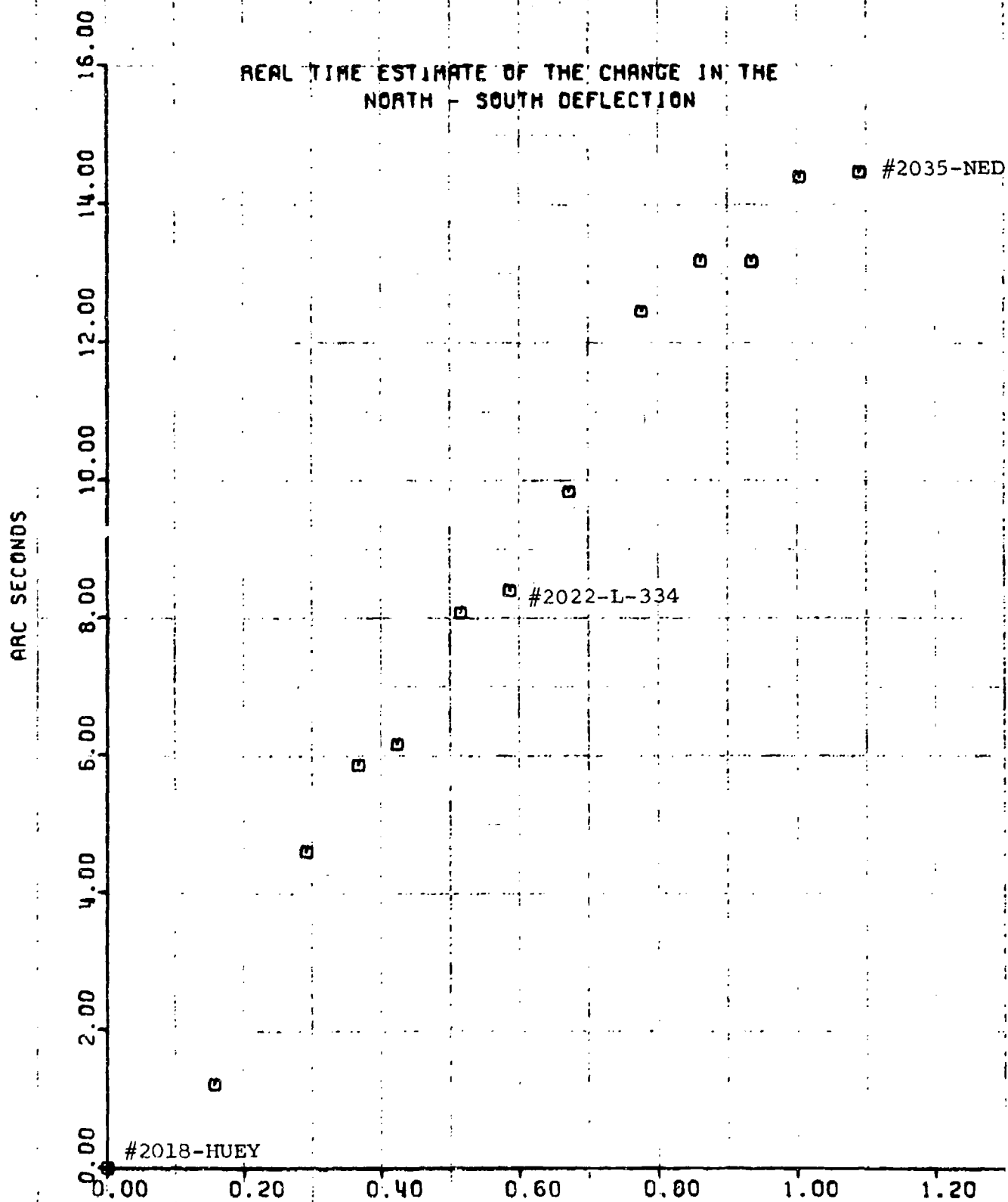
#2021-K-334

#2018-HUEY

TIME IN HOURS
Figure F-1.16

WHITESANDS DATA RUN -10A,LEG-4

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-1.17

WHITESANDS DATA, RUN -108, LEG-4

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00

#2035--NED

#2005-W-335

#2001-BEASLEY

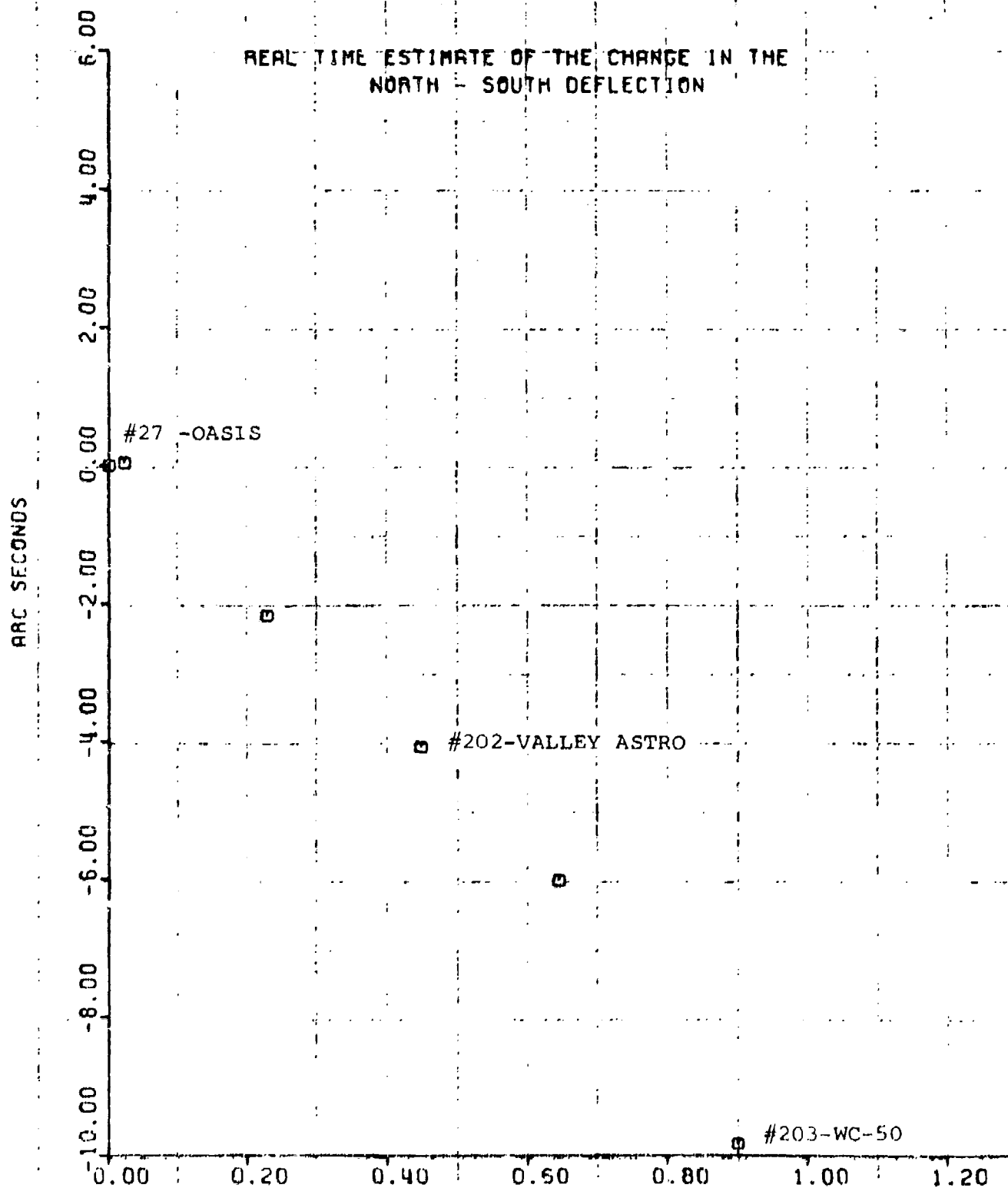
TIME IN HOURS

Figure F-1.18

0.00 0.10 0.20 0.30 0.40 0.50 0.60

WHITESANDS DATA RUN -13A,LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

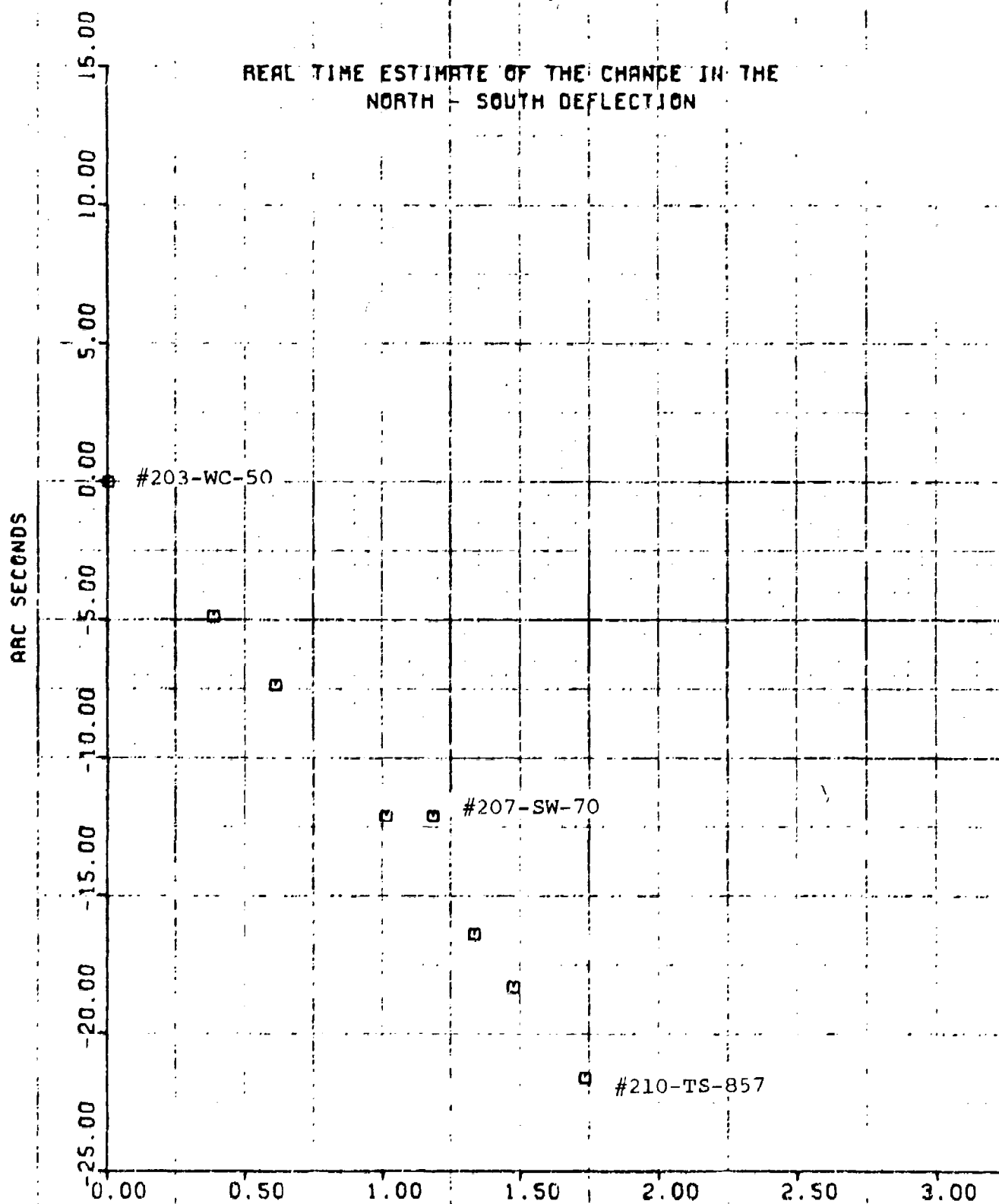


TIME IN HOURS

Figure F-1.19

WHITESANDS DATA, RUN -13B.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-1.20

WHITESANDS DATA, RUN -14A, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00

#208-BASIN

#205-TS-204-2

#203-WC-50

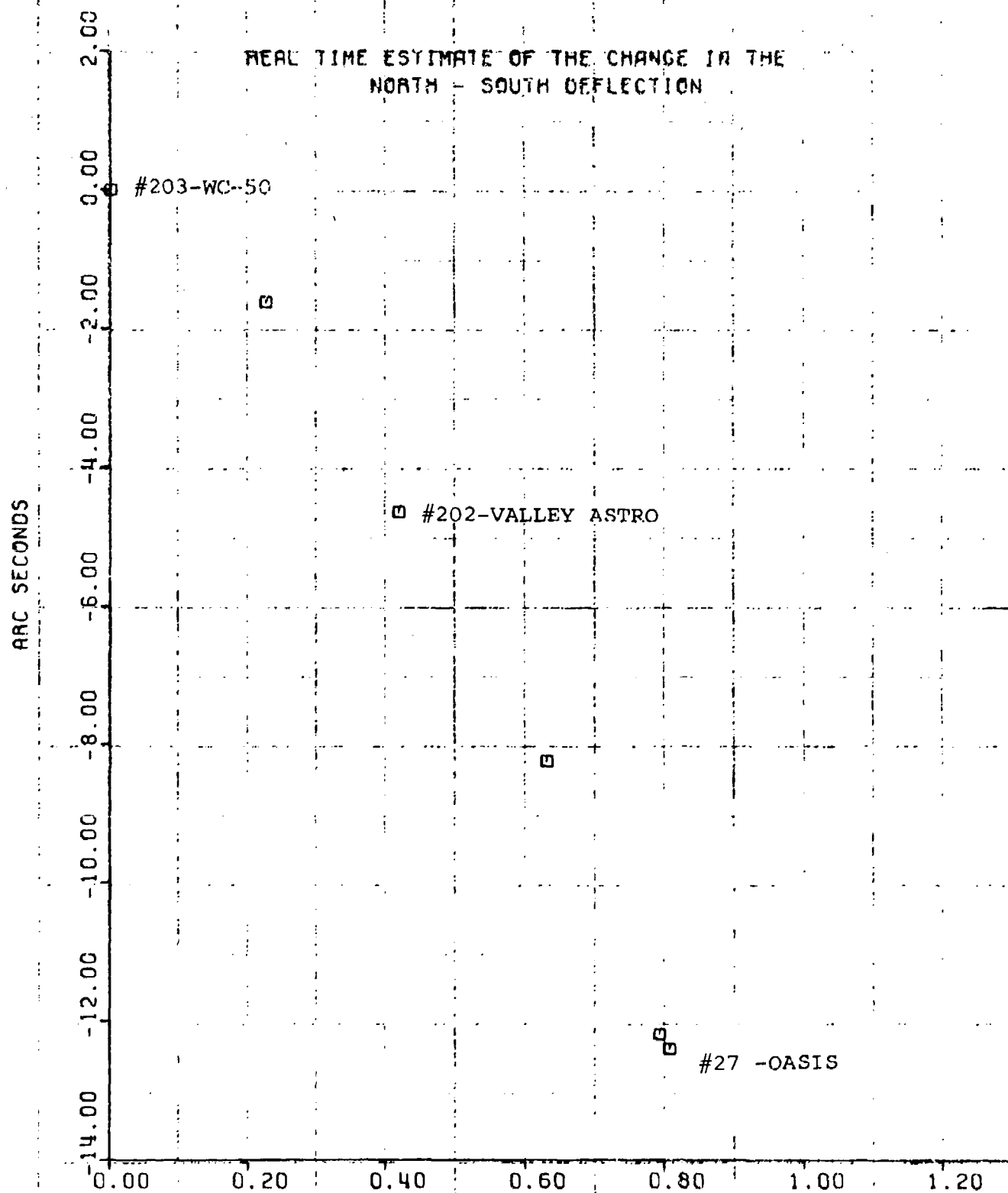
0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS

Figure F-1.21

WHITESANDS DATA RUN -14B.L50-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-1.22

WHITESANDS DATA RUN - 3A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00

#1-TULAROSA SB

#3-RHODES

#5-SALT

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS
Figure F-2.1

WHITESANDS DATA, RUN - 3B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

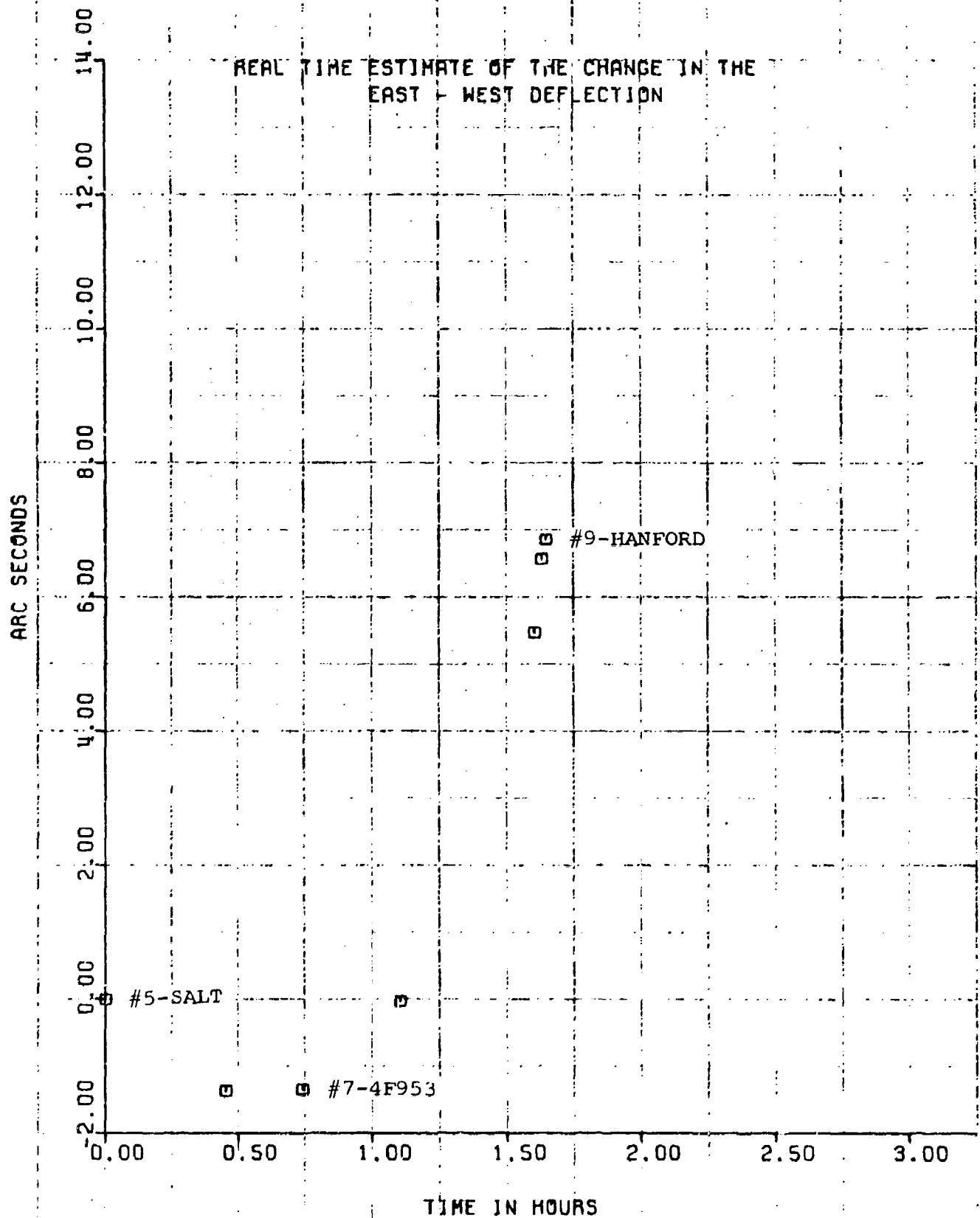


Figure F2.2

WHITESANDS DATA, RUN - 4A, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

□ #5-SALT

□

□ #7-4F953

B

#9-HANFORD

ARC SECONDS

0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS
Figure F-2.3

WHITESANDS DATA, RUN - 4B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

0.00

0.20

0.40

0.60

0.80

1.00

1.20

#3-RHODES

#1-TULAROSA SB

#5-SALT

TIME IN HOURS

Figure F-2.4

WHITESANDS DATA.RUN - 1A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

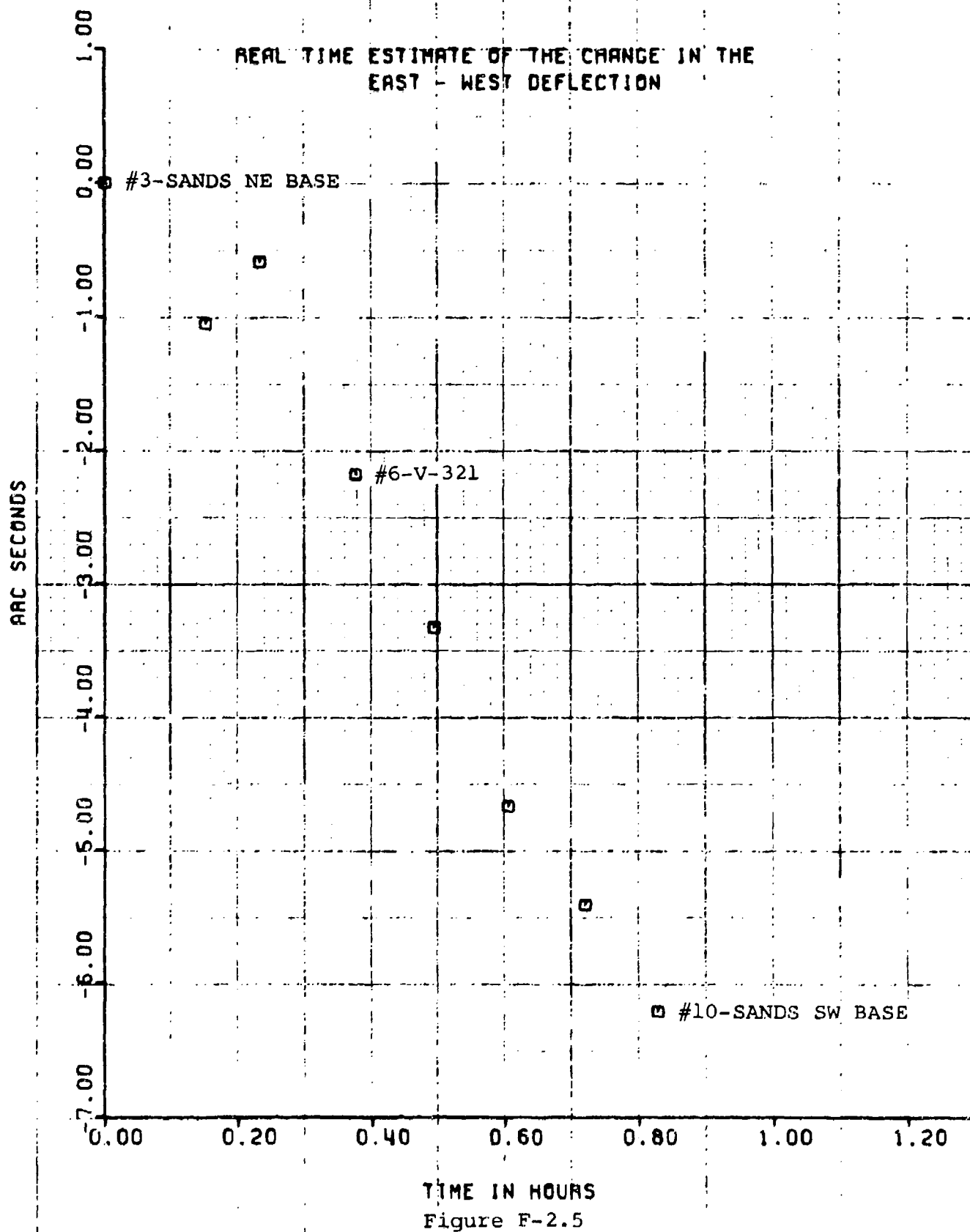
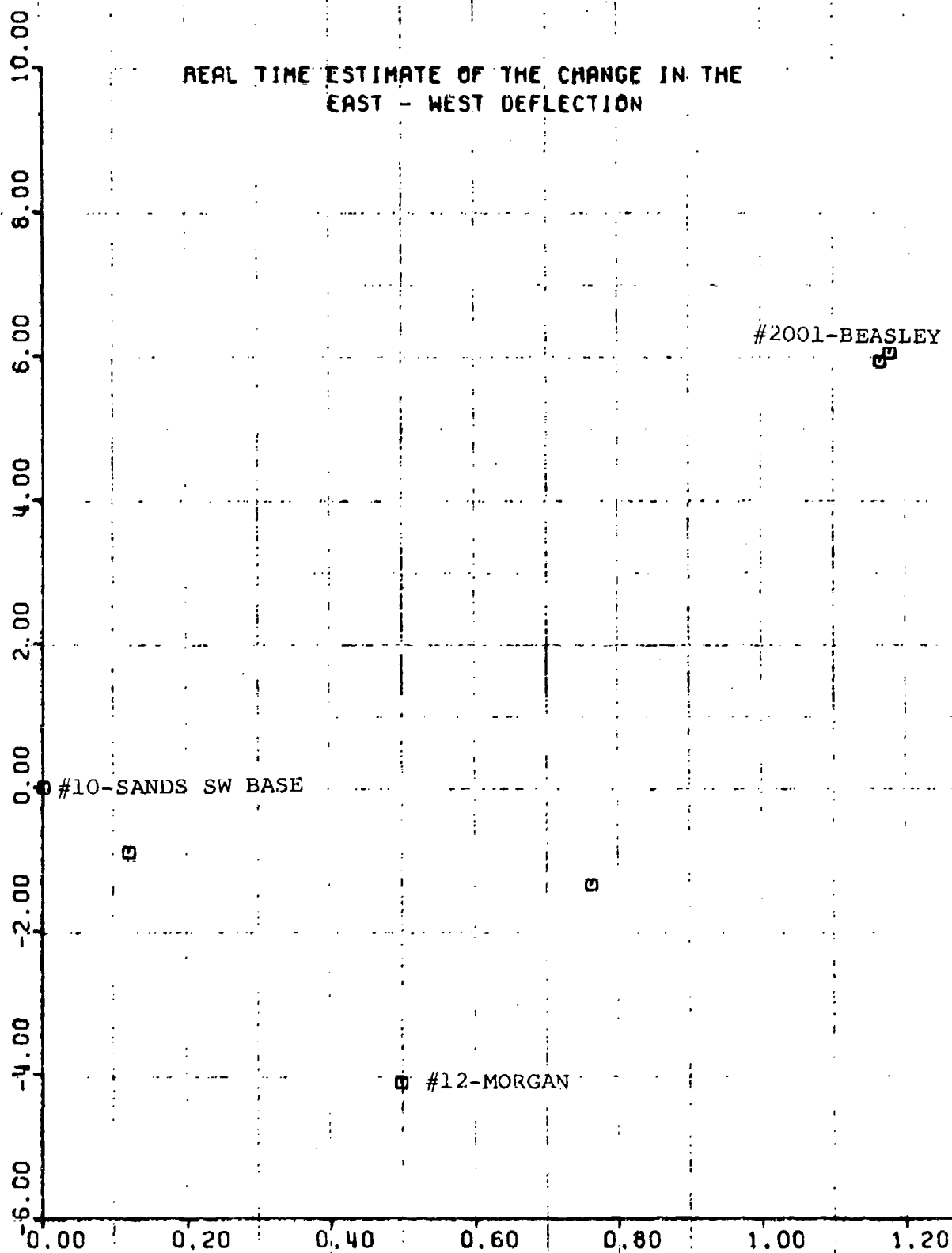


Figure F-2.5

WHITESANDS DATA.RUN - 18.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS

Figure F-2.6

WHITESANDS DATA, RUN - 2A, LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#2001-BEASLEY

0.00

0.20

0.40

0.60

0.80

1.00

1.20

TIME IN HOURS

Figure F-2.7

#10-SANDS SW BASE

#12-MORGAN

WHITESANDS DATA RUN - 2B.LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00

#10-SANDS SW BASE

#6-V-321

#3-SANDS NE BASE

TIME IN HOURS
Figure F-2.8

0.00 0.20 0.40 0.60 0.80 1.00 1.20

WHITESANDS DATA RUN - 9A, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00

#2001-BEASLEY

#10-SANDS SW BASE

#13-EASY

0.00 0.20 0.40 0.60 0.80 1.00 1.20

TIME IN HOURS
Figure F-2.9

ARC SECONDS

WHITESANDS DATA RUN - 9B.LEG-1

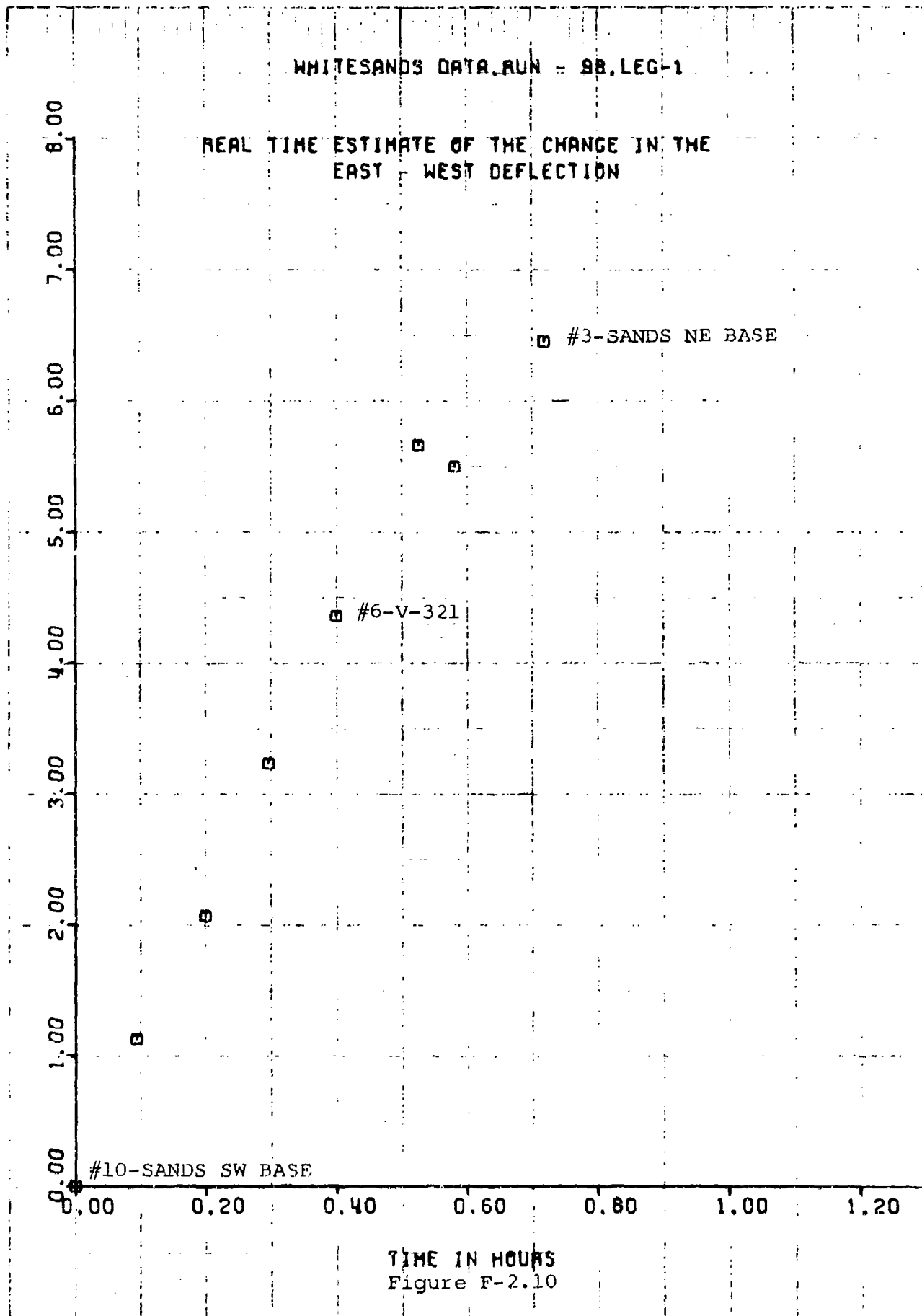
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

#3-SANDS NE BASE

#6-V-321

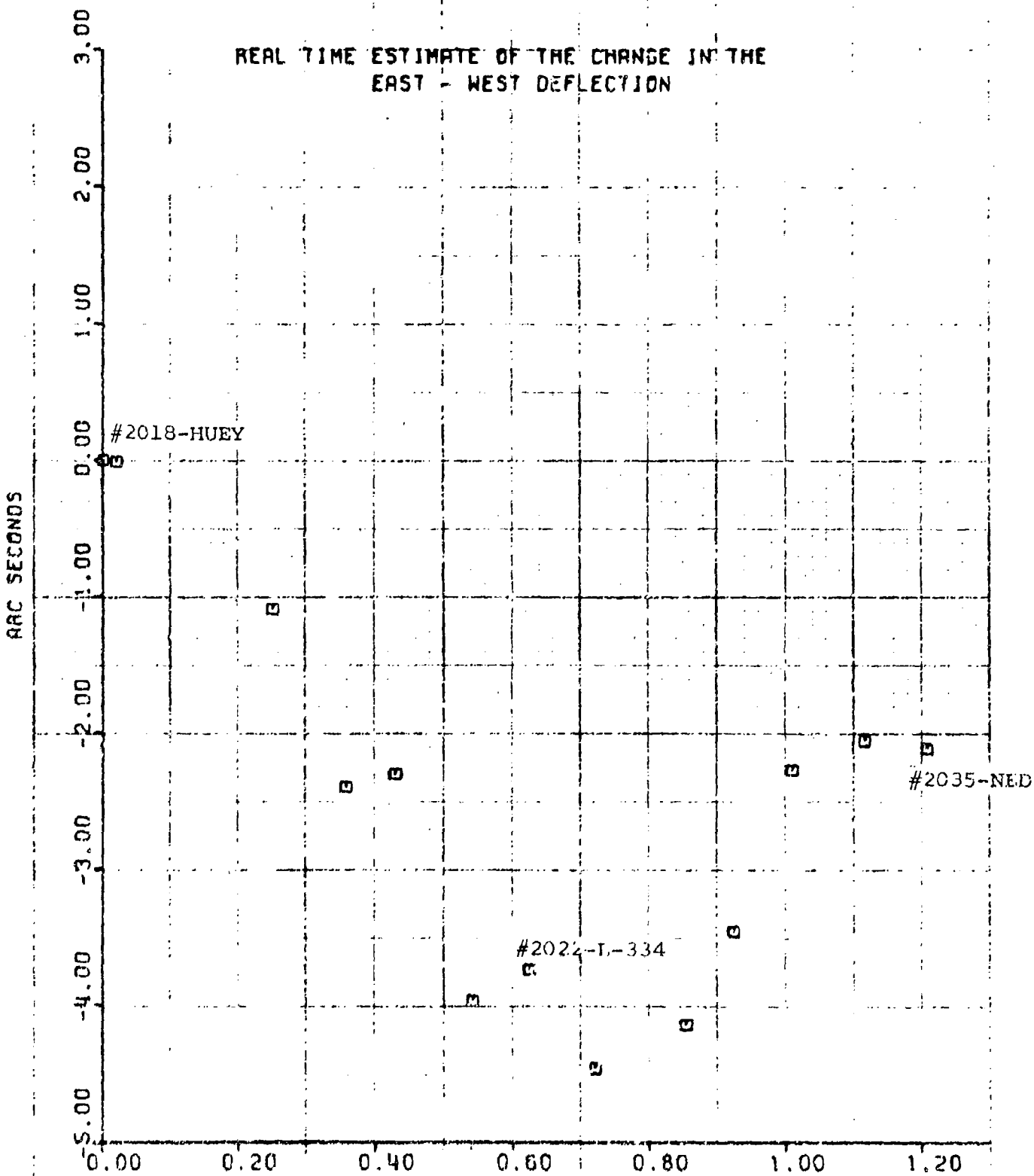
#10-SANDS SW BASE

TIME IN HOURS
Figure F-2.10



WHITESANDS DATA.RUN - 2A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS

Figure F-2.11

WHITESANDS DATA, RUN - 2B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

8.00

7.00

6.00

5.00

4.00

3.00

2.00

1.00

0.00

#2035-NED

0.00

0.10

0.20

0.30

0.40

0.50

0.60

#2005-W-335

#2001-BEASLEY

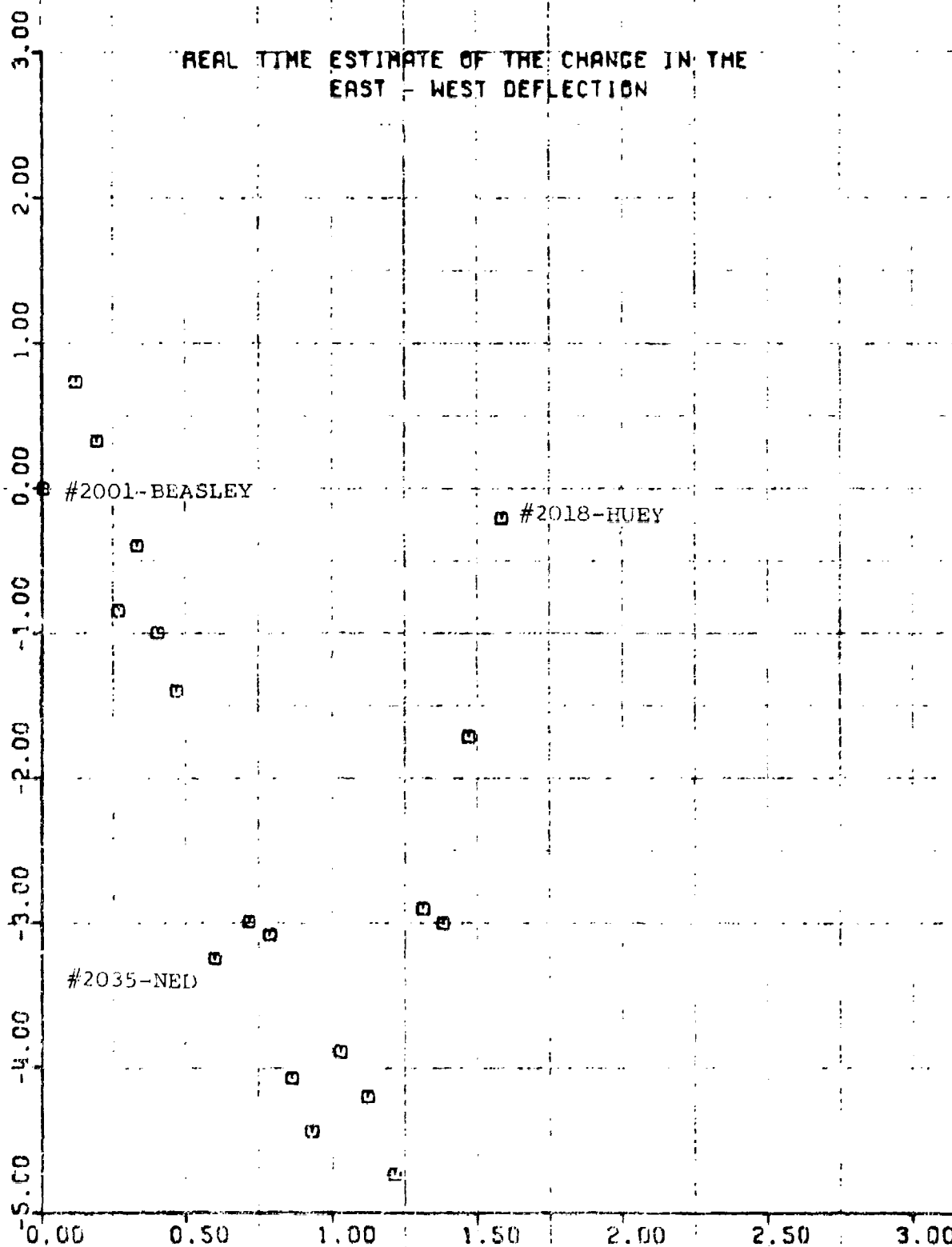
TIME IN HOURS

Figure F-2.12

WHITESANDS DATA RUN - BA,LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

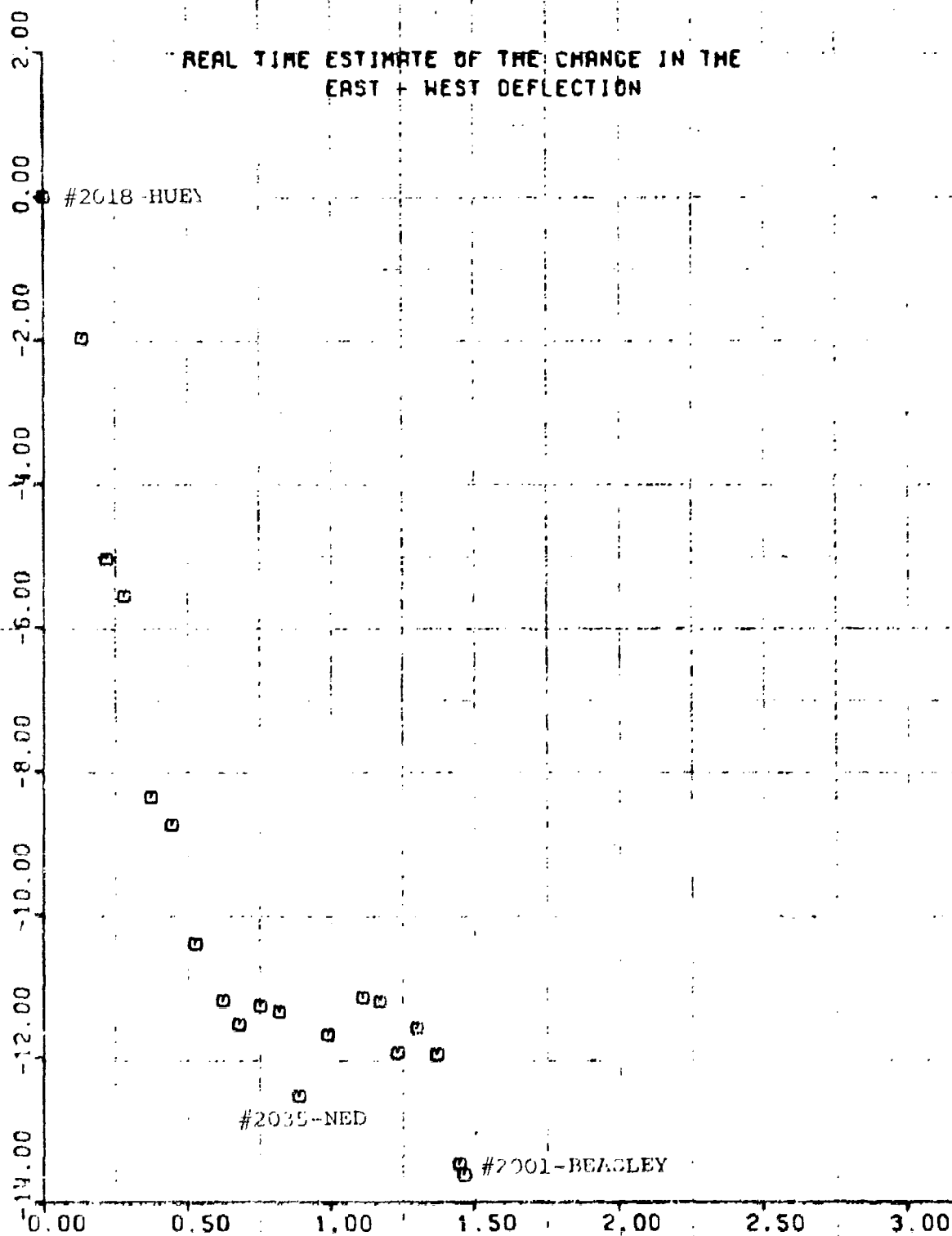


TIME IN HOURS
Figure F-2.13

WHITESANDS DATA RUN - 88.LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure F-2.14

WHITESANDS DATA RUN -10A, LEC-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00

#2001-BEASLEY

#2004-X-335

#2035-NED

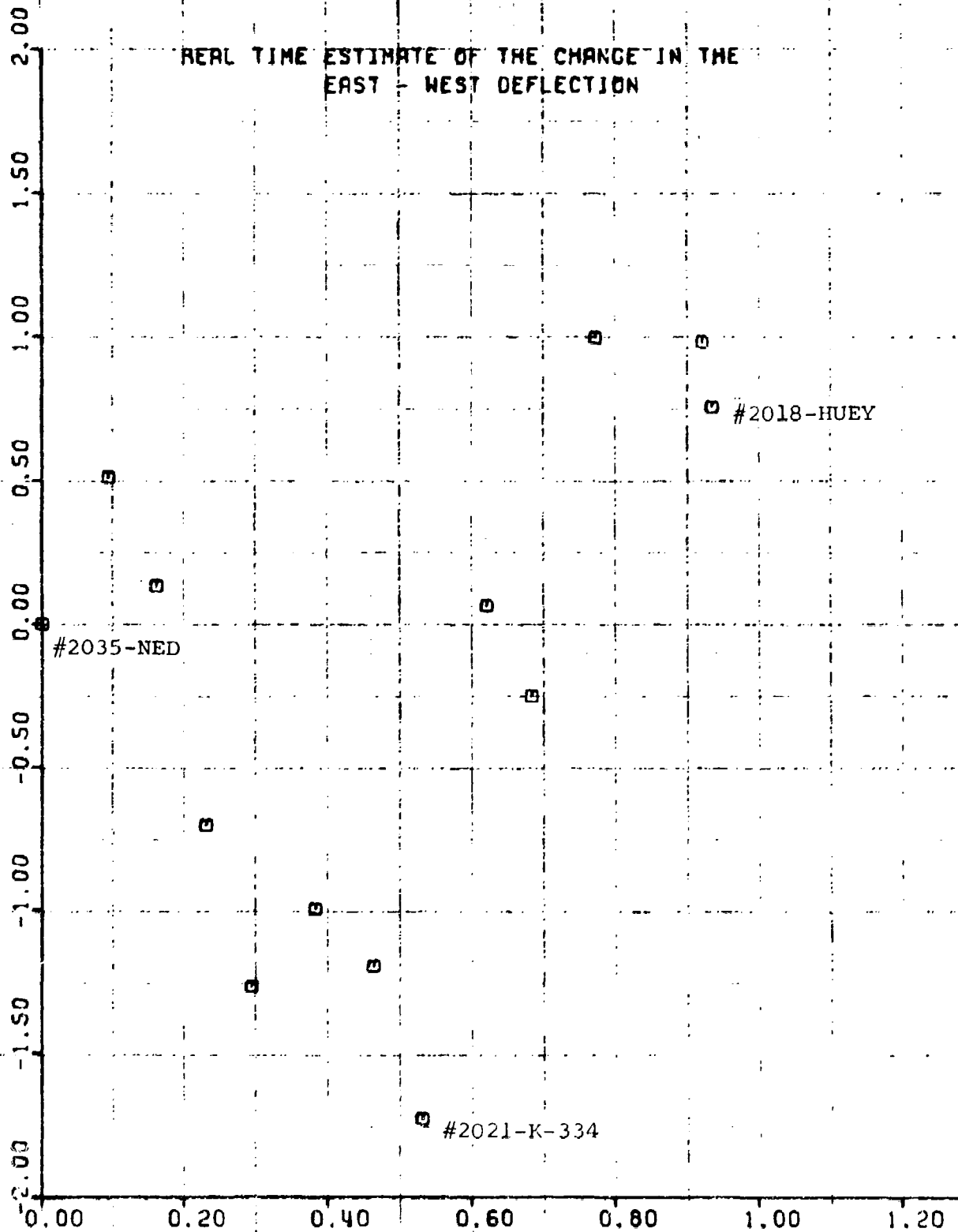
0.00 0.10 0.20 0.30 0.40 0.50 0.60

TIME IN HOURS
Figure F-2.15

WHITESANDS DATA RUN -10B.LEG-2

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure F-2.16

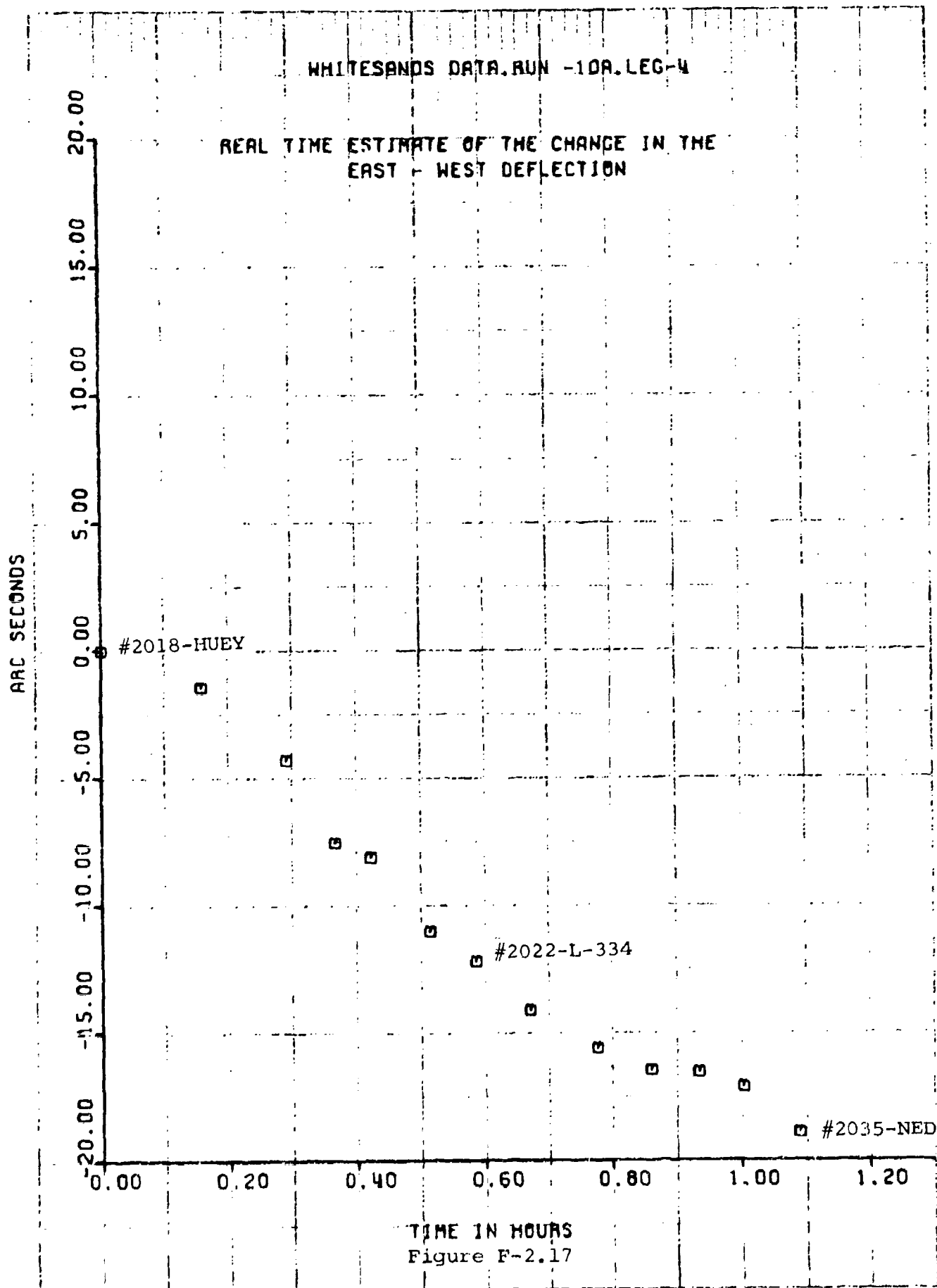


Figure F-2.17

WHITESANDS DATA, RUN -108, LEG-4

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00

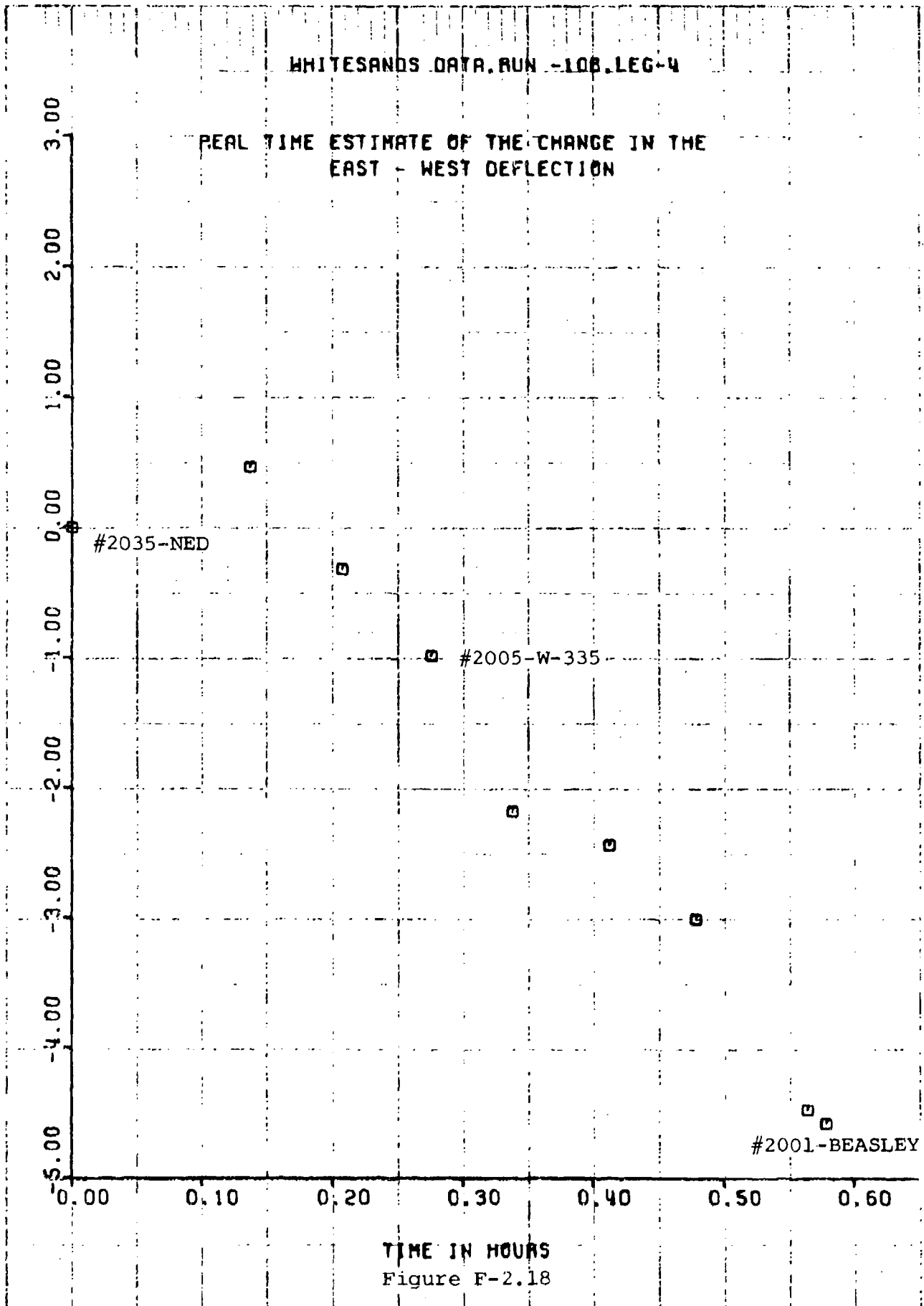
#2035-NED

#2005-W-335

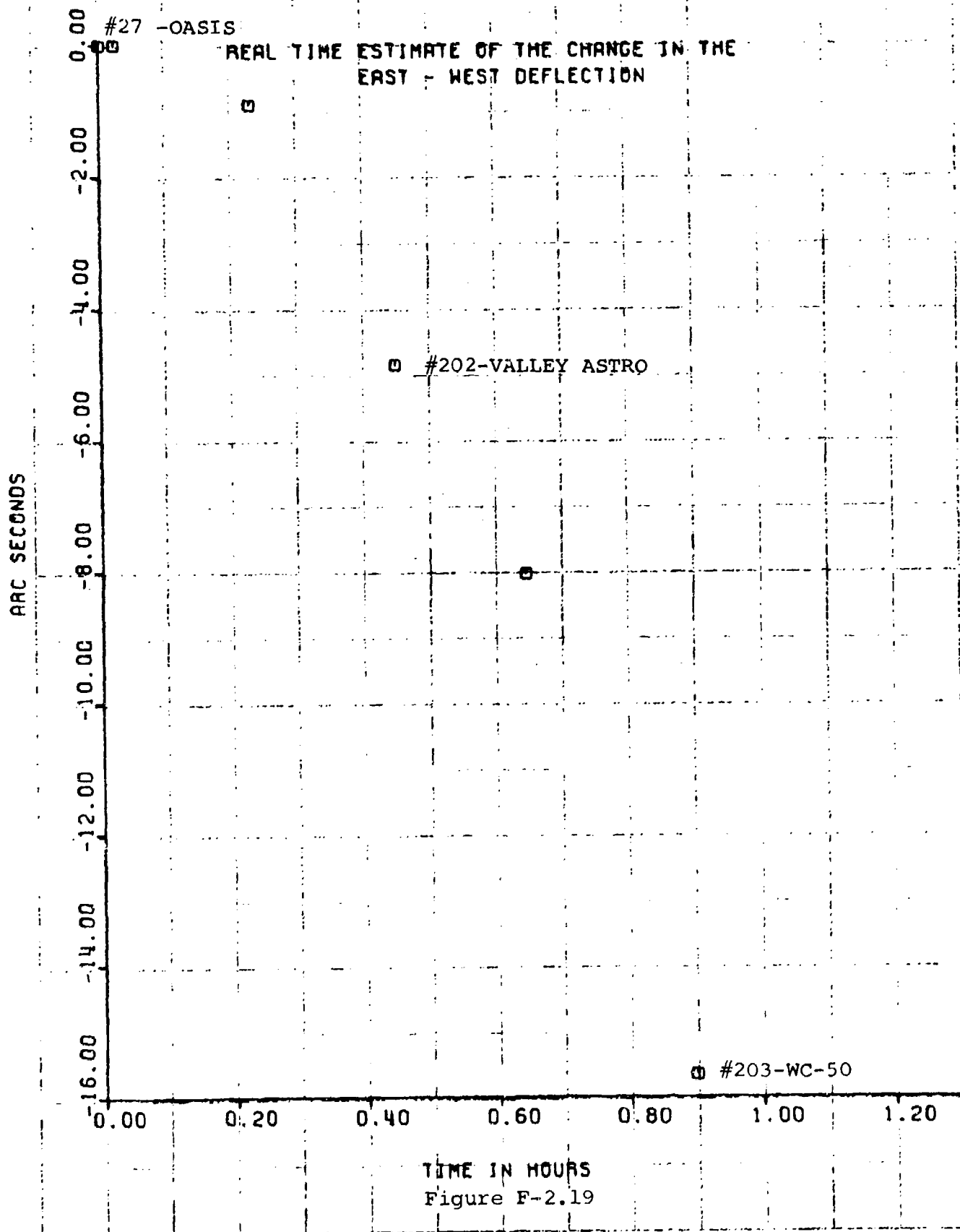
#2001-BEASLEY

0.00 0.10 0.20 0.30 0.40 0.50 0.60

TIME IN HOURS
Figure F-2.18

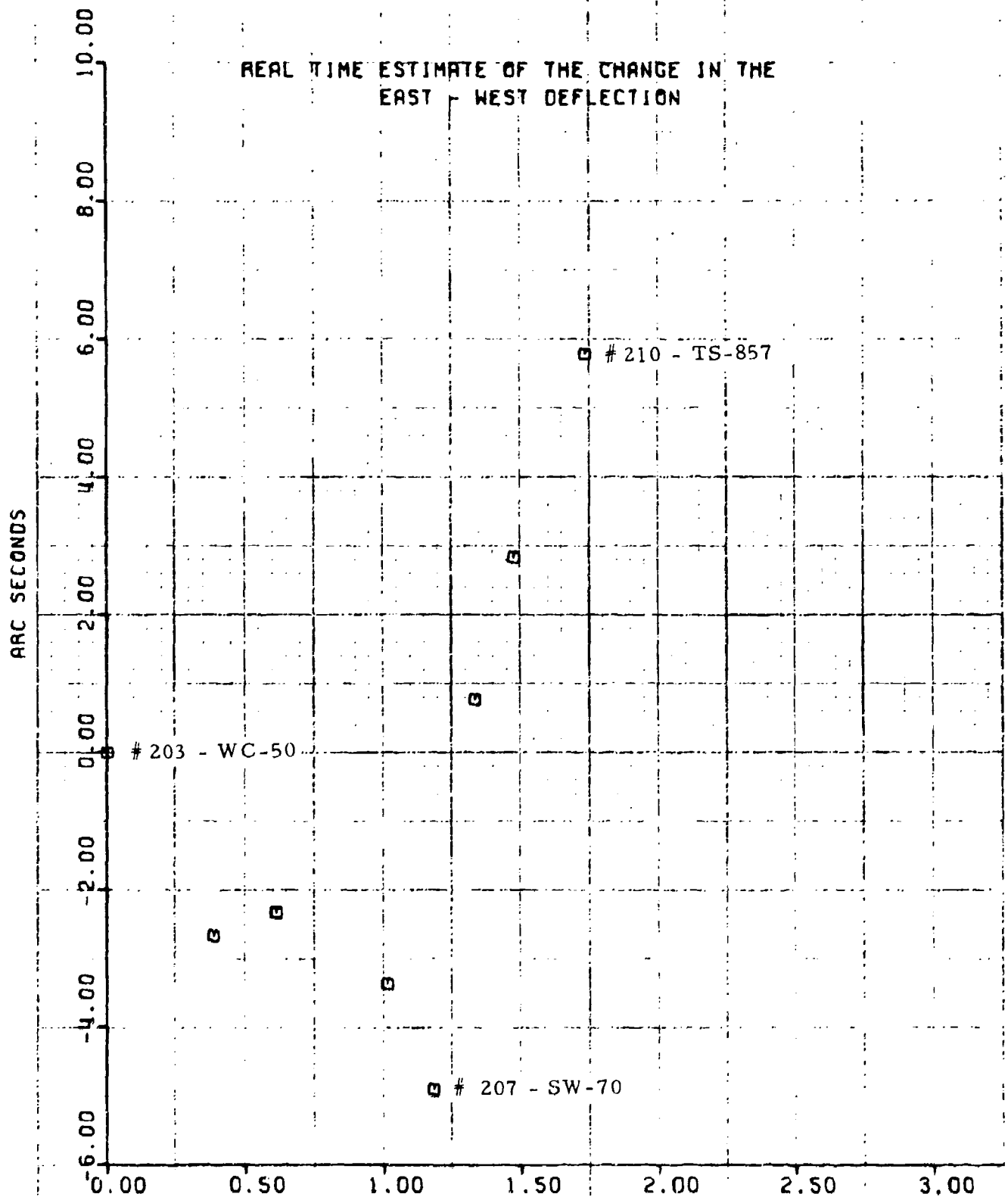


WHITESANDS DATA RUN -13A.LEG-1



WHITESANDS DATA, RUN -13B, LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-2.20

WHITESANDS DATA RUN -14A.LEG-1

REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00

#208-BASIN

#205-TS-204-2

#203-WC-50

S

S

S

0.00

0.20

0.40

0.60

0.80

1.00

1.20

TIME IN HOURS

Figure F-2.21

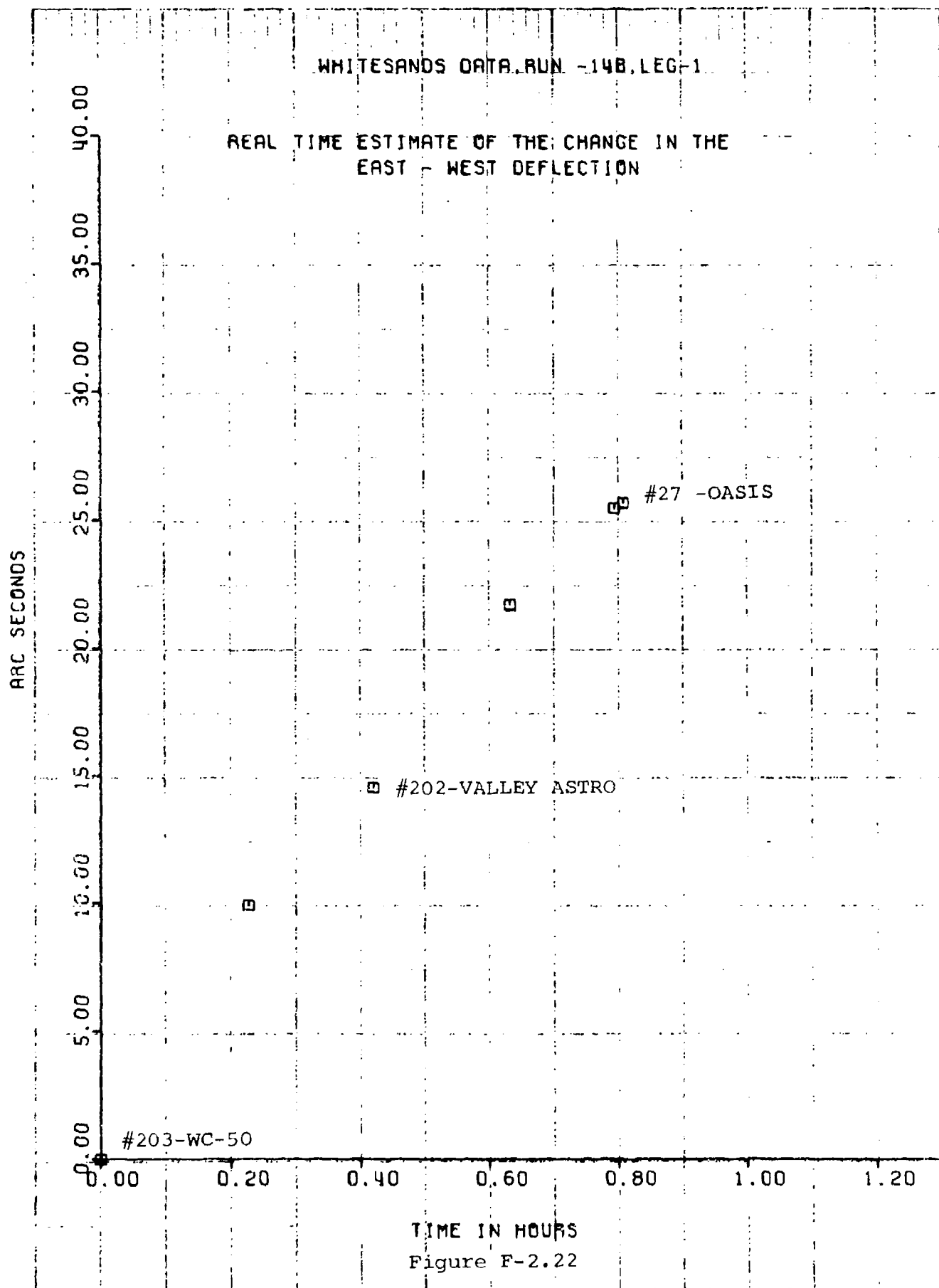
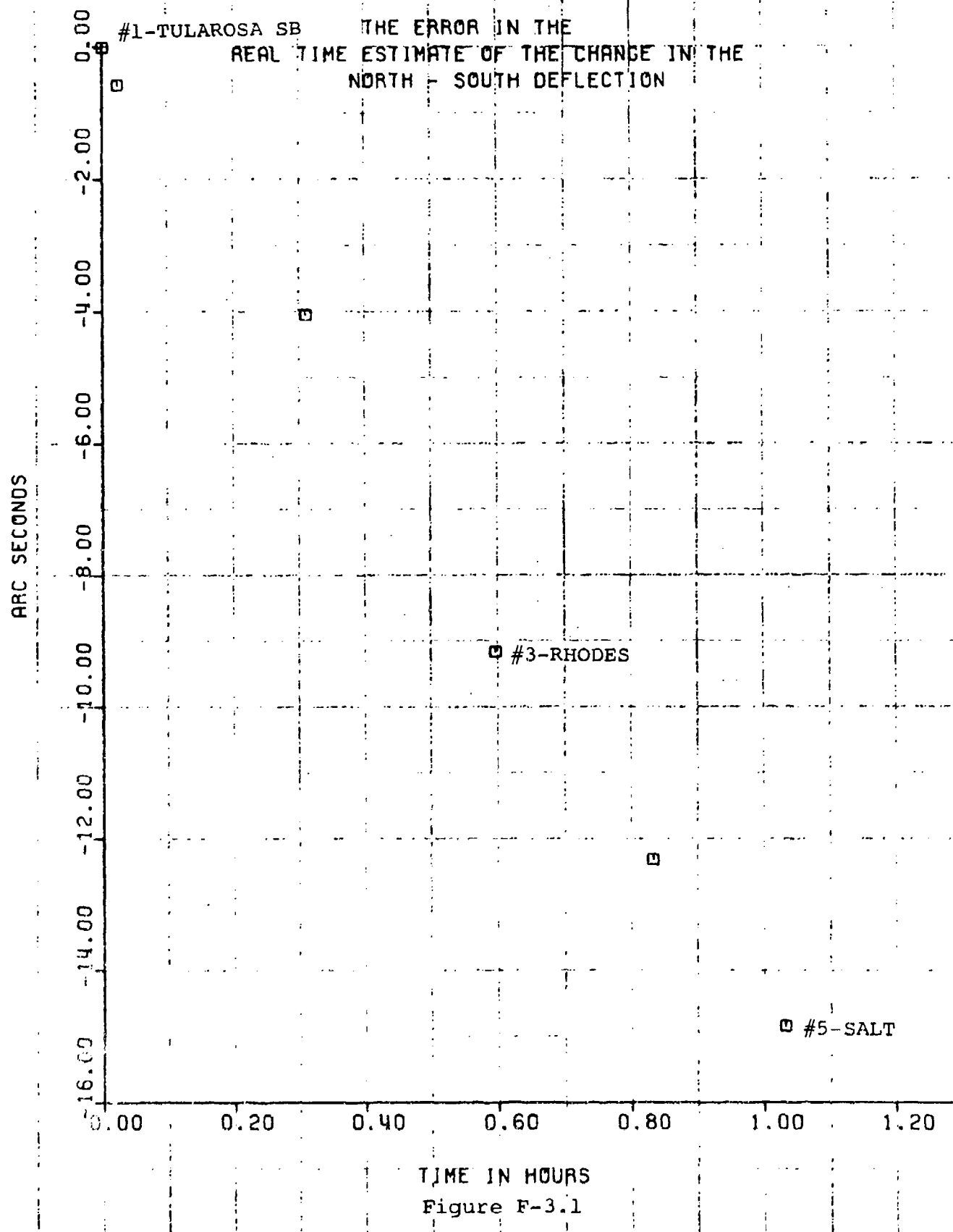


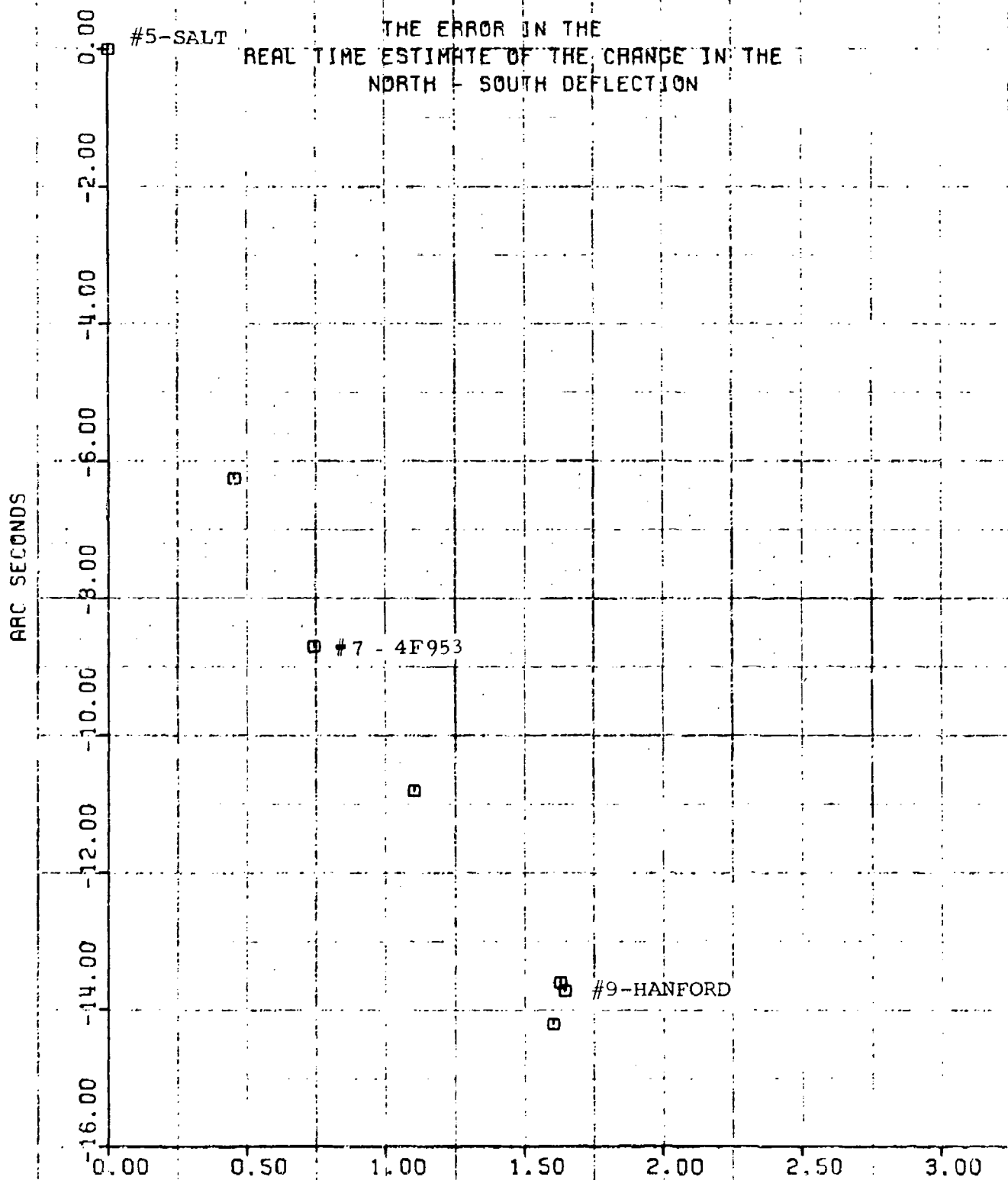
Figure F-2.22

WHITESANDS DATA, RUN - 3A, LEG-1



WHITESANDS DATA, RUN - 3B, LEG-1

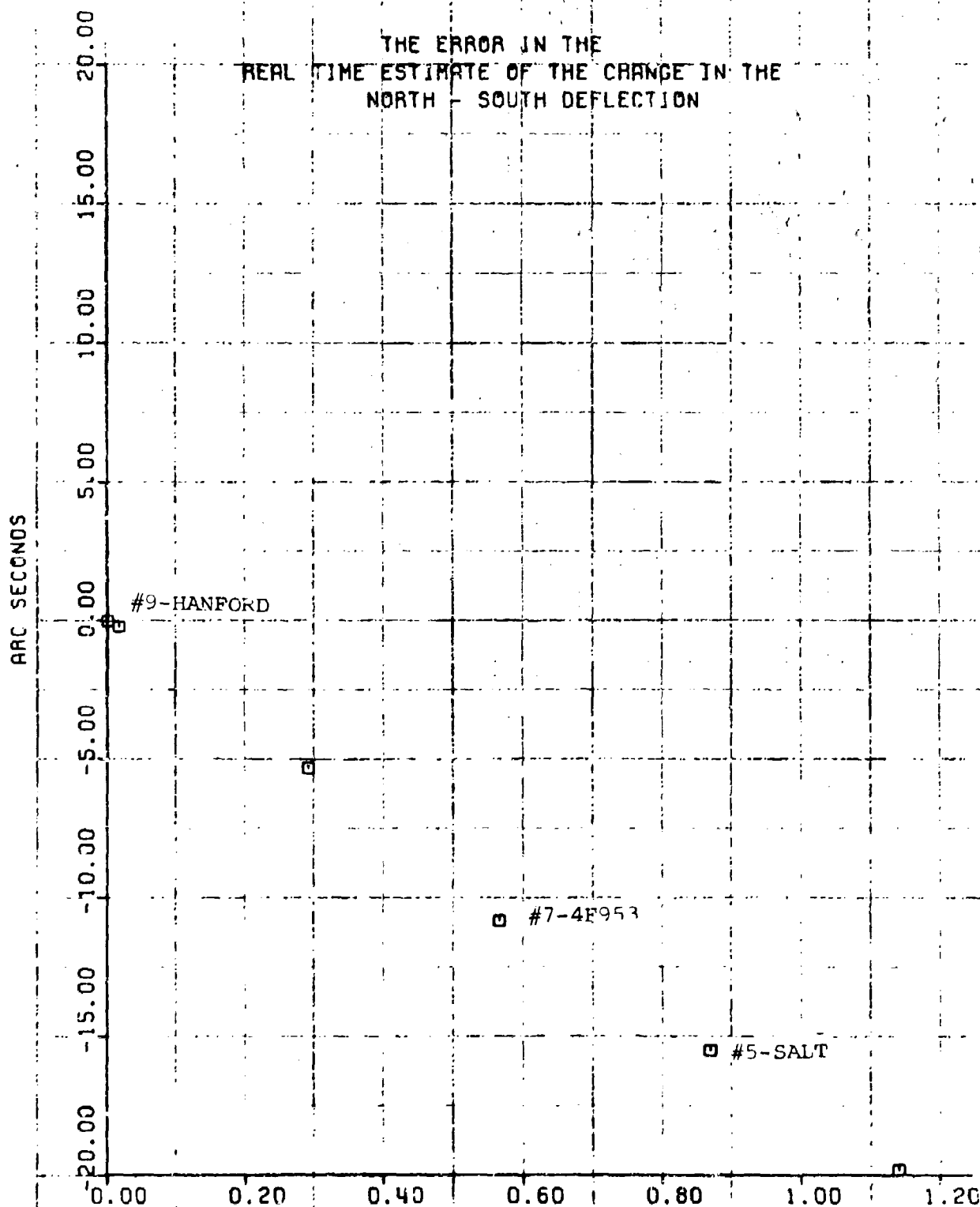
THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-3.2

WHITESANDS DATA RUN - WA.LEG-1

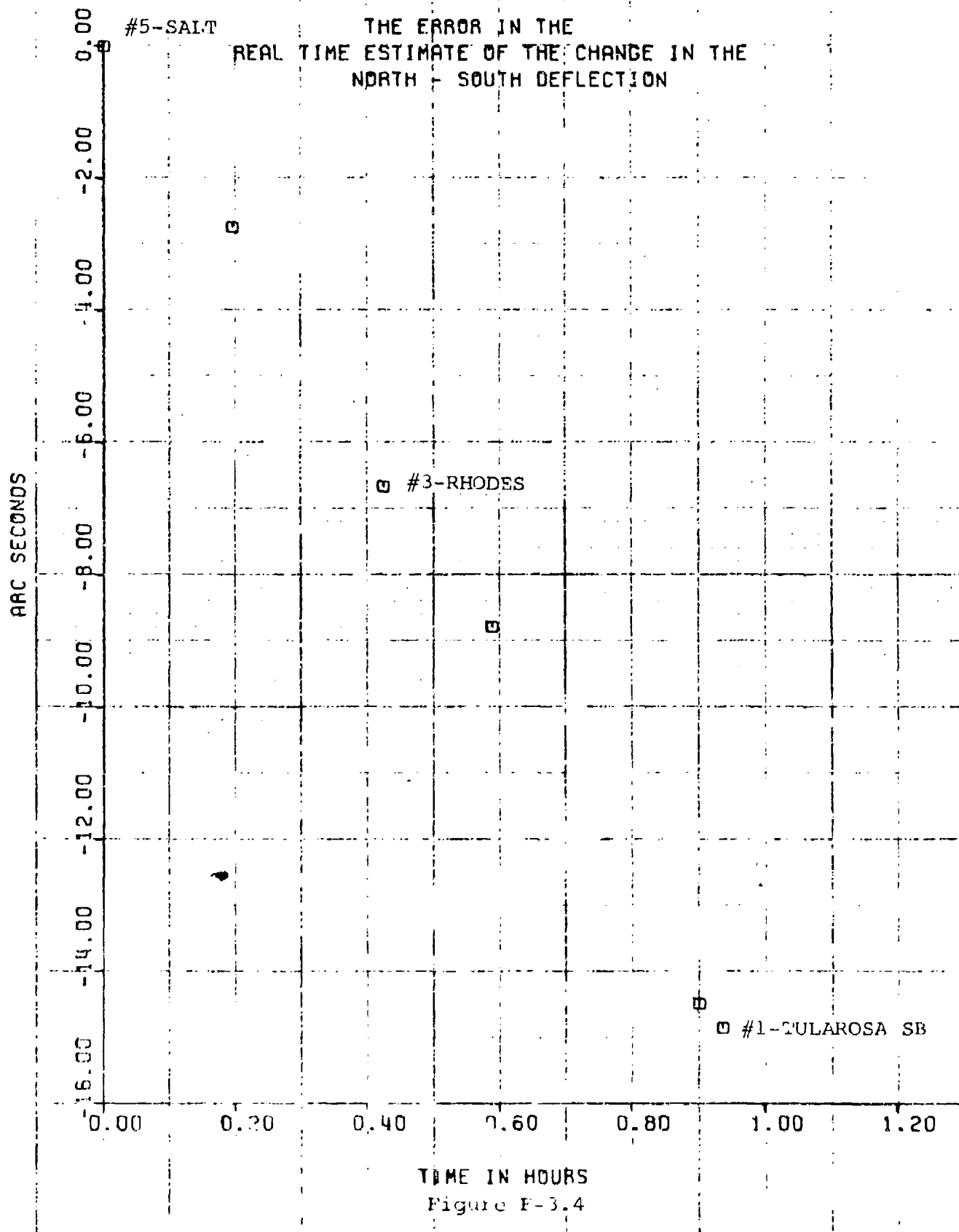
THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-3.3

WHITESANDS DATA RUN - WB.LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



WHITESANDS DATA, RUN - 3A, LEC-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#1-TULAROSA SB

#3-RHOES

#5-SALT

0.20

0.40

0.60

0.80

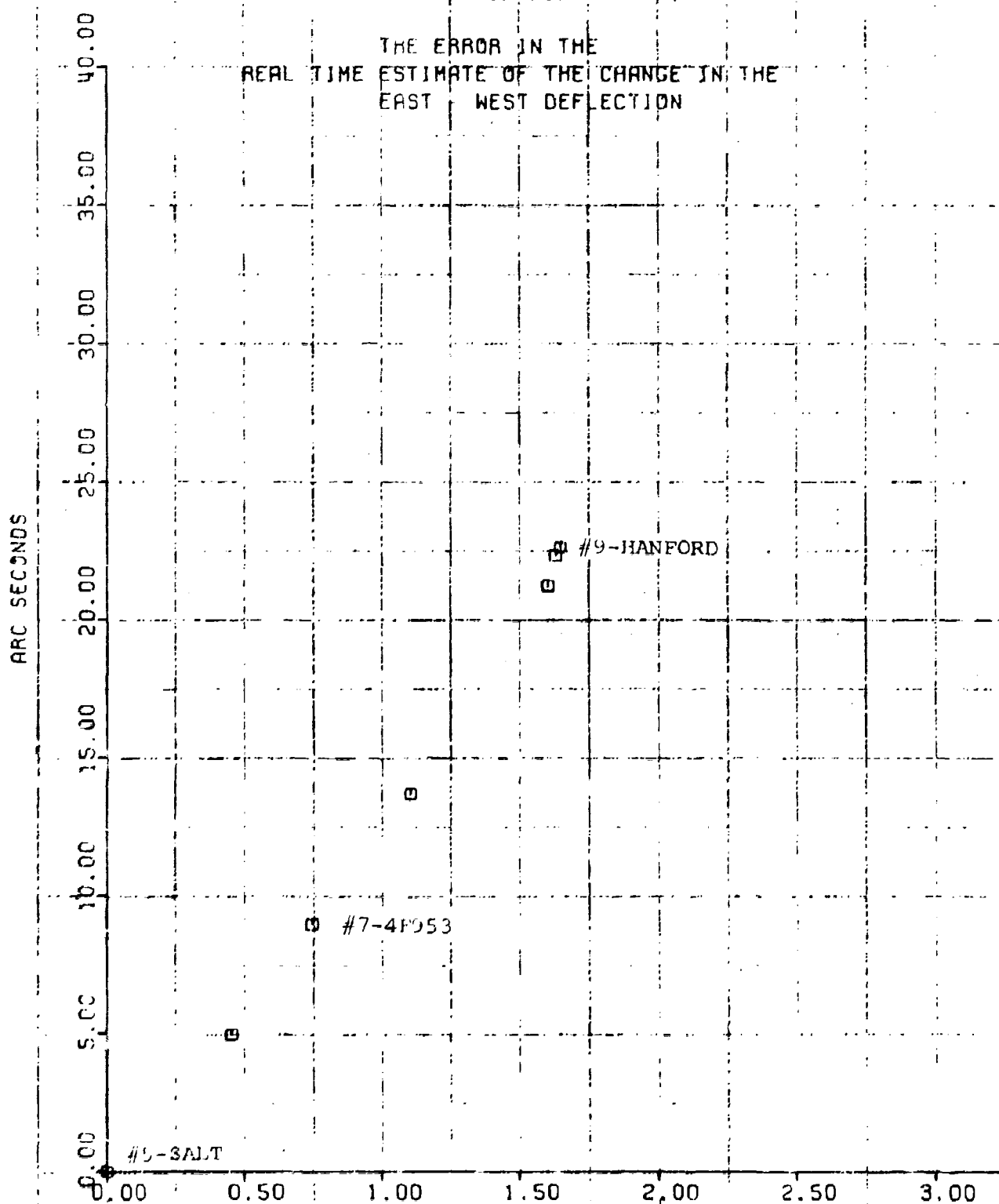
1.00

1.20

TIME IN HOURS
Figure F-4.1

WHITESANDS DATA RUN - 3B.LEG-1

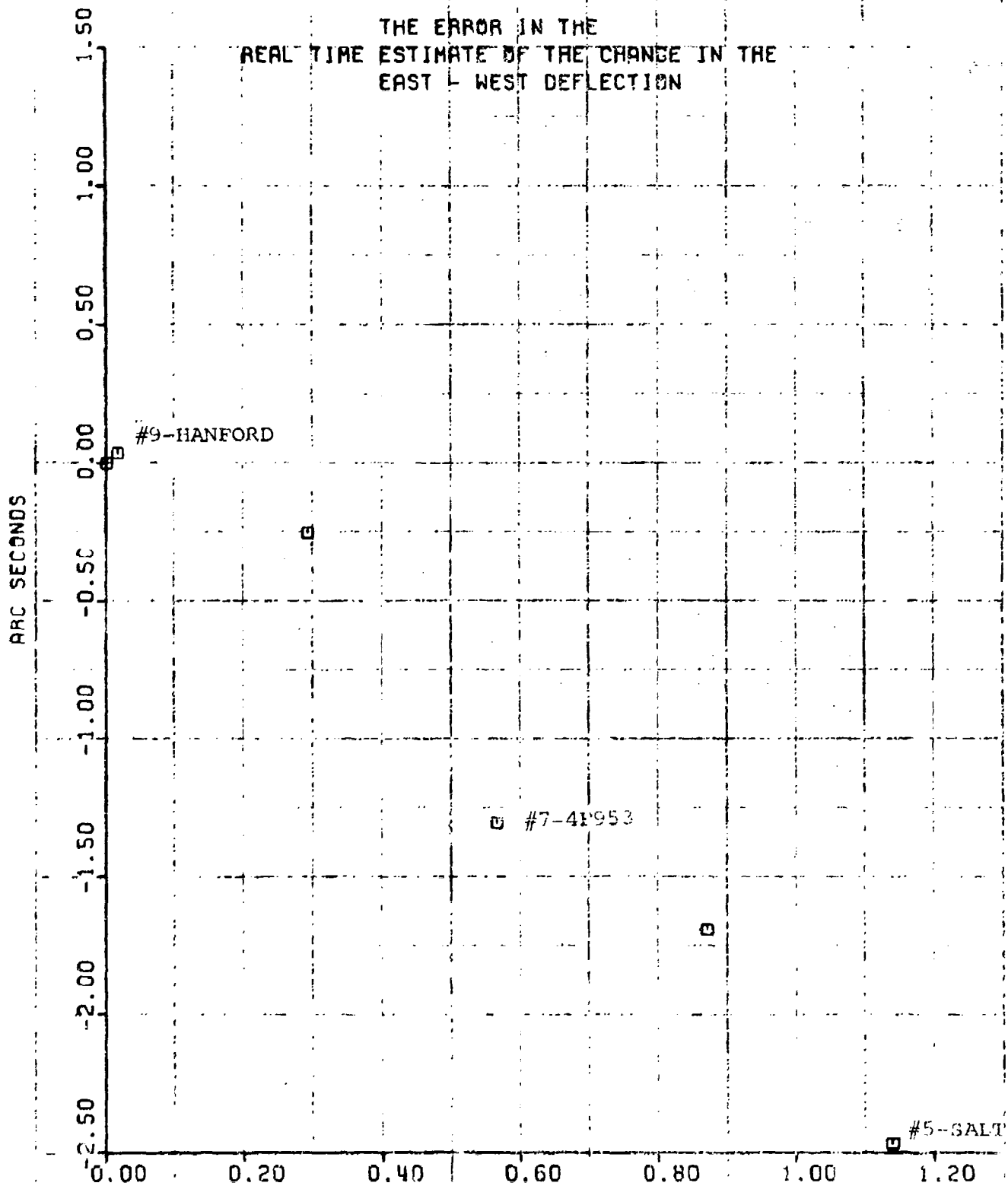
THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST WEST DEFLECTION



TIME IN HOURS
Figure F-4.2

WHITESANDS DATA, RUN - 4A, LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-4.3

WHITESANDS DATA.RUN - UB.LEG-1

THE ERROR IN THE
REAL TIME ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

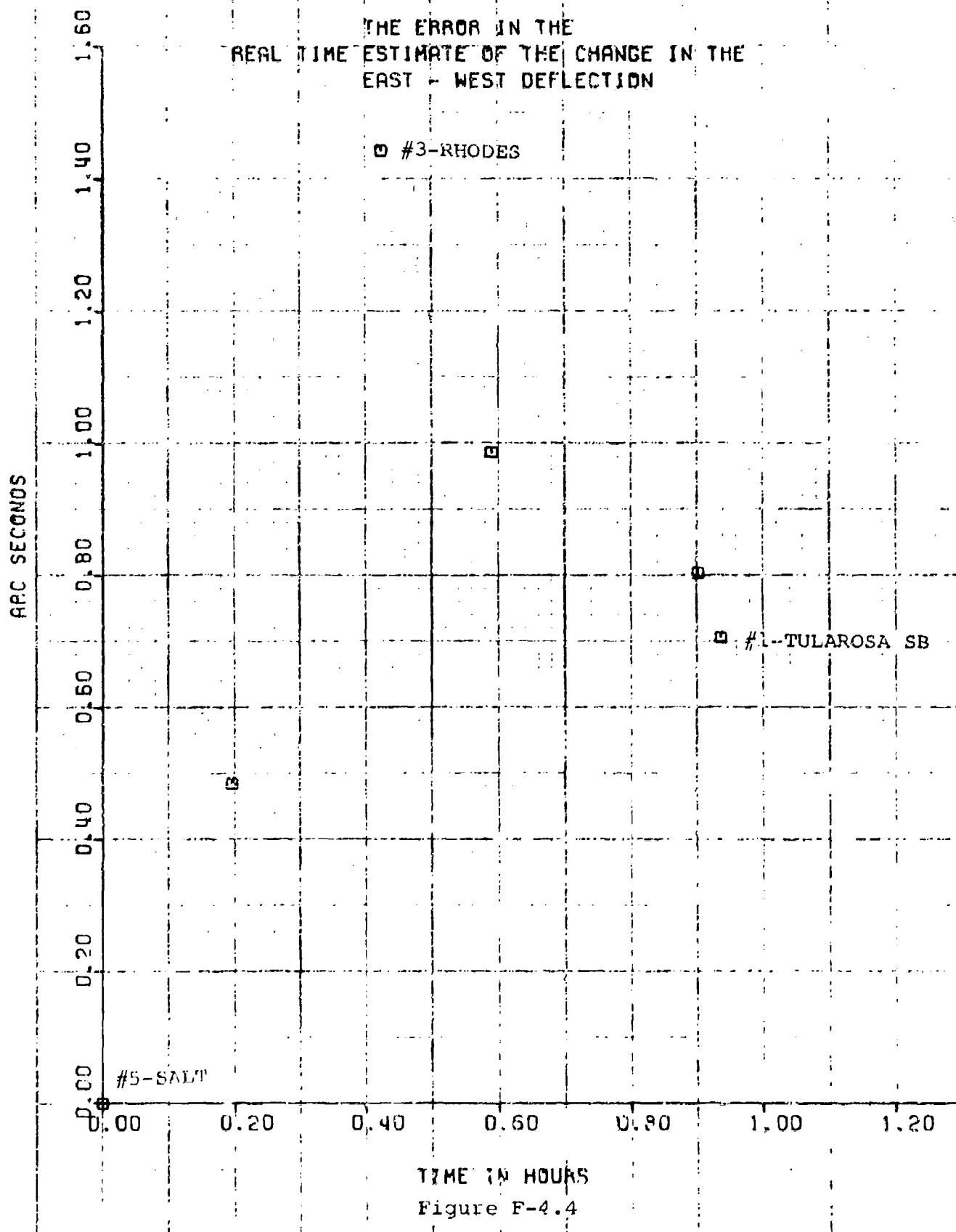
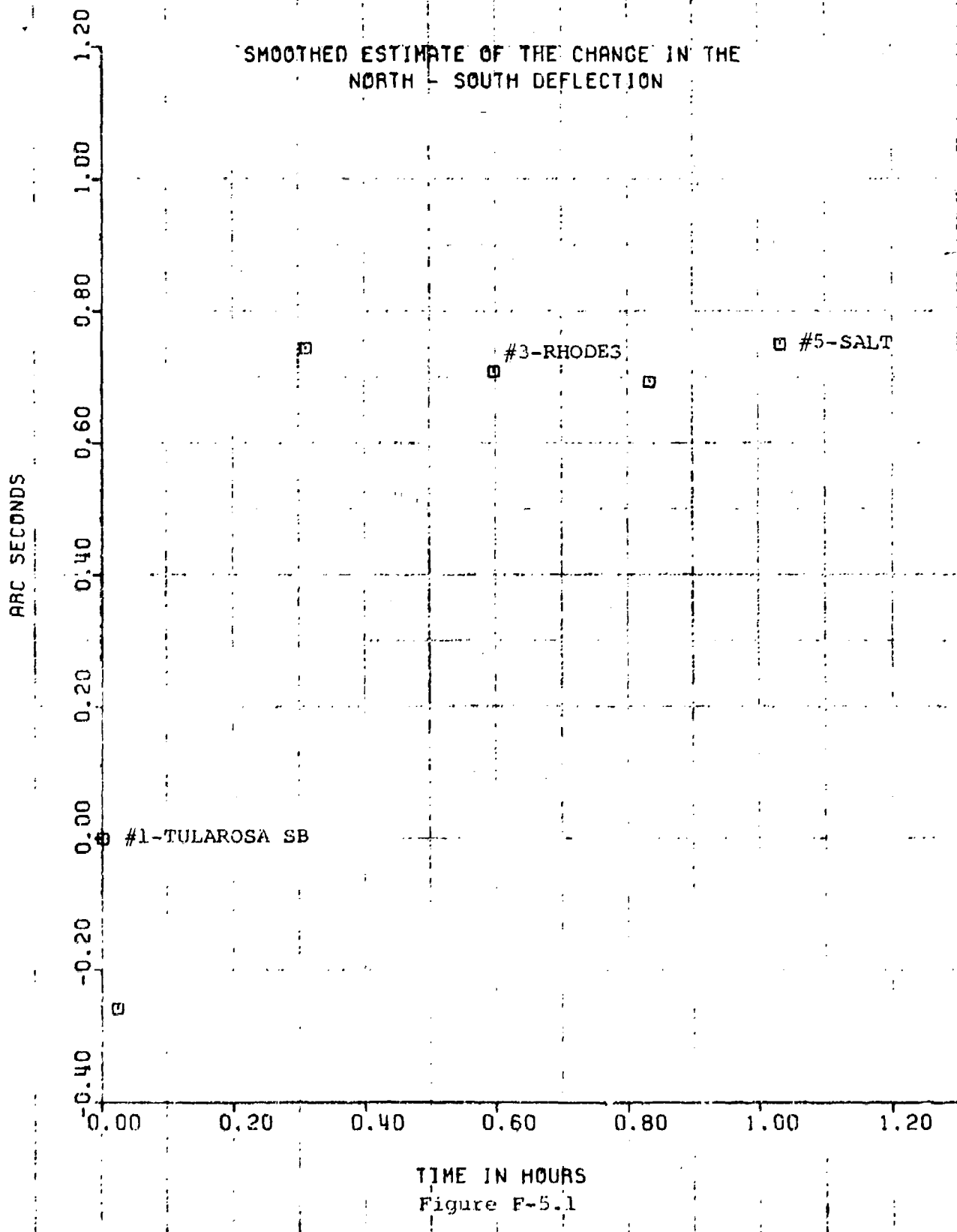


Figure F-4.4

WHITESANDS DATA, RUN - 3A, LEG-1

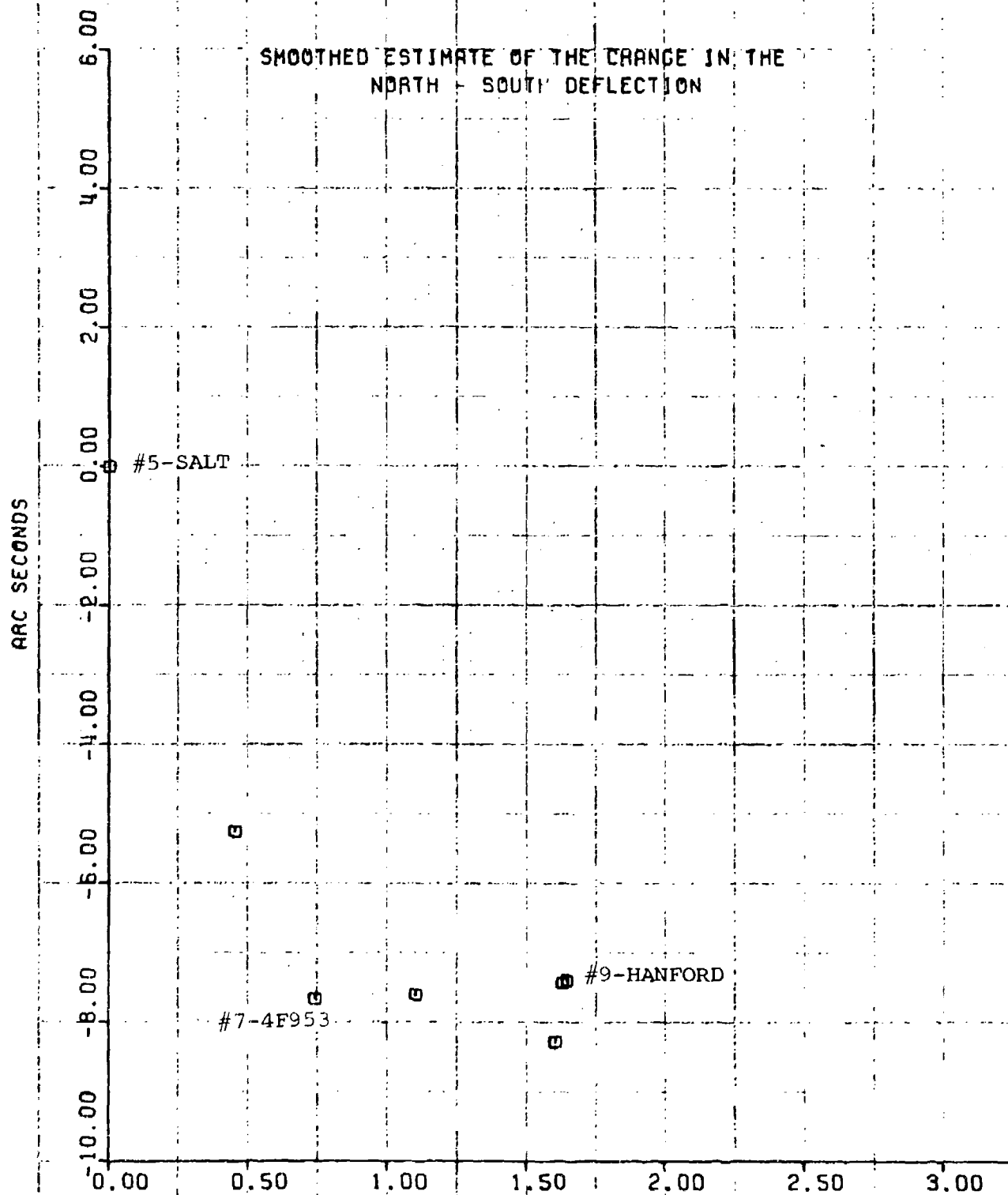
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-5.1

WHITESANDS DATA, RUN - 3B, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

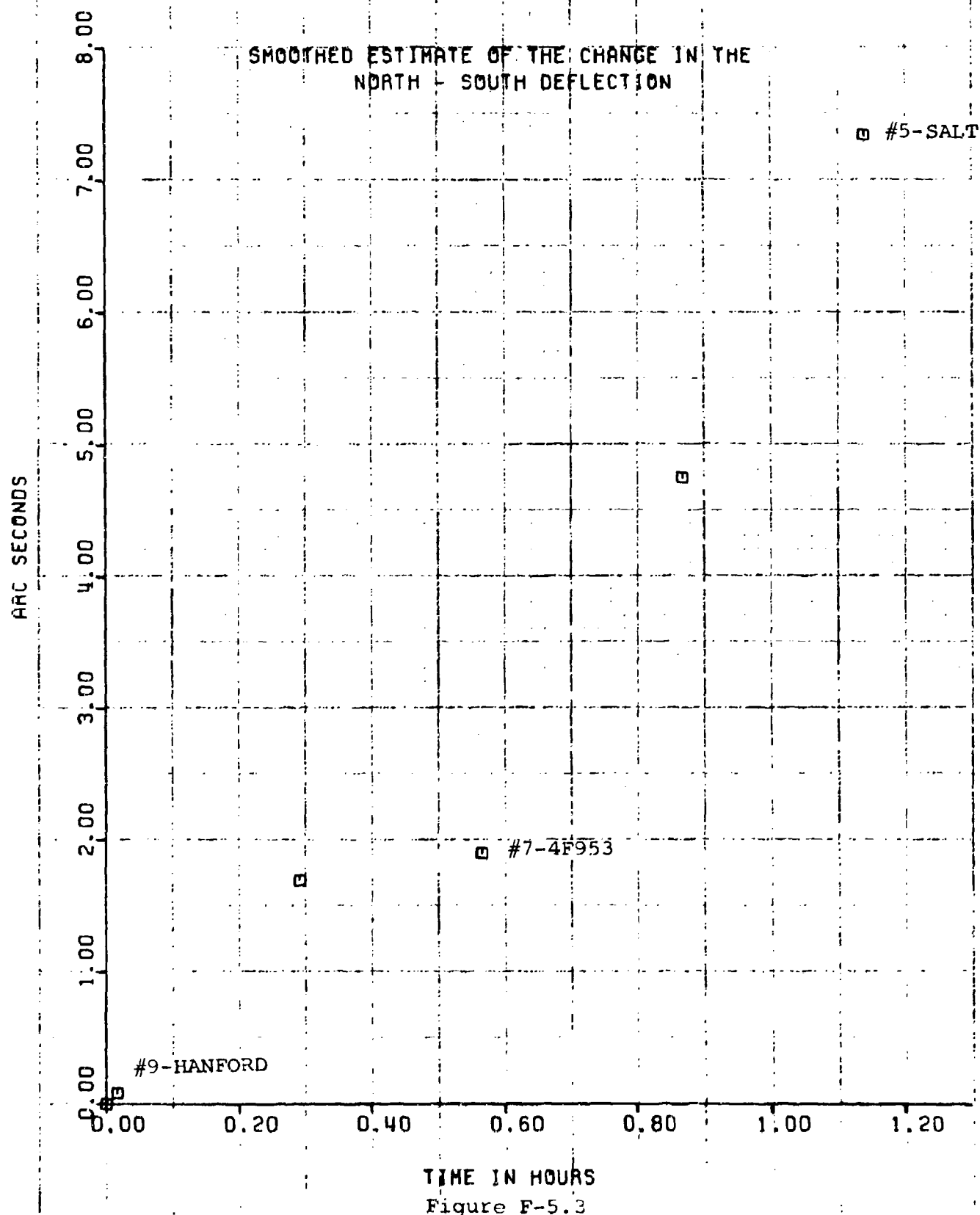


TIME IN HOURS

Figure F-5.2

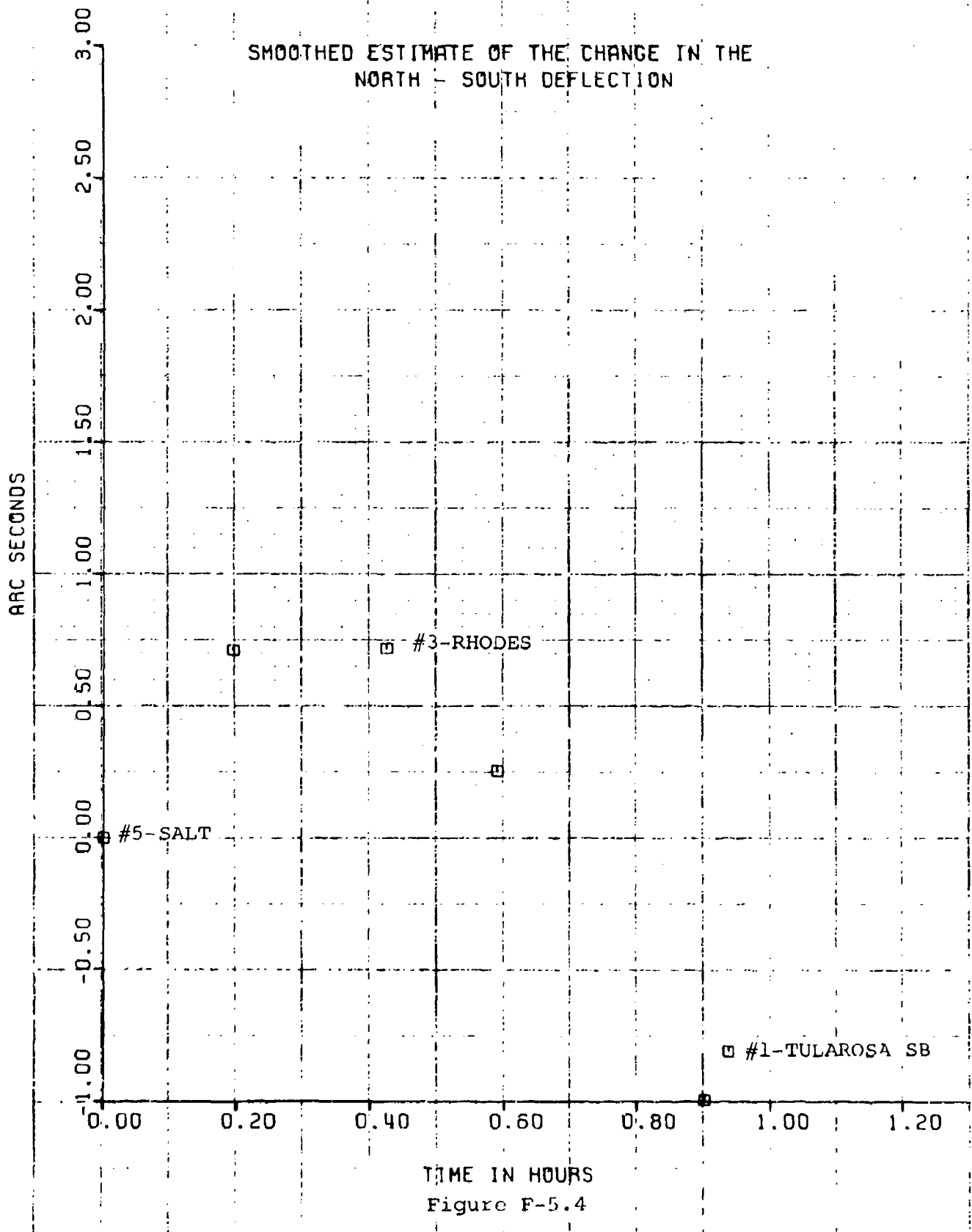
WHITESANDS DATA RUN - 4A, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



WHITESANDS DATA, RUN - 4B, LEG-1

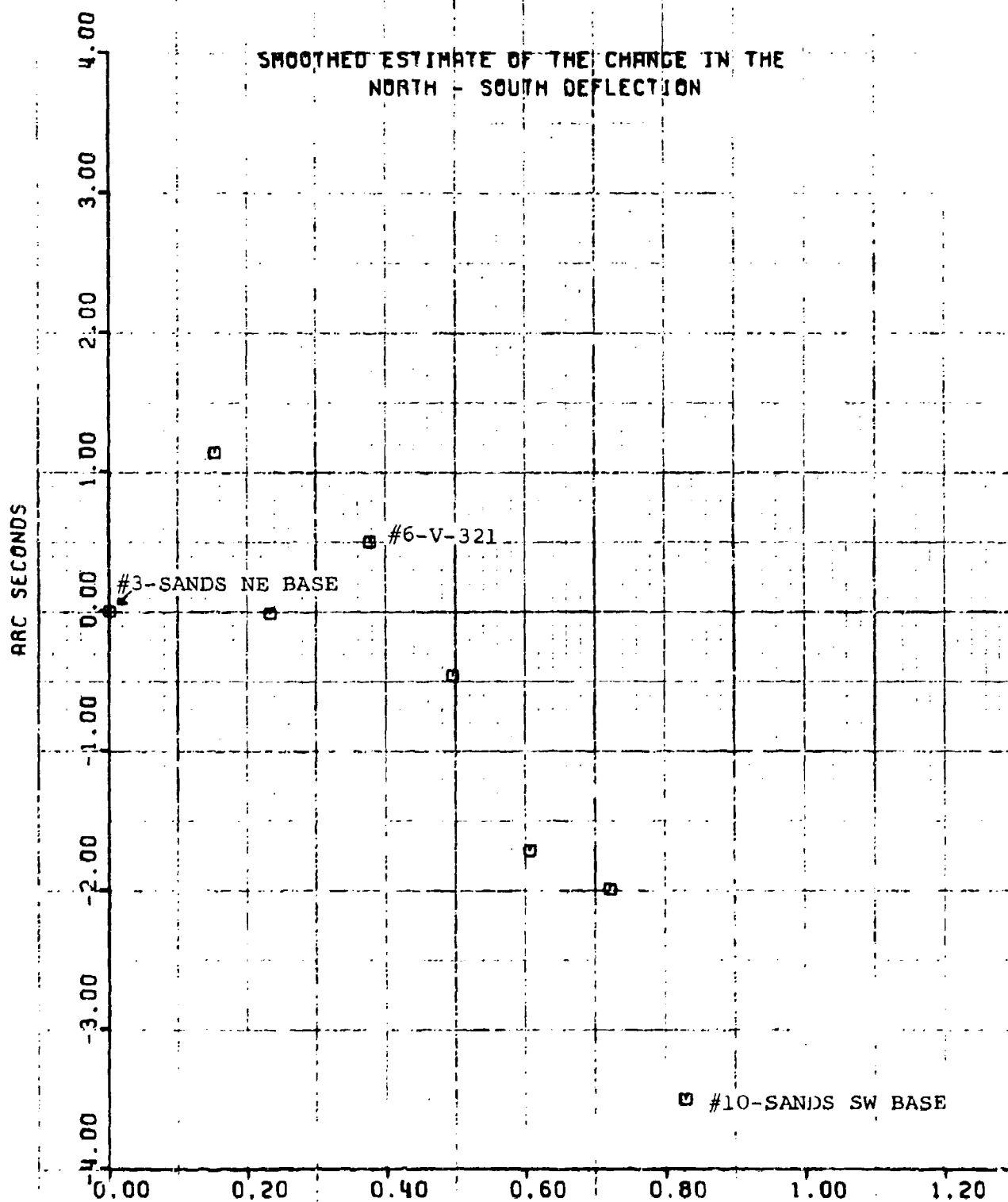
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-5.4

WHITESANDS DATA.RUN - 1A.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS

Figure F-5.5

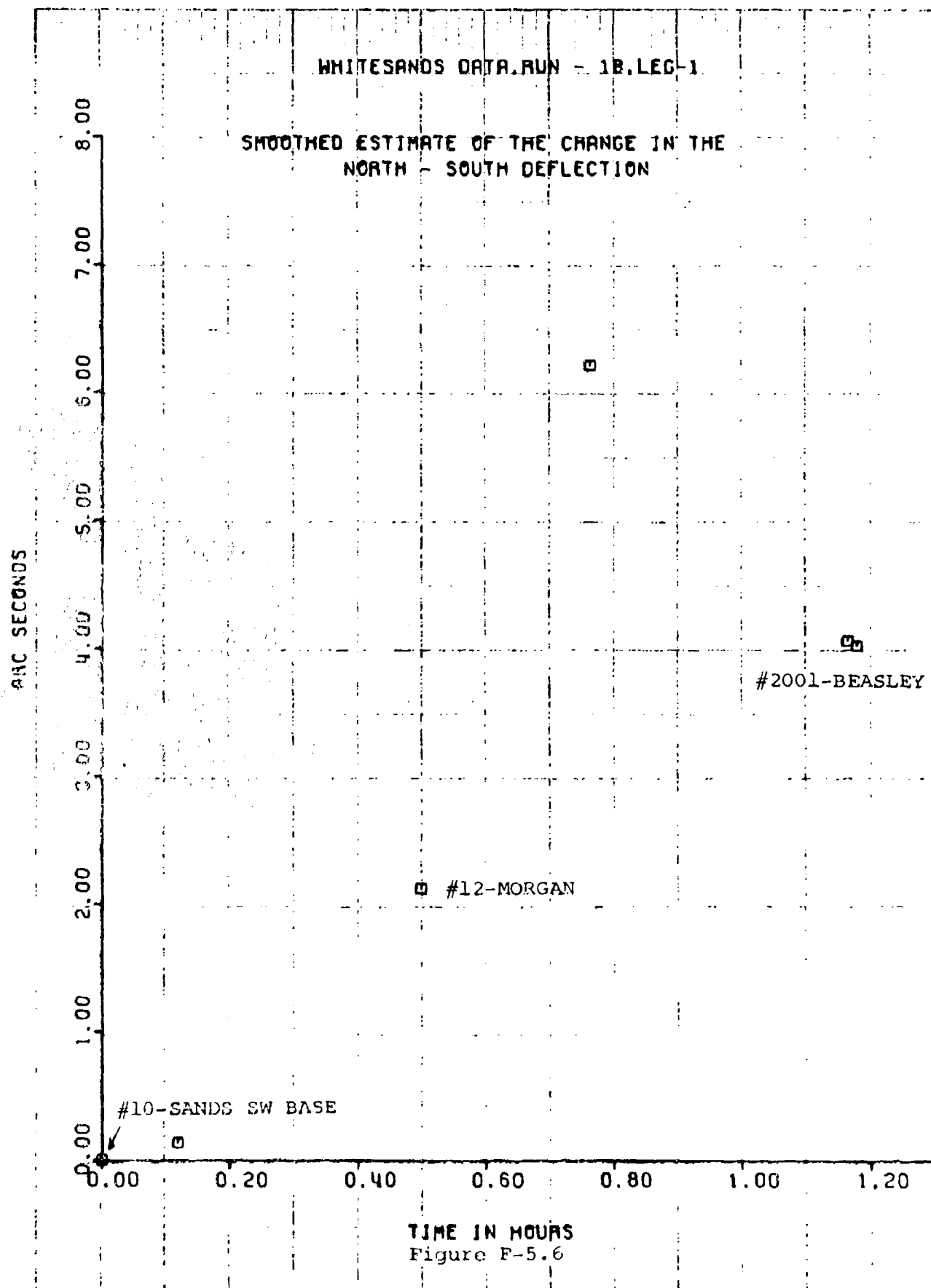
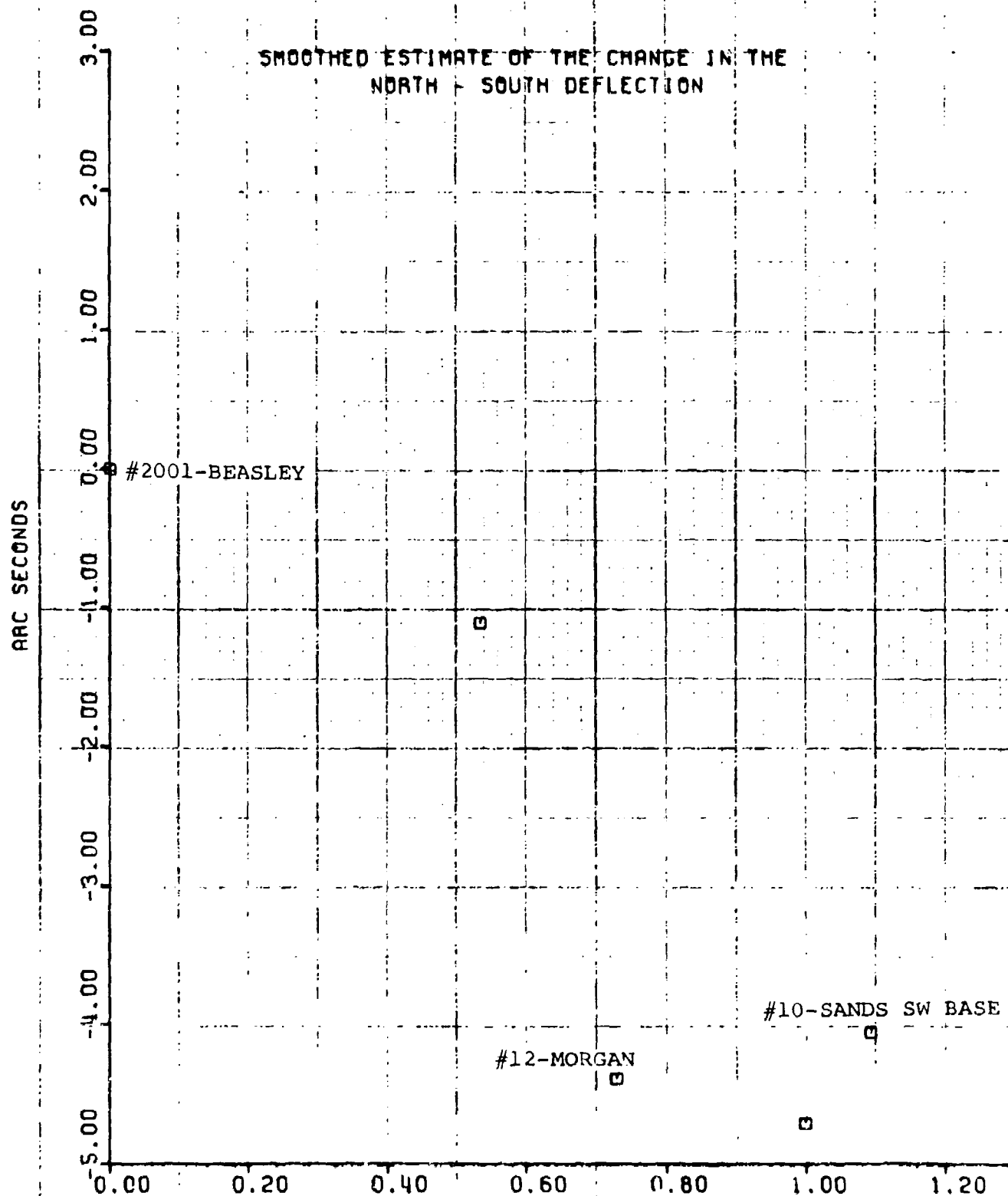


Figure F-5.6

WHITESANDS DATA.RUN - 2A,LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS

Figure F-5.7

WHITESANDS DATA RUN - 2B.LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS

4.00

3.50

3.00

2.50

2.00

1.50

1.00

0.50

0.00

#10-SANDS SW BASE

#6-V-321

#3-SANDS NE BASE

0.00

0.20

0.40

0.60

0.80

1.00

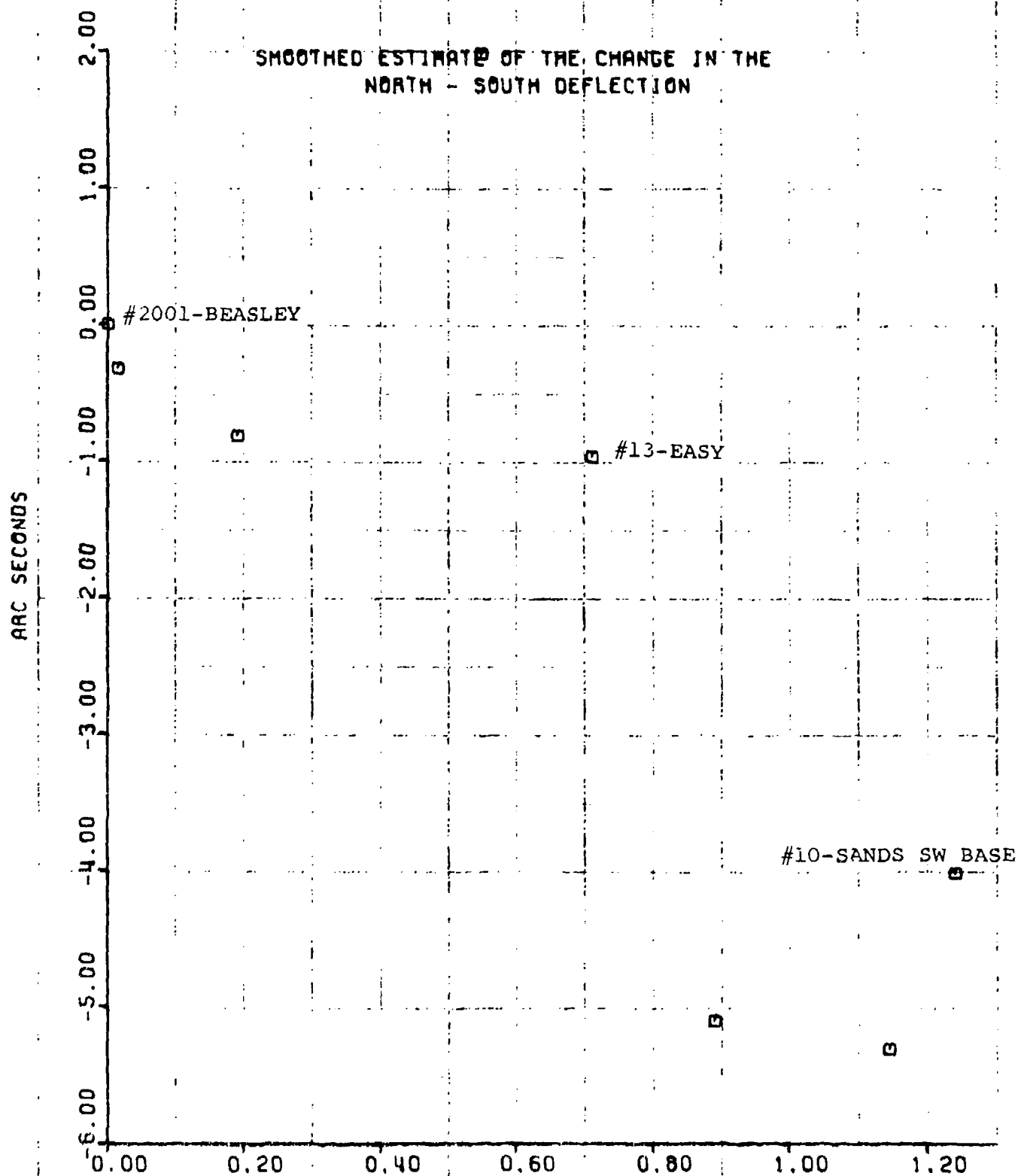
1.20

TIME IN HOURS

Figure F-5.8

WHITESANDS DATA.RUN - 8A.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F 5.9

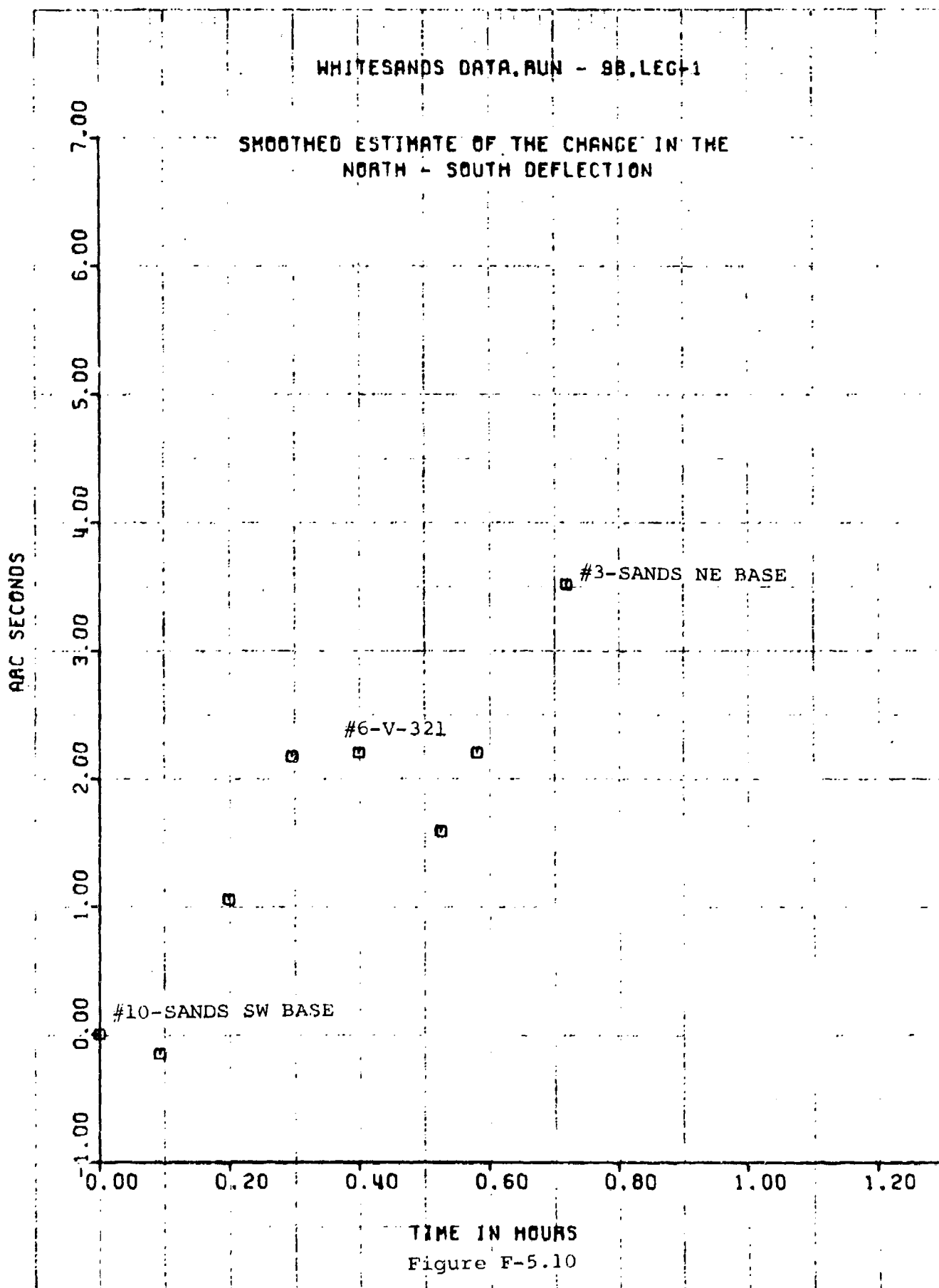


Figure F-5.10

WHITESANDS DATA.RUN - 2A.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

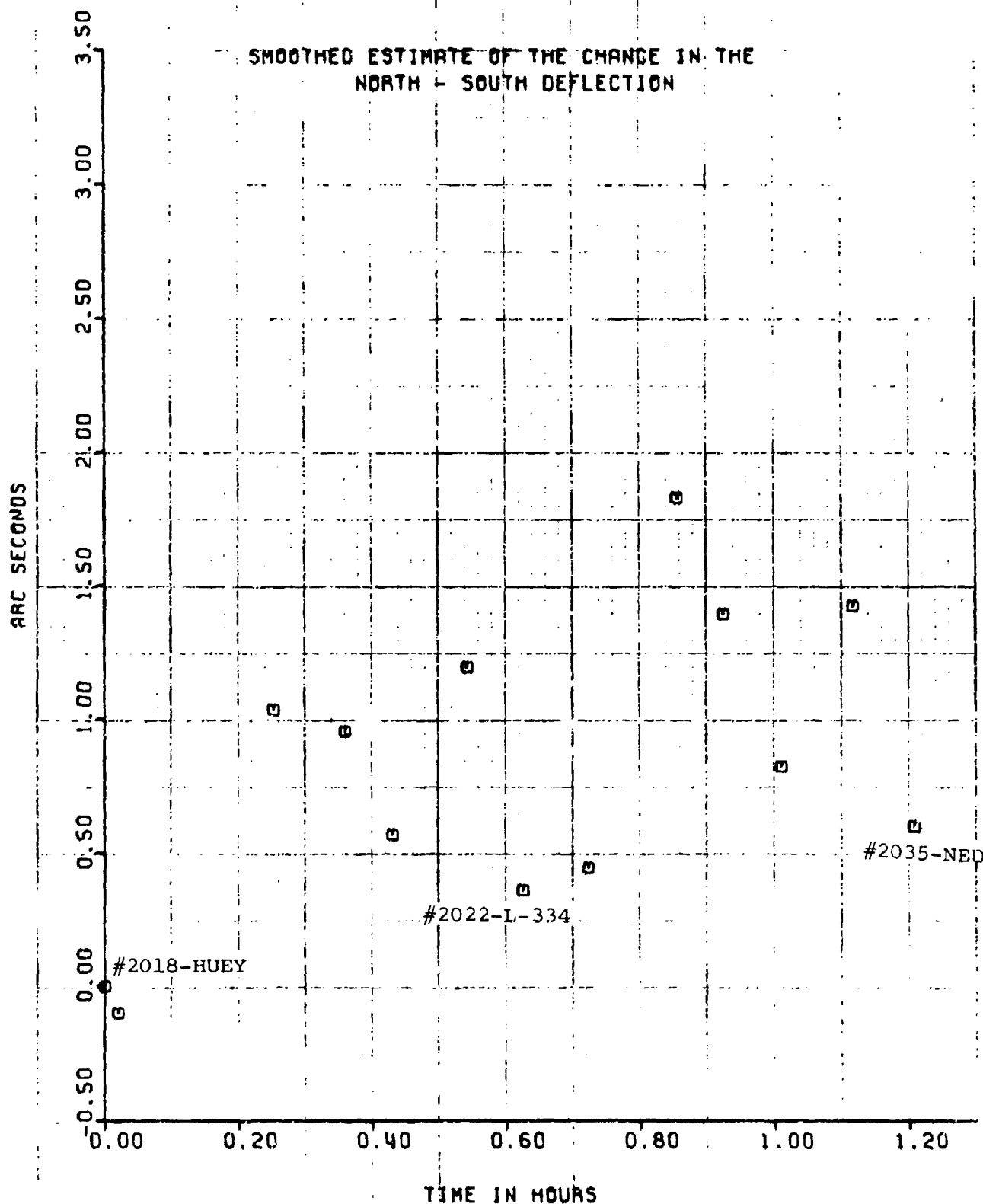
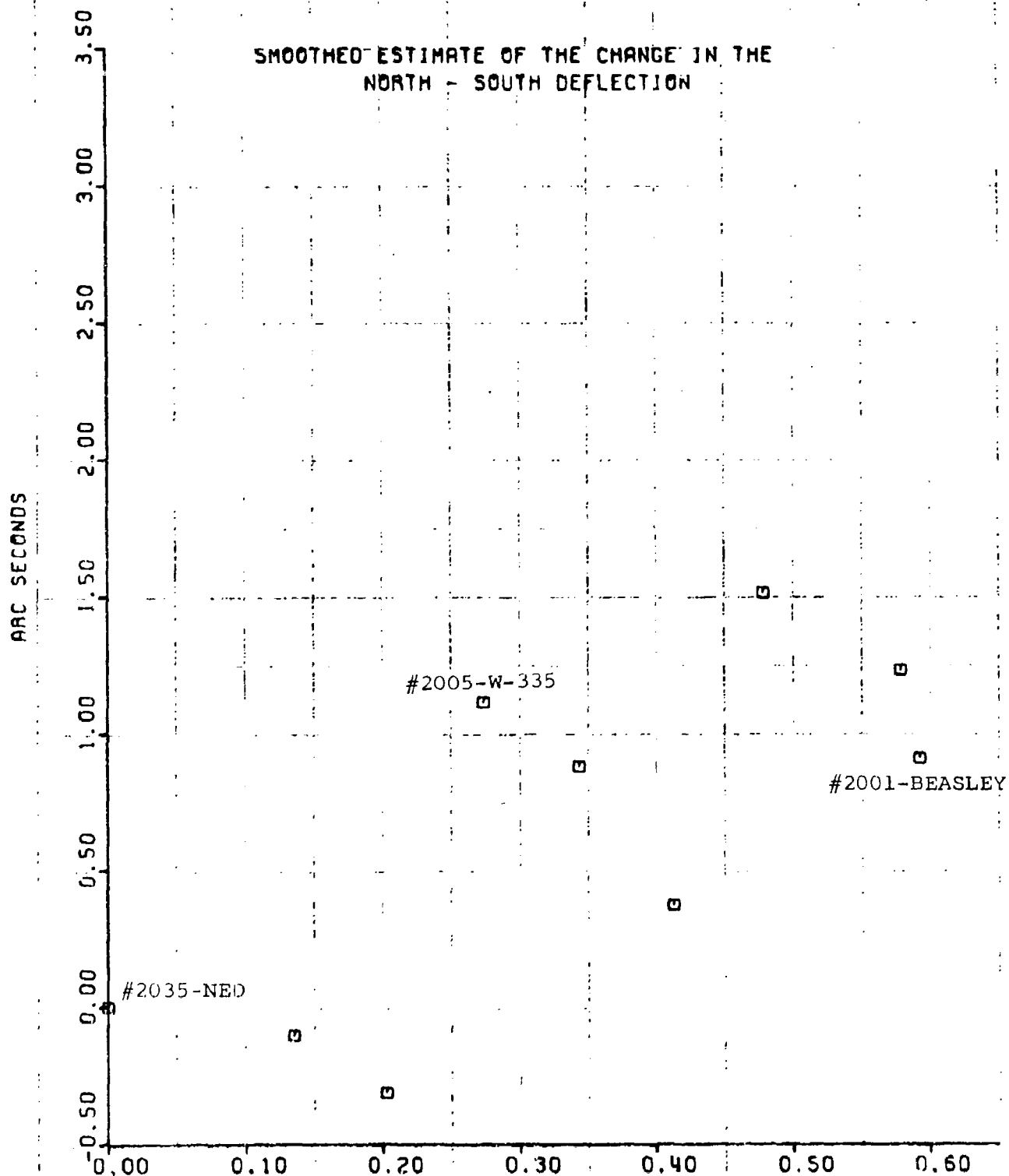


Figure F-5.11

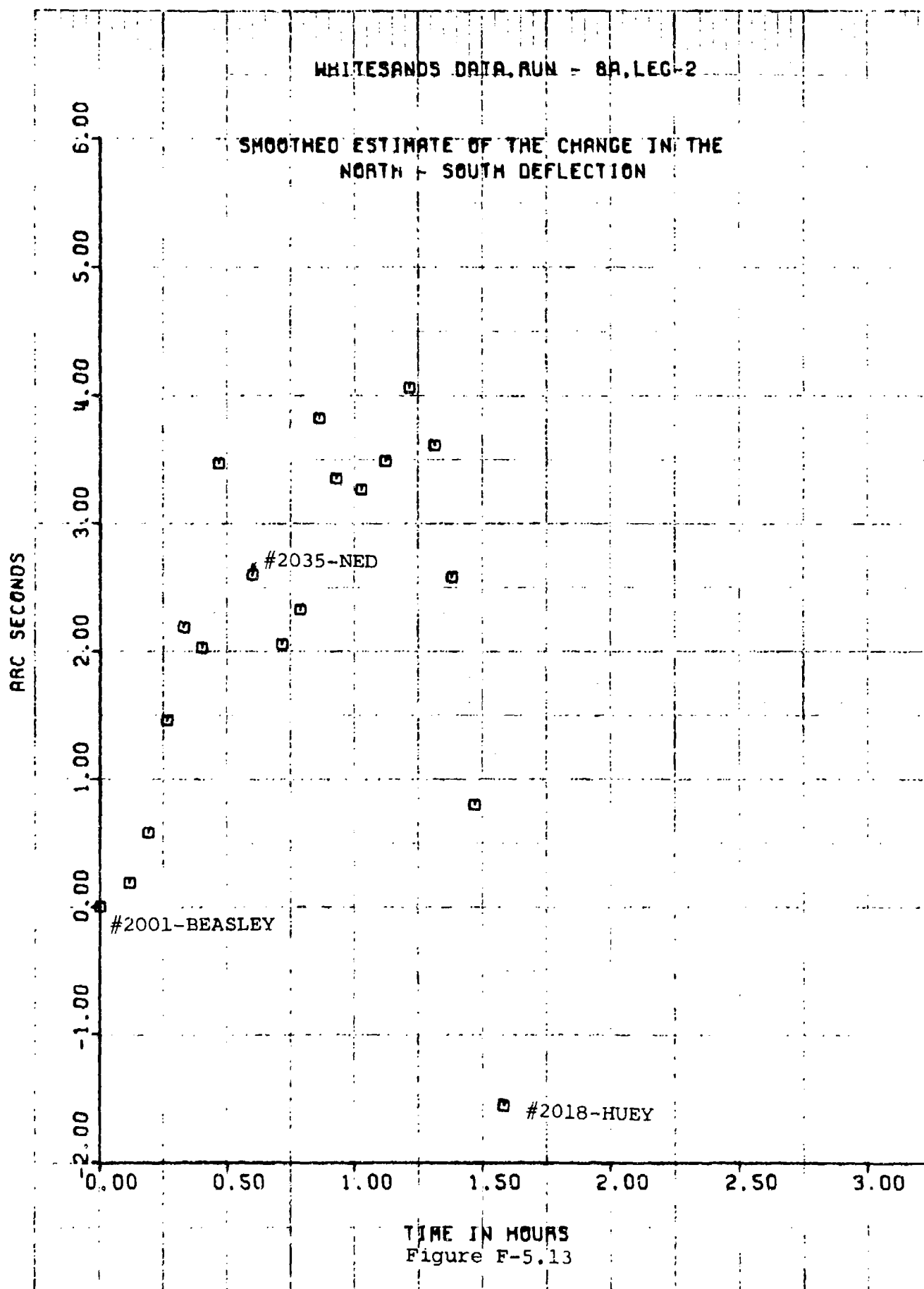
WHITESANDS DATA, RUN - 2B, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS

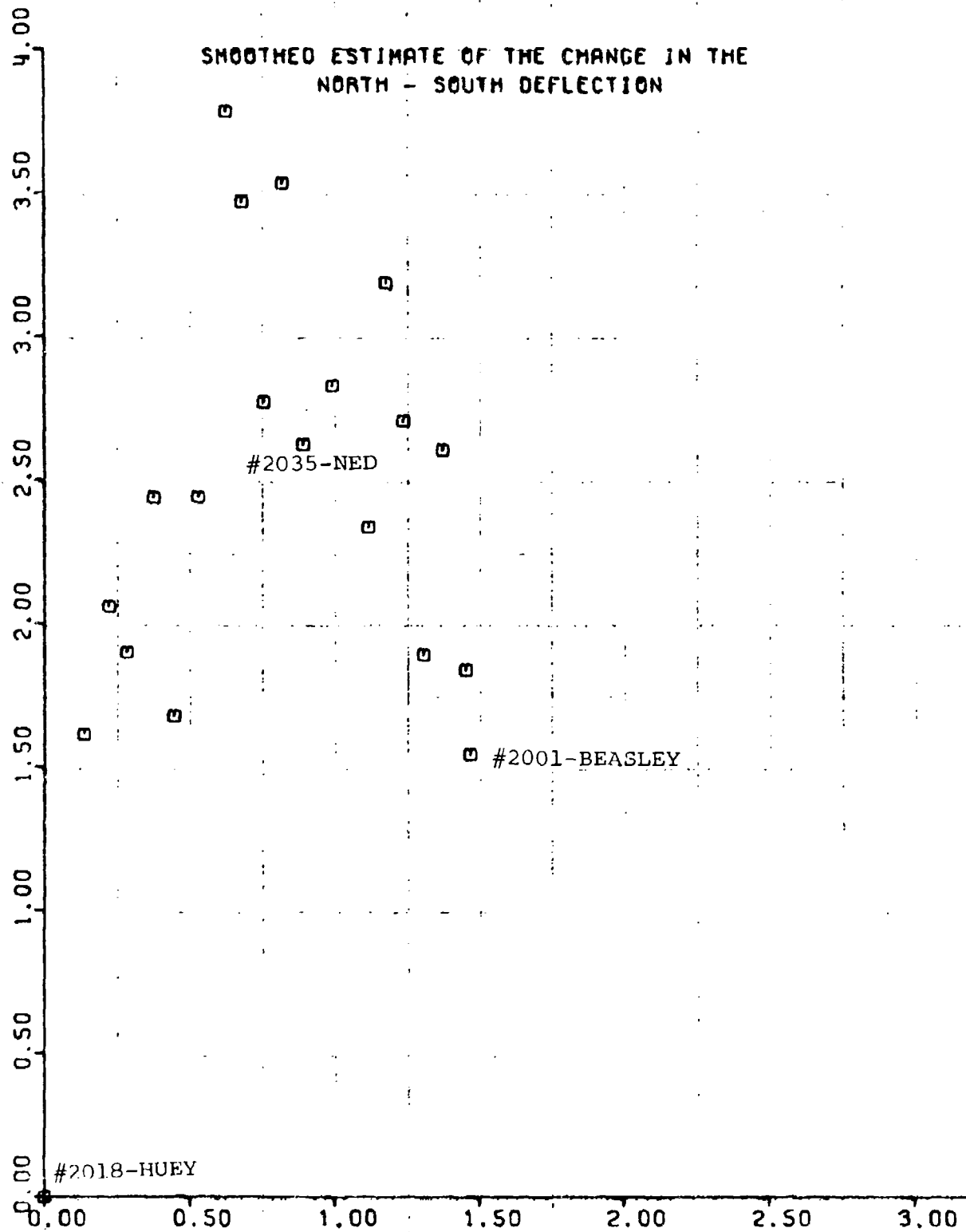
Figure F-5.12



WHITESANDS DATA.RUN - 88.LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

ARC SECONDS



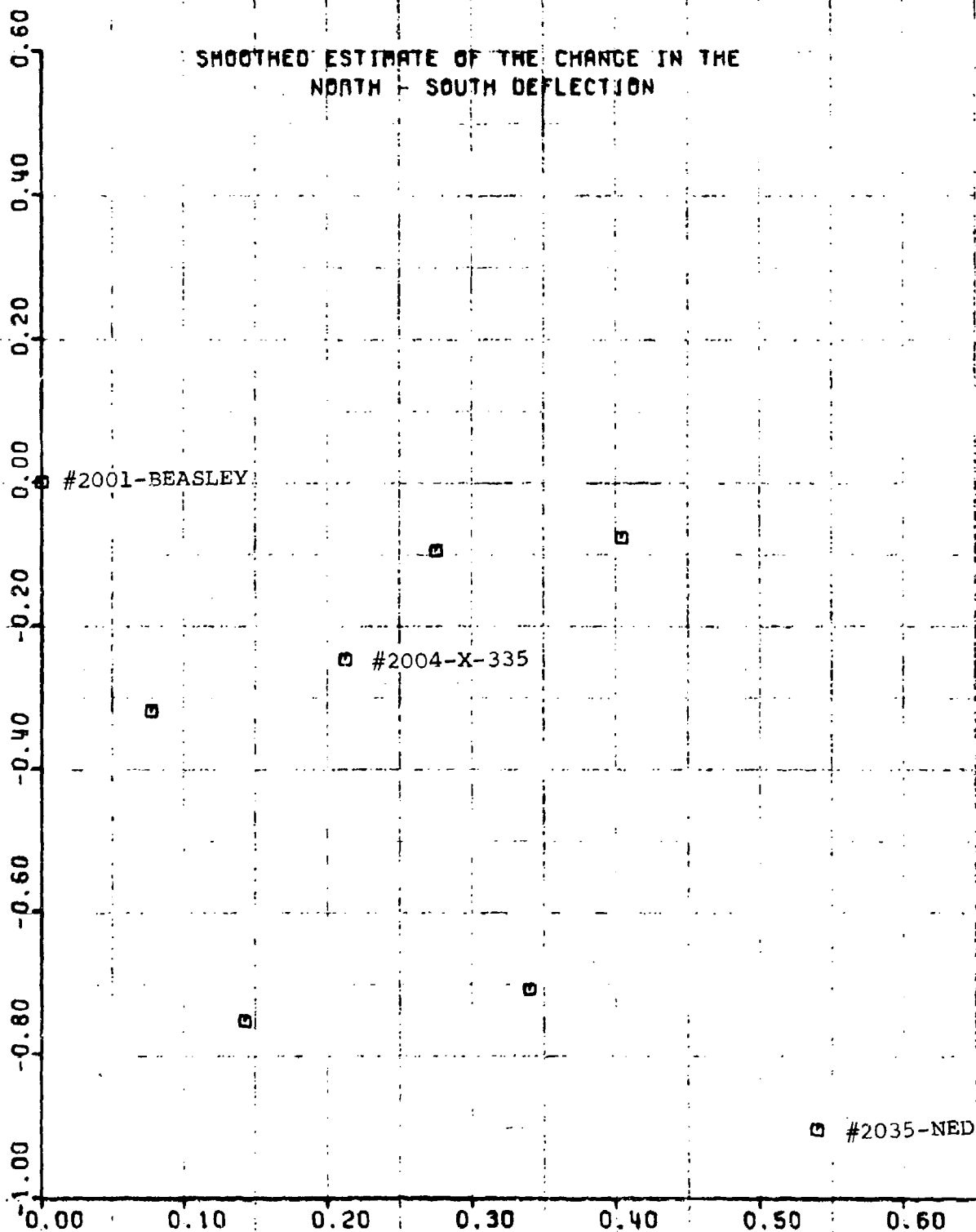
TIME IN HOURS

Figure F-5.14

WHITESANDS DATA RUN -10A.LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

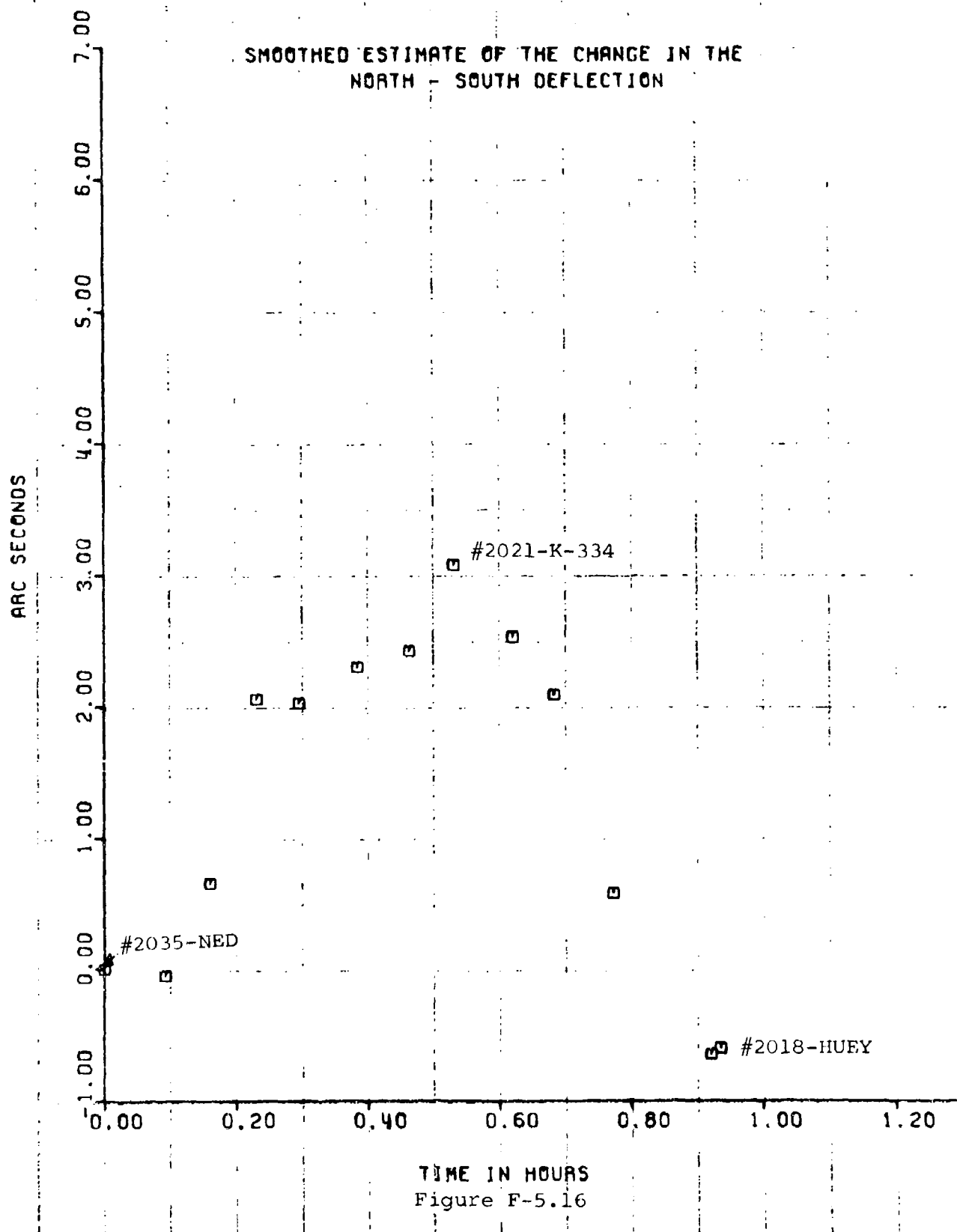
ARC SECONDS



TIME IN HOURS
Figure F-5.15

WHITESANDS DATA.RUN -108.LEG-2

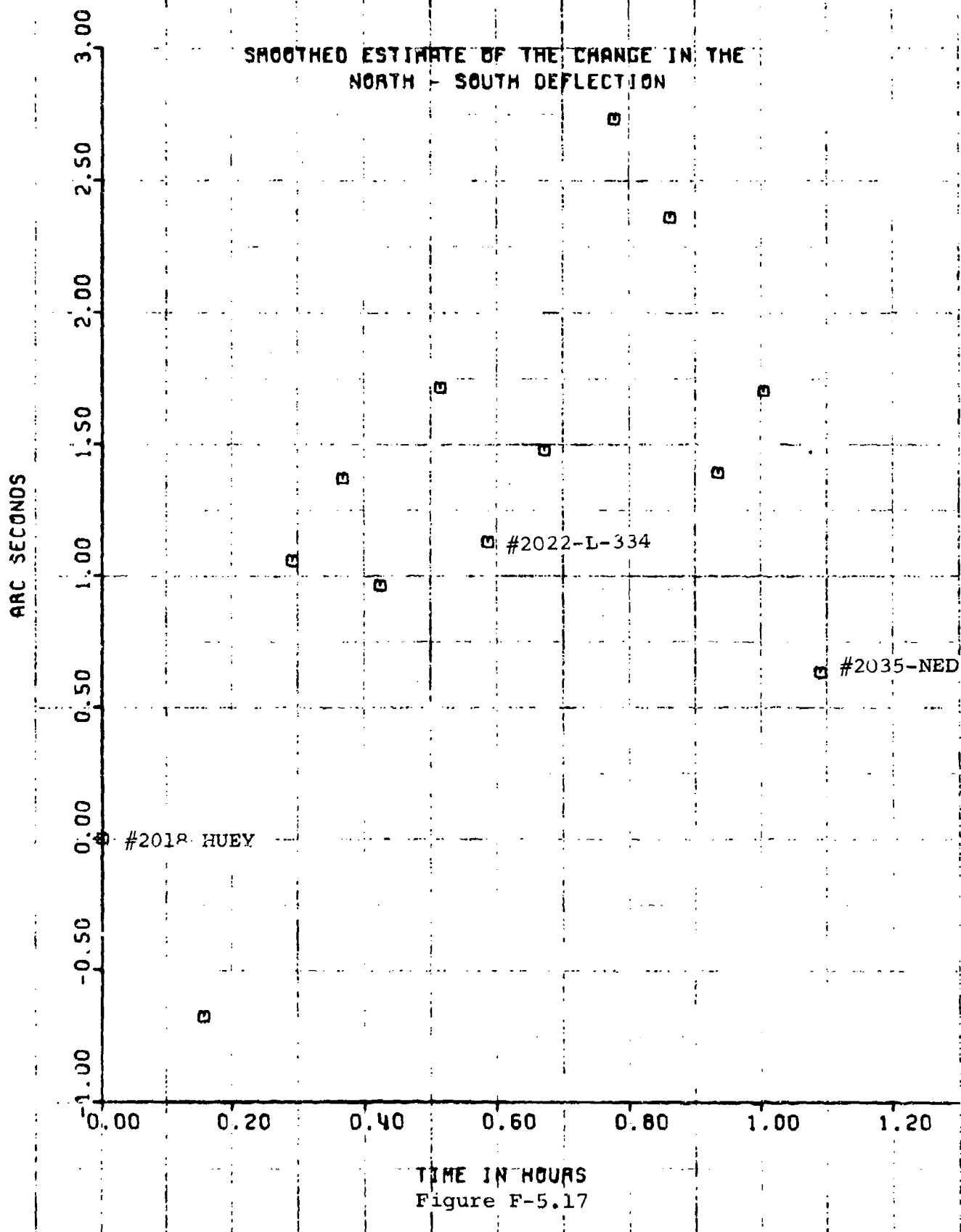
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-5.16

WHITESANDS DATA, RUN -10A, LEG-4

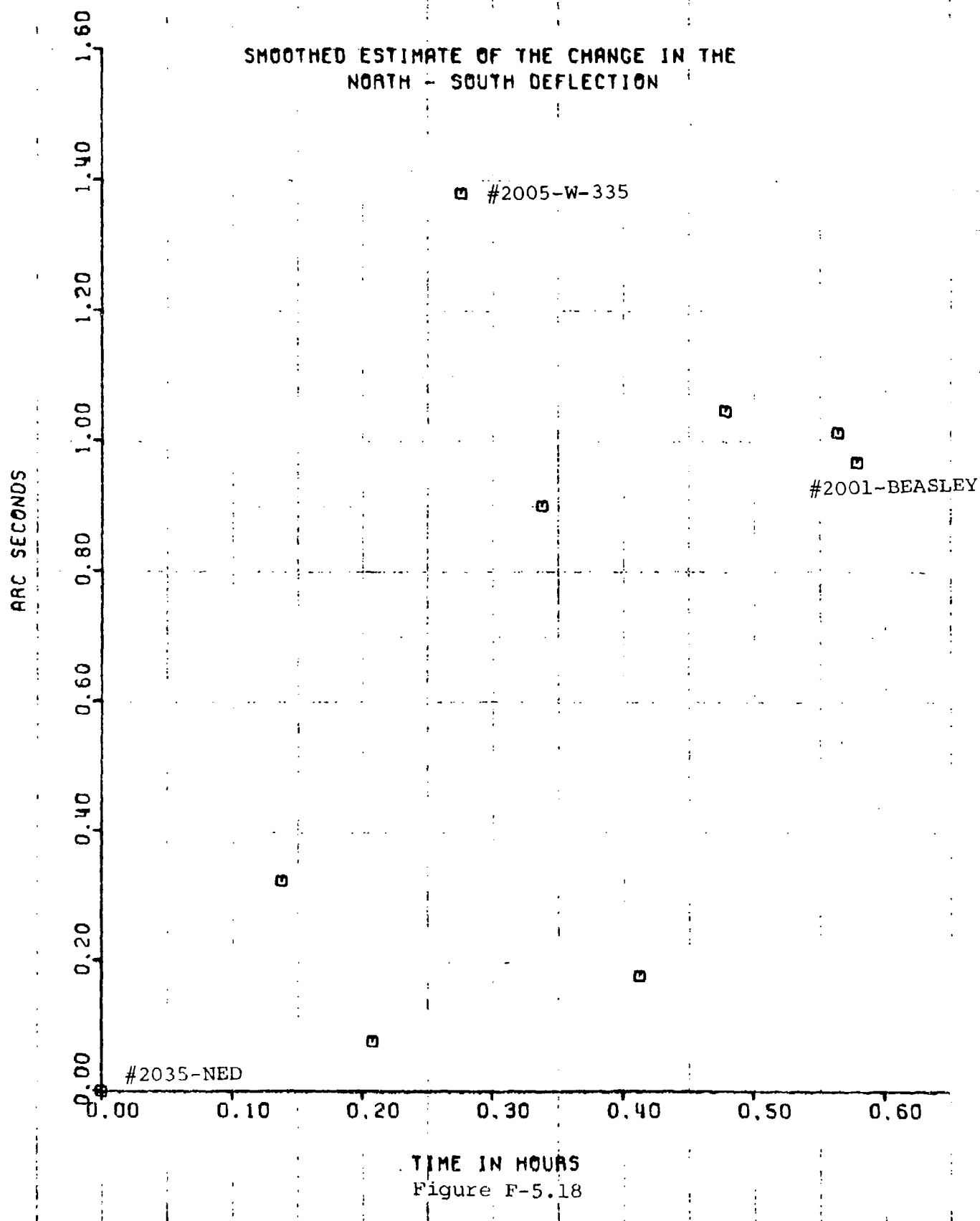
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-5.17

WHITESANDS DATA, RUN -108, LEG-4

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



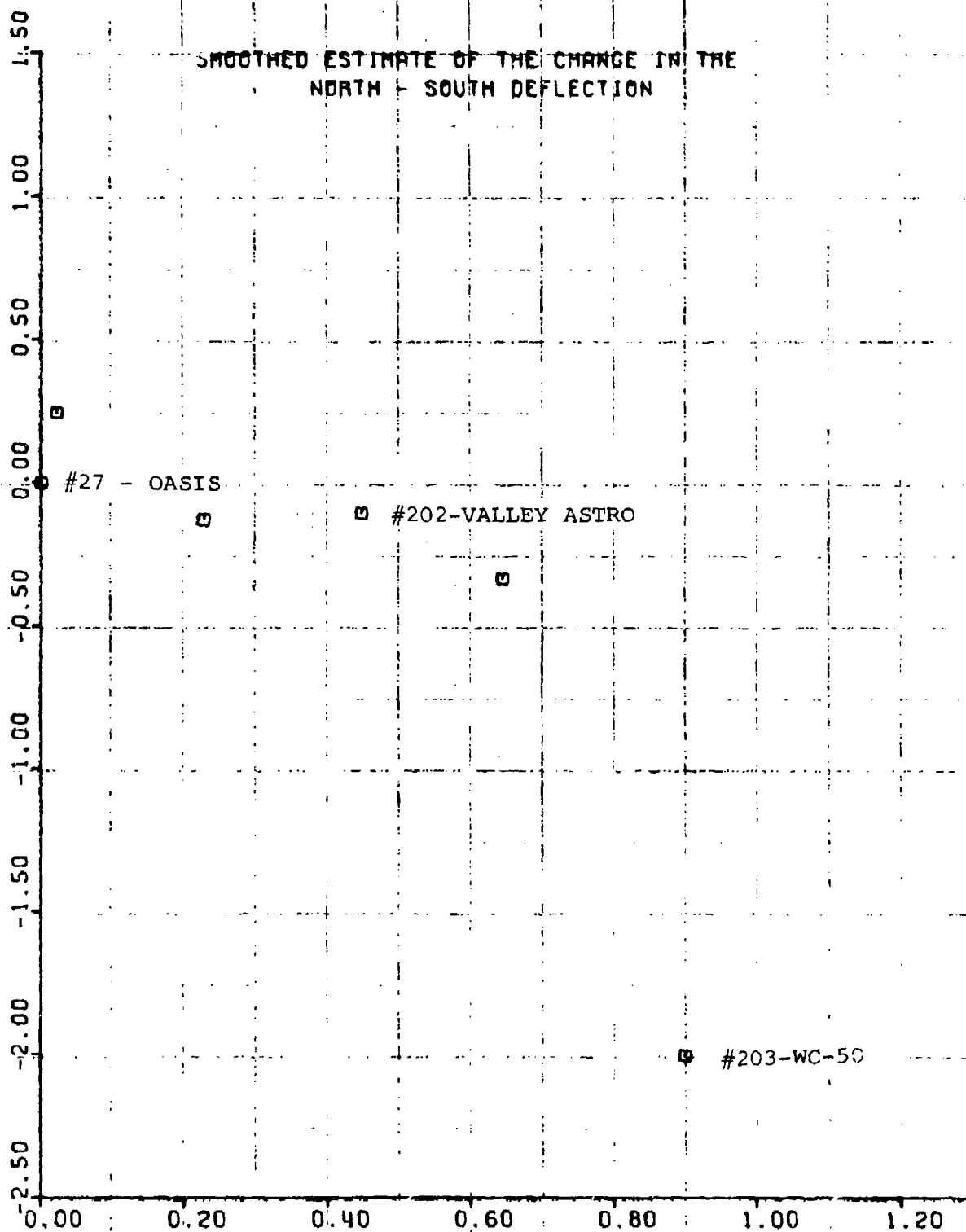
TIME IN HOURS

Figure F-5.18

WHITESANDS DATA RUN - 13A.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

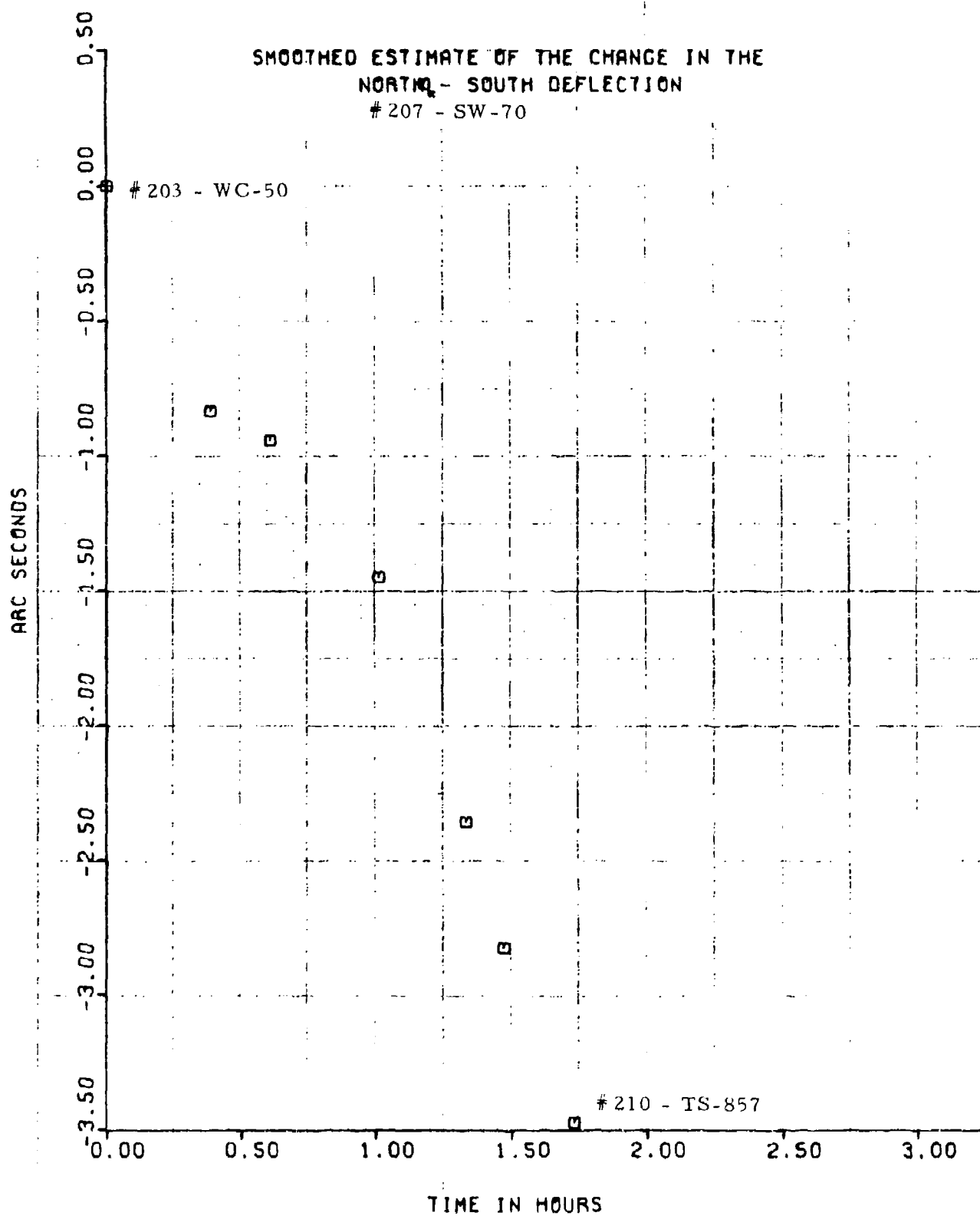
ARC SECONDS



TIME IN HOURS

Figure F-5.19

WHITESANDS DATA, RUN -13B, LEG-1

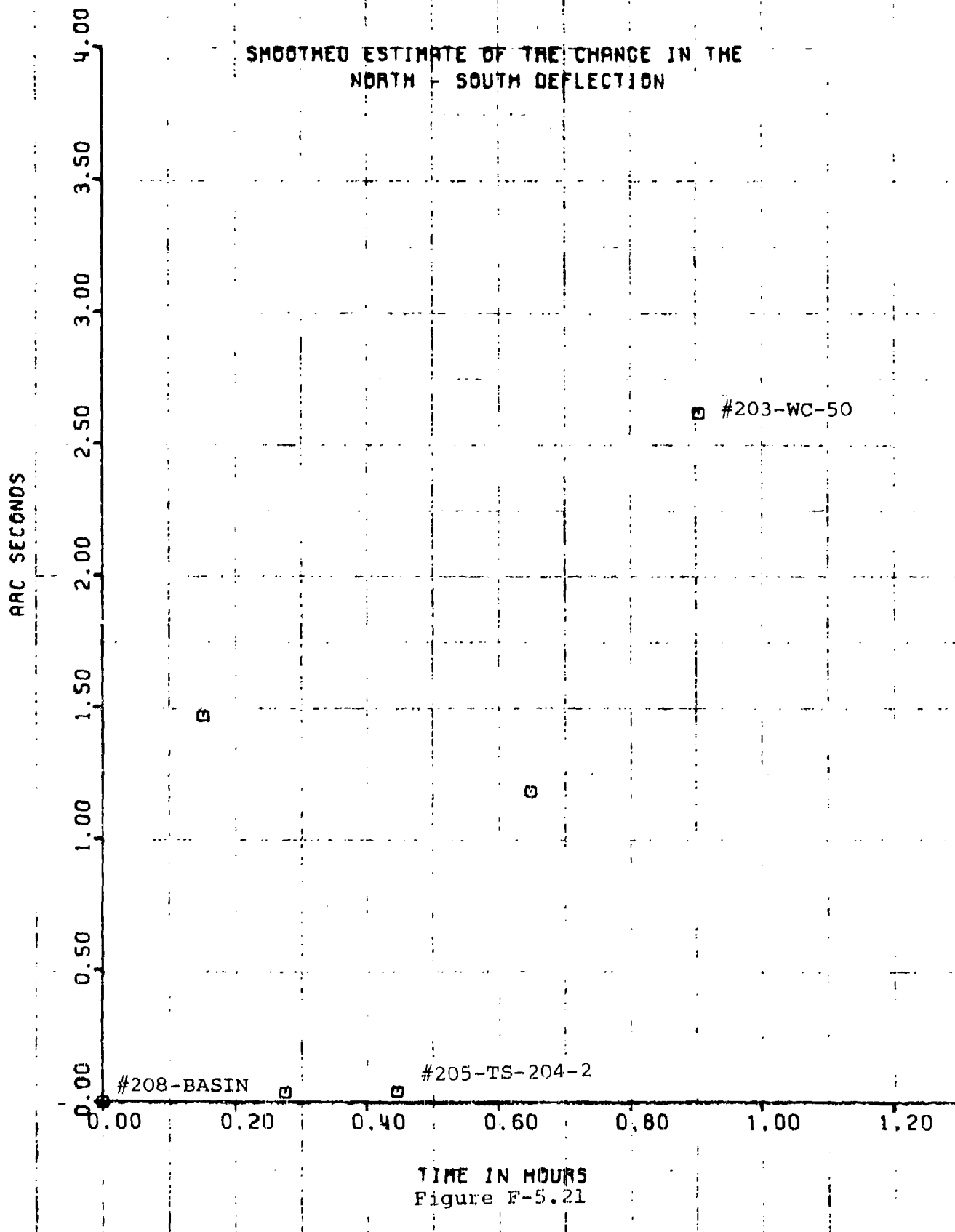


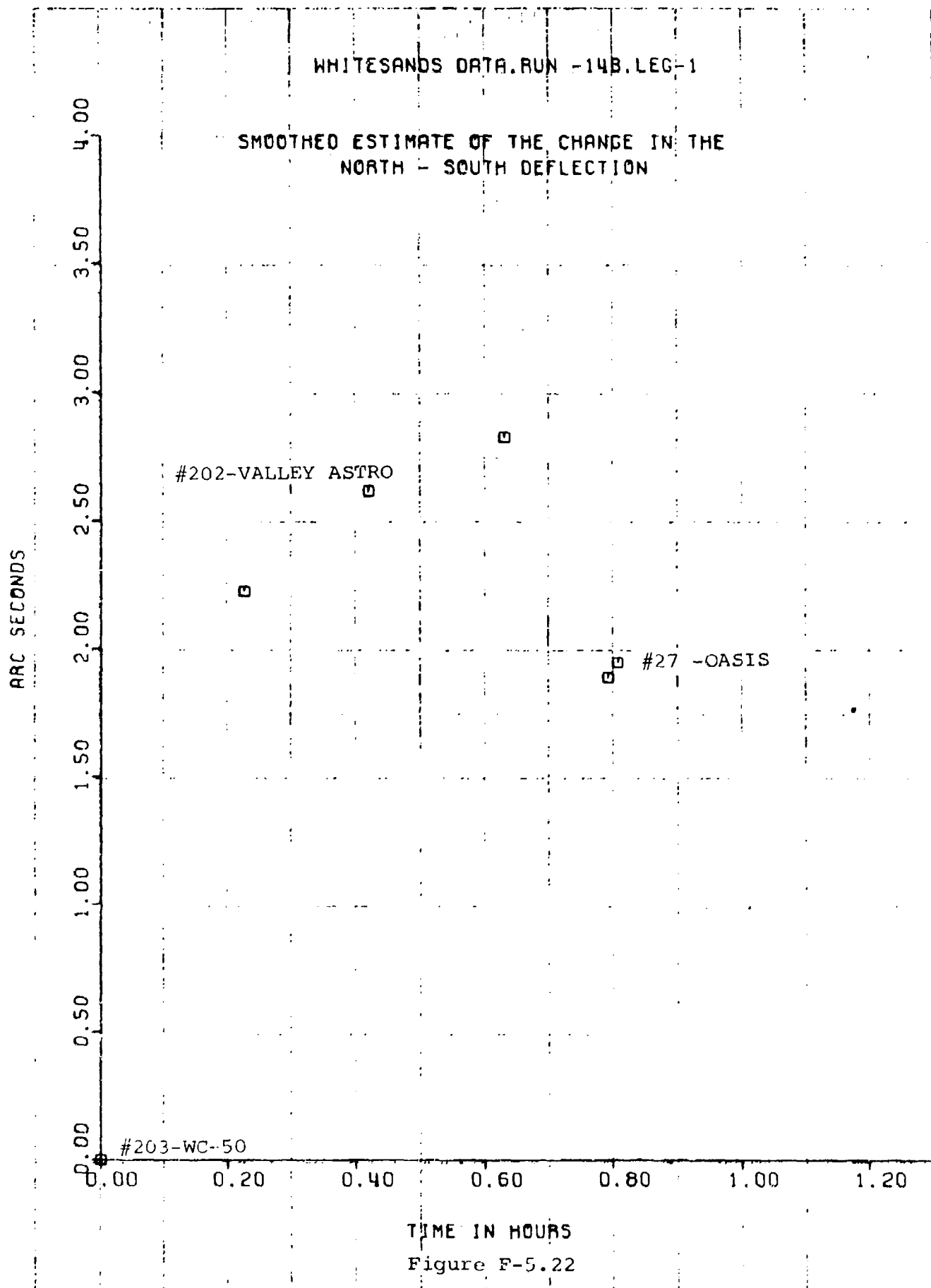
TIME IN HOURS

Figure F-5.20

WHITESANDS DATA, RUN -14A, LEG-1

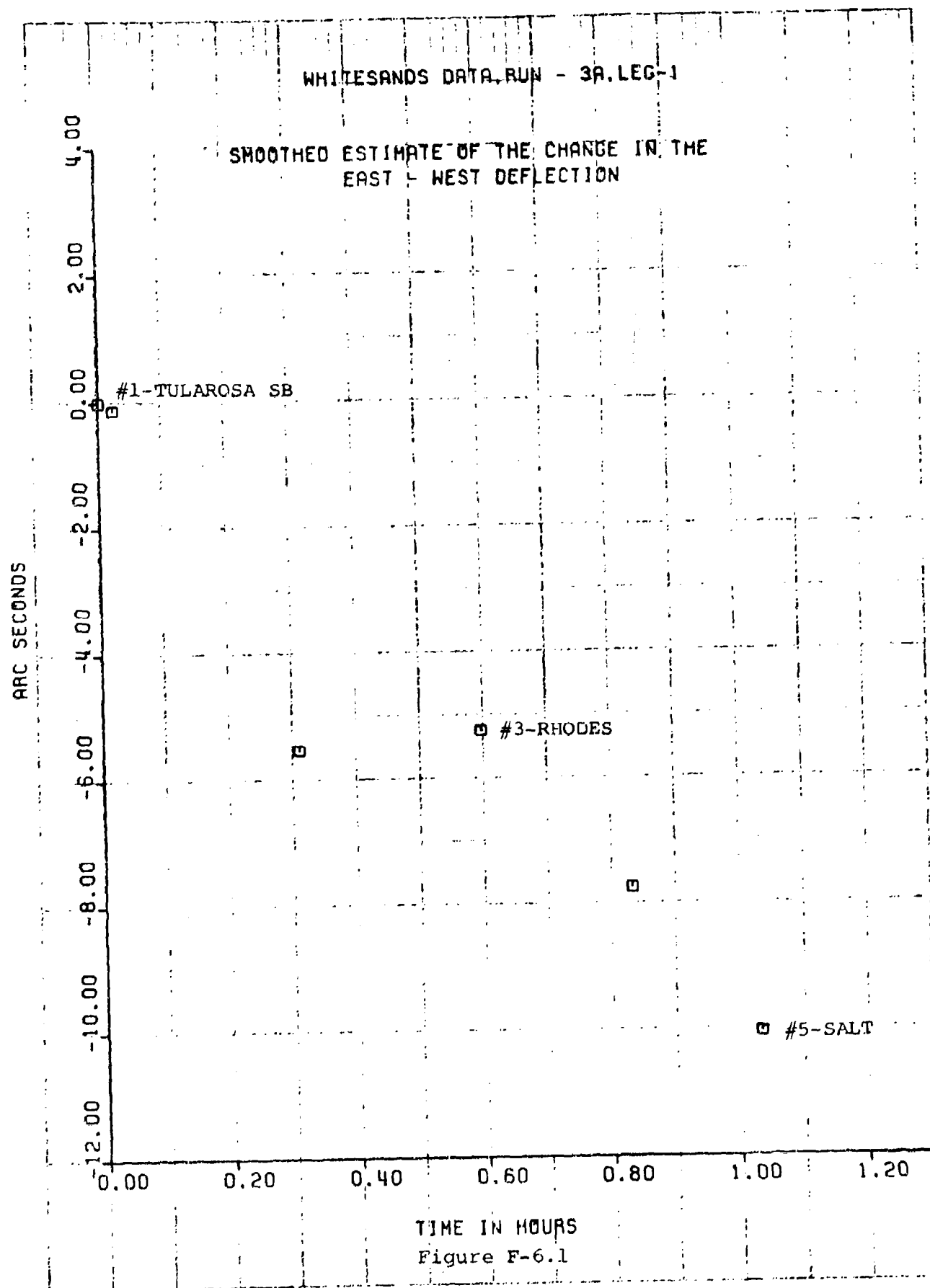
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION





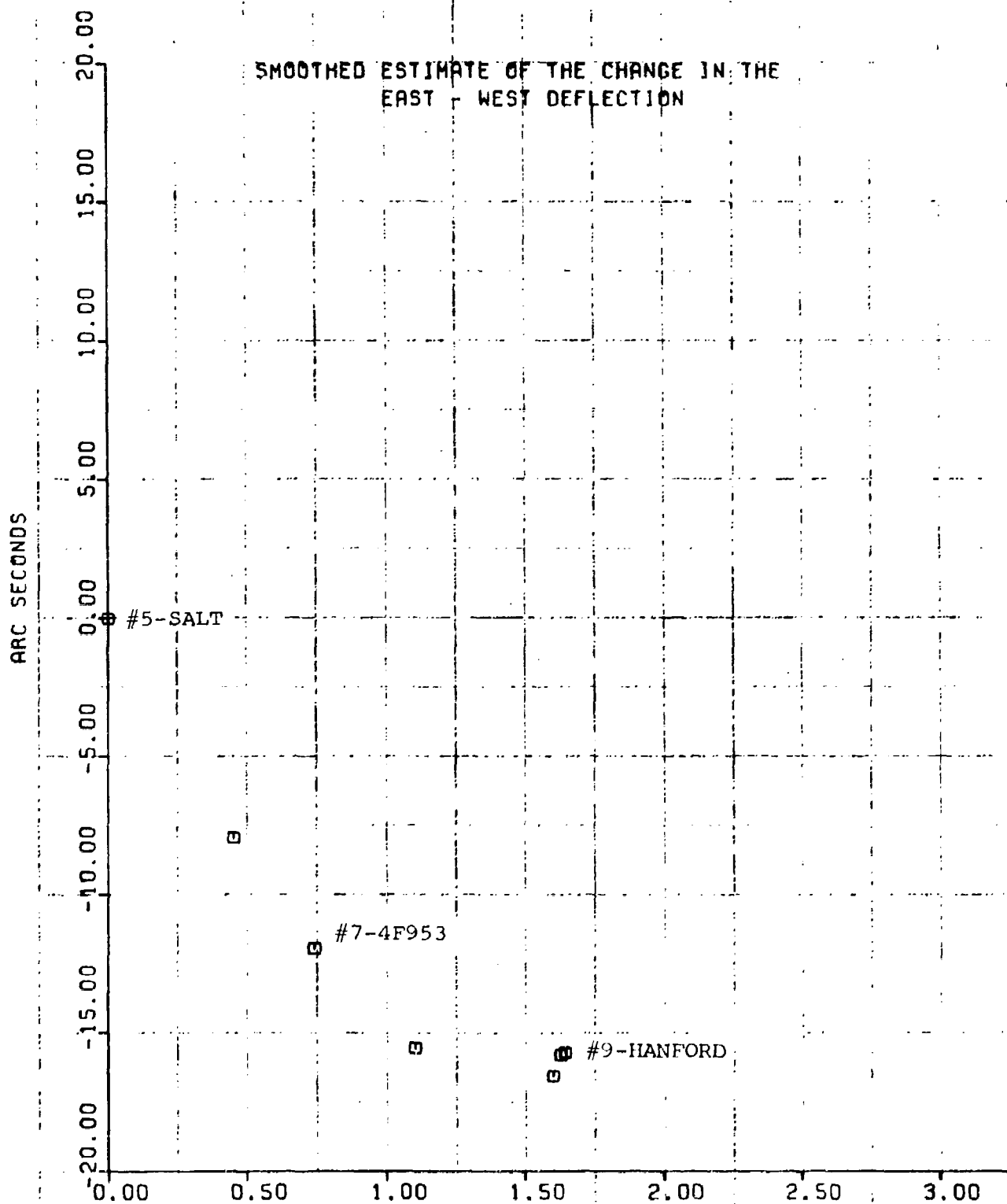
TIME IN HOURS

Figure F-5.22



WHITESANDS DATA, RUN - 3B.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

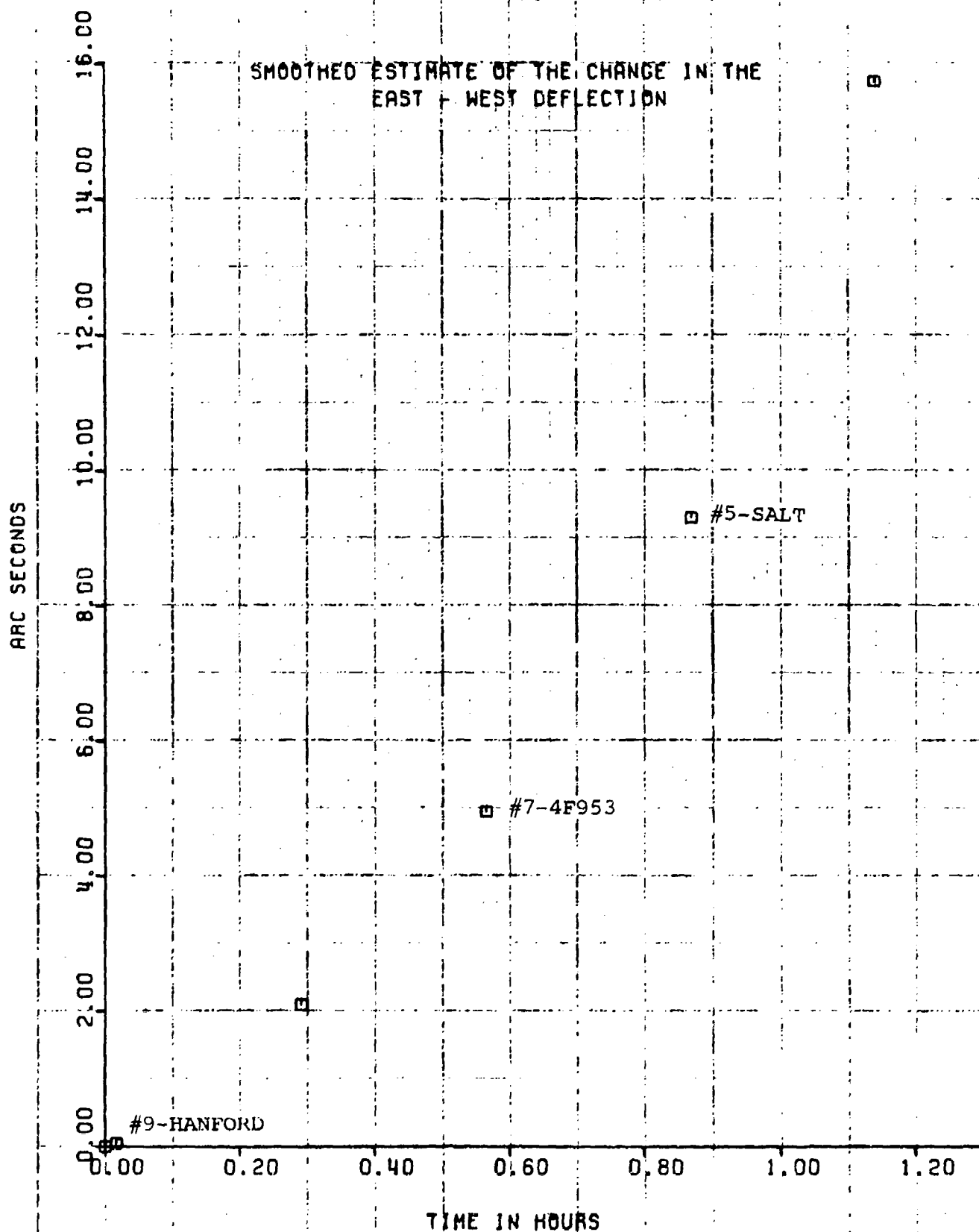


TIME IN HOURS

Figure F-6.2

WHITESANDS DATA, RUN - 4A, LEG-1

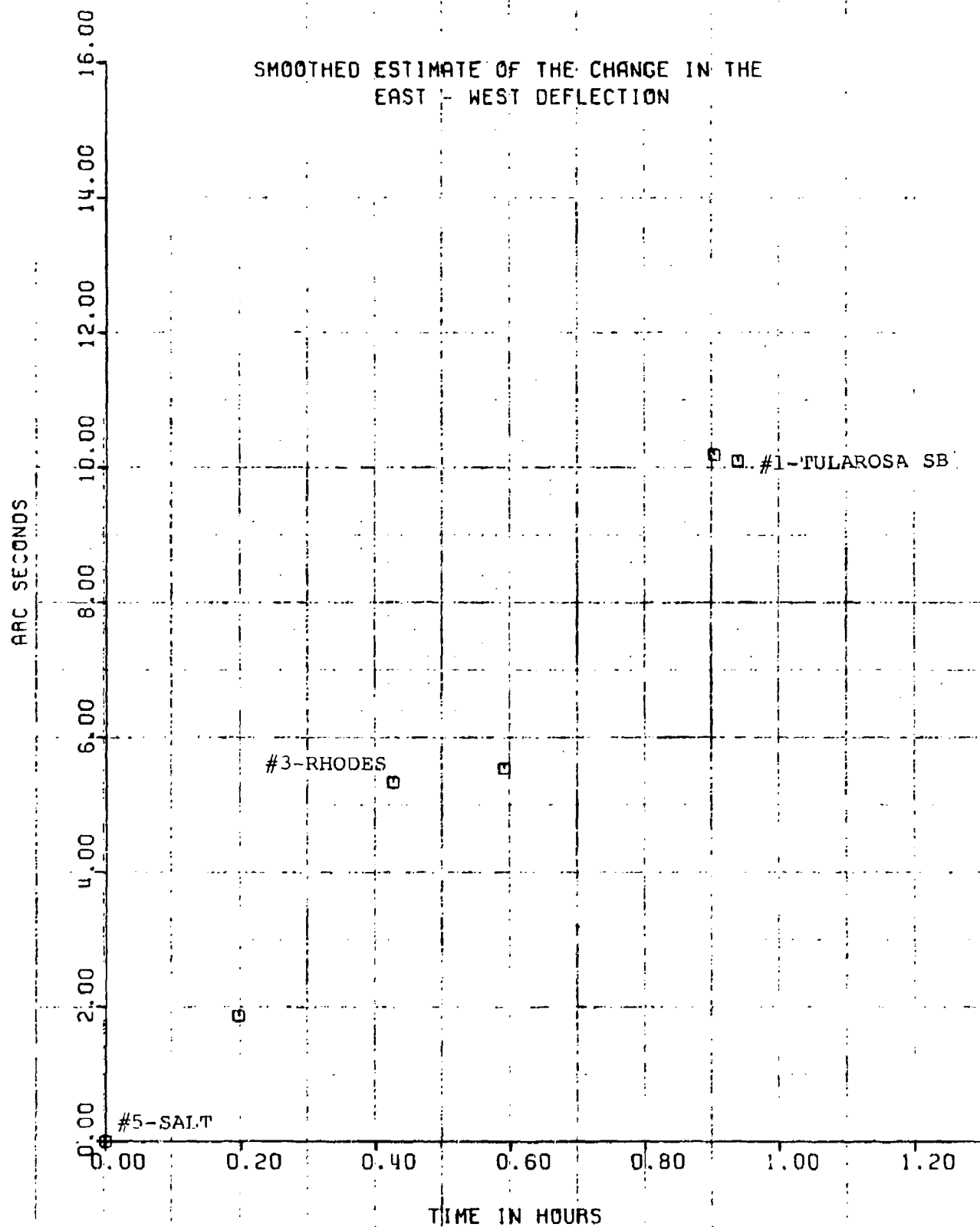
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-6.3

WHITESANDS DATA, RUN - 48, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-6.4

WHITESANDS DATA.RUN - 1A.LEG-1

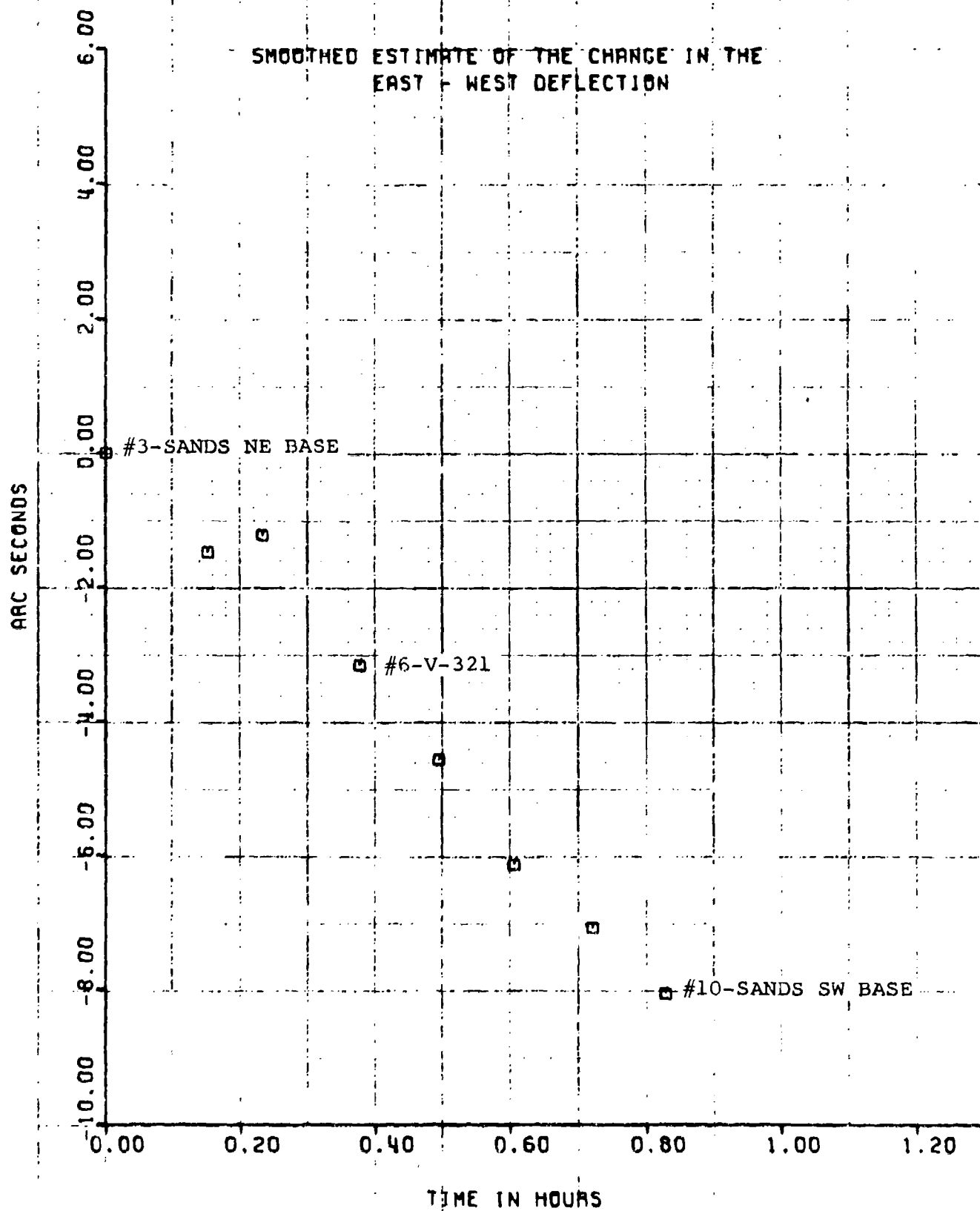
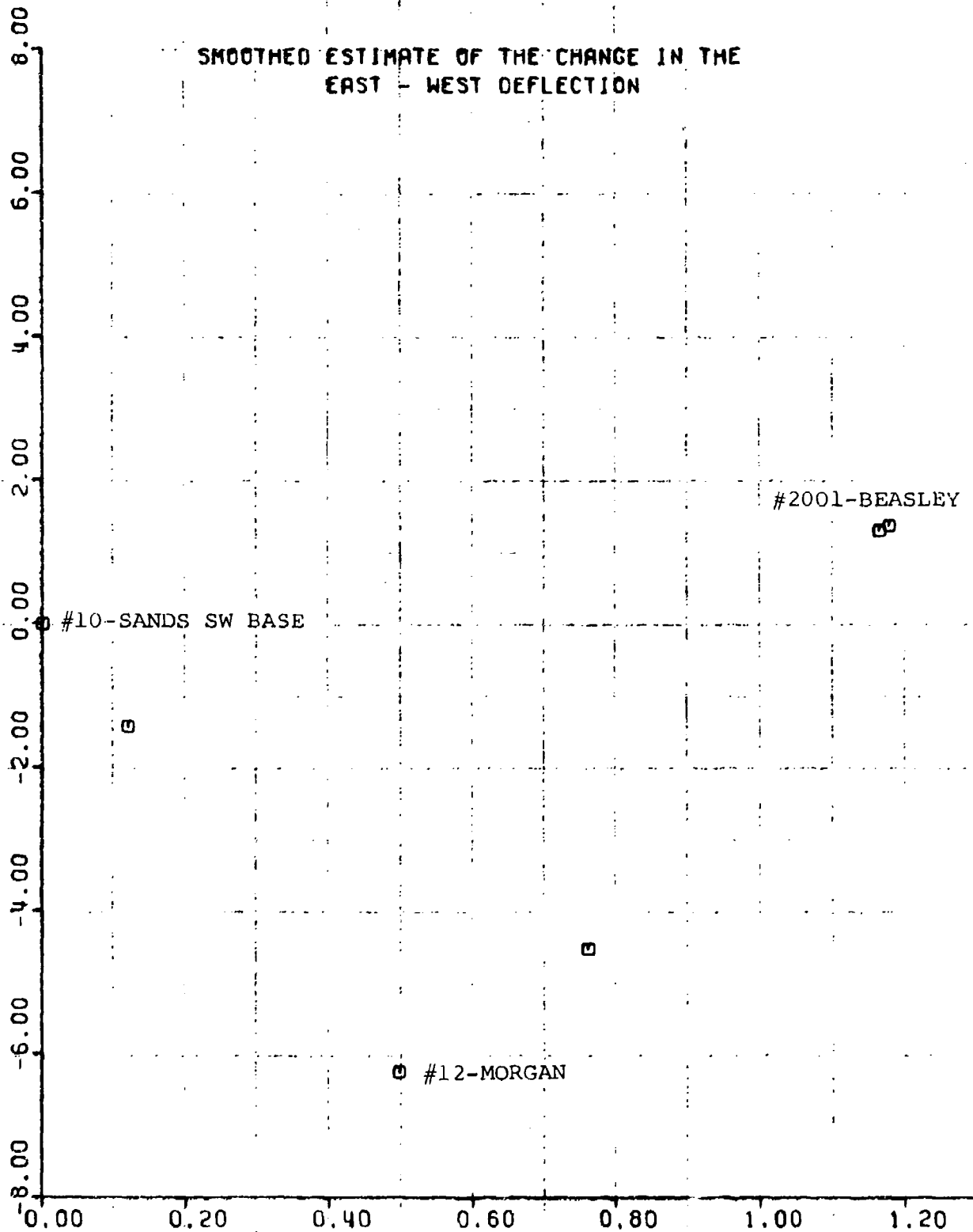


Figure F-6.5

WHITESANDS DATA RUN - 1B, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

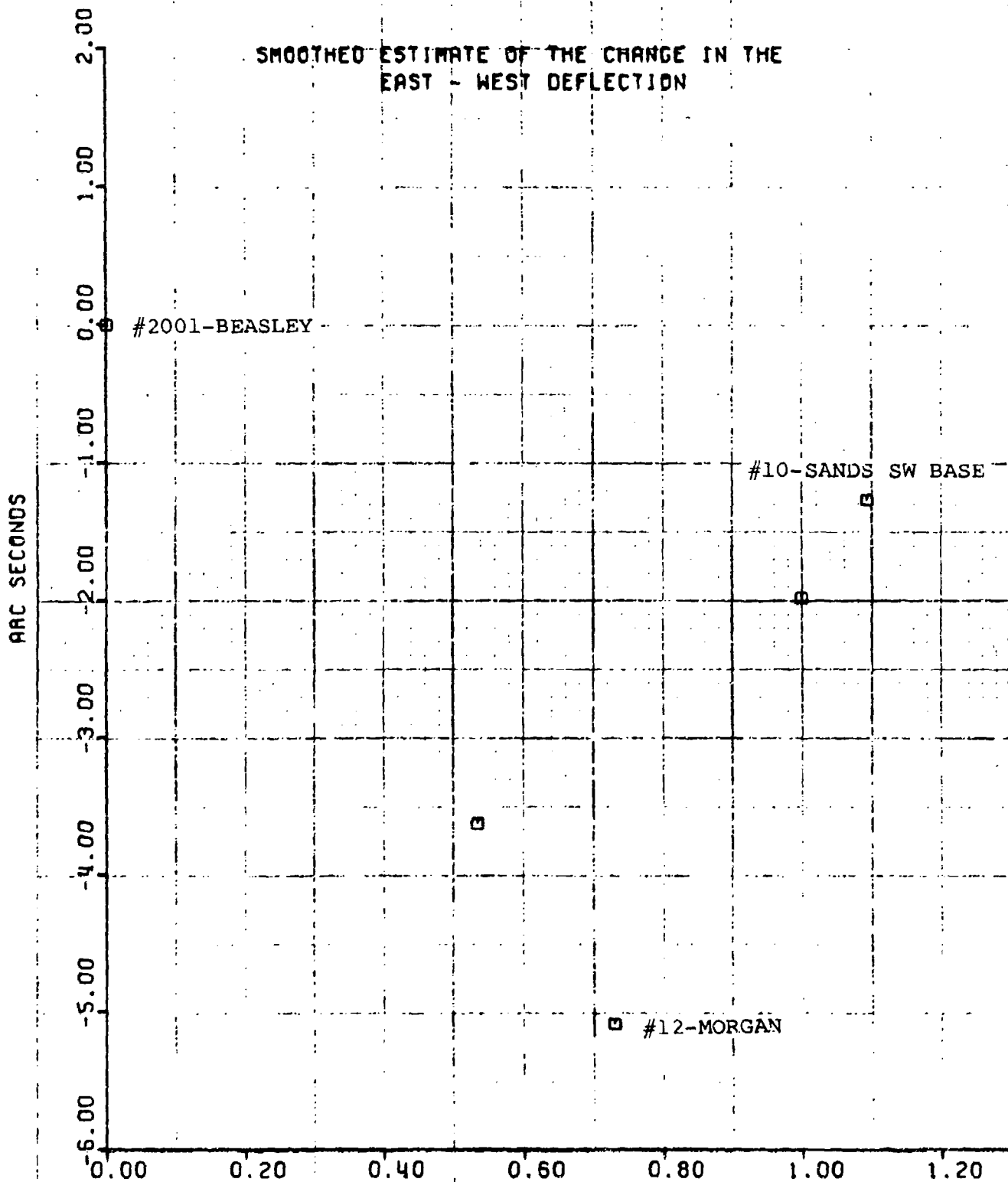
ARC SECONDS



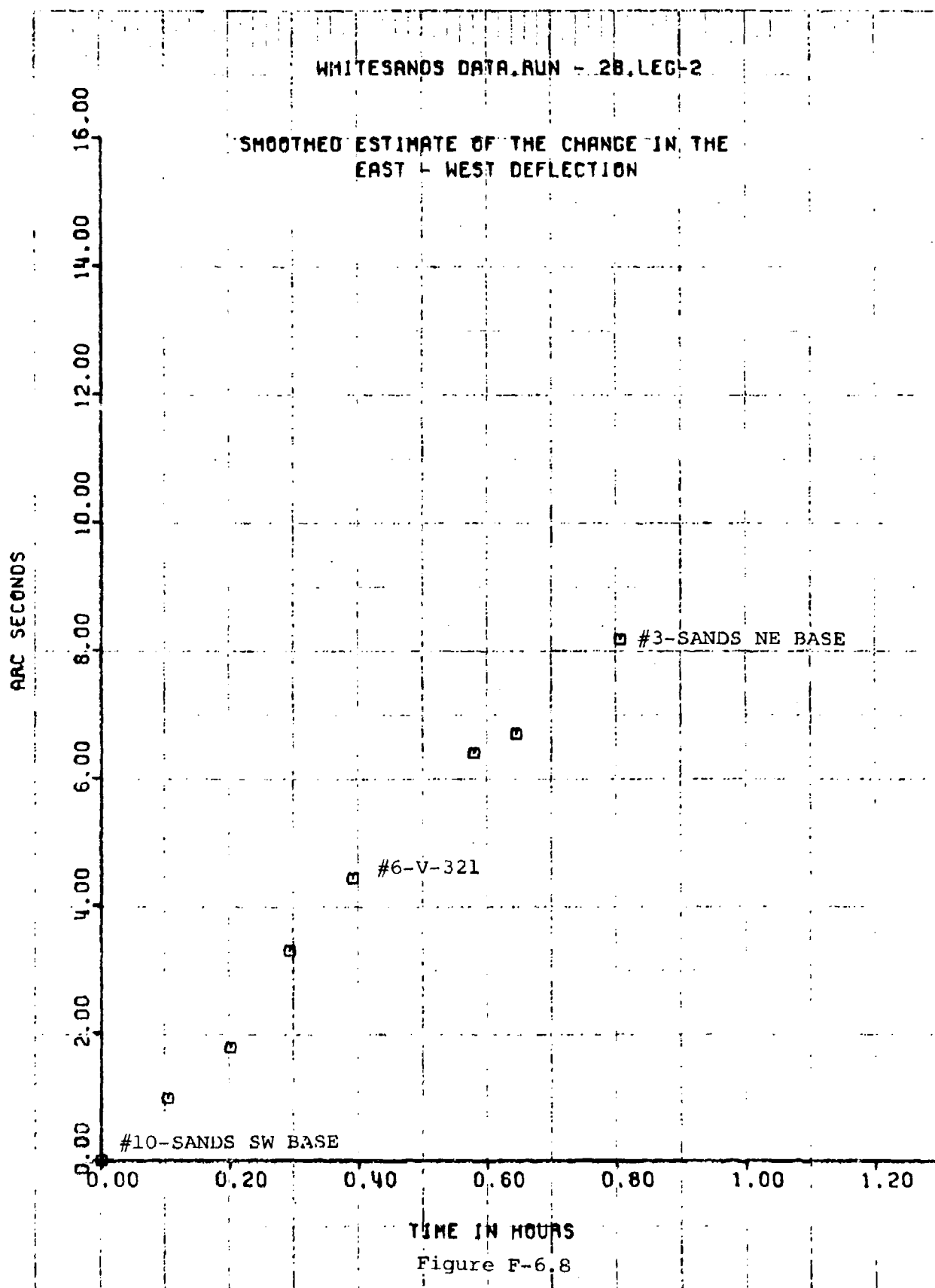
TIME IN HOURS
Figure F-6.6

WHITESANDS DATA.RUN - 2A.LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



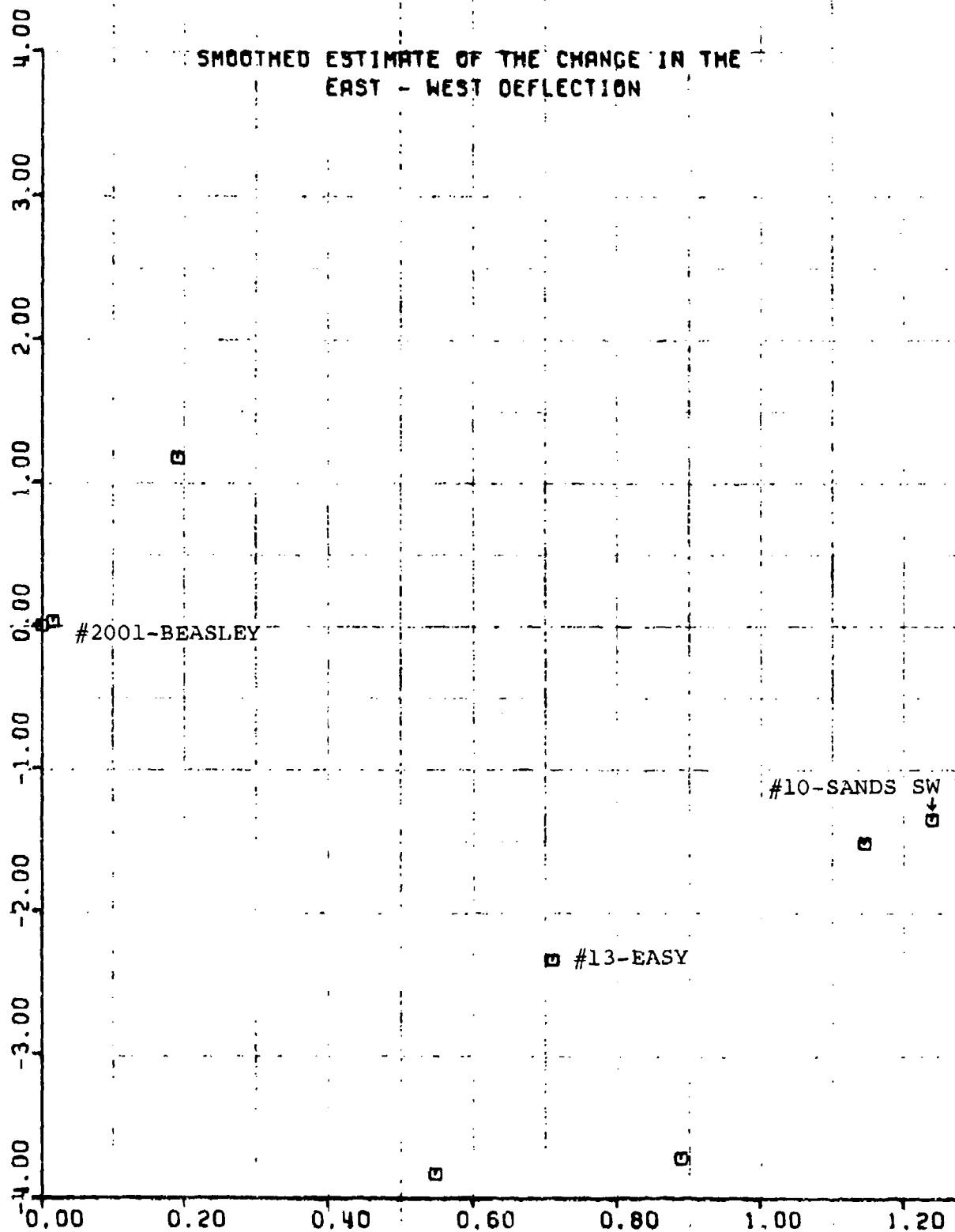
TIME IN HOURS
Figure F-6.7



WHITESANDS DATA, RUN - 9A, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure F-6.9

WHITESANDS DATA, RUN - 88.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#10-SANDS SW BASE

#6-V-321

#3-SANDS NE BASE

TIME IN HOURS

Figure F-6.10

0.00 0.20 0.40 0.60 0.80 1.00 1.20

WHITESANDS DATA.RUN - 2A.LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

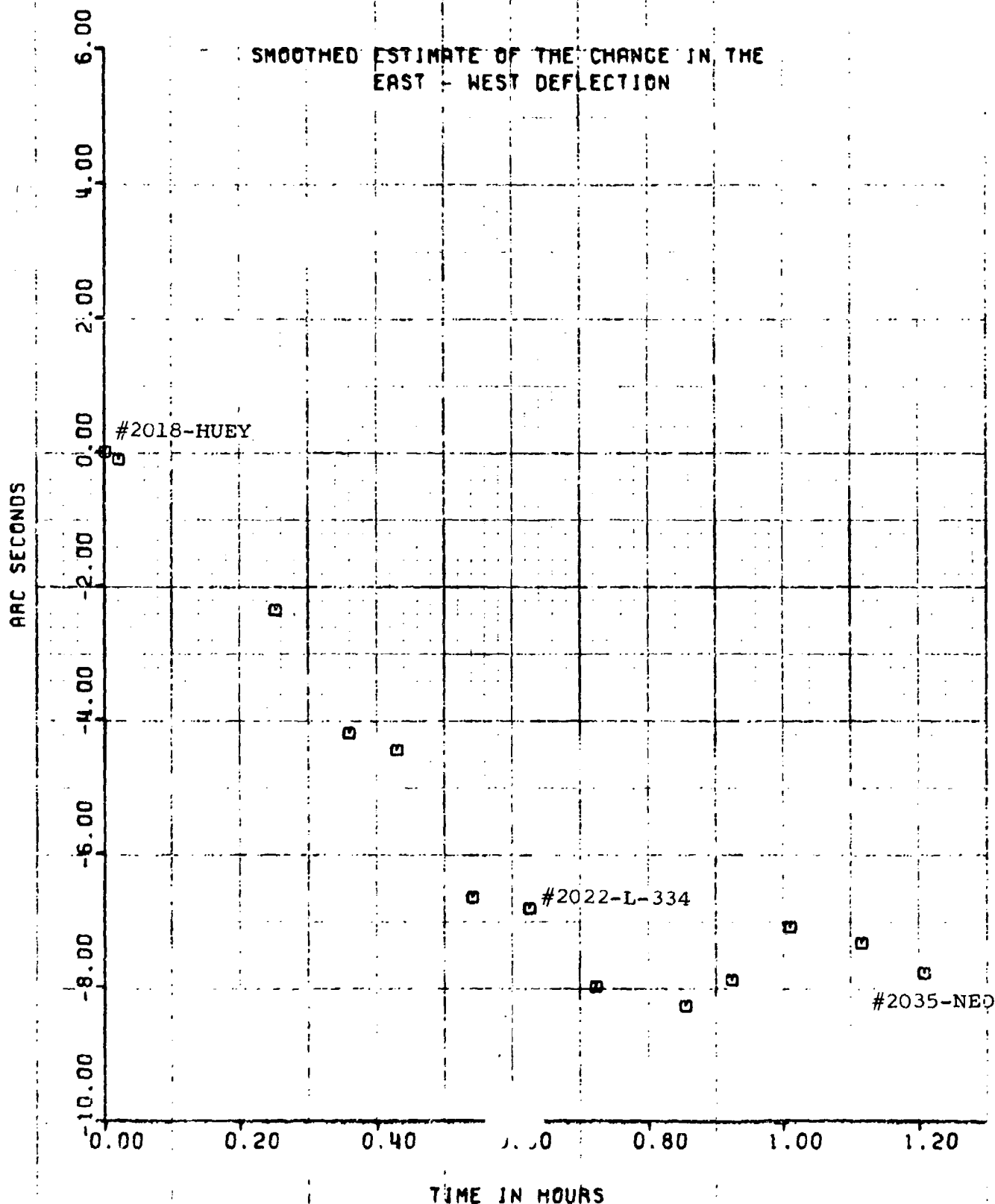
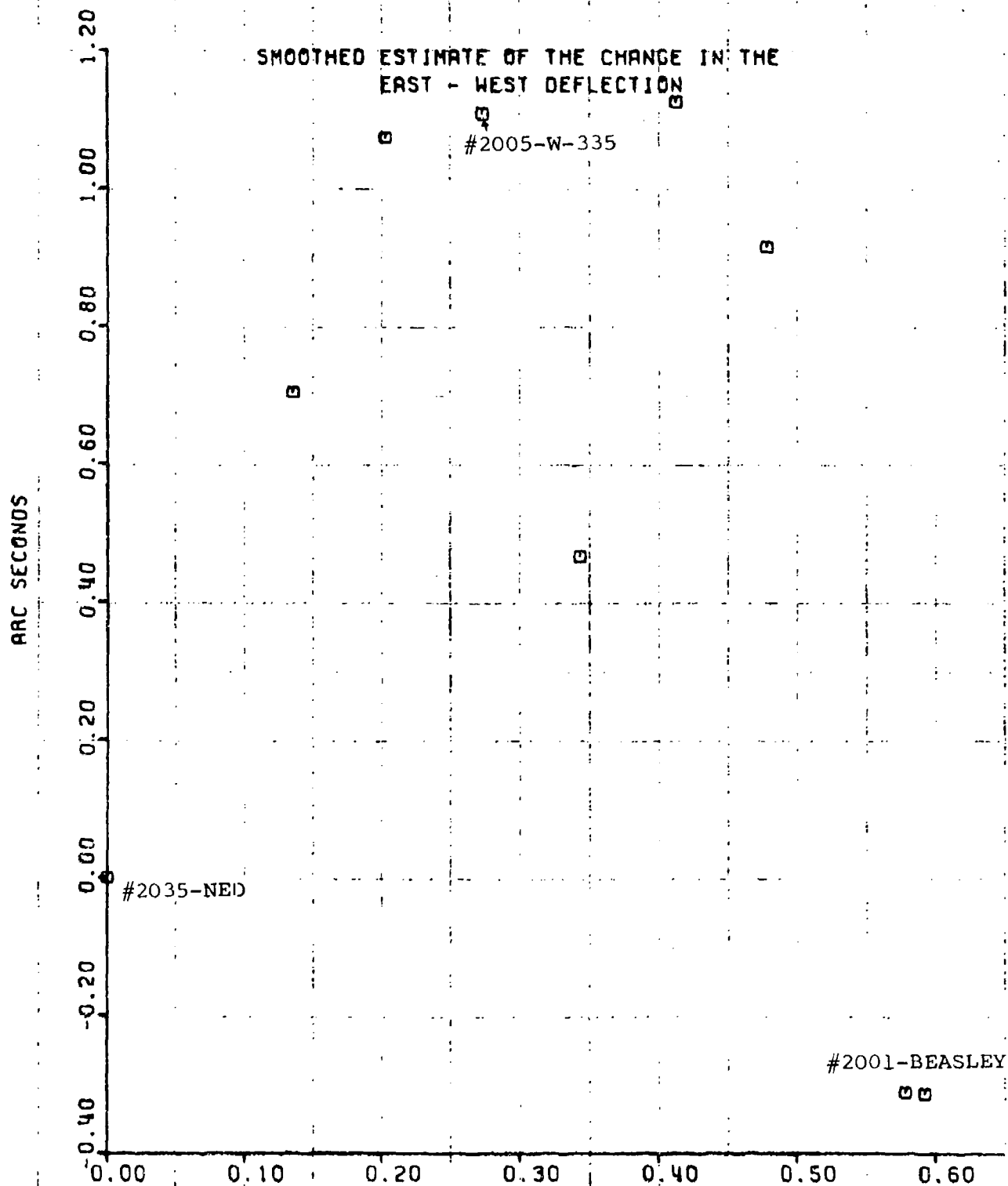


Figure F-6.11

WHITESANDS DATA, RUN - 2B, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-6.12

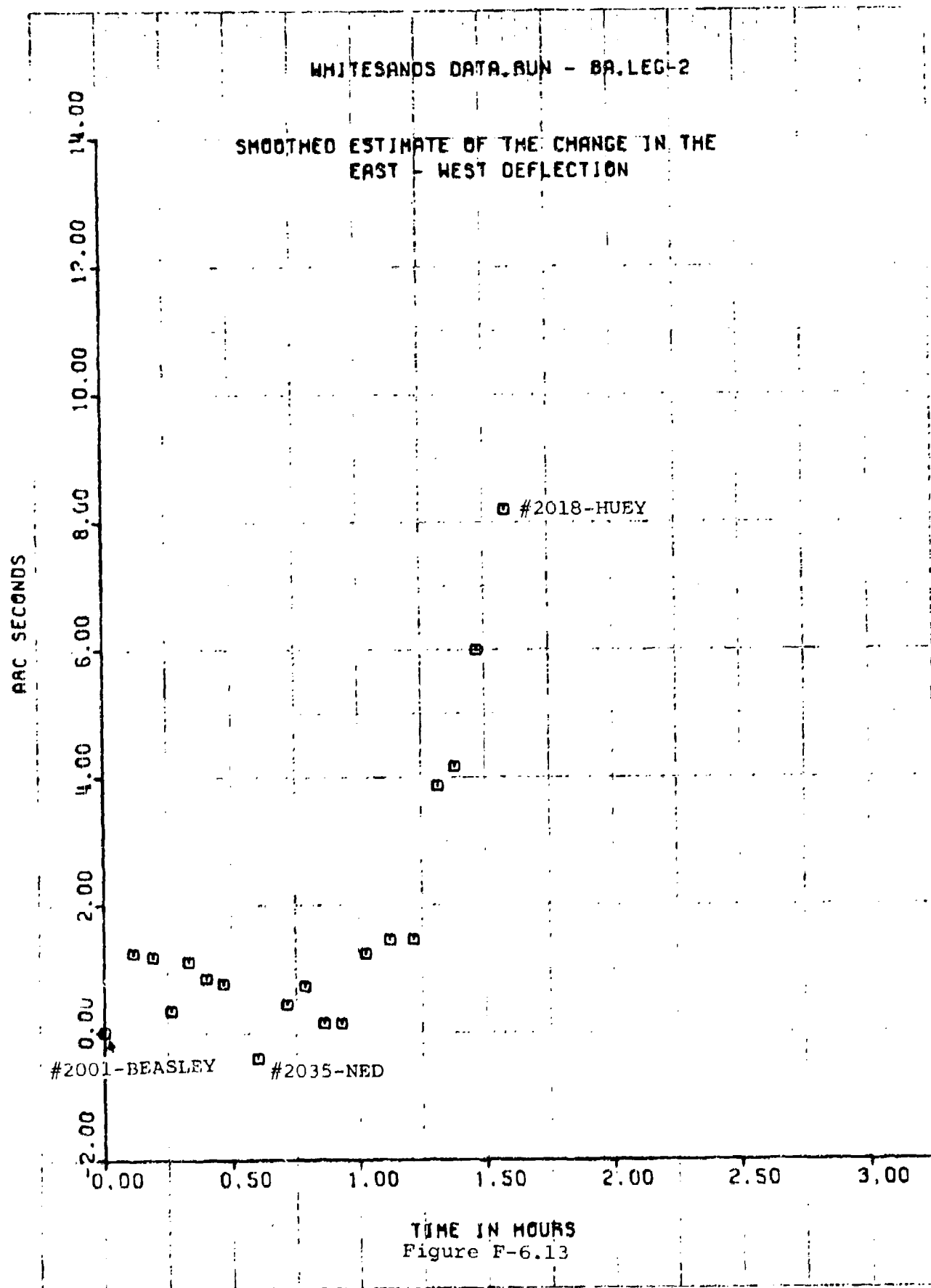
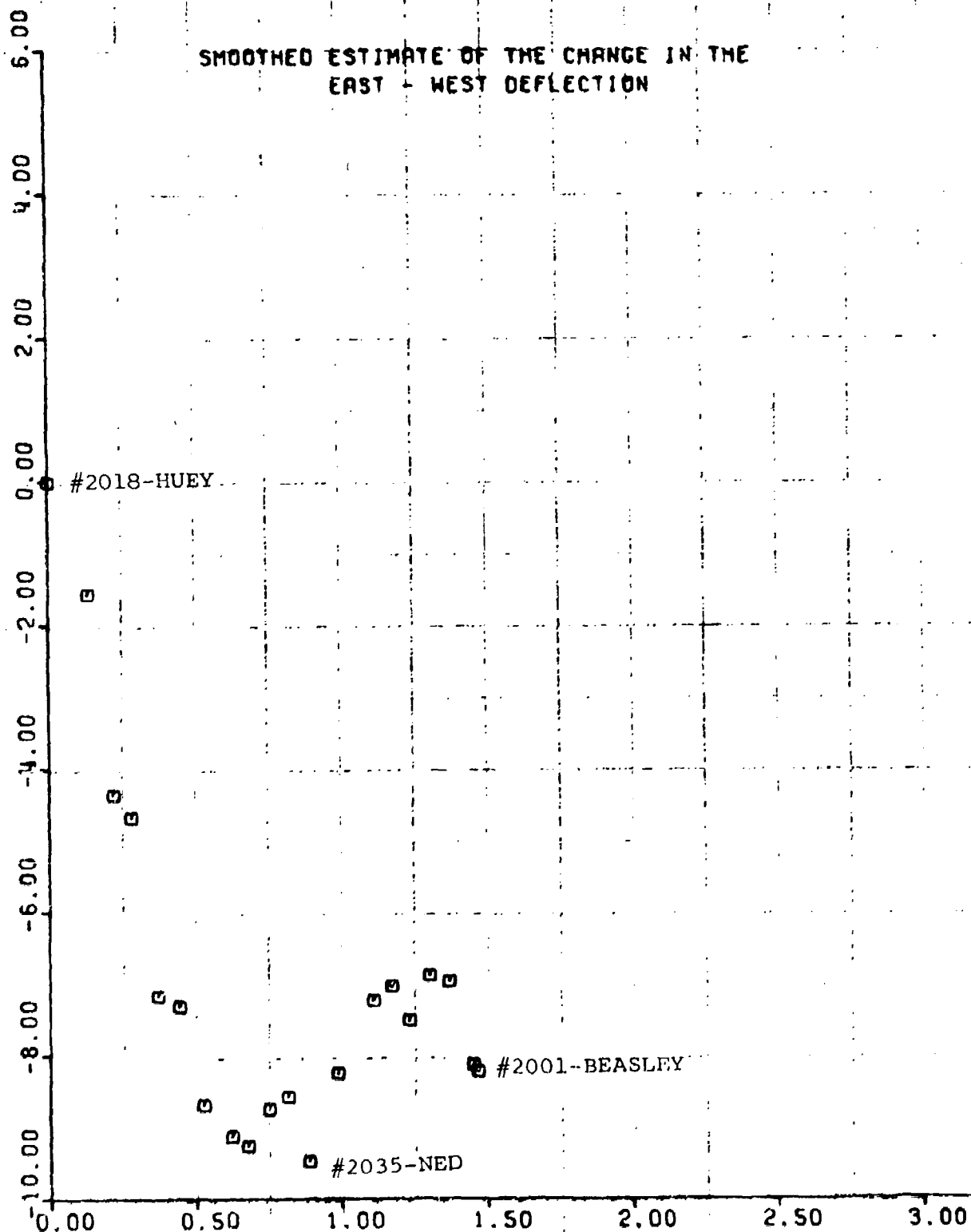


Figure F-6.13

WHITESANDS DATA.RUN - 88.LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

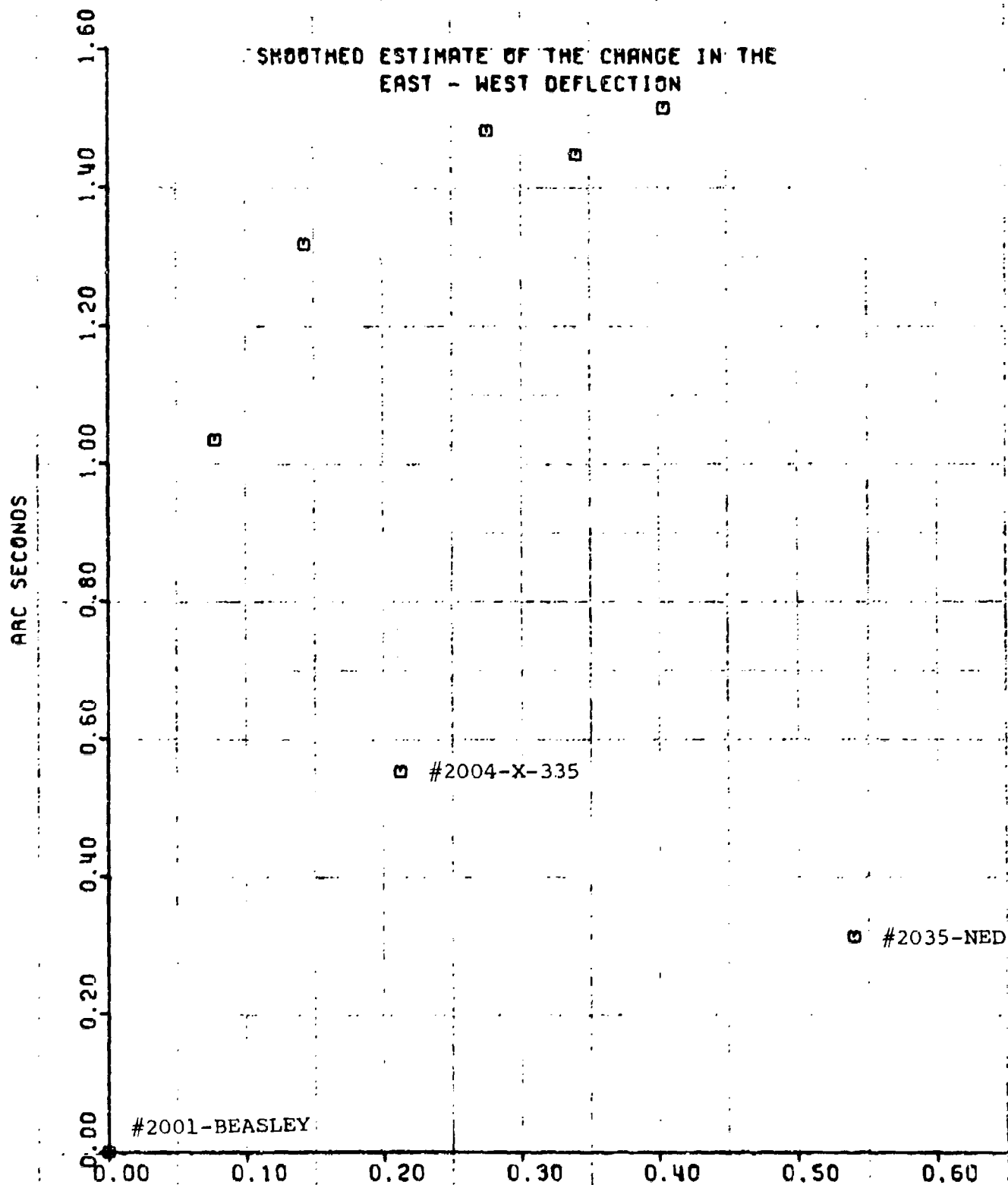


TIME IN HOURS

Figure F-6.14

WHITESANDS DATA.RUN -10A.LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-6.15

WHITESANDS DATA, RUN -108, LEG-2

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

#2018-HUEY

ARC SECONDS

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00

#2035-NED

#2021-K-334

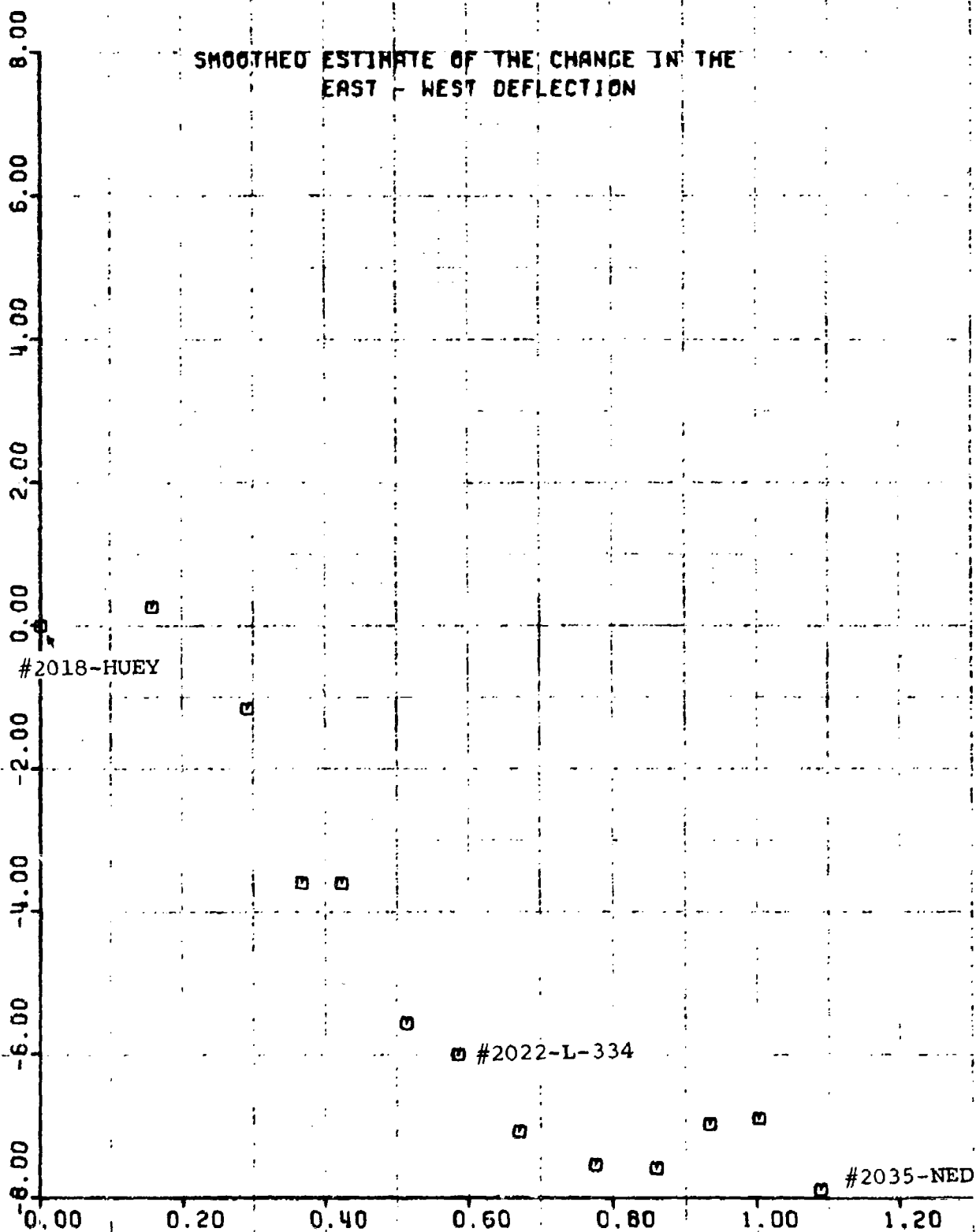
TIME IN HOURS
Figure F-6.16

0.00 0.20 0.40 0.60 0.80 1.00 1.20

WHITESANDS DATA, RUN -10A, LEG-4

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

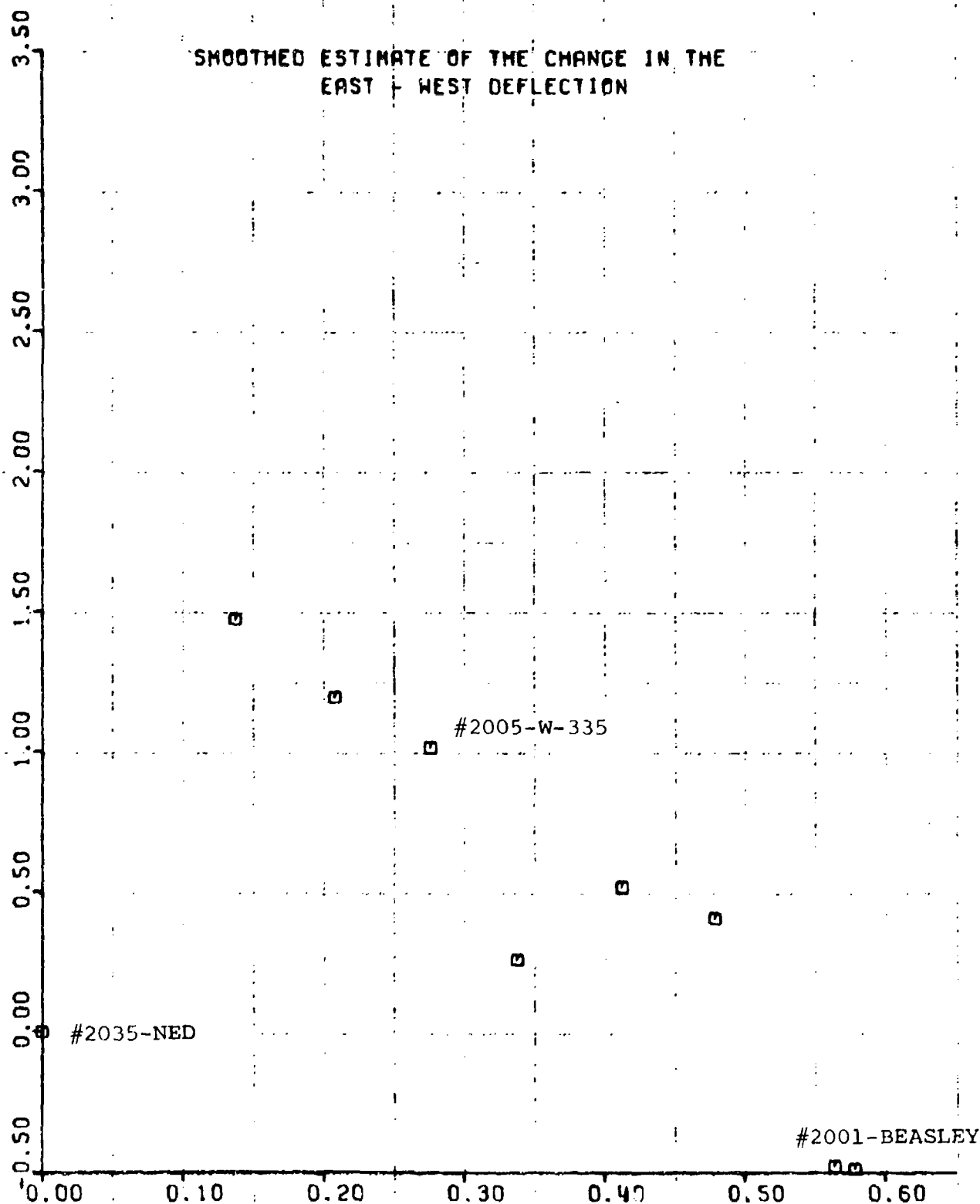


TIME IN HOURS
Figure F-6.17

WHITESANDS DATA.RUN -108.LEG-4

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS



TIME IN HOURS
Figure F-6.18

WHITESANDS DATA RUN -13A, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00

#27 -OASIS

#202-VALLEY ASTRO

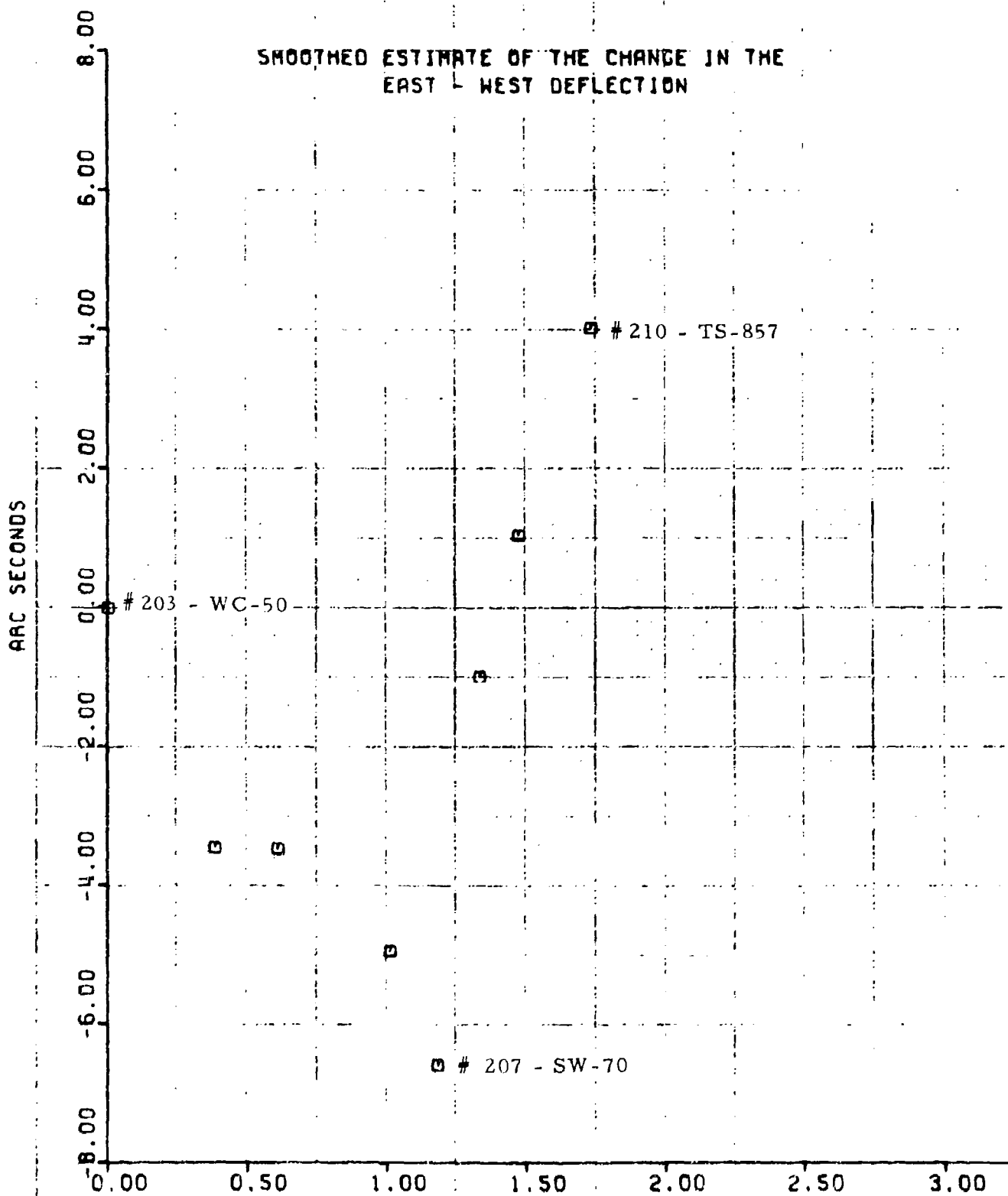
#203-WC-50

0.00 0.20 0.40 0.60 0.80 1.00 1.20

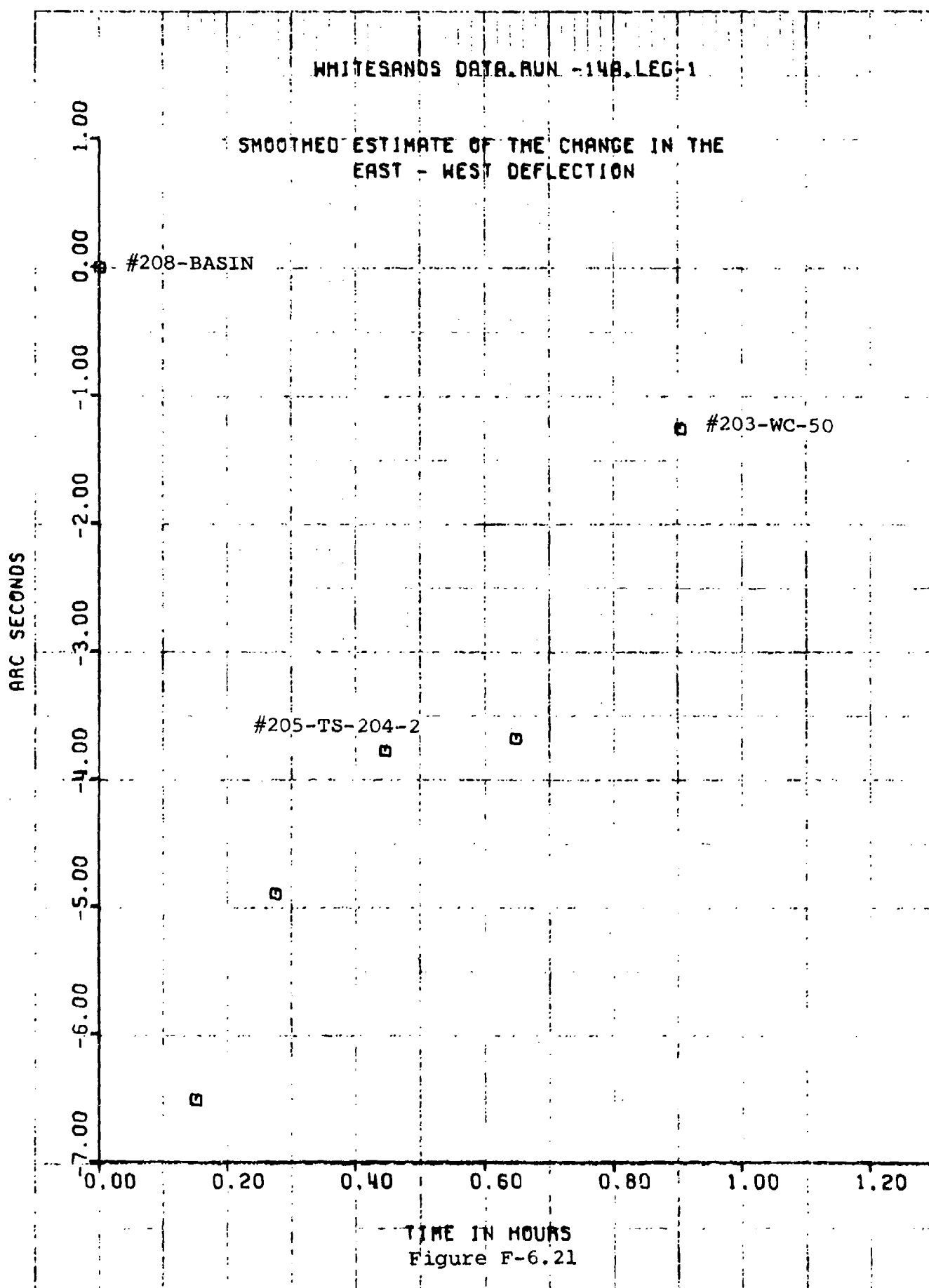
TIME IN HOURS
Figure F-6.19

WHITESANDS DATA, RUN -138, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-6.20



WHITESANDS DATA RUN -148, LEG-1

SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

ARC SECONDS

16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

#203-WC-50

0

0

#202-VALLEY ASTRO

0

0

#27 -OASIS

0.00

0.20

0.40

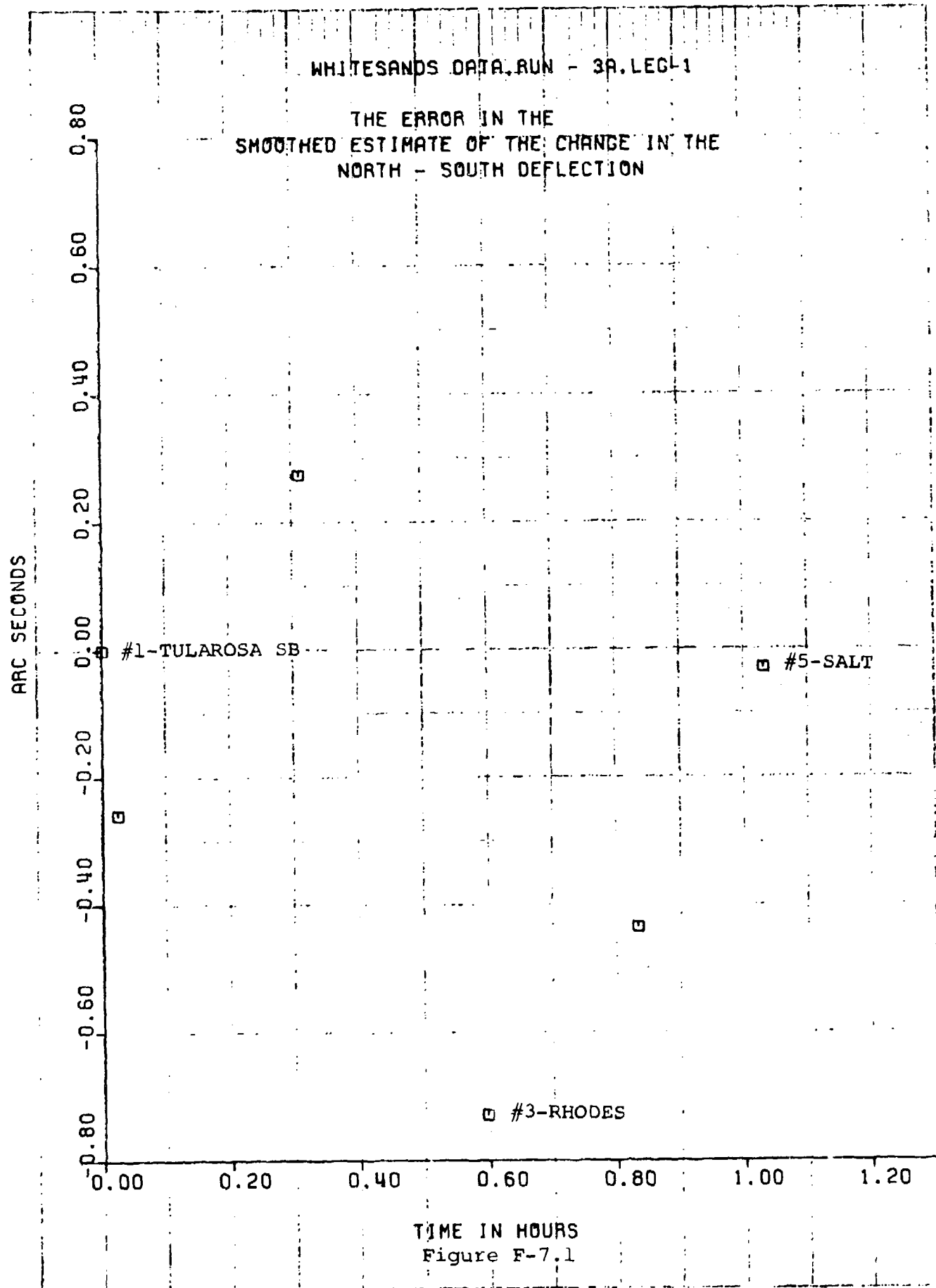
0.60

0.80

1.00

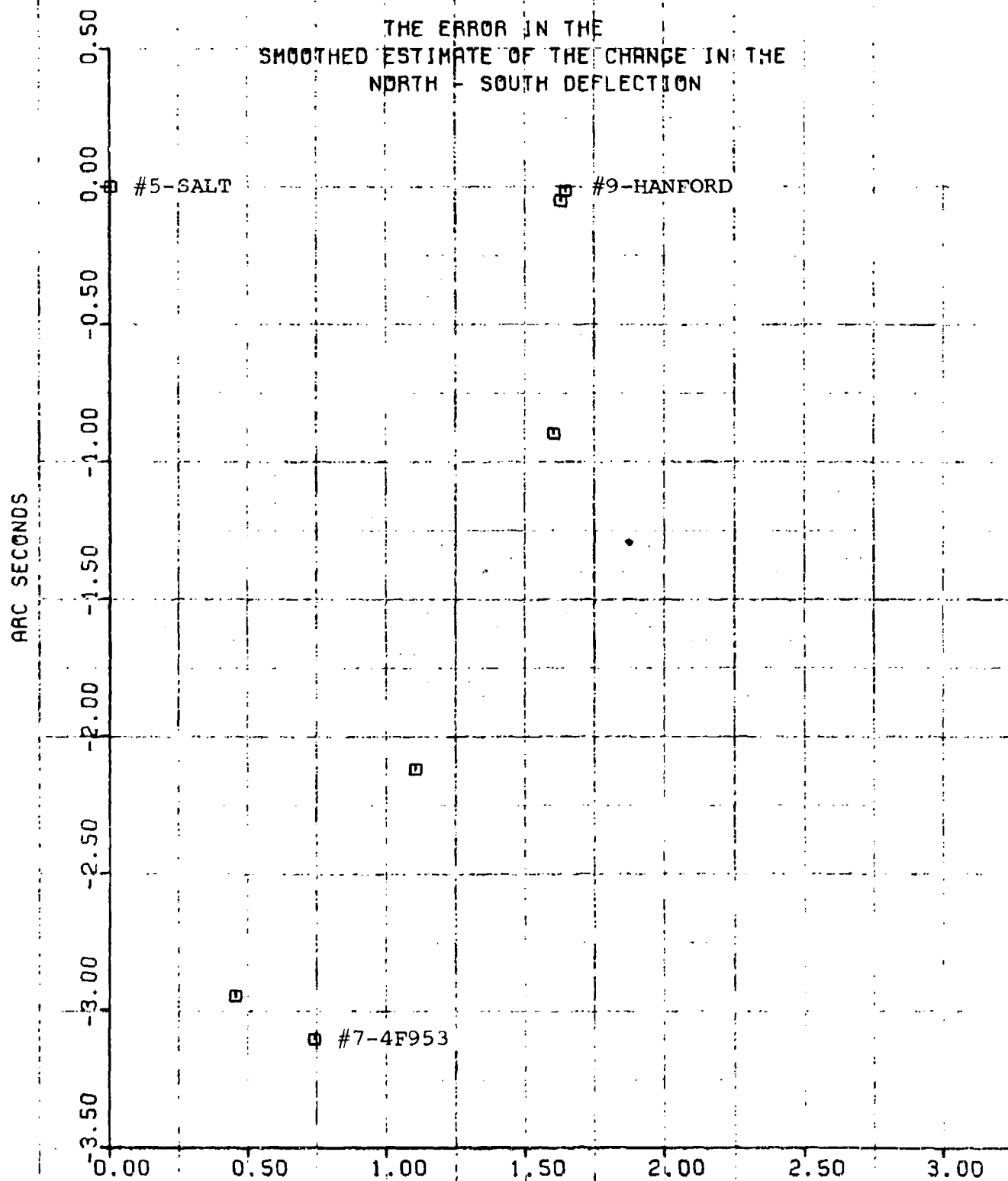
1.20

TIME IN HOURS
Figure F-6.22



WHITESANDS DATA.RUN - 3B.LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION

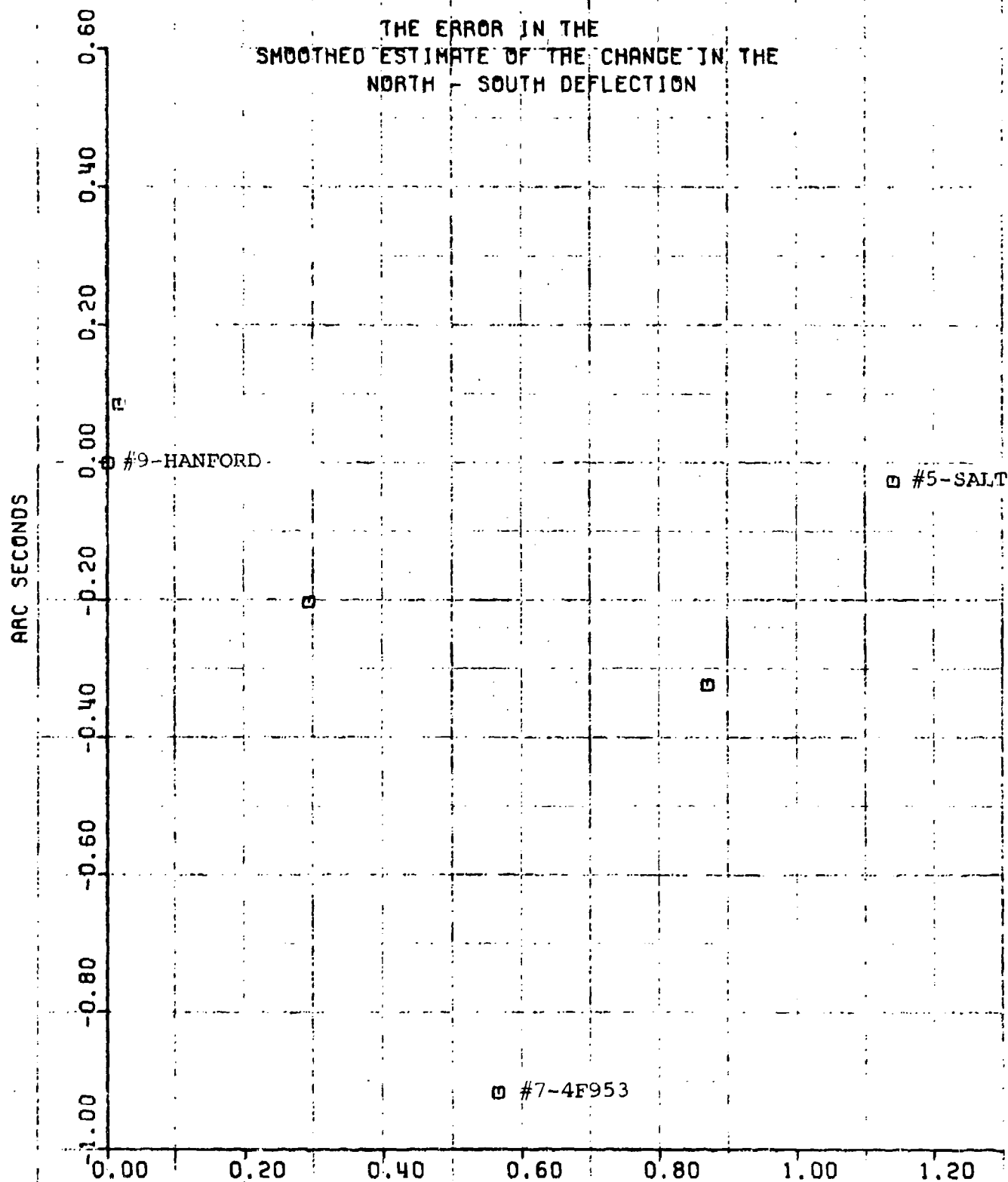


TIME IN HOURS

Figure F-7.2

WHITESANDS DATA, RUN - WA, LEG-1

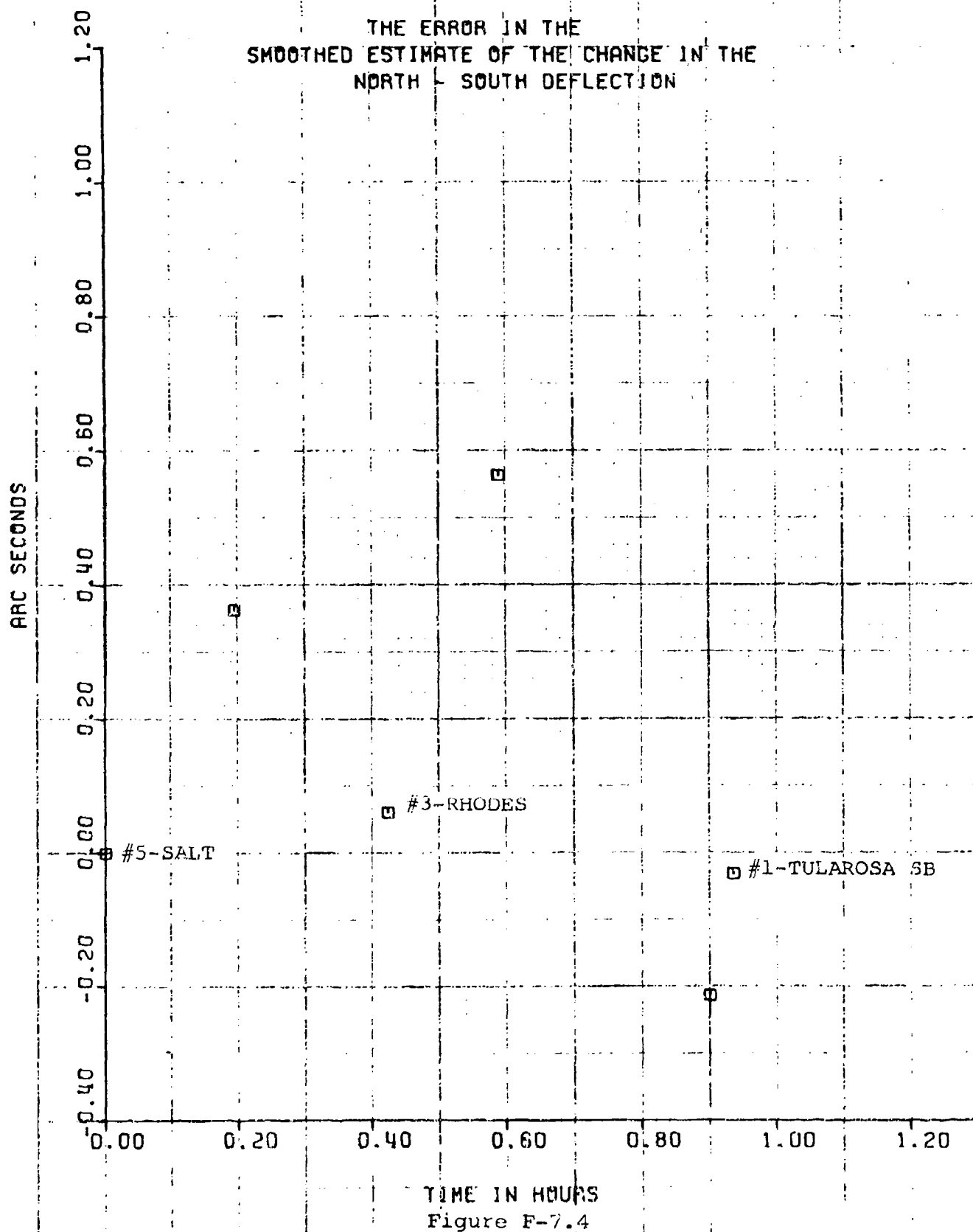
THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-7.3

WHITESANDS DATA, RUN - 4B, LEG-1

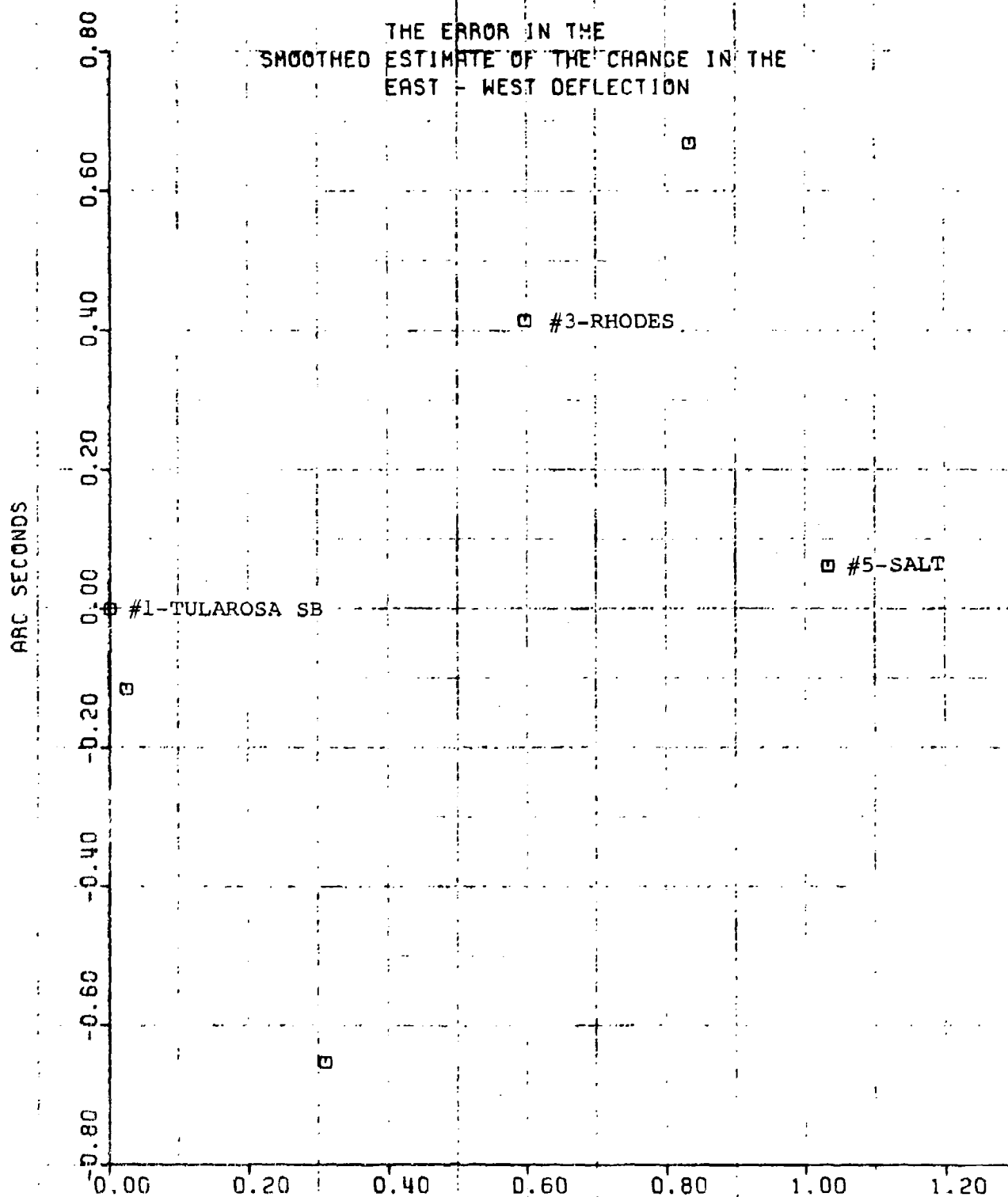
THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
NORTH - SOUTH DEFLECTION



TIME IN HOURS
Figure F-7.4

WHITESANDS DATA RUN - 3A, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

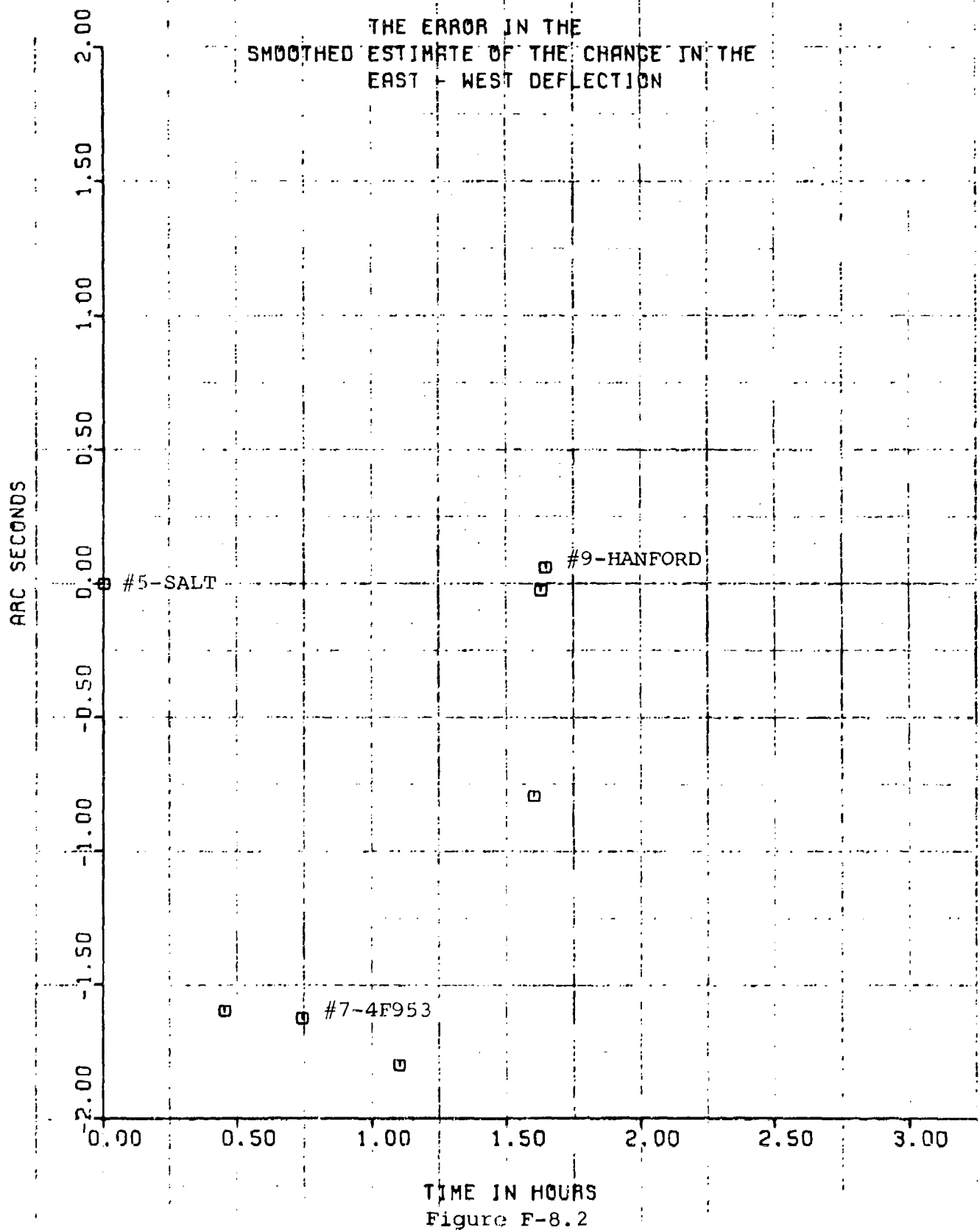


TIME IN HOURS

Figure F-8.1

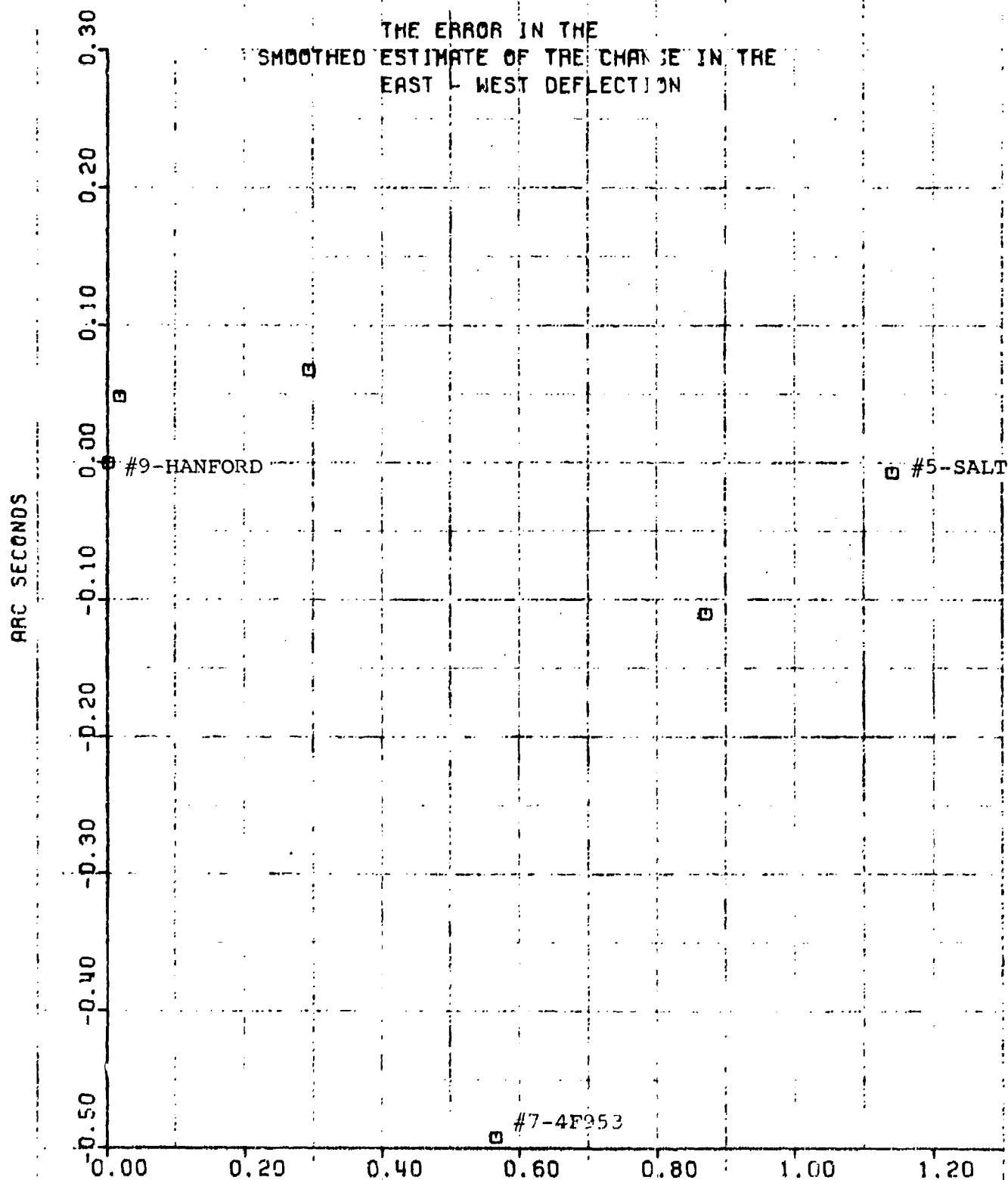
WHITESANDS DATA, RUN - 3B, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



WHITESANDS DATA, RUN - 4A, LEC-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION



TIME IN HOURS
Figure F-8.3

WHITESANDS DATA, RUN - 4B, LEG-1

THE ERROR IN THE
SMOOTHED ESTIMATE OF THE CHANGE IN THE
EAST - WEST DEFLECTION

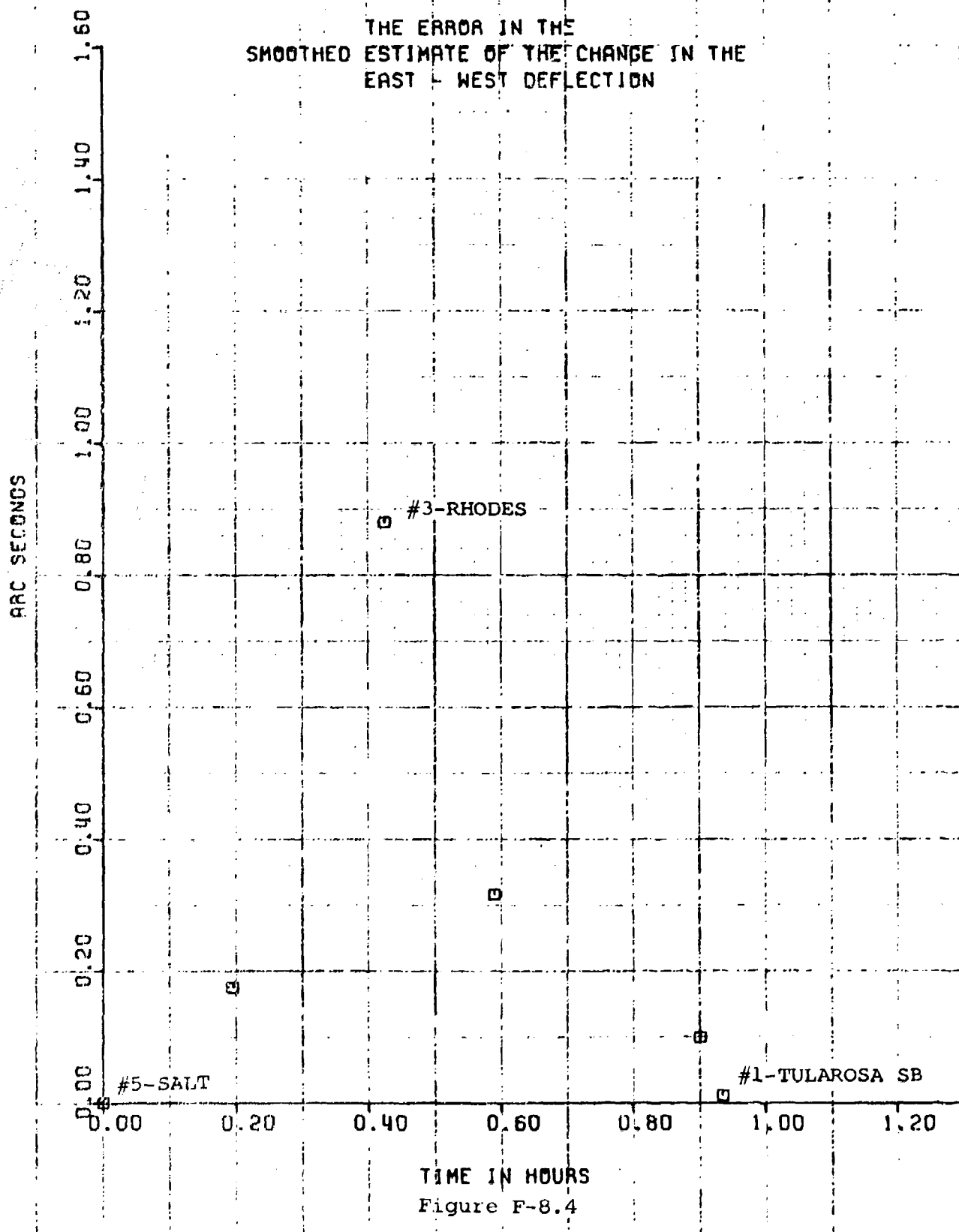


Figure F-8.4

APPENDIX G

SMOOTHED ESTIMATES OF CHANGE AND THE ERRORS IN THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL FOR ALL MISSIONS

This appendix contains a complete summary of the error in the change or the smoothed estimate of the change in the deflection of the vertical for all the original missions and their subsets. Each table contains that particular set of runs which traversed the same reference stations. Generally the tables are divided into two groups. Tables G-1 through G-5 contain all of the original 17 missions as recorded over White Sands Test Course. Also included in this group are the missions which were reduced to eliminate major heading changes (5A, 5B, 6A, 6B, 7A, 7B). The second group contains Tables G-6 through A-9 where the original missions were divided to reduce the elapsed time between initiation and closure. This group includes runs 3A/B, 4A/B, 1(1)A/B, 2(2)A/B, 9A/B, 2(1)A/B, 8(2)A/B, 10(2)A/B, 10(4)A/B, 13A/B, and 14A/B. The word 'Ref' in the tables refer to the initial and closure points used by the off-line smoother and were limited to those points where deflection of the vertical data was known. All of the changes in the tables were computed using the 'Ref' point at the top of all the columns as the initial value.

The following is a synopsis of each table:

TABLE G-1

- Values of the error in the change in the deflection of the vertical for runs 3, 4, 5, 5A/B.
- RMS error values for each individual reference point and each run
- 5A/B removed major heading change

TABLE G-2

- Values of the error in the change in the deflection of the vertical for original runs 6, 7.
- Values of the error in the change in the deflection of the vertical for 6A/B, 7A/B where a major heading change was removed.
- RMS error values for each individual reference point and each run.

TABLES G-3, G-4, G-5

- Values of the smoothed estimates of the change in the deflections of the vertical grouped according to common reference points [G-3(1(1), 2(2), 9)], [G-4 (2(1), 8(2), 10(2), 10(4))], [G-5(13, 14, 16(1), 16(2), 16(3))]
- Reference values of change are noted where given
- RMS values of error in the change are computed for each individual point
- RMS value of error for all points in Table G-3 only

TABLE G-6

- Value of the error in the change in the deflection of the vertical for runs 3A/B, 4A/B with reduced travel periods
- RMS error values for each individual reference point and each run

TABLES G-7, G-8, G-9

- Values of the smoothed estimates of the change in the deflections of the vertical grouped according to common reference points [G-7 (1(1)A/B, 2(2)A/B, 9A/B), [G-8(2(1)A/B, 8(2)A/B, 10(2)A/B, 10(4)A/B), [G-9 (13A/B, 14A/B)]
- Reference values of change are noted where given
- RMS values of error in the change are computed for each given point
- RMS value of error for all points in Table G-7 only.

TABLE G-1
THE ERROR IN THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL FOR WHITE SANDS TEST DATA OF RUNS NUMBER 3, 4, AND 5
(Reduced as recorded in original runs) Runs 5A and 5B were Divided to Eliminate Major Heading Changes

Station Name	Station ID Number	N-S Deflection (Arc-Sec) 5						E-W Deflection 7					
		Run Number						Run Number					
		3	4	5	5A	5B	RMS ¹	3	4	5	5A	5B	RMS ¹
TULAROSA S.B.	1	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
OASIS	2	-1.3	0.6	3.1/ 5.1	0.4	2.3	1.4	-2.0	-0.7	1.3/-0.4	1.6	-0.5	1.0
RHODES	3	-3.7	0.0	4.4/ 6.4	-0.3	1.9	1.1	-2.2	-0.7	1.4/-0.8	1.5	-1.0	1.3
VALLEY ASTRO	4	-4.5	0.2	7.1/ 8.5	0.5	2.1	1.3	-3.0	-2.0	0.8/-1.7	1.4	-1.5	1.8
SALT	5	-5.0	-0.4	8.4/ 9.6	0.2	1.6	1.0	-4.5	-2.8	-0.4/-2.2	0.2	-2.2	2.1
WC-50	6	-6.3	-0.6	10.7/11.9	-0.2	1.2	0.8	-5.0	-2.2	-1.6/-2.2	-1.0	-2.0	1.8
4F953	7	-5.5	-1.2	13.0	Ref	Ref	1.2	-4.3	-1.8	-0.5	Ref	Ref	1.8
Q-48	8	-3.5	-0.3	NA	NA	NA	0.3	-3.4	-0.6	NA	NA	NA	0.6
HANFORD	9	Ref	Ref	NA	NA	NA	Ref	Ref	Ref	NA	NA	NA	Ref
RMS		4.5	0.6	8.6	0.3	1.9	1.1	3.6	1.7	1.4	1.4	1.6	1.6

Note: 1 - RMS includes only Runs 4, 5A, 5B

NA - Not Available

Ref - Reference Point

TABLE G-2
THE ERROR IN THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL FOR THE WHITE SANDS DATA OF RUNS NUMBER 6 AND 7
[Reduced as recorded in original runs] Runs 6A, 6B, 7A, 7B were Divided to Eliminate Major Heading Changes

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) §						E-W Deflection (Arc-Seconds) ¶							
		Run Number						Run Number							
		6	7	6A	6B	7A	7B	RMS ¹	6	7	6A	6B	7A	7B	RMS ¹
WC-50	1	Ref	Ref	Ref			Ref	Ref	Ref	Ref				Ref	Ref
LAURA CENTER	2	4.6	3.3	1.9			1.3	1.6	1.7	0.6	0.6			0.2	0.4
GUN	3	6.2	4.8	2.4			1.4	2.0	2.7	1.7	1.1			1.1	1.1
SHOT	4	6.7	7.4	2.0			2.5	2.3	4.0	2.1	1.8			1.4	1.6
D-3 1/2	5	8.3	7.5	2.9			1.7	2.4	3.4	2.0	0.8			1.1	1.0
NW-30	6	8.6	7.0	1.9			Ref	1.9	3.3	0.9	-0.1			Ref	0.1
D-3	7	8.4	8.0	Ref				Ref	4.6	1.4	Ref				Ref
SEE HORN	8	9.9	6.3			Ref		Ref	5.3	2.0			Ref		Ref
GERI	9	8.3	3.4			Ref		1.3	3.6	1.4		Ref	0.1		0.1
NICK 2	10	5.5	2.8			-1.1		1.0	3.8	1.2		0.9	0.4		0.7
BRYCE	11	NA	2.3			-1.0		1.0	NA	2.9		NA	2.0		2.0
WHITE	12	NA	1.3			-1.2		1.2	NA	3.0		NA	2.4		2.4
FRY	13	2.4	0.1			-1.3		0.9	2.0	2.0		0.9	1.7		1.4
CARMEN	14	0.9	-0.3			-1.0		0.8	1.8	1.6		1.0	1.5		1.3
CONN	15	Ref	Ref			Ref		Ref	Ref	Ref		Ref	Ref		Ref
RMS		6.9	5.0	2.3	0.5	1.2	1.8	1.6	3.5	1.9	1.0	0.9	1.6	1.1	1.3

Note: 1 - RMS includes only Runs 6A, 6B, 7A, 7B

NA - Not Available

Ref - Reference Point

TABLE G-3
THE SMOOTHED ESTIMATES OF THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL AND THE ERROR FOR KNOWN REFERENCE
POINTS OF RUNS NUMBER 1(1), 2(2), AND 9 FOR THE WHITE SANDS TEST DATA
(Reduced as recorded in original runs)

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) 5					E-W Deflection (Arc-Seconds) 7				
		Run Number			Ref. Value of Change	RMS Value of Error in Change	Run Number			Ref. Value of Change	RMS Value of Error in Change
		1(1)	2(2)	9			1(1)	2(2)	9		
SANDS NE BASE	3	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
OTERO AZ ECC	4	0.7	-1.5	-1.4	NA	NA	-1.7	-1.7	-0.9	NA	NA
OTERO ECC	5	-0.6	-2.4	-2.0	-0.2	1.7	-1.6	-2.0	-0.7	-1.8	0.7
V-321	6	-0.5	-2.2	-1.4	NA	NA	-3.8	-4.2	-2.0	NA	NA
ADD ECC	7	-1.8	-3.6	-1.4	-1.3	1.4	-5.4	-5.4	-3.1	-3.8	1.4
IPS-2	8	-3.3	-4.0	-2.6	NA	NA	-7.2	-7.0	-4.3	NA	NA
C-322	9	-3.9	-5.7	-3.7	NA	NA	-8.4	-7.9	-5.3	NA	NA
SANDS SW BASE	10	-5.6	-6.3	-3.6	-3.5	2.0	-9.5	-8.9	-6.5	-8.5	1.3
TRAVES	11	-5.2	-6.7	-4.8	-4.3	1.5	-10.9	-9.6	-6.8	-9.4	1.7
MORGAN	12	-2.5	-5.7	-2.6	-3.3	1.6	-15.2	-12.4	-9.3	-13.3	2.6
EASY	13	2.1	-1.9	-0.4	-0.3	1.7	-13.2	-10.8	-8.2	-14.7	4.5
LAP ASTRO	14	NA	NA	2.5	3.5	1.0	NA	NA	-9.9	-13.1	3.2
BEASLEY	2001	Ref	Ref	Ref	0.6	Ref	Ref	Ref	Ref	-6.7	Ref
RMS						1.5					2.5

NA - Not Available
Ref - Reference Point

TABLE G-4
THE SMOOTHED ESTIMATES OF THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL AND THE ERROR FOR KNOWN REFERENCE
POINTS OF RUNS NUMBER 2(1), 8(2), 10(2), AND 10(4) FOR THE WHITE SANDS TEST DATA
(Reduced as recorded in the original runs)

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) §					RMS Value of Error in Change	E-W Deflection (Arc-Seconds) ¶					Ref. Value of Change	RMS Value of Error in Change
		Run Number				Ref. Value of Change		Run Number						
		2(1)	8(2)	10(2)	10(4)			2(1)	8(2)	10(2)	10(4)			
BEASLEY	2001	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
Z-335	2002	0.8	0.2/1.1	0.1	0.4	NA	1.0	1.0/ 1.1	1.1	0.8	NA	NA		
Y-335	2003	-0.2	0.5/0.4	-0.1	-0.2	NA	1.1	0.9/ 1.1	1.5	0.8	NA	NA		
X-335	2004	0.4	1.4/1.3	0.8	0.7	NA	0.3	-0.1/ 0.3	0.8	0.5	NA	NA	1.0	
W-335	2005	0.8	2.1/1.8	1.2	1.4	-0.1	0.8	0.6/ 0.7	1.8	1.2	0.1	0.1		
V-335	2006/2038	-0.5	1.9/0.9	0.9	0.4	NA	0.6	0.2/ 0.4	1.8	1.2	NA	NA		
U-335	2007/2037	-0.2	3.4/1.4	1.9	0.9	NA	0.1	0.1/-0.8	1.9	1.4	NA	NA	1.6	
NED	2035	0.2	2.5/1.2	1.7	1.0	-0.9	-0.9	-1.3/-2.2	0.9	-0.2	0.4	0.4		
YB60	2034	0.9	1.9/2.2	1.4	1.9	NA	-0.4	-0.7/-1.4	2.1	0.8	NA	NA		
YB59	2033	0.2	2.2/1.4	1.9	1.5	NA	0.0	-0.5/-1.7	2.2	0.8	NA	NA		
YB58	2032	0.7	3.7/2.1	3.1	2.3	NA	0.8	-1.2/-2.4	1.9	0.2	NA	NA		
YB57	2031	1.0	3.2/2.4	2.9	2.6	NA	-1.1	-1.3/-2.3	1.8	0.3	NA	NA		
M-334	2023	-0.5	3.1/1.0	2.9	1.1	NA	-0.6	-0.3/-2.0	2.7	0.8	NA	NA		
L-334	2022	-0.7	3.4/0.2	2.8	0.6	NA	0.7	-0.3/-0.8	3.0	1.9	NA	NA		
K-334	2021	0.1	3.9/1.0	3.3	1.1	NA	0.9	-0.4/-0.8	3.0	2.4	NA	NA		
FIRE	2049	-0.6	3.5/0.4	2.5	0.1	NA	3.3	1.9/ 1.6	5.4	4.4	NA	NA		
H-334	2020	-0.3	2.5/0.5	1.8	0.5	NA	3.6	2.1/ 1.8	5.5	4.4	NA	NA		
F-334	2019	-0.3	0.7/0.1	0.1	0.0	NA	5.6	3.7/ 4.4	7.3	6.9	NA	NA		
HUEY	2018	Ref	-1.6	Ref	Ref	-1.6	Ref	5.8	Ref	Ref	8.2	Ref	2.4	

NA - Not Available
Ref - Reference Point

TABLE G-5
THE SMOOTHED ESTIMATES OF THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL AND THE ERROR FOR KNOWN REFERENCE
POINTS OF RUNS NUMBER 13, 14, AND 16 FOR THE WHITE SANDS TEST DATA
(Reduced as recorded in original runs)

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) δ										E-W Deflections (Arc-Seconds) ϵ					RMS Value of Error in Change
		Run Number					Ref. Value of Change	RMS Value of Error in Change	Run Number					Ref. Value of Change			
		13	14	16(1)	16(2)	16(3)			13	14	16(1)	16(2)	16(3)				
JACK	22			Ref		Ref	Ref						Ref	Ref			
MONUMENT 14	26			1.9		0.1	NA						1.3	0.8	NA		
IPS 3	3			3.0		-0.1	NA						2.3	0.9	NA		
OASIS	27	Ref	Ref	5.1	Ref	Ref	1.4	3.9	Ref	Ref	2.0	Ref	Ref	-0.7	Ref	2.7	
RHODES	201	0.1	1.6	NA	NA		NA	0.7	0.4	-1.1	-2.0	NA	NA	-0.7	NA	0.9	
VALLEY ASTRO	202	0.4	2.2	4.7	4.2		1.7	0.4	2.8	-5.2	-6.6	-3.7	-4.1	-4.2	-3.4	0.5	
G-48	30	NA	NA	2.7	0.8		NA	NA	1.8	NA	NA	-3.8	-5.7	NA	NA	3.5	
SALT	31	0.5	2.5	Ref	Ref		1.4	0.0	1.3	-8.4	-8.8	Ref	Ref	-5.9	-5.1	4.5	
WC-50	203	-0.8	1.1					-2.3	1.3	-16.0	-15.9			-11.5			
NW-50	204	-1.8	-1.3					NA		-18.4	-17.1			NA	NA		
TS-204-2	205	-2.0	-3.1					NA		-17.9	-16.3			NA	NA		
TS-344	206	-2.8	-3.7					NA		-18.3	-16.6			NA	NA		
SW-70	207	-1.1	-2.7					NA		-19.5	-17.6			NA	NA		
BASIN	208	-3.0	Ref					-4.9	1.0	-13.6	Ref			-10.1		3.4	
G-237	209	-4.5						NA		-11.2				NA	NA		
TS-857	210	Ref.						-5.8		Ref				-7.5			

NA - Not Available
Ref - Reference Point

TABLE G-6
THE ERROR IN THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL FOR WHITE SANDS TEST DATA OF
RUNS 3 AND 4 DIVIDED TO REDUCED TRAVEL PERIODS BETWEEN CLOSURES

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) ξ			E-W Deflection (Arc-Seconds) η		
		Run Number		RMS	Run Number		RMS
		3 A/B	4 A/B		3 A/B	4 A/B	
TULAROSA S. B.	1	Ref	Ref	Ref	Ref	Ref	Ref
OASIS	2	0.3	0.6	0.5	-0.7	0.3	0.5
RHODES	3	-0.7	0.1	0.5	0.4	0.9	0.7
VALLEY ASTRO	4	-0.4	0.4	0.4	0.7	0.2	0.5
SALT	5	Ref	Ref	Ref	Ref	Ref	Ref
WC-50	6	-2.9	-0.3	2.1	-1.6	-0.1	1.1
4F953	7	-3.1	-0.9	2.3	-1.6	-0.5	1.2
Q-48	8	-2.1	-0.2	1.5	-1.8	0.1	1.3
HANFORD	9	Ref	Ref	Ref	Ref	Ref	Ref
RMS		2.3	0.5	1.4	1.3	0.4	0.9

Ref - Reference Point

TABLE G-7
THE SMOOTHED ESTIMATES OF THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL AND THE ERROR FOR KNOWN REFERENCE
POINTS OF RUNS 1(1), 2(2), AND 9 FOR THE WHITE SANDS TEST DATA
(TRAVEL LEGS DIVIDED TO REDUCE TIME PERIODS BETWEEN CLOSURE POINTS)

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) ±						E-W Deflection (Arc-Seconds) ±					
		Run Number			Ref. Value of Change	RMS Value of Error in Change	Run Number			Ref. Value of Change	RMS Value of Error in Change		
		1(1) A/B	2(2) A/B	9 A/B			1(1) A/B	2(2) A/B	9 A/B				
SANDS NE BASE	3	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
OTERO AZ ECC	4	1.1	-0.9	-1.3	NA	-1.5	NA	-1.2	NA	-1.2	NA	NA	NA
OTERO ECC	5	0.0	-1.6	-1.9	-0.2	-1.2	1.3	-1.1	-0.9	-1.1	-0.9	0.6	0.6
V-321	6	0.5	-0.8	-1.3	NA	-3.2	NA	-2.7	NA	-2.7	NA	NA	NA
ADD ECC	7	-0.5	-1.8	-1.3	-1.3	-4.6	0.5	-4.0	-3.8	-4.0	-3.8	0.8	0.8
IPS-2	8	-1.7	-1.9	-2.5	NA	-6.1	NA	-5.4	NA	-5.4	NA	NA	NA
C-322	9	-2.0	-3.2	-3.7	NA	-7.1	NA	-6.7	NA	-6.7	NA	NA	NA
SANDS SW BASE	10	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
TRAVES	11	0.1	-0.7	-1.3	-0.8	-1.4	0.6	-0.2	-1.3	-0.2	-1.3	0.7	0.7
MORGAN	12	2.1	-0.3	-1.1	0.2	-6.3	1.4	-2.4	-5.2	-2.4	-5.2	1.9	1.9
EASY	13	6.2	3.0	3.1	3.2	-4.5	1.7	-1.0	-6.6	-1.0	-6.6	4.2	4.2
LAB ASTRO	14	NA	NA	6.0	6.0	NA	0.0	-2.5	1.4	-2.5	1.4	3.9	3.9
BEASLEY	2001	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
RMS							1.1					2.5	2.5

NA - Not Available
Ref - Reference Point

TABLE G-8
THE SMOOTHED ESTIMATES OF THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL OF RUNS 2(1), 8(2), 10(2) AND 10(4)
FOR THE WHITE SANDS TEST DATA (TRAVEL LEGS DIVIDED TO REDUCE TIME PERIODS BETWEEN CLOSURE POINTS)

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) S					E-W Deflection (Arc-Seconds) T				
		Run Number					Run Number				
		2(1) A/B	8(2) A	8(2) B	10(2) A/B	10(4) A/B	2(1) A/B	8(2) A	8(2) B	10(2) A/B	10(4) A/B
BEASLEY	2001	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Z-335	2002	0.6	0.2	1.1	-0.3	0.1	1.2	1.2	1.3	1.0	0.9
Y-335	2003	-0.5	0.6	0.3	-0.8	-0.8	1.4	1.2	1.3	1.3	1.0
X-335	2004	0.0	1.5	1.2	-0.2	-0.1	0.8	0.3	0.7	0.6	0.7
W-335	2005	0.2	2.2	1.6	-0.1	0.4	1.4	1.1	1.2	1.5	1.5
V-335	2006/2038	-0.6	2.0	0.8	-0.7	-0.9	1.4	0.8	1.0	1.4	1.7
U-335	2007/2037	-0.8	3.5	1.3	-0.1	-0.6	1.0	0.8	0.0	1.5	2.0
NED	2035	Ref	2.6	1.1	Ref	Ref	Ref	-0.4	1.2	Ref	Ref
YB60	2034	0.8	2.1	2.0	-0.1	1.1	0.5	0.4	0.3	1.2	1.0
YB59	2033	0.2	2.3	1.2	0.7	0.8	0.7	0.7	0.5	1.4	0.9
YB58	2032	0.8	3.8	1.9	2.1	1.7	-0.1	0.1	1.0	1.1	0.3
YB57	2031	1.2	3.4	2.2	2.0	2.1	-0.5	0.1	0.9	1.0	0.3
M-334	2023	-0.2	3.3	0.9	2.3	0.8	-0.2	1.2	0.5	1.9	0.8
L-334	2022	-0.2	3.5	0.1	2.4	0.5	1.0	1.5	0.9	2.3	1.9
K-334	2021	0.6	4.1	0.9	3.1	1.1	1.1	1.5	1.1	2.3	2.3
FIRE	2049	0.0	3.6	0.4	2.5	0.3	3.3	3.9	3.6	4.8	4.3
H-334	2020	0.4	2.5	0.5	2.1	0.7	3.6	4.2	3.9	4.9	4.3
F-334	2019	0.4	0.8	0.1	0.6	0.4	5.4	6.0	6.7	6.8	6.7
HUEY	2018	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref

Ref - Reference Point

TABLE G-9
THE SMOOTHED ESTIMATES OF THE CHANGE IN THE DEFLECTIONS OF THE VERTICAL AND THE ERROR FOR KNOWN REFERENCE POINTS
OF RUNS 13 AND 14 FOR THE WHITE SANDS TEST DATA (TRAVEL LEGS DIVIDED TO REDUCE TIME PERIODS BETWEEN CLOSURE POINTS)

Station Name	Station ID Number	N-S Deflection (Arc-Seconds) *				E-W Deflection (Arc-Seconds) *			
		Run Number		Ref. Value of Change	RMS Value of Error in Change	Run Number		Ref. Value of Change	RMS Value of Error in Change
		13 A/B	14 A/B			13 A/B	14 A/B		
QASIS	27	Ref	Ref	Ref		Ref	Ref	Ref	
RHODES	201	-0.7	2.8	1.0	1.5	0.0	-1.1	-0.5	0.6
VALLEY ASTRO	29/202	-0.1	0.7	0.7	0.6	-3.0	-4.6	-3.5	0.9
G-48	30	NA	NA	NA		NA	NA	NA	
SALT	31	-0.3	0.3	0.3	0.4	-5.2	-5.7	-5.2	0.5
WC-50	203	Ref	Ref	Ref		Ref	Ref	Ref	
NW-50	204	-0.8	-1.4	NA		-3.5	-2.4	NA	
TS-204-2	205	-0.9	-2.6	NA		-3.5	-2.5	NA	
TS-444	206	-1.4	-2.6	NA		-4.9	-3.6	NA	
SE-70	207	0.4	-1.2	NA		-6.6	-5.3	NA	
BASIN	208	-2.4	Ref	-2.6	0.2	-1.0	Ref	0.6	1.0
G-247	209	-2.8		NA		1.0		NA	
TS-857	210	Ref		Ref		Ref		Ref	

NA - Not Available

Ref - Reference Point

APPENDIX H

"BEST" ESTIMATES OF THE DEFLECTION OF THE VERTICAL AT STATIONS WHERE REFERENCE VALUES WERE NOT AVAILABLE

The "Best" estimate values of the deflection of the vertical for the stations where the reference values were not available were derived using the average of the change in the deflections of the vertical as measured by the RGSS system. Several estimates of the change were available for most of the unknown stations and the different missions used to compute each of the averages is noted in Table H-1. Three stations (IPS-1, MOTEL, K-237) where reference values were not given are excluded from the "Best" estimate list. This was done because these stations were traversed either before the first known reference value or after the last known reference value for a mission. Therefore, they are not included in the estimates as obtained from the FORTRAN smoothing program.

Additional reference values were provided after the "Best" estimate values were determined for the four (4) stations noted in Table H-2. The values of the error for the N-S and E-W deflections of the vertical are computed for each station and the RMS value of the error for the four (4) stations is included in the table.

TABLE H.1
 "BEST" ESTIMATES OF THE DEFLECTIONS OF THE VERTICAL AT STATIONS WHERE
 NO REFERENCE VALUES WERE AVAILABLE

Station Name	Station ID Number	Estimated N-S Deflection (ξ) (Arc-sec)	Estimated E-W Deflection (η) (Arc-sec)	Runs Where Measured
OTERO AZ ECC	4	-1.60	4.98	
V-321	6	-1.94	3.13	1(1)
IPS-2	8	-3.63	0.32	2(2)
C-322	9	-4.66	-0.71	9
Z-335	2002	0.03	0.76	2(1), 8(2) 10(2), 10(4)
Y-335	2003	-0.48	0.81	
X-335	2004	0.30	0.16	
V-335	2006/2038	0.02	0.70	
U-335	2007/2037	0.67	0.45	
YB-60	2034	0.73	0.15	
YB-59	2033	0.38	0.27	
YB-58	2032, 31, 32	1.03	-0.06	
YB-57	2031	1.07	-0.31	
M-334	2023	0.44	0.24	
L-334	2022	0.28	0.88	
K-334	2021	0.69	1.11	
IIRL RM-1	2049	0.29	3.42	
H-334	2020	0.29	3.20	
F-334	2019	-0.44	5.72	
NW-50	204	-5.15	-5.71	13, 14
TS-204-2	205	-5.97	-5.41	
TS-344	206	-6.45	-6.21	
SV-70	207	-4.97	-7.61	
G-237	209	-6.50	-1.18	13
MONUMENT 14	26	-2.35	11.79	16(1), 16(3)
IPS-3	3	-1.99	12.34	
G-48	30	-1.05	6.70	16(1), 16(2)

TABLE H-2

ADDITIONAL REFERENCE VALUES AND "BEST" ESTIMATES OF THE DEFLECTION OF THE VERTICAL
FOR STATIONS ON RUNS 13 AND 14

Station Name	N-S Deflection (Arc-Sec) δ			E-W Deflection (Arc-Sec) ϵ		
	Reference Value	"Best" Estimated Value	Value of Error	Reference Value	"Best" Estimated Value	Value of Error
NW-50	-7.01	-5.15	1.86	-4.15	-5.71	-1.56
TS-204-2	-7.50	-5.97	1.53	-4.35	-5.41	-1.06
TS-344	-6.42	-6.45	-0.03	-5.31	-6.21	-0.90
SW-70	-6.50	-4.97	1.53	-6.74	-7.61	-0.87
RMS			1.32			1.31

APPENDIX I

KALMAN ESTIMATES OF FREE-AIR GRAVITY ANOMALY CHANGES AND THE ERRORS IN THE ESTIMATES

The free-air gravity anomaly estimates (DZ), generated by the Kalman mechanization are recorded at each station during the mission. Where reference free-air gravity anomaly values were available for the various missions, the changes (ΔG) from station to station in the estimates and reference values were computed. The real-time Kalman estimates were not compensated and the real-time changes are recorded directly in the tables. The total error from Runs 2(1), 8(2), 10(2) and 10(4) [where all the reference values were given] is 2.0 milligals (RMS) Table I-1. It should be noted that the errors in the column for the real-time Kalman estimates of Run 8(2) (Table I-1) are the RMS of the two errors generated for each station on this particular test run. Since only a minimum of reference points were given for all the other runs, they are collectively summarized in Table I-2.

TABLE 1-1
THE RAW KALMAN ESTIMATES OF THE FREE AIR GRAVITY ANOMALY CHANGES AND THE ERRORS FOR KNOWN REFERENCE
VALUES OF RUNS 2(1), 8(2), 10(2) AND 10(4) FOR THE WHITE SANDS TEST DATA

Station Name	Station ID Number	ΔG - Raw Kalman Estimate of Free Air Gravity Change (ΔDZ) - Milligals				Change in Reference Free Air Gravity Anomalies-Milligals	Error in the Raw Kalman Estimates of Free Air Gravity Change - Milligals			
		Run Number					Run Number			
		2(1)	8(2)	10(2)	10(4)		2(1)	8(2) RMS	10(2)	10(4)
BEASLEY	2001	Ref	Ref	Ref	Ref	Ref	-3.8	2.4	1.9	-4.0
Z-335	2002	-3.0	0.8/-2.6	2.7	-3.2	0.8	-0.8	1.7	-2.8	0.1
Y-335	2003	-0.7	-2.2/0.5	-2.7	0.2	0.1	0	1.0	1.1	-1.4
X-335	2004	0.5	1.9/0.2	1.6	-0.9	0.5	2.2	1.9	0.9	2.9
W-335	2005	3.6	3.8/2.5	2.3	4.3	1.4	-1.2	1.7	-2.8	0.5
V-335	2006/2038	1.4	0.3/1.9	-0.2	3.1	2.6	3.7	1.3	0.2	-1.9
U-335	2007/2037	6.6	3.1/4.7	3.1	1.0	2.9	-4.1	2.5	3.4	1.1
NED	2035	0.7	7.5/2.6	8.2	5.9	4.8	0.2	1.2	0	0.6
YB60	2034	1.7	2.9/0.6	1.5	2.1	1.5	-1.0	2.1	-2.1	0.2
YB59	2033	-0.3	-2.3/0.6	-1.4	0.9	0.7	-1.1	1.6	-0.6	-1.1
YB58	2032	1.3	2.7/0.1	1.8	1.3	2.4	2.9	1.5	1.5	2.3
YB57	2031	4.8	2.5/4.0	3.4	4.2	1.9	-2.9	1.9	-0.5	-1.0
M-334	2023	-2.7	-1.9/-1.4	-0.3	-0.8	0.2	1.5	1.6	1.4	0.9
L-334	2022	-0.9	-0.7/-1.3	-1.2	-1.7	-2.6	0.6	1.2	1.5	0.6
K-334	2021	-1.0	0/-0.9	-0.1	-1.0	-1.6	0.7	1.8	-1.6	1.4
H-334	2020	-2.3	-3.9/-0.4	-3.2	-0.2	-1.6	0.6	1.3	1.8	-1.3
F-334	2019	3.0	2.9/0.6	4.2	1.1	2.4	-4.6	2.6	-4.9	2.2
HUEY	2018	4.3	8.8/12.6	4.0	11.1	8.9				
						RMS	2.4	1.8	2.1	1.7

Ref - Reference Point

TABLE 1-2.
THE RAW KALMAN ESTIMATES OF THE FREE AIR GRAVITY ANOMALY CHANGES AND THE ERRORS FOR KNOWN REFERENCE VALUES OF SELECTED
RUNS IN THE WHITE SANDS TEST DATA

Station Name	Station ID Number	ΔG - Raw Kalman Estimate of Free Air Gravity Change (ΔDZ)-Milligals										Change in Reference Free Air Gravity Anomalies - Milligals
		Run Number										
		3	4	5	1	2(2)	9	13	14	16(1)	16(2)	
OASIS	2 27	Ref	Ref	Ref				Ref	Ref	Ref	Ref	Ref
VALLEY ASTRO	4 202 29	-15.3	-17.2	-17.6	-15.4			-20	-14.1	-12.4	-12.7	-15.2
SALT	5 31	-14.2	-13.7	-13.4	-13.8			-13.5	-14.4	-14.2	-14.8	-14.0
4F053	7	14.0	15.2	NA				NA	NA	NA	NA	12.1
Motel	2					Ref						Ref
OTERO ECC	5				7.2	5.7	-3.6					-4.1
SANDS SW BASE	10				-14.5	-15.6	-15.1					-14.9
BEASLEY	2001				4.1	4.0	4.5					-1.8

Station Name	ID Number	Error in the Raw Kalman Estimate of Free Air Gravity Change - Milligals									
		Error in the Raw Kalman Estimate of Free Air Gravity Change - Milligals									
		3	4	5	1	2(2)	9	13	14	16(1)	16(2)
VALLEY ASTRO	4 202 29	0.1	2.0	1.7				4.8	1.1	2.8	2.5
SALT	5 31	6.2	0.3	0.4				0.5	0.4	0.2	0.8
4F053	7	1.0	3.1	NA				NA	NA	NA	NA
OTERO ECC	5				11.3	1.6	0.5				
SANDS SW BASE	10				0.4	0.7	0.2				
BEASLEY	2001				5.0	5.8	6.3				

NA - Not Available
Ref - Reference Point