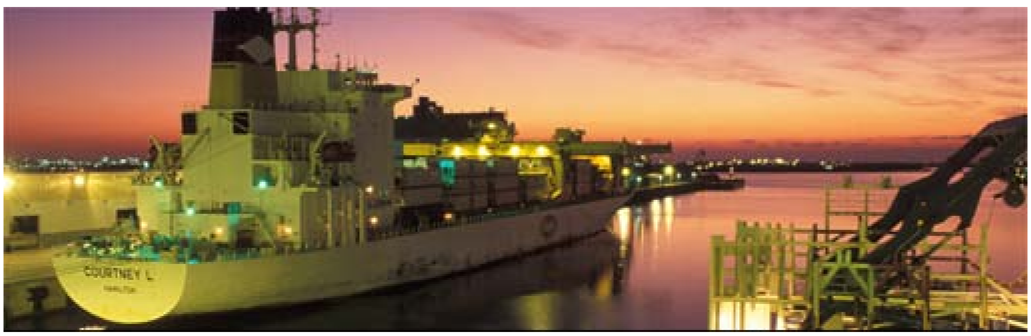

Freeport Harbor Field Data Collection Program
Final Report

Freeport Harbor Field Data Collection Program Final Report

Michael Tubman, Trimbak M. Parchure, Ben Brown, Nolan Raphelt, and Bradley Guay

Coastal and Hydraulics Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

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1. Introduction

1.1 Purpose

A field data collection program in Freeport Harbor, Texas (Figure 1), was conducted for the Galveston District of the Corps of Engineers during the fall of 2003. The primary purpose of the program was to obtain data needed to validate RMA-2 and TABS-MD depth-averaged numerical hydrodynamic models. The currents calculated by the verified models were input to a ship simulator used to assess proposed harbor improvement plans. The secondary objective of the program was to collect data for a desktop study to estimate the shoaling rates in the proposed modified navigation channels. As described in the Scope of Work (SOW, Appendix A), the work plan included water-level and water-quality (salinity and suspended sediment concentrations) measurements for a 24- to 30-day period at four locations, transects of current measurements across the navigation channel, and water quality measurements, over a spring tidal cycle, and 35 bottom-sediment samples. During collection of the bottom-sediment samples, mid-depth water samples were collected for water-quality measurements

As specified in the SOW, the deliverables of the field data collection program are:

- Time series of water-level measurements at four locations over a 24- to 30-day period.
- Time series of salinities and suspended sediment concentrations at four locations over a 24- to 30- day period.
- Current data along transects across the navigation channel over a tidal cycle.
- Salinity and suspended sediment concentration values at three depths in the water column in the middle of the navigation channel during the current transect measurements.
- Salinity and suspended sediment concentration values from mid-depth at 35 locations.
- Grain-size distribution of 35 bottom sediment samples taken from the:

Gulf Intercoastal Waterway (GIWW) channel	5 samples
Freeport Harbor Channel and GIWW junction	5 samples
Inner reach of the Freeport Harbor Channel	25 samples

Funding for the program was provided by the Galveston District of the Corps of Engineers (Point of Contact (POC): Laura Vera, CESWG-EC-EH, Tel# 409-766-6370) to the U.S. Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL). The project was conducted by ERDC personnel Thad C. Pratt (POC, ERDC-CHL-HF-HM, Tel# 601-634-2959), Howard Benson, Chris Callegan, John Kirklin, Tate McAlpin, and Sam Varnell.

1.2 Study Area

Freeport Harbor is located about 40 miles southwest of Galveston Harbor on the Texas coast (Figure 1). As shown in Figure 2, Freeport Harbor has a deep-draft

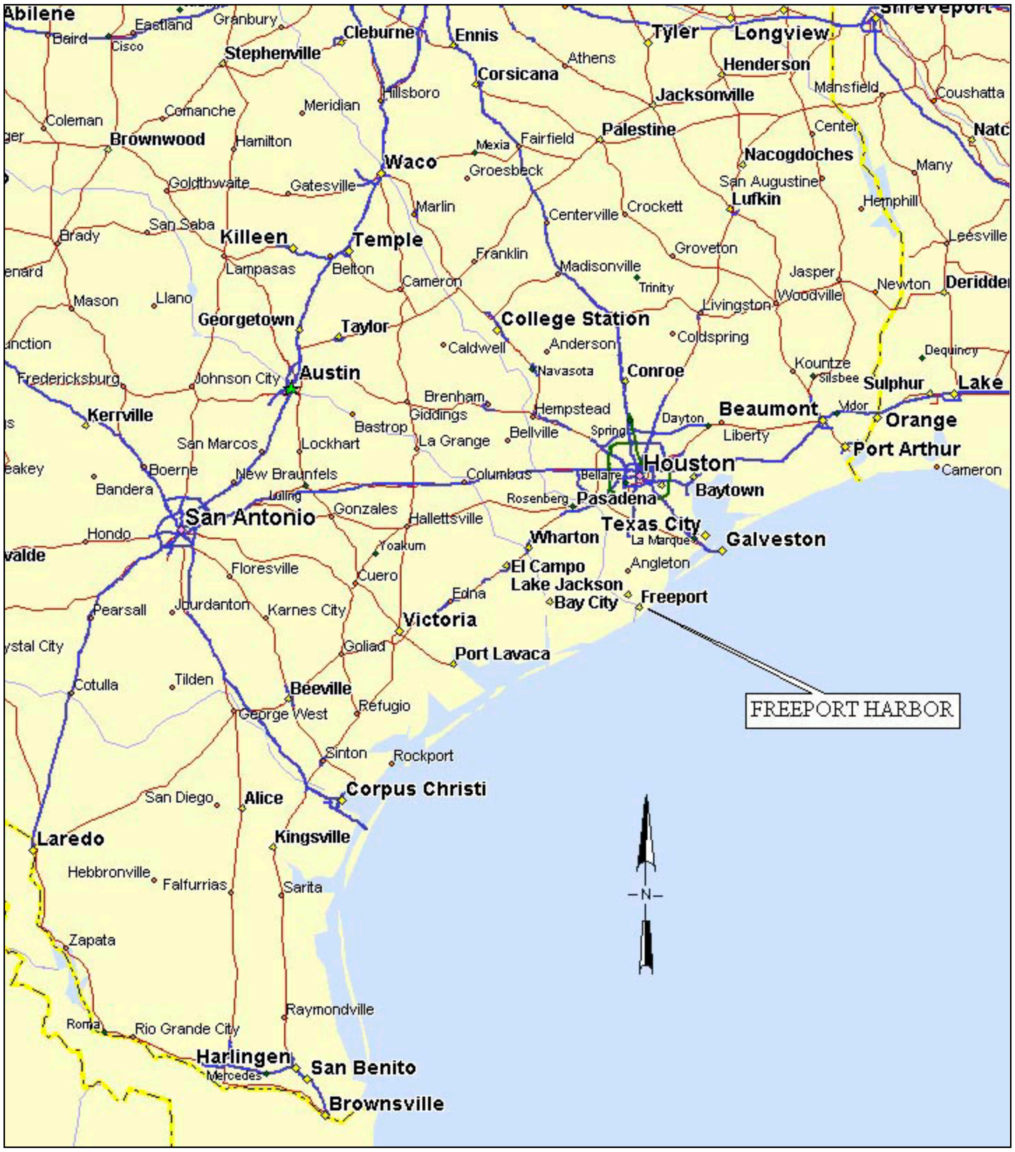


Figure 1. Location of Freeport Harbor on the Texas coast.

navigation channel that connects the harbor facilities to the Gulf of Mexico. The navigation channel has two segments, an outer straight entrance channel in the Gulf of Mexico, which extends approximately five miles out from the shoreline and has a maintained navigable width of 400 feet with a project depth of 47 feet, and a winding inner navigation channel inside the coastline that includes the harbor facilities, with varying width and depth along its course. Historically, the inner navigation channel was the old Brazos River. It was disconnected from the Brazos River and is now a dead-end

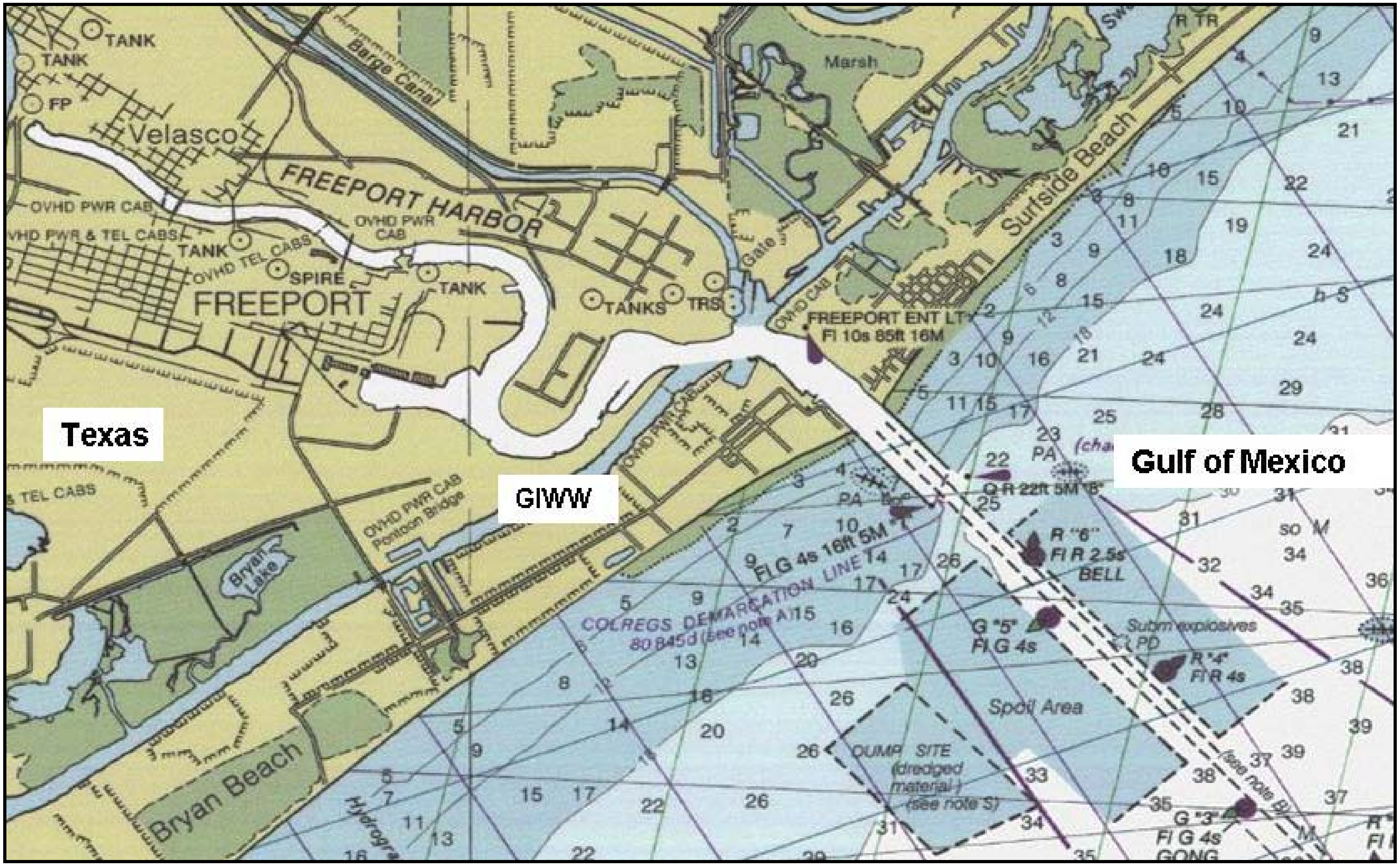


Figure 2. Freeport Harbor and surrounding area.

channel with levees constructed along both banks. The inner navigation channel has a tide gate constructed across it (just under the “T” in “FREEPORT HARBOR” in Figure 2), which restricts the maximum depth at the location of the gate to16 feet. There are road and railway bridges upstream of the tide gate that produce constrictions, and impose restrictions on the navigation in this area. The Gulf Intracoastal Waterway (GIWW), the navigation channel, and a barge canal, intersect approximately one mile landward of the shoreline, producing a region of complex current flow patterns.

The tides in the harbor are predominantly diurnal with a mean range of 1.35 ft and a diurnal range (i.e., the difference between mean higher high water and mean lower low water) of 1.76 ft. Tidal current speeds in the harbor are relatively low.

2. Approach

2.1 Design of the Data Collection Program

The tidal forcing in Freeport Harbor is from tides in the GIWW that enter from the northeast, through San Luis Pass and West Bay near Galveston, from the southwest, where the Brazos River connects with the Gulf of Mexico, and through the entrance channel from the Gulf of Mexico. Therefore, in addition to making tide measurements in the harbor, water-level gages were placed in the entrance channel, and in the GIWW northeast and southwest of the navigation channel (referred to in this report as the east and west GIWW) . The locations of the water-level gages are shown in Figure 3.

Figure 3 also shows the locations of the automatic water samplers. Water samples were taken to address the potential effects of the proposed harbor improvement plan on salinity and suspended sediment concentrations in the harbor. The placement and sampling plan for the automatic water samplers was designed to measure daily averages at two locations in the harbor, and at three peripheral locations that could influence conditions in the harbor (i.e., the east and west GIWW and the entrance channel). The sampling scheme combined 12 hourly samples into a single sample every 12 hours.

The original SOW called for current data across the navigation channel. However, before the surveys were conducted, it was recognized that data were needed not only from within the navigation channel, but also from the three channels that influence conditions at their confluence in the navigation channel (i.e., the east and west GIWW and the barge channel). Therefore current measurements were made along the four transects shown in Figure 4.

For the purposes of the study, the strongest currents were assumed to be the most significant, and the plan in the SOW was to survey the transects during a spring tide. During the surveys, water samples were collected near the center of each transect line at the surface, mid-depth, and near-bottom, to obtain data on the vertical distributions of salinity and suspended sediments, and their variations over a tidal cycle.

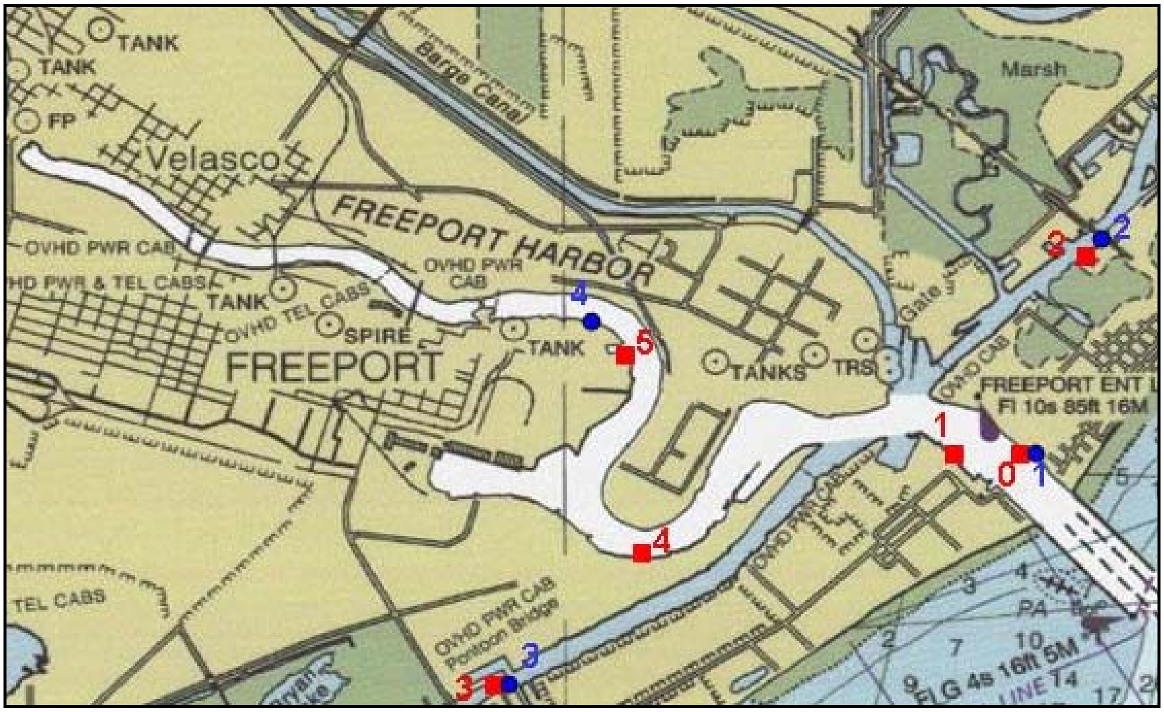


Figure 3. Locations of the four water-level gages (blue circles), and the six automatic water sampling stations (red squares).

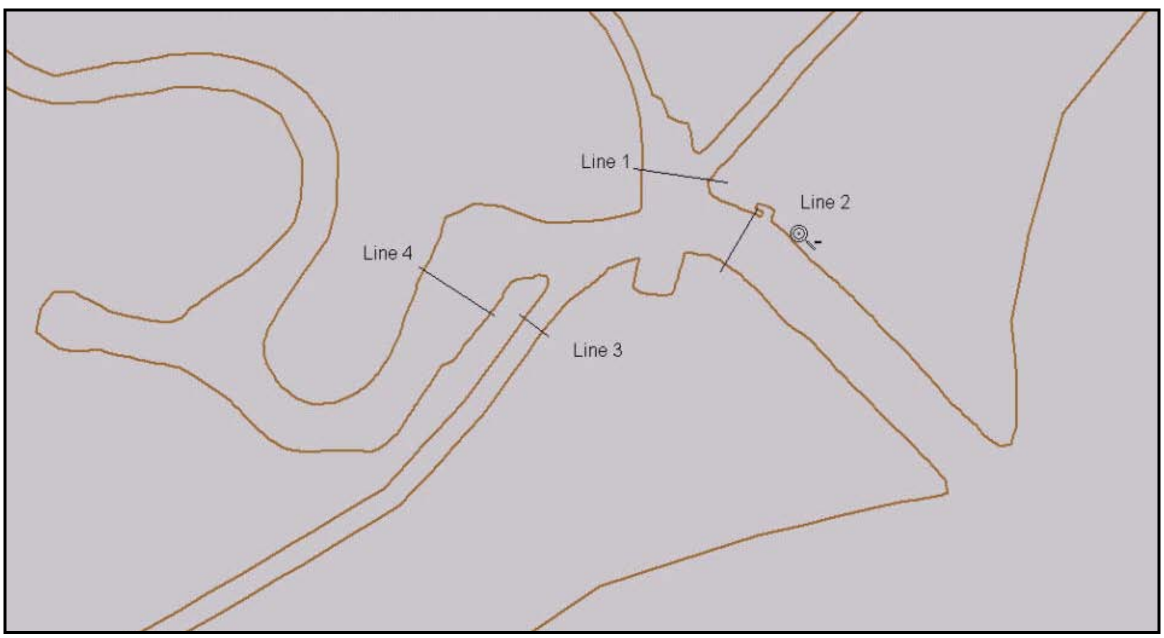


Figure 4. Locations of the current-measurements transect lines.

The sea bed is a source for sediment that is put into suspension, as well as being a place where suspended sediments can be deposited. Figure 5 shows the locations of 33 bed samples that were taken to determine the spatial distribution of bed grain-size along

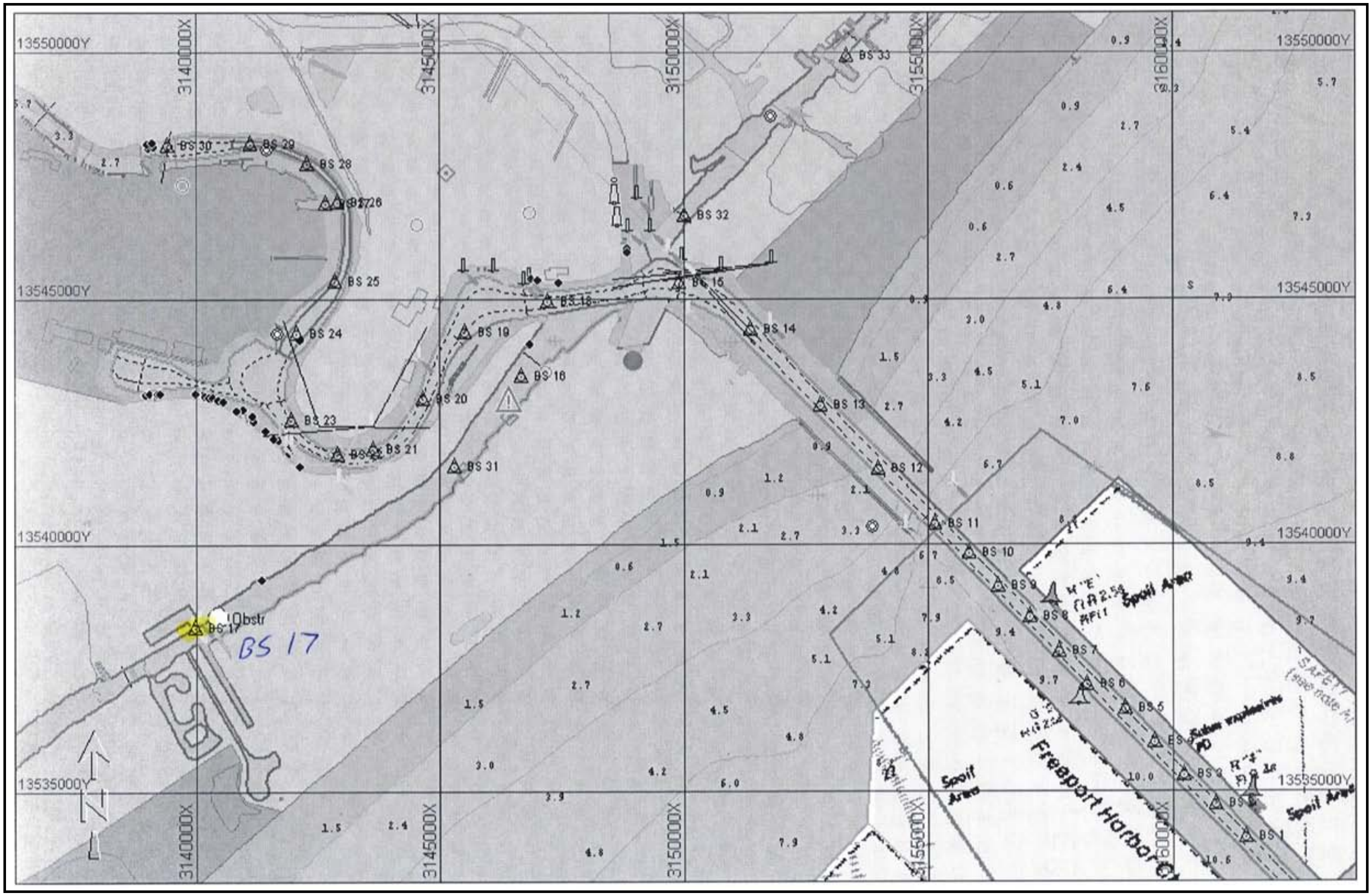


Figure 5. Locations of the bed samples and concurrent water samples.

the navigation channel. Water samples were taken concurrently at the same locations to determine the spatial distribution of salinity and suspended sediment.

2.2 Instrumentation

Water-level measurements were made using Coastal Leasing Microtides systems. The Microtides is a self-contained, internally recording, microprocessor-controlled measurement system (Figure 6). It determines the water elevation by measuring the pressure of the water column above it using a Foxboro Pressure Sensor with an accuracy of 0.1 percent of full scale. For the 30-psia systems that were deployed, the 0.1 percent accuracy approximately equates to a 0.07-ft of seawater accuracy.

Before deployment, the water-level gages were programmed to record a measurement every second for 1 minute, and record the average pressure over the one-minute interval. This was repeated every 5 minutes. A short bench-test run was made, and the measured pressures were compared to atmospheric pressure.

Figure 6. Microtides self-contained, internally recording, microprocessor controlled, water-level gage.

The water-level recorders are well suited to the Freeport Harbor environment. They were deployed well below the surface (approximately 6 ft), so that they were not visible from the surface, even at low tide. This helped avoid interference with them in this heavily traveled area.

Water samples were automatically collected using Teledyne ISCO Model 3700 Portable Samplers (Figure 7). The Model 3700 is a programmable general purpose liquid sampler that is well suited for unattended coastal deployments. It is lightweight and battery operated, and can be programmed to pump selected water volume samples at specified times. The water samples are automatically stored in individual bottles inside the unit's weather-proof housing (Figure 8). The samples are pumped through a tube with the intake at the desired sample depth. The four samplers were programmed to take 0.0053-ft^3 (150-ml) samples every hour for 12 hours and store the 12 samples as a composite 0.032-ft^3 (900-ml) sample in individual 0.035-ft^3 (1-liter) sample bottles (Figure 9). This procedure was followed continuously, filling the 24 1-liter sample bottles in each unit in 12 days.

An acoustic Doppler current profiling (ADCP) system was used to measure current velocity across the four survey transects (Figure 4). The ADCP transmits sound bursts into the water that are scattered back to the instrument by particulate matter suspended in the flowing water. The current meter listens for the returning signals and assigns depths to the received signals based on speed of sound and the time-after-transmit that the signals are received. The current speeds at those depths are based on the change in frequency caused by the moving particles. This change in frequency is called Doppler shift. The survey was performed using a 1200 kHz ADCP manufactured by RD Instruments, Inc (RDI). It was mounted to the side of a survey vessel (Figure 10) and transmitted its signals down toward the bottom as the vessel navigated along the survey lines. During data collection, it measured vessel velocity, water velocity, water temperature, and bottom bathymetry. The measurement of the velocity of the vessel over the bottom allows the current velocity data to be corrected for the movement of the survey vessel. When in a fixed mooring, the manufacture specifies accuracies of +/- 0.00656 ft/s (0.2 cm/s) for current speed and +/- 2 deg for current direction.

Just prior to beginning the transect current surveys, a magnetic-deviation correction was made by navigating pairs of back-and-forth lines along fixed headings. The differences between the ADCP system's bottom-track output headings, which were magnetic directions from the system's internal compass, and true-direction headings from a Global Positioning System (GPS) were measured. From the average value of these differences, a magnetic-deviation correction was calculated and entered into the ADCP system. It was verified by driving the survey vessel in a circle which started and ended at the exact same location. The path of the survey vessel around the circle was plotted using the ADCP's bottom-track data. The accuracy of the magnetic-deviation correction was verified when the bottom track data showed that the survey vessel had completed the circle and returned to the starting location.

Figure 7. Two Teledyne ISCO Model 3700 Portable Samplers. The top protective covers are off, exposing the pump mechanisms and the programming interfaces.

Discrete water samples were manually collected using a 0.071 ft^3 (2 liter) Niskin sampler. The sampler was attached to a wire and lowered to the desired depth. In the open position, it is a tube open at both ends that allows water to flow through it. A weight attached to the wire (i.e., a “messenger”) was released at the surface and traveled down the wire. It struck the release mechanism on the sampler, which allowed two stoppers to close the ends of the tube and seal the sample. The sampler was pulled to the surface with the wire and the contents were poured into a 0.00104 ft^3 (8 oz) sample bottle. The sample bottles were taken to the laboratory for suspended sediment and salinity analyses.

Bed samples were taken using a drag bucket. It is dragged along the bed by a rope, and the weight of a chain attached to the open end of the bucket forces it to quickly dig into the bed and fill the bucket with a bed sample. The rope is then used to bring the sample to the surface where it is transferred to a sample container.

Figure 8. Two water samplers covered and deployed. The intake hoses from each unit go over the bulkhead into the water and take samples from two different depths.

2.3 Instrument Deployments

The water-level gages were placed on horizontal pedestals welded at 90-degree angles to one end of 8-ft-long aluminum “angle-irons” (Figure 11), and strapped to the angle-irons. They were deployed by bolting the ends of the angle-irons opposite the gages to wooden pilings (Figures 12 and 13). A water-level recorder dedicated to recording atmospheric pressure was placed on land near TG3. The atmospheric pressure measurements measured by this gage were subtracted from the pressures measured by the other gages, resulting in measurements of only water-column pressures.

Four of the automatic water samplers were placed adjacent to bulkheads at industrial sites with restricted access (Figure 8). The two samplers that were in the entrance channel (i.e., WS0 and WS1) were clamped to stands which were in-turn clamped to pilings that supported navigation markers in the channel (Figure 13). At stations WS2 and WS5, two water samplers were installed with their intakes at different depths (Figure 8). One of the intakes at each of these stations was set at 3 ft above the bed, the same as those at WS0, WS1, WS3, and WS4. The other intakes at WS2 and WS5 were set at approximately mid-depth, which was 7.5 ft above the bed at WS2 and 7.0 ft above the bed at WS5.

Figure 9. A test sample being poured from one of the 0.035-ft^3 (1-liter) sample bottles in the water sampler. Each sampler container 24 of these bottles.

3. Chronology of Events

3.1 Preparations, Field and Post-retrieval Activities

The instruments were deployed during the first field effort from October 8 to 16, 2003. The current measurements along the transects were conducted during the second field effort from October 27 to 30, 2003. Coincident with the current measurements, water samples were collected. The deployed instruments were recovered during the third field effort from November 17 to 19, 2003, and bed-sediment and water samples were taken. Detailed chronologies of the program during these times are given in Tables 1 through 3.

3.2 Discussion

CHL responded quickly after receiving a Letter of Intent from the District on October 8, 2003. The automatic water samplers and tide gages were deployed 8 days later on October 16. The deployed instrumentation and coverage complied fully with the SOW.

Table 1 – Summary of activities for the first field effort – October 8 – 16, 2003		
Date	Time (local)	Activities
10/8-10/10	day	planning, arranging logistics, instrument and boat preparation, packing equipment
10/14	day	Varnell, Callegan, Kirklin, and Benson transport equipment and boat to Freeport by truck
!0/15	06:00	prepare water-level gages and boat for deployment of gages and water samplers
	07:45	deployed TG1 deployed
	08:35	deployed two water samplers – WS2
	12:00	deployed TG2 and WS3
	14:00	deployed WS4
	16:50	deployed TG3
	18:00	deployed WS5
10/16	06:00	check WS2
	07:30	deployed WS1
	08:30	deployed WS0
	09:30	deployed TG4
	day-evening	returned to Vicksburg

Table 2 – Summary of activities for the second field effort – Oct. 28 – Nov. 1, 2003		
Date	Time (local)	Activities
10/27	day	Varnell, Callegan, Kirklin, McAlpin, transport equipment to Freeport by truck
10/28	day	Benson and Waller go to Freeport by van
	morning	deployed new WS1 and serviced TG2
	afternoon	prepared boat for ADCP survey, calibrated ADCP, located tidal benchmarks
10/29	day-night	current transect surveys and water samples
10/30	morning	current transect surveys and water samples
	afternoon-evening	serviced water-level gages and water samplers, and surveyed water-level gage elevations
10/31	day	returned to Vicksburg

After deployment, it was reported that the automatic water sampler at WS1 in the entrance channel was missing (possibly hit by a barge). A replacement was installed on October 28 during the second field effort, and the automatic water samplers at the remaining 5 stations were serviced. It was discovered that the top was left on one sample bottle at WS3, so there was no sample for 2400 (CST) on October 18. It was also found that the battery in the water sampler at WS5, the one with its intake at 7.0 ft above the bed, had died on October 22 after 7 days of collecting samples. The water samples from the initial 12 days of water-sampler deployment were returned to ERDC for analysis. The water-level gages were also serviced. It was discovered that TG3 had leaked and did not record valid data. The water-level recorder at TG3 was replaced, and

Table 3 – Summary of activities for the third field effort – November 17 - 19, 2003		
Date	Time (local)	Activities
11/17	day	Varnell, Callegan, Kirklin, Benson transport equipment to Freeport
11/18	08:15	recovered WS3
	08:45	recovered WS5
	09:15	recovered WS4
	10:00	recovered WS0
	10:30	recovered new WS1
	10:45	recovered WS2
	afternoon	demoblilize water samplers
	18:00-19:00	recovered water-level recorders
11/19	08:00-09:00	took bottom sediment samples
	day	returned to Vicksburg

Figure 10. Typical mounting for current transect ADCP on side of survey vessel.

data from all the water-level recorders were brought back to ERDC. During the second field effort current measurements were made along the four survey transects for 25 hours, as specified in the SOW. Water samples were taken near the center of transect lines at three depths each time the current measurements were made.

The automatic water samplers and tide gages were recovered on November 18 during the third field effort. The water samplers had reached their maximum capacity of 12 days of sampling from the time they were serviced during the second field effort. Over the

Figure 11. Typical water-level gage installation systems with the recorders attached to the ends of angle irons.

entire program, they took samples for a total of 24 days, which agreed with the SOW. All four water-level gages were recovered during the third field effort, and had recorded 100 percent data since the second field effort. Over the entire program, three of the water-level gages each recorded a total of 34 days of data, exceeding that which would have been collected during the 24- to 30-day deployment periods specified in the SOW. At TG3, where the first gage that was deployed leaked, water-level measurements were made over 19 days. The 33 bed samples and concurrent mid-depth water samples at the same locations were collected during the third field effort, as specified in the SOW.

4.0 Data Processing and Analysis

4.1 Processing Steps

The data from the Microtides water-level gages were down-loaded from the systems using software supplied by the manufacturer. They were checked to verify that the atmospheric pressures recorded before and after deployment were correct. Using the atmospheric pressure values recorded by the water-level recorder kept on land at TG3, the atmospheric pressures were subtracted from the data, and the pressures were converted to water-level values using a representative density for sea water of 1.02 times the density of fresh water (i.e., 62.4 lb/ft^3). The depths recorded just after deployment and just prior to recovery were checked to verify that they agreed with the field observations at those times. The water levels were referenced to the record means and stored in ASCII files.

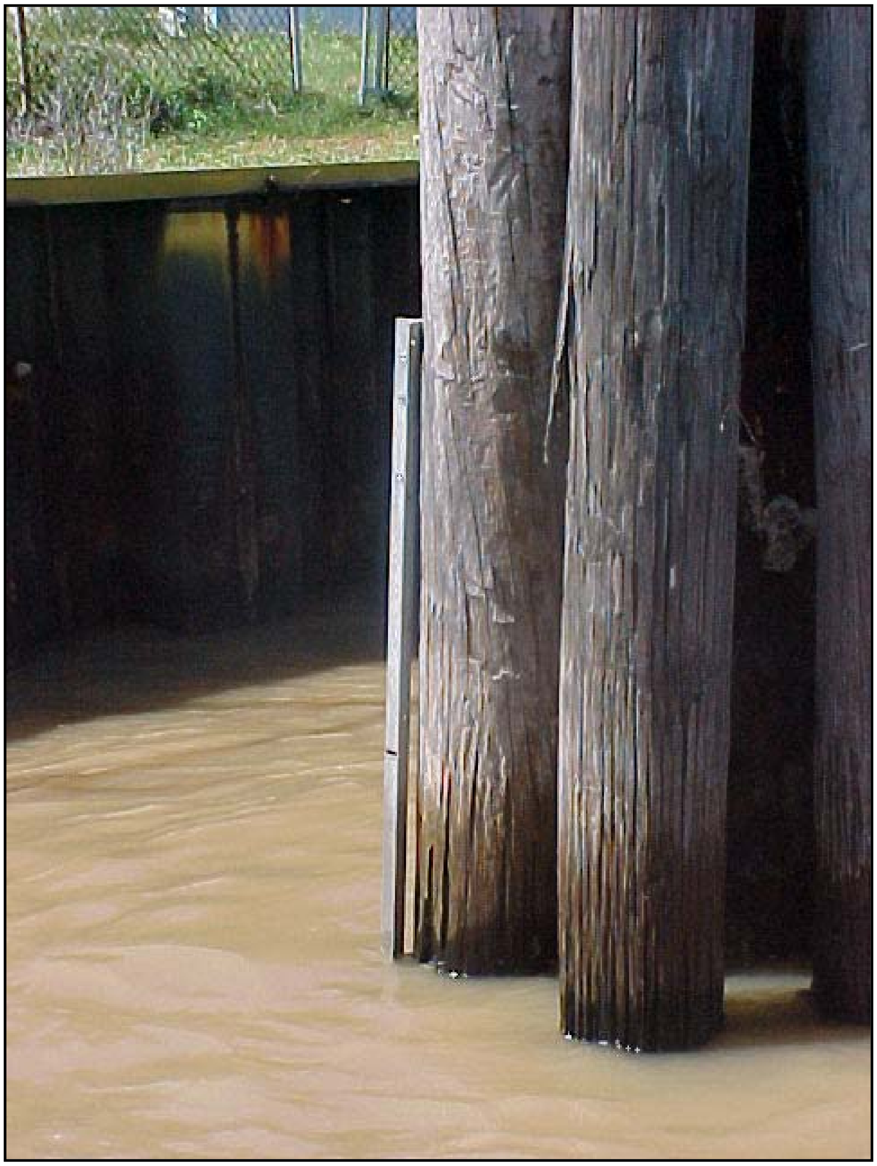


Figure 12. Angle iron bolted to a piling with water-level recorder attached to bottom.

Samples of approximately 0.0084 ft^3 (8 oz) were taken in the field from the 0.032 ft^3 (900 ml) water samples collected by the automatic water samplers over consecutive 12-hr periods. They were packed in ice and returned to the sediment laboratory at CHL in Vicksburg, where they were kept refrigerated until early December when they were analyzed. In the laboratory 0.00035-ft^3 samples were taken from them and allowed to drain through filter papers having 1.3 x 10^{-6} ft (0.4 microns) diameter pores through them. The filter papers were weighed on a laboratory balance just prior to this procedure. Immediately afterwards they were dried in an oven and the filter papers and suspended sediment trapped on them were weighed again. After taking the difference between the before-and-after weights, the suspended sediment concentrations were calculated in units of milligrams per liter. Water was drawn from each of the samples returned from the field and put through an AGE 2100 autocell to determine the salinity. The autocell measures

Figure 13. Automatic water sampler clamped to a stand which was clamped to a navigation marker piling. An angle iron that holds a water-level recorder is bolted to the piling under the water sampler.

the conductivity and temperature of the sample. Using the equation of state, it determines the salinity of the sample to an accuracy of better than 0.01 ppt. The water samples obtained during the current transect survey, and those obtained at the time the bed samples were collected, were analyzed the same way.

The first step in processing the current transect survey data was to compare the survey field notes with the ASCII files of GPS navigation data recorded for each transect. There were two objectives in the process. The first was to verify that the field notes matched the file numbers to the correct survey transect lines. The times and locations in the GPS navigation files provided this information. The second objective was to determine the exact time when each survey line was acquired and started by the survey vessel, and when the line was complete. By matching these times to the times of the measurements recorded in the ADCP data files, data not along the transect line were eliminated from further processing.

The software package supplied by RDI used to acquire the current transect data (WinRiver) was used for the next step in processing the transect data. WinRiver converted the binary data recorded by the ADCP to ASCII output files. Two data quality indicators are given in these files. They are percent-good pings and backscatter intensity. These two parameters were reviewed for data quality. In addition to the current speeds and directions in the depth cells, the WinRiver ASCII output files also contain the times of the measurements, total depths, latitudes and longitudes at the locations of the measurements (from the GPS), and the total volume transport across the transect line from the current. From these files, an in-house program created files that contained the times, latitudes and longitudes, and depths for the measurements, and the current speeds and directions in the cells down to a level equal to 94 percent of the total depth. In the final 6 percent of the depth, acoustic side-lobe interference adversely affects the measurements. Using these files, an in-house program calculated the vector current average over the water column from the first depth-cell, at a depth of approximately 3 feet below the surface, to the last depth-cell in the processed profile. These vector averages were stored in ASCII files, and plotted in time series plots.

The bed sediment samples were analyzed to determine the percentages of sand and silt plus clay, percentage moisture content, bulk density, percentage of total organic matter, and grain-size distribution. The samples were weighed and then dried and reweighed, the differences in these weights determined the percent moisture content. The bulk densities of the dried samples were determined by weighing specific volumes of the samples. The percent organic content of each sample was determined by first placing a weighed portion of the sample in a special oven. The oven ignited and burnt off the organic portion of the sample. It was then reweighed to determine the weight of what had been burnt, which is the organic content of the sample. The wet sieving method was used as the first step in separating the sand from the silt plus sand, and in determining the grain-size distribution. The method uses a stack of trays which have screens across them with spacings that get progressively finer down the stack. Each screen passes only the particles that are finer then the spaces in its screen. Particles that are smaller than 2.1×10^{-4} ft (64 microns), the range of silt and clay, pass completely through the stack. After the sample passes through the stack, the particles trapped by each tray are weighed to determine the grain-size distribution of the fraction larger then 64 microns, the range of sand. The percentage of each sample trapped by the trays is the percentage of the sample that is sand, while the percentage of the sample that passes through the tray stack is the percentage of the sample that is silt plus clay. The fraction that passed through the stack was analyzed with Laser Particle Size Analyzer to obtain its grain-size distribution.

4.2 Data Return and Assessment of Data Quality

Water-level data are missing at TG3 from 16 through 29 October because the recorder leaked. Other than during this period, and for this one recorder, there are 100 percent good data.

. The automatic water sampler at WS1 was lost and there are no data from WS1 from 16 through 27 October. Except for the period from 23-27 October when the automatic water sampler at WS5 failed to sample, nearly 100 percent of the samples at all 6 water-sample stations that were recovered were obtained. One sample was missed for some unknown reason at WS5 at 0400 (CST) on 7 November, and one was missed at 0600 (CST) on 18 October.

Ship and barge traffic, which caused current disturbances and movements of the survey vessel, affected the quality of the current measurements along the transects. There is no practical way to calculate the resulting errors that these introduced. Based on the magnitude of the seemingly random fluctuations in current directions recorded along the inner navigation channel transect (where tidal currents were low), it is estimated that the noise level was around +/-0.5 ft/s. All transect lines were surveyed each hour during the survey as planned.

All water samples were obtained as planned using the Niskin sampler. All bed samples were also obtained as planned. Figure 14 shows the data return for the deployed instrumentation.

4.3 Analysis

The water-level data are plotted in Appendix B. The tidal characteristics at TG1, TG2, and TG4 do not vary significantly from each other. They are predominantly diurnal with neap tidal ranges of 0.8 ft to 1.5 ft, and spring tidal ranges of 2.5 ft to 3 ft. The tides are also predominantly diurnal at TG3, but the ranges are 0.2 to 0.5 ft smaller then they are at the other three locations. There are small oscillations with periods that are roughly twenty times shorter then the diurnal tidal period present at all four locations. These are likely the result of harbor seiching. The most obvious ones are seen on the records from TG3 and TG4, where they have a period of around one hour and magnitudes of about 0.2 ft.

The suspended sediment concentrations in the samples collected by the automatic water samplers are plotted in Appendix C. There is no specific spatial pattern seen in them, or in the suspended sediment concentrations of the samples obtained during the transect current survey (Appendix E). Excluding some peak values, the concentrations mostly ranged between 10 and 80 mg/l at Stations 0, 2, 4 and 5. With the exception of one spike that might have been caused by ship or barge traffic, higher concentrations varying between 50 and 185 mg/l were measured at Station 3, which is located in the GIWW southwest of the navigation channel toward the Brazos River. This may be due to sediment load brought by the River. Near-bed suspension concentrations showed some

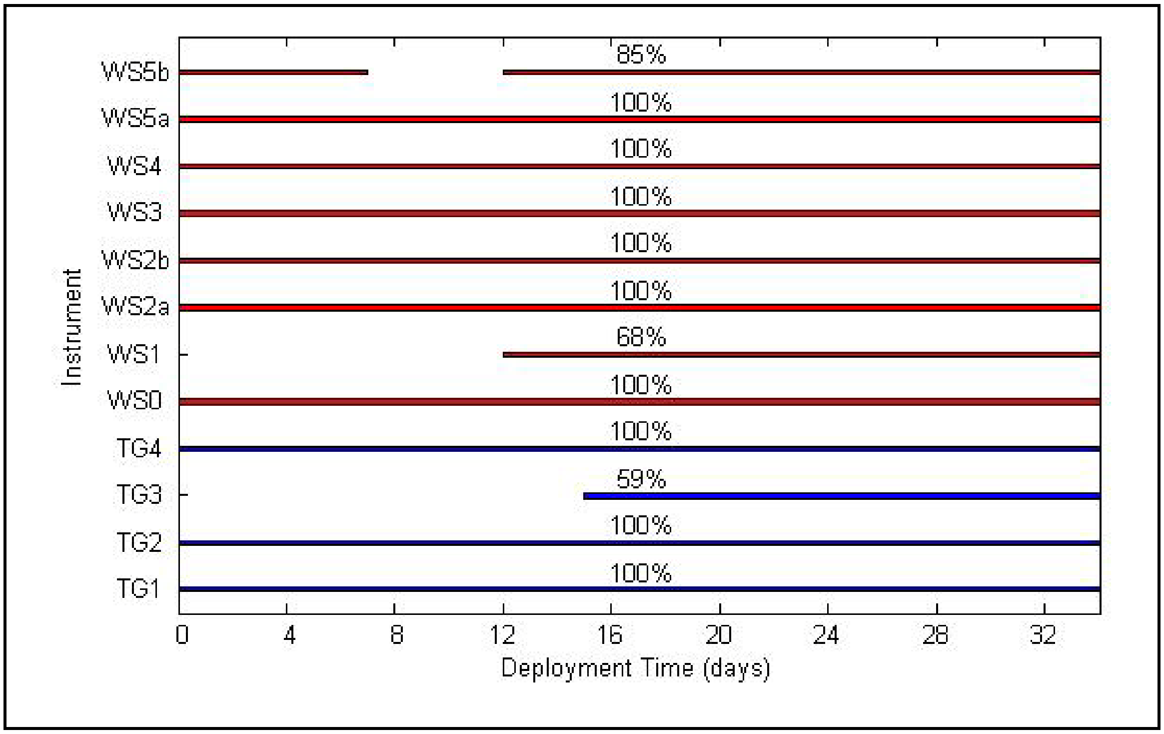


Figure 14. Summary of data return. Deployment time zero is October 16, 2003. The TG's are water-level recorders and the WS's are automatic water samplers. See Figure 3 for instrument locations.

large fluctuations. This may be due to bed sediment entering water samples during collection, or due to instantaneous high resuspension caused by ship and barge traffic. The median diameter of sediment in suspension varied between 46 and 92 micron-size.

The salinities of the water in the samples collected by the automatic water samplers are plotted in Appendix C. During the first week of deployment, salinities in the samples were the lowest. At WS3 they started at around 6 ppt and rose to around 15 ppt over the 7-day period. At WS0 and WS 4, they ranged from around 15 pt to around 22 ppt. At the other three stations they were between 20 and 25 ppt during this period. During the remainder of the deployment, salinities were generally between 25 and 32 ppt at all locations except WS3, which is toward the Brazos River. At WS3 they ranged from around 16 to around 27 ppt.

The salinities of the water samples collected during the transect current survey are plotted in Appendix C. During the survey, there was vertical salinity stratification at every transect. As expected, the surface samples have the smallest salinities and the bottom samples have the greatest. Transect 3 shows the most vertical variation at times when the current is flowing north at the transect from the direction of the Brazos River. During these times, the surface salinities at T3 decrease. With some lag, the salinities at T4 show more stratification and lower salinities at times when they occur at T3, indicating that the Brazos River is a freshwater source for Freeport Harbor. Surface salinities at T3 ranged from around 23 ppt to around 29 ppt, while bottom salinities were in the range of 25 ppt to 30 ppt. However, the 25 ppt measurement is a single measurement at the beginning of the survey, and may be erroneous. If this single point is ignored, the bottom salinities are in the range of 27 ppt to 30 ppt. Surface salinities at T4 were in the range of 25 ppt to 31 ppt, while bottom salinities were in the range of 30 ppt to 33 ppt. In general, mid-depth and bottom salinities stayed within relatively narrow ranges near 30 ppt at all stations, while surface salinities varied significantly over the tidal cycle.

The salinities of the mid-depth water samples taken when the bed sediment samples were taken are given in Appendix F. The samples were from different depths because they are from the middle of the water column in different total water depths. This makes it difficult to use them to obtain information about horizontal salinity differences, since they vary due to vertical salinity stratification as well as due to horizontal variations. However, there is a general pattern. Salinity at the station closest to the Brazos River, near the location of WS3, was 4.87 ppt, while at the junction of the Freeport Harbor navigation channel and the GIWW, it was 22.96 ppt. At the station in the GIWW that was furthest to the northeast, it was 18.55 ppt. In the Freeport Harbor entrance channel, the salinities were in the range of 21 ppt to 32 ppt. This also indicates that Brazos River outflow in the GIWW is a source of fresh water for Freeport Harbor. Higher salinity from the Gulf of Mexico enters the Harbor through the entrance channel.

A complete set of depth-averaged current plots for all measurements made during the 25-hr current transect survey are in Appendix D. In these plots, depth-averaged currents are assigned positive and negative values based on 180-degree direction criteria. For example, along T1 and T3, if the current direction is toward the north between 280 to 100 clockwise degrees, the currents are positive. If they are toward the south between 100 and 280 clockwise degrees, they are negative. Along T2, negative currents are flood flow toward the west from the Gulf of Mexico, and positive currents are ebb flows toward the east out of the entrance channel into the Gulf. At T4, positive currents are out of the harbor toward the GIWW, and negative currents are into the harbor. The plots show that the tidal currents measured in the Freeport Harbor inner navigation channel along T4 are all within the noise level of the survey. The noise can be the result of a combination of rocking of the survey vessel, in response to waves and boat wakes, and harbor seiching at frequencies much higher then that of the tides, as well as turbulence from stirring of the harbor by ships, barges, and even the survey vessel. The noise level along T4 appears to be about 0.5 ft/s, so what is known from the survey is that tidal currents in the Harbor were less than 0.5 ft/s.

Twelve plots have been taken from Appendix D to illustrate typical ebb and flood conditions during the survey, and are shown in Figures 15 through 26. Transect 2 is in the entrance channel, and its flow defines ebb and flood. Figure 15 shows predominantly flood flow in the entrance channel. In all plots along T2, the transect is plotted from north to south across the channel. At 1514 on 29 October, the flow in the northern half of the channel is within the survey noise level, and may be ebbing. However, in the southern half of the channel, there is relatively strong flood flow with a maximum speed of 2.41

ft/s. Transects 1 and 3 in the GIWW are plotted east to west. Figure 16 shows that what is happening along T1 (northeast of the entrance channel) at 1501 may be connected with

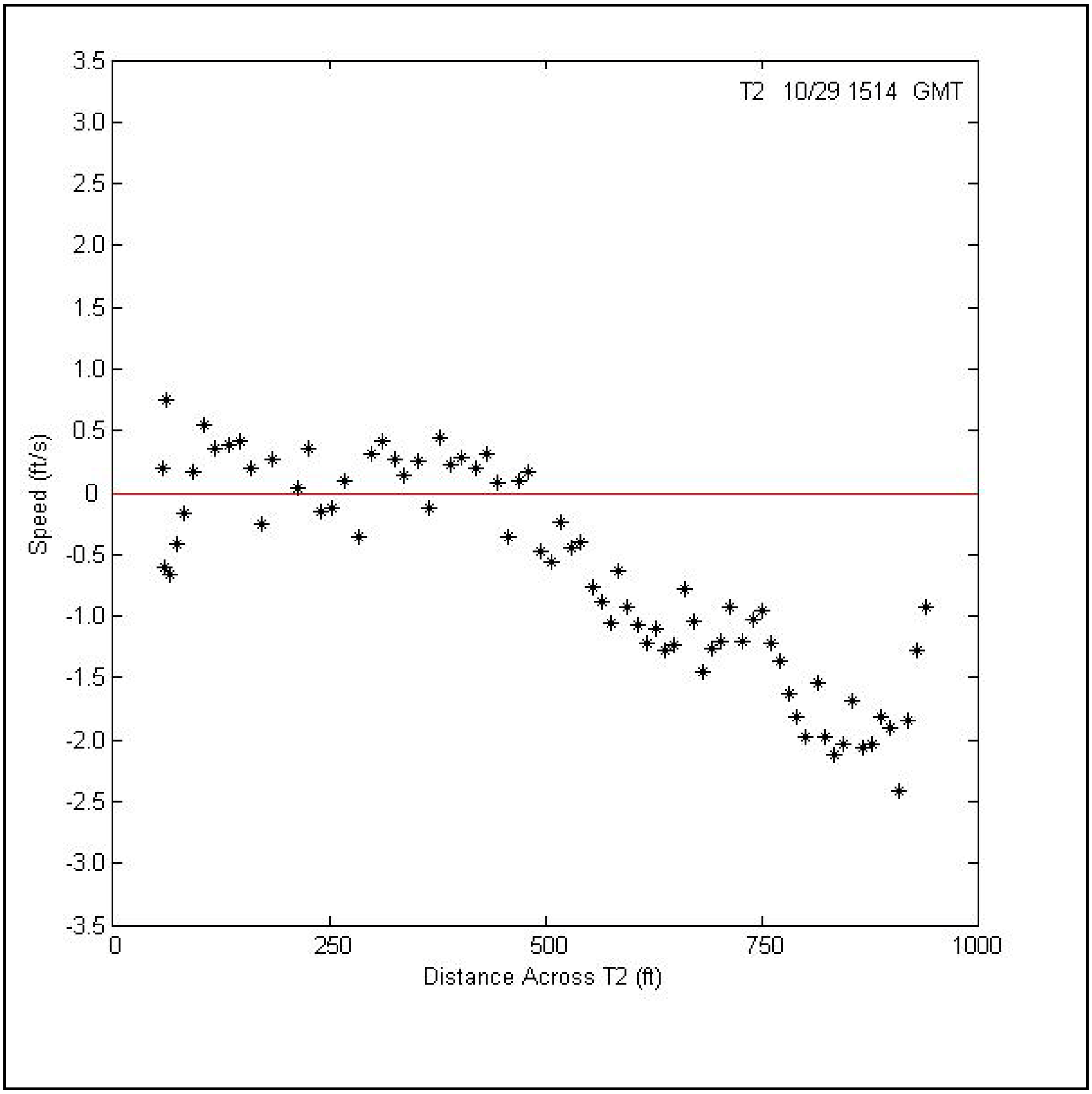


Figure 15. Currents measured along Transect 2 at 1514 on 29 October. Positive currents are ebb flows toward the east into the Gulf of Mexico and negative flows are flood flows from the Gulf toward the west. The transect is plotted north to south across the entrance channel.

the cross-channel flow changes along T2. It shows that on the eastern side of the GIWW there is strong flow to the south with a maximum speed of 3.11 ft/s that may be entering the entrance channel and be part of the possible ebb flow along on the northern side of the channel. On the western side of the GIWW along T1, the flow is in the noise level, and may be going in the opposite direction toward the north. At about the same time (1525), Figure 17 shows that the flow along T3 (southwest of the entrance channel) is all

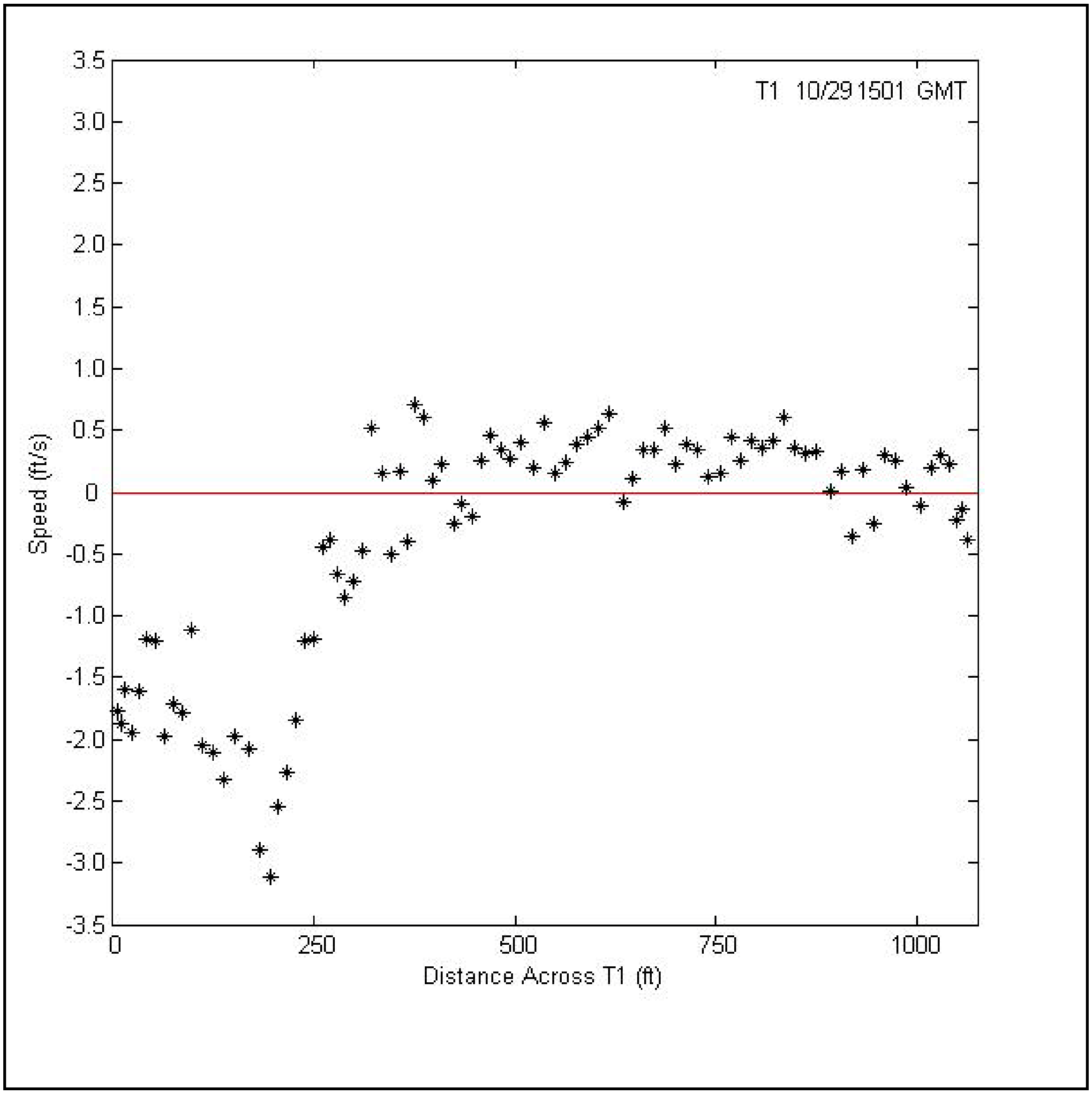


Figure 16. Currents measured along T1 at 1501 on 29 October. Positive currents are toward the north and negative currents are toward the south. The transect is plotted east to west across the GIWW.

toward the north. Along T4 at 1435 (Figure 18), the flow is very low, and is within the noise level. Approximately 24 hours later this pattern is repeated, as shown in Figures 19-22. Along T2 at 1553 on 30 October (Figure 19), the flow on the northern side of the entrance channel is clearly ebbing, while once again it is flooding on the southern side of the channel. Flow is once again toward the south on the eastern side of the GIWW at T1 (Figure 20), with low, possible northward flow on the west side, and flow at T3 (Figure 21) is all toward the north. At T4, as it is at all times, the flow is low and in the noise level.

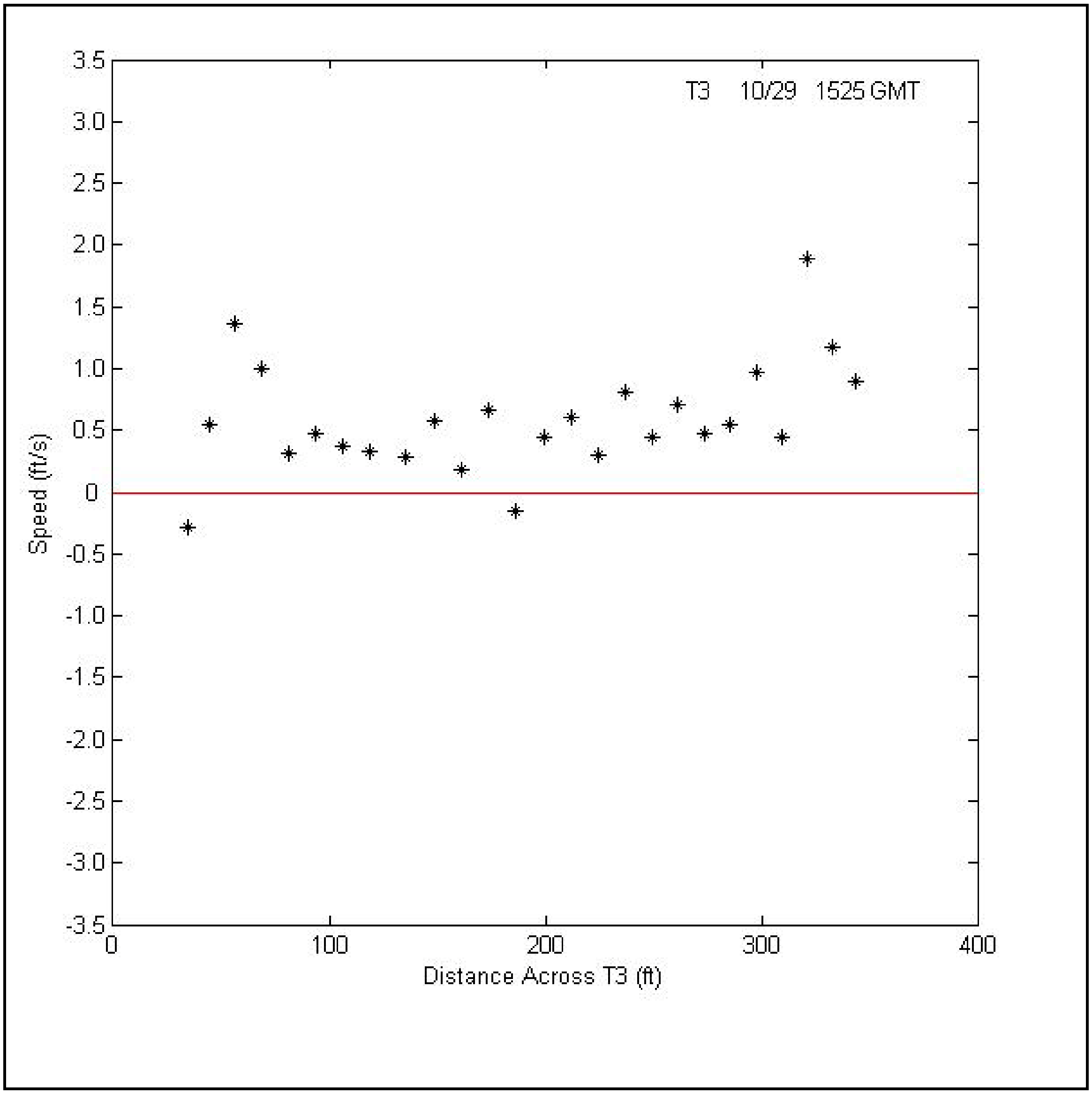


Figure 17. Currents measured along T3 at 1525 on 29 October. Positive currents are toward the north and negative currents are toward the south. The transect is plotted east to west across the GIWW.

Conditions during predominantly ebb flow along T2 are shown in Figure 23. With the exception of some outlying points that are most likely erroneous, the flow across T2 is all ebb into the Gulf at 0227 on 29 October with a maximum speed of 1.23 ft/s (excluding an outlying point). Along T1 at 2307 (Figure 24), the flow is almost all toward the north with a maximum speed of 1.24 ft/s, while along T3 at 2240 (Figure 25) the flow is all toward the south with a maximum speed of 1.39 ft/s. Along T4 (Figure 26), the flow is within the noise level.

The results of the analyses of the bed sediment samples are given in Appendix G. The average composition of the sediment in the entrance channel is 26.14 percent sand and

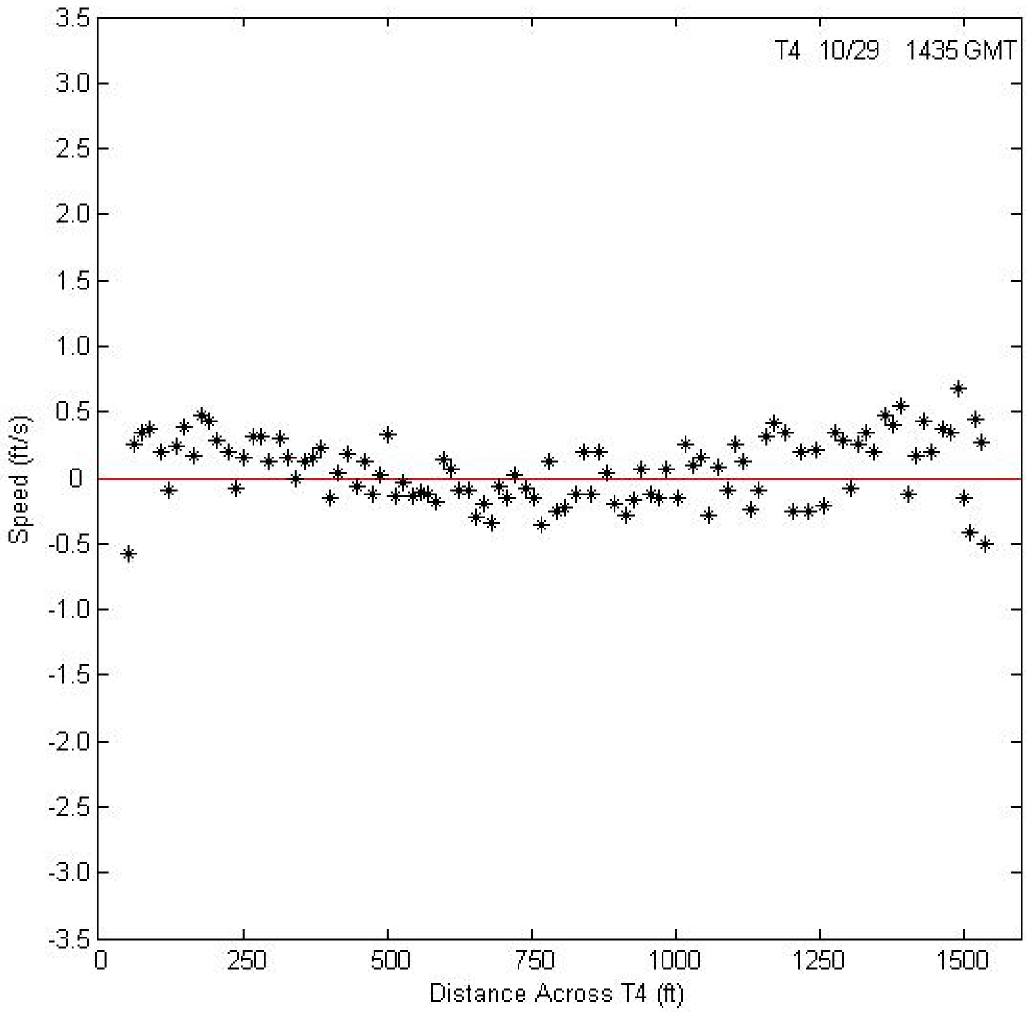


Figure 18. Currents measured along T4 at 1435 on 29 October. Positive currents are toward the north away from Freeport Harbor toward the GIWW, and negative currents are toward the south into the Harbor. The transect is plotted east to west across the Freeport Harbor inner navigation channel.

73.86 percent silt and clay with 5.86 percent organic contents. In the inner navigation channel, the average composition is 17.15 percent sand and 82.85 percent silt and clay with 7.25 percent organic components.

4.4 Deliverables

Plots of all data are in Appendices B, C, D, E, F, and G, and are in electronic form on the project DVD as "jpeg" files (Appendix H). They are:

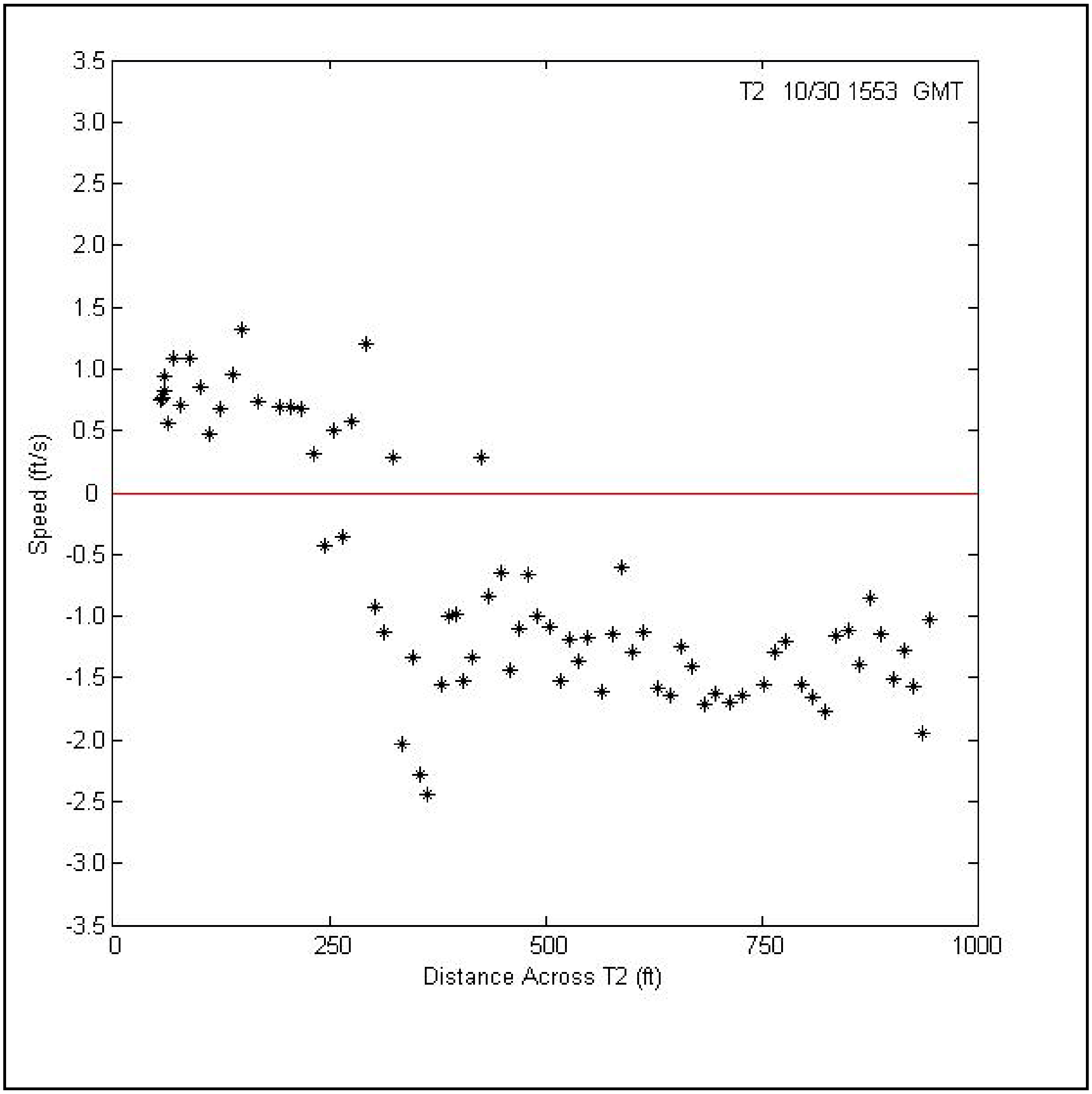


Figure 19. Currents measured along Transect 2 at 1553 on 30 October. Positive currents are ebb flows toward the east into the Gulf of Mexico and negative flows are flood flows from the Gulf toward the west. The transect is plotted north to south across the entrance channel.

1. Time series of water-level measurements at four locations (TG1, TG2, TG3, and TG4) in Appendix B.
2. Time series of salinities and suspended sediment concentrations at six locations (WS0, WS1, WS2, WS3, WS4, and WS5) in Appendix C.
3. Current data along transects across the navigation channel (T2 and T4) and across the GIWW (T1 and T3) over a tidal cycle in Appendix D.

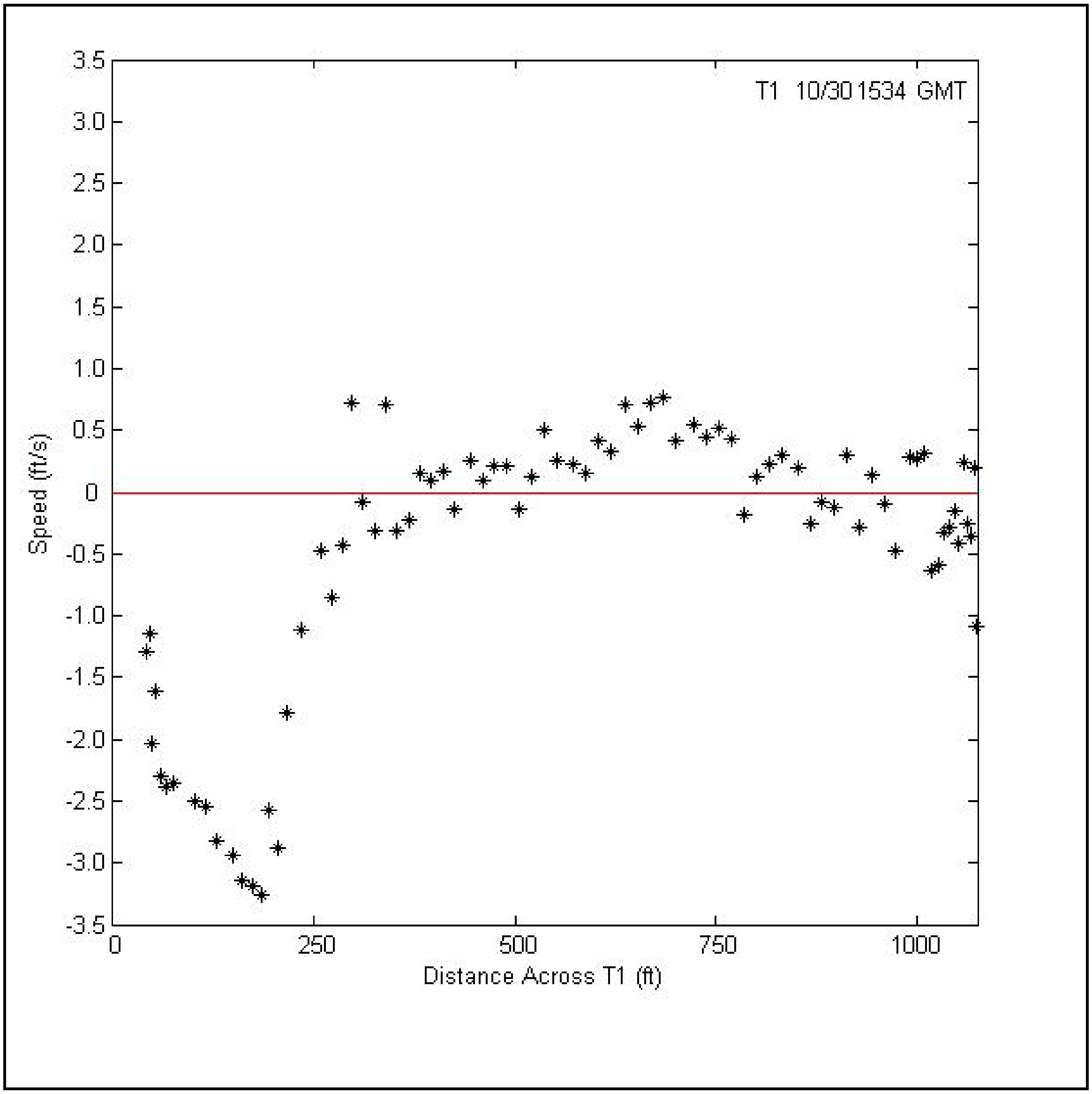


Figure 20. Currents measured along Transect 1 at 1534 on 30 October. Positive currents are toward the north and negative currents are toward the south. The transect is plotted east to west across the GIWW.

4. Salinity and suspended sediment concentration values at 3 depths in the water column at the centerline of the navigation channel during the current transect measurements in Appendix E.
5. Salinity and suspended sediment concentration values from mid-depth at 33 locations in Appendix F.
6. Grain-size distribution of 33 bed sediment samples taken from 33 locations in Appendix G.

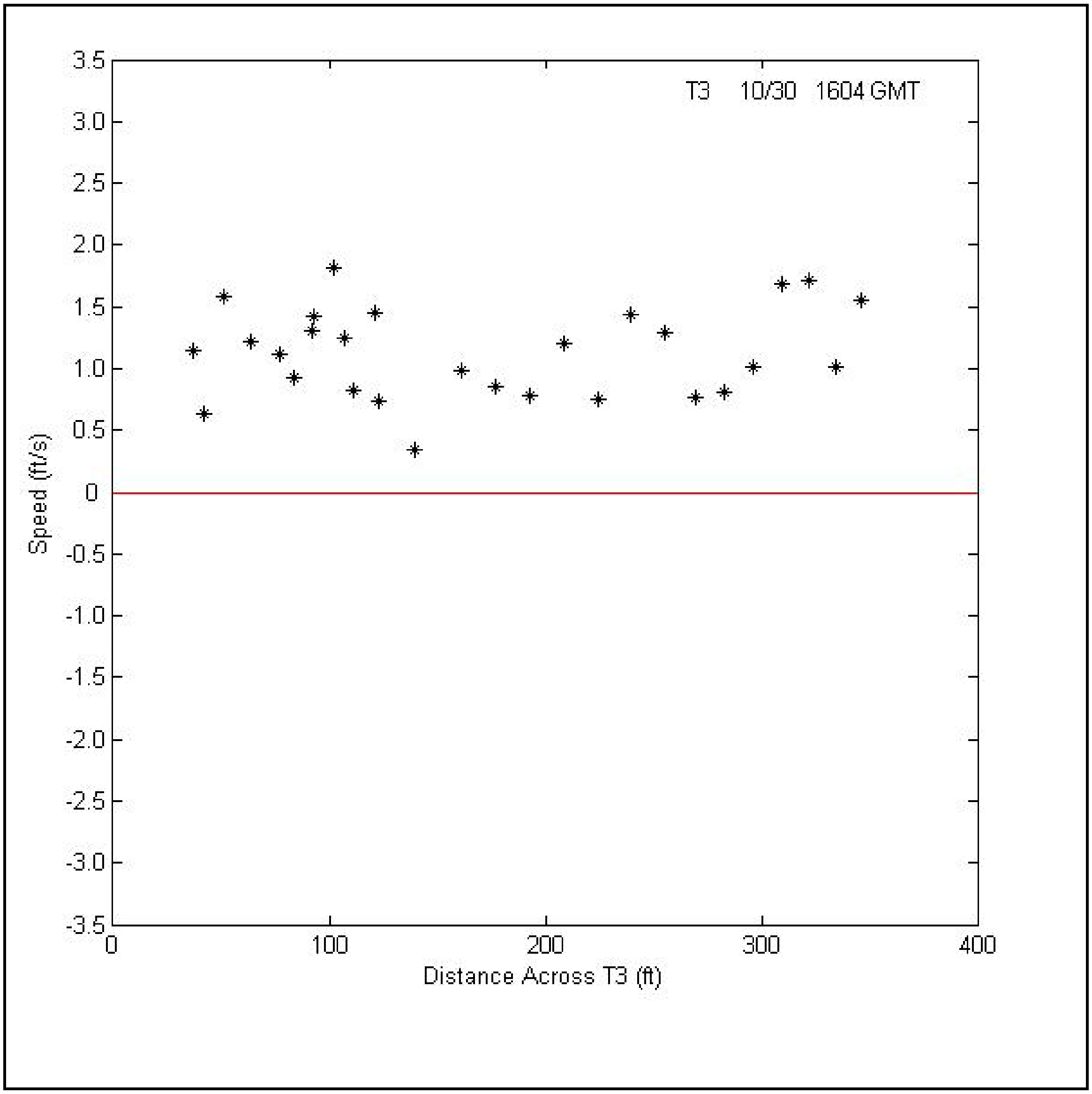


Figure 21. Currents measured along T3 at 1640 on 30 October. Positive currents are toward the north and negative currents are toward the south. The transect is plotted east to west across the GIWW.

5. Summary and Conclusions

A field data collection program in Freeport Harbor, Texas, and the adjacent GIWW was conducted from 14 October 2003 to 10 November 2003. Four water-level gages and six automatic water samplers were deployed for this period. In addition, a 25-hour current transect survey was conducted on 29-30 October. One of the water-level gages leaked and did not record data from its deployment on 16 October until it was replaced on 30 November. The other three water-level recorders recorded data for the entire deployment period. The replacement recorder recorded good data until it was recovered with the other recorders at the end of the deployment period. One automatic water sampler was lost and

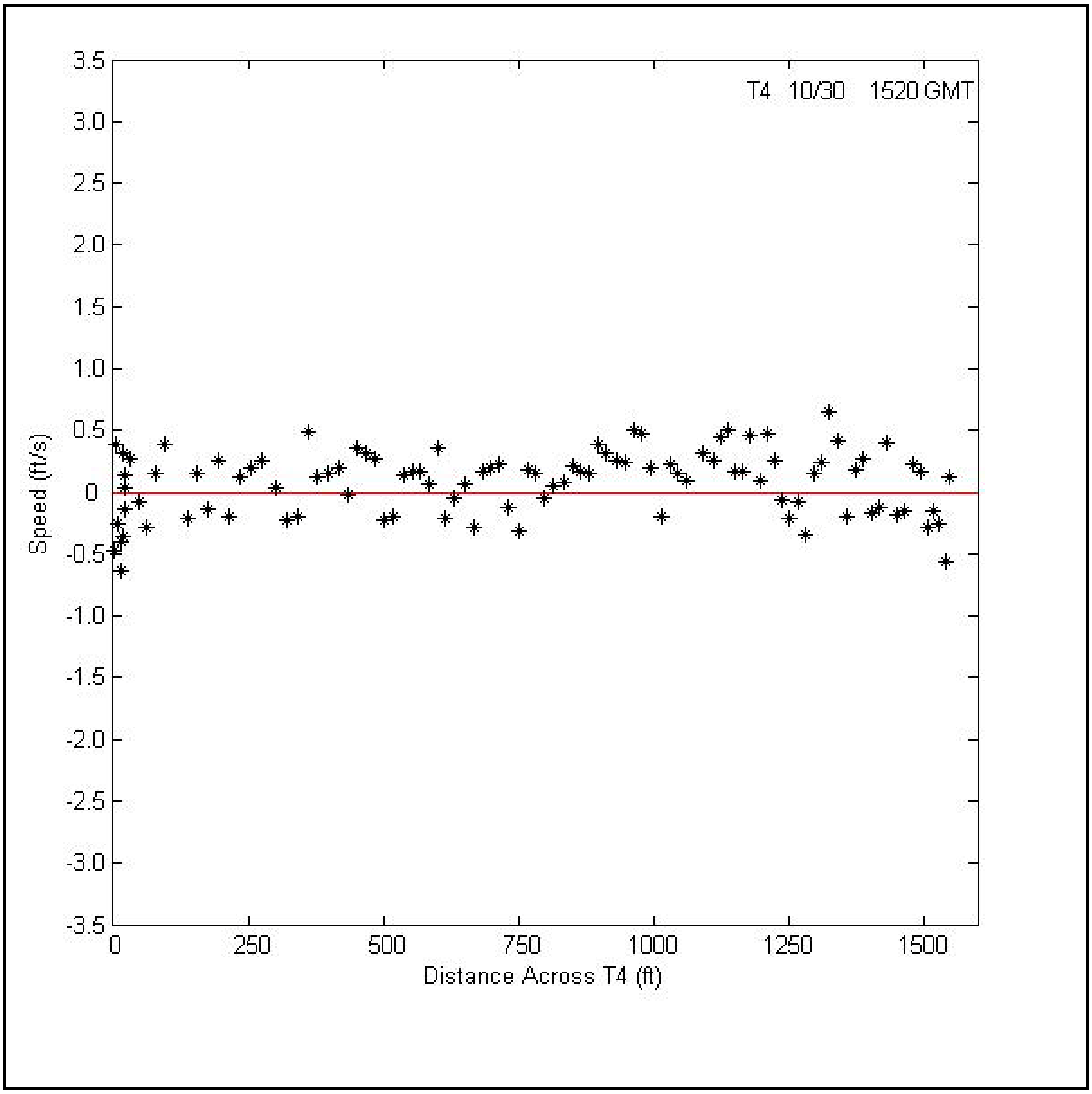


Figure 22. Currents measured along T4 at 1520 on 30 October. Positive currents are toward the north away from Freeport Harbor toward the GIWW, and negative currents are toward the south into the Harbor. The transect is plotted east to west across the Freeport Harbor inner navigation channel.

there are no data at one location from 16 to 28 October. The other automatic water samplers collected samples over the entire deployment period, with the exception of one sampler that failed to collect samples from 23-27 October. The samples were analyzed for salinity and total suspended solids.

Tidal characteristics at the water-level recorders in the entrance and inner navigation channels, as well as the one to the northeast of the channel in the GIWW, did not vary significantly from each other. They were predominantly diurnal with neap tide ranges 0.8 ft to 1.5 ft, and spring tidal ranges of 2.5 ft to 3 ft. The tides were also predominantly

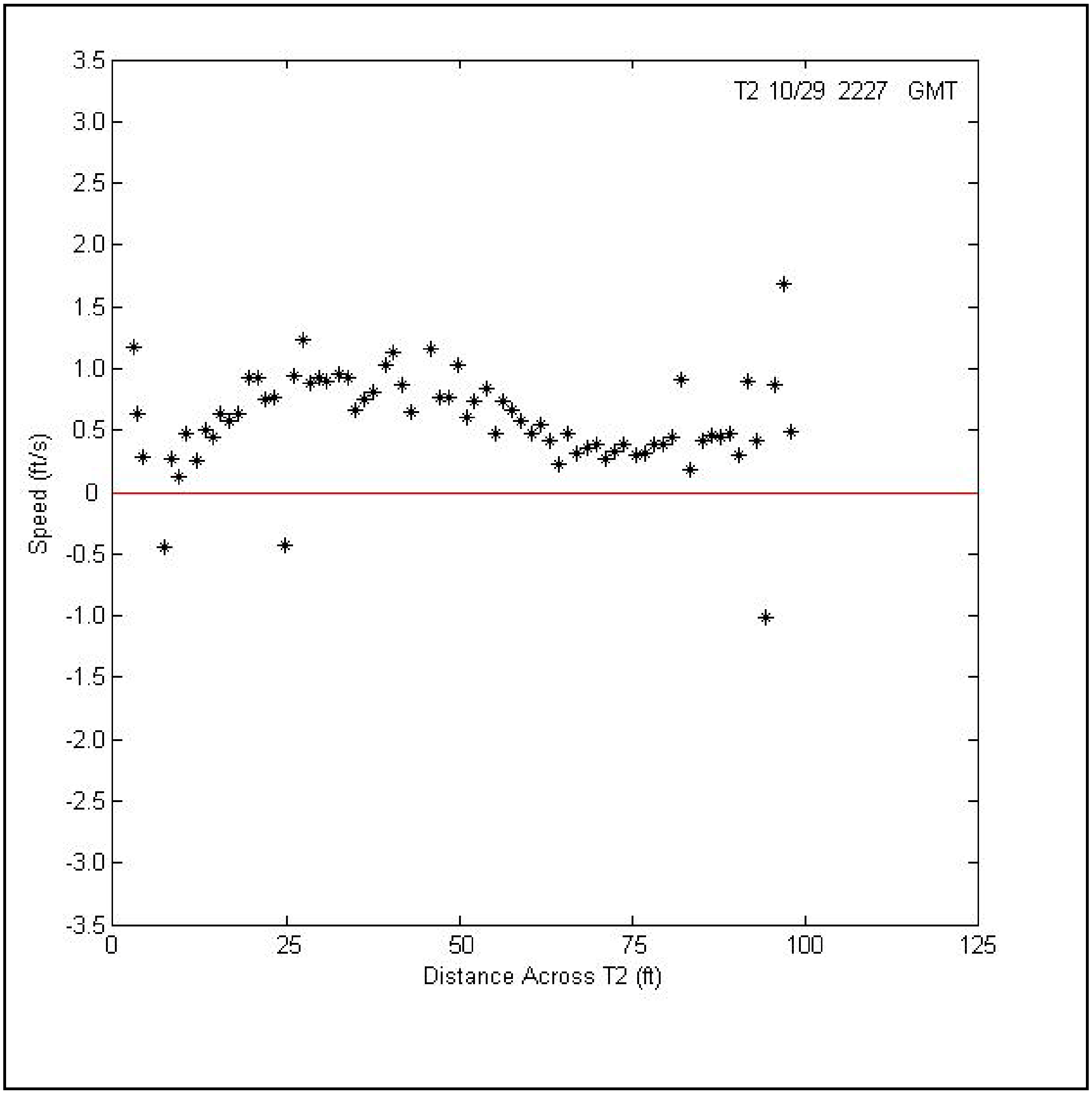


Figure 23. Currents measured along Transect 2 at 2227 on 29 October. Positive currents are ebb flows toward the east into the Gulf of Mexico and negative flows are flood flows from the Gulf toward the west. The transect is plotted north to south across the entrance channel.

diurnal at the fourth water-level recorder to the southwest of the channel in the GIWW, but the ranges were 0.2 to 0.5 ft smaller then they were at the other three locations.

There is no specific spatial or temporal trend in suspended sediment concentrations seen in the results of the analyses of the water samples from the automatic water samplers. Excluding some anomalous values, the concentrations mostly ranged between 10 and 80 mg/l at the stations in the entrance and inner navigation channels, and at the one to the northeast of the channel in the GIWW. At the station to the southwest in the GIWW toward the Brazos River, concentrations varied between 50 and 185 mg/l. This may have

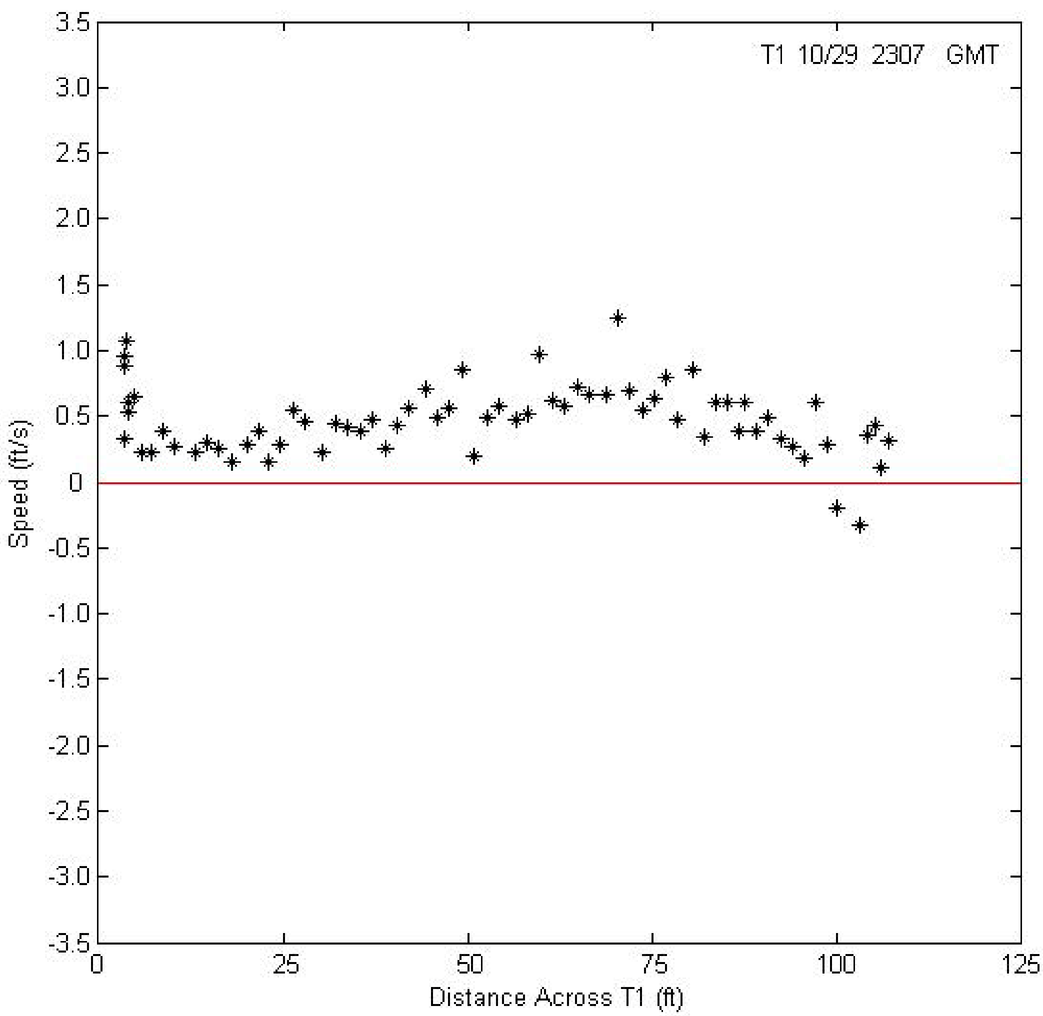


Figure 24. Currents measured along Transect 1 at 2307 on 29 October. Positive currents are toward the north and negative currents are toward the south. The transect is plotted east to west across the GIWW.

been due to the samples containing sediment from the River. Salinities during the program ranged from around 15 ppt to around 32 ppt at all locations except those to the southwest of the navigation channel in the GIWW near the Brazos River, where salinities as low as around 5 ppt were measured. The data indicates that the Brazos River is a source of freshwater for the Harbor.

A 25-hour current transect survey was conducted at four transect locations. One transect was located in the entrance channel, and one was across the inner navigation channel. The other two were northeast and southwest of the navigation channel in the GIWW. Each transect was surveyed every hour. At all times during the current transect

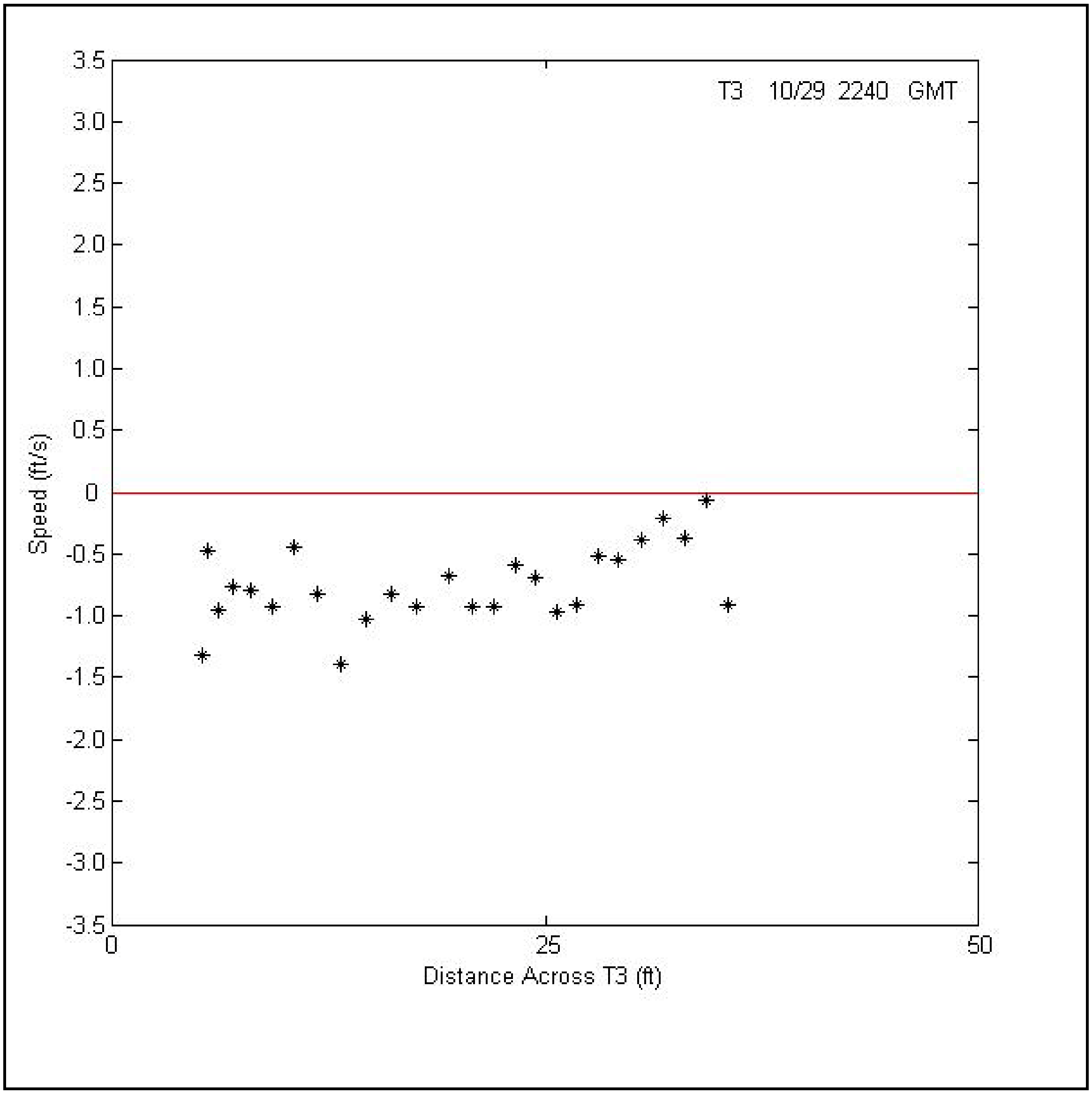


Figure 25. Currents measured along T3 at 2240 on 29 October. Positive currents are toward the north and negative currents are toward the south. The transect is plotted east to west across the GIWW.

survey, the flow in the inner navigation channel was very low, and within the noise level for the survey (approximately 0.5 ft/s). During flood flow in the entrance channel, there was significant cross-channel variations in the current along the transect in the entrance channel, and along the transect just to the northeast of the channel in the GIWW. A maximum speed of 3.56 ft/s toward the entrance navigation channel was measured along this transect on the eastern side of the GIWW. Maximum flood flows along the transect in the entrance channel were between 2.0 and 2.5 ft/s, while maximum ebb flows were between 1.0 and 1.5 ft/s.

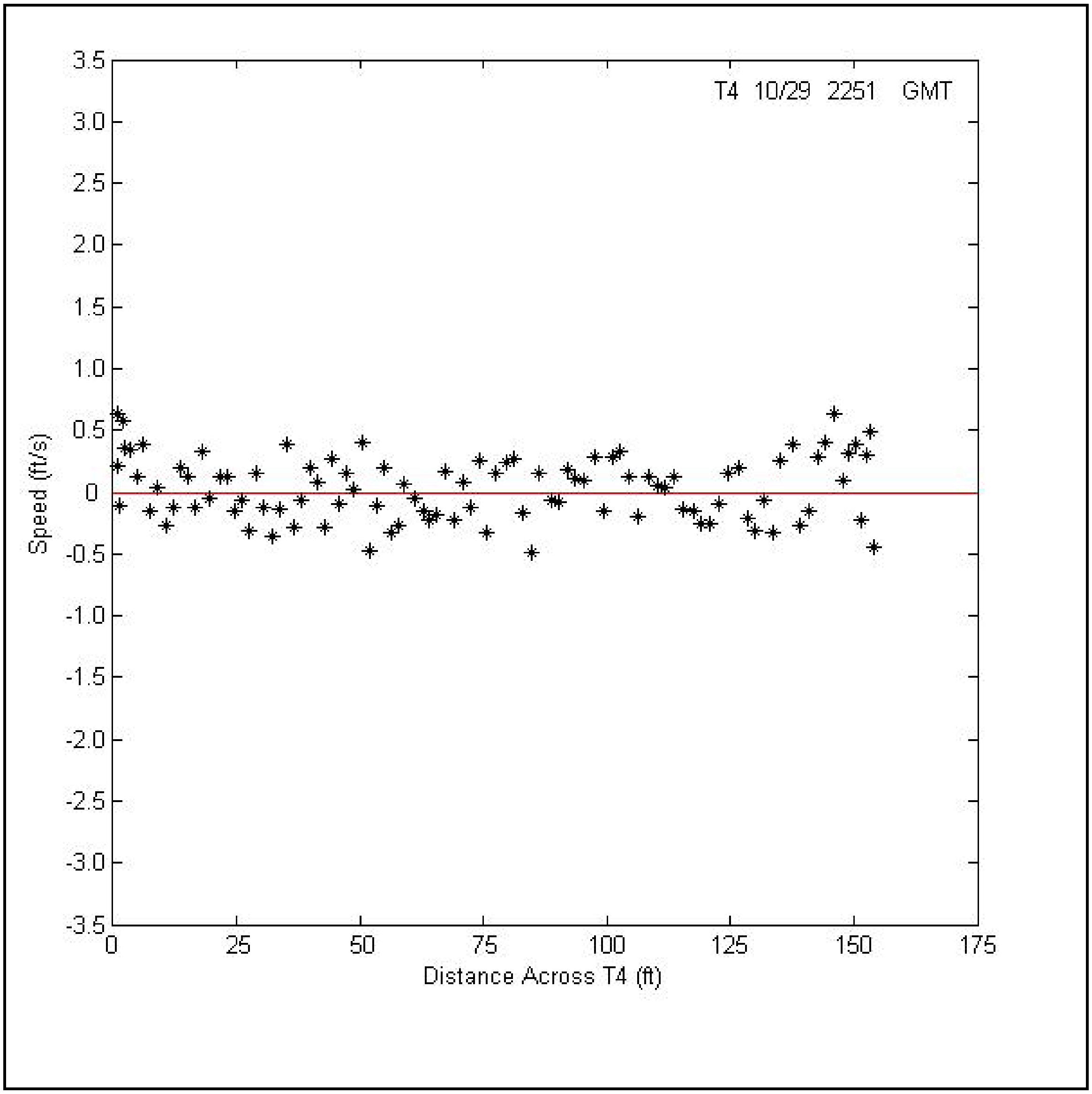


Figure 26. Currents measured along T4 at 2251 on 29 October. Positive currents are toward the north away from Freeport Harbor toward the GIWW, and negative currents are toward the south into the Harbor. The transect is plotted east to west across the Freeport Harbor inner navigation channel.

Water samples at three depths along each transect were collected over the 25-hour current transect survey and were analyzed for salinity and total suspended solids. Bed sediment samples and mid-depth water samples were collected at 33 stations. The water samples were analyzed for salinity and total suspended solids. No specific spatial pattern was observed in the suspended sediment results. The salinity results indicate that the Brazos River supplies fresh water to the GIWW, which then gets transported into Freeport Harbor. Higher salinity water enters the Harbor through the entrance channel. The bed samples were analyzed for bulk density, moisture content, grain-size distribution and organic contents. They showed that the bed in the navigation channel is predominantly silt and clay with an average organic content of around 5 to 7 percent.

Appendix A Scope of Work

Scope of Work of the Field Data Collection for Freeport Harbor Hydrodynamic and Sediment Studies

Background

1. In an effort to provide field data for the Freeport Harbor Sediment ship simulator model, numerical model and desktop sediment study verification, a plan is proposed to collect data of water-level, current magnitude and direction, and sediments (bed material characterization and suspended concentrations).

Approach

2. The technical approach to meet the study purposes will be based on state–of-the-art field data collection techniques and equipment. The proposed study will be conducted with adherence to accepted scientific and engineering principles to provide technically correct and defensible results.

Proposed Data Collection Plan

3. It is proposed to conduct a field data collection effort that will provide the necessary data on suspended sediment concentrations, bottom sediment characteristics, and hydrodynamics (currents and tides) that represent existing conditions in the study area. The field data collection program will provide short-term intensive data (spring tidal cycle, 25 hours) of hydrodynamics and water quality. In addition, water quality parameters and water levels will be monitored for a 30-day period.

4. The potential sites for the water-level and water quality data collection equipment will require the use of existing United States Coast Guard (USCG) Aids-to-Navigation (ATON) such as channel markers and range markers as platforms for deployment of the water-level instruments. Permission to utilize the ATONs will be requested by a formal letter to the USCG District Commander.

5. It is proposed to utilize ERDC data collection vessels to collect current data and water quality samples at four data collection locations in the study area (see Figure 1). While on-site, the ERDC data collection vessels will perform a series of cross-channel transects using an Acoustic Doppler Profile System (ADCP) to collect the tidal current data. Following each transect using the ADCP, each data collection vessel will collect a number of water samples (approximately three samples in the vertical) at the channel centerline for water quality assessment (salinity and suspended sediment concentrations). The ADCP transects and centerline water quality samples will be collected on hourly intervals over one tidal cycle. The water sampling will follow the hourly collection routine during this data collection effort. At the conclusion of the field data collection effort, these water samples will be transported back to ERDC for laboratory analysis. Two of the proposed ADCP transect sites are located to the northeast and southwest of the junction of the Gulf Intercoastal Waterway (GIWW) and the Freeport Harbor Canal. A third ADCP site is located southeast of the junction of the Freeport Harbor Channel

and the GIWW. The fourth location is inside the Freeport Channel as shown in Figure 1. These data are to be collected during spring tide conditions.

6. Water level recorders and water quality sampling equipment will be deployed for a 24 or 30-day period to capture water level fluctuations and associated water quality changes. Approximately four individual water level recorders and four sets of (2) automatic water samplers will be deployed to provide this information. Upon completion of the field data collection effort the water level data and the water quality samples will be returned to ERDC for processing and analysis.

7. Approximately thirty-five bed samples will be collected from the study area. The number of samples in each reach is given below:

GIWW Channel:	5 samples
Freeport Harbor Channel and GIWW junction:	5 samples
Inner reach of Freeport Harbor Channel (approx. 2.5 miles)	<u>25 samples</u>
Total	35 samples

8. In addition to the surface bed material samples, water samples will be collected at the mid-depth of the water column at all locations where surface bed material samples are collected. The total number of these water samples to be collected will equal the number of bed material samples.

9. During the data collection period, it will be necessary to have additional information recorded that could be used to interpret the sediment characterization results prior to using the data in the sediment desktop study. Additional information that will be obtained will be local weather conditions at site during the period of data collection should be recorded.

10. All bed samples will be analyzed to determine particle size distribution. The bed material samples containing more than thirty percent clay will be analyzed by wet sieving to determine sand and silt + clay split percentage (percentage finer than 64 μ). Total moisture content and total percentage of organic contents of only these samples will also be determined.

11. All the water samples will be analyzed to determine the salinity and total suspended solids concentrations.

Products

12. All data will be provided to the modelers as they become available from the data processing and analysis efforts. A summary field data memorandum will be prepared and forwarded to the District following the completion of the data processing and analysis.

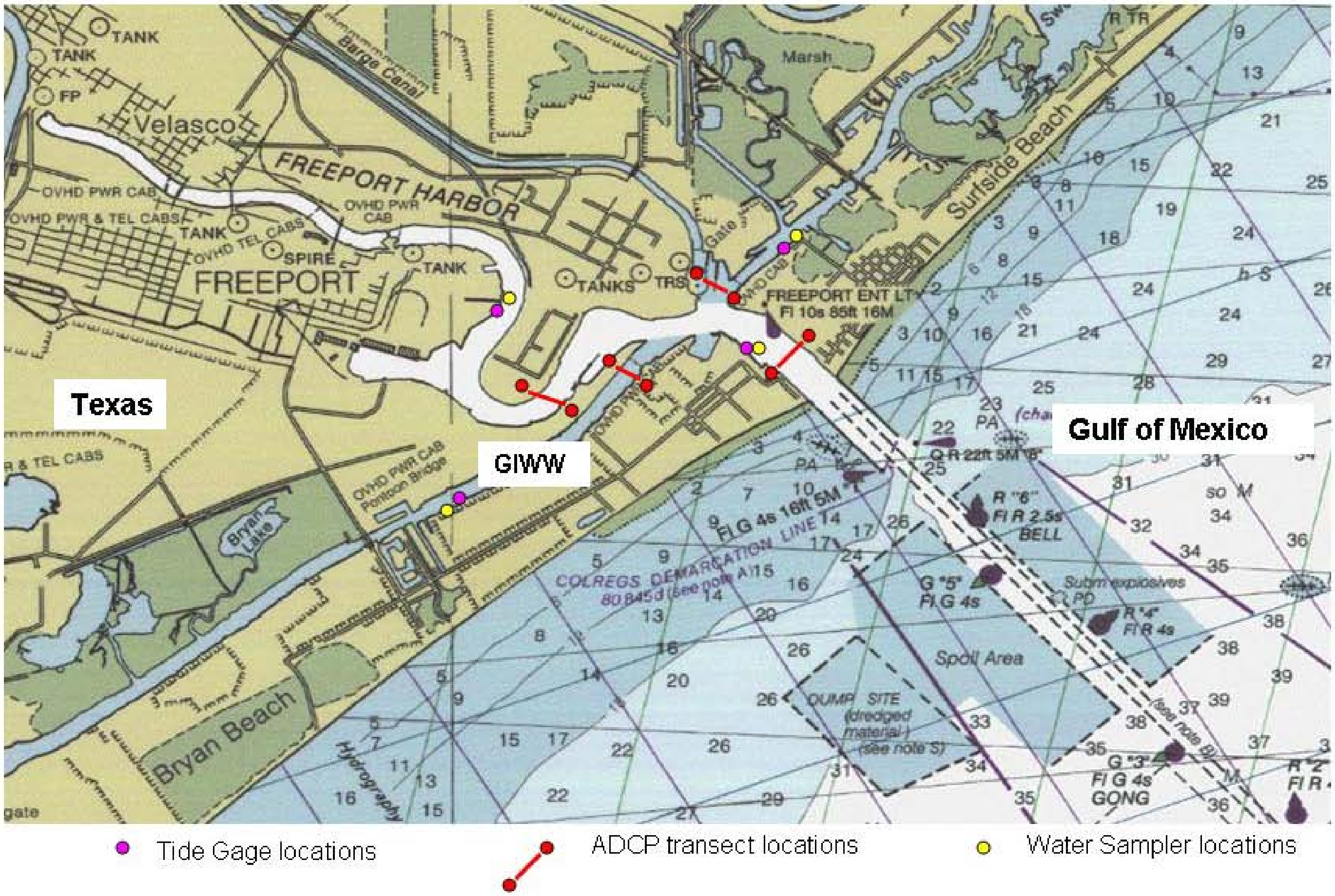
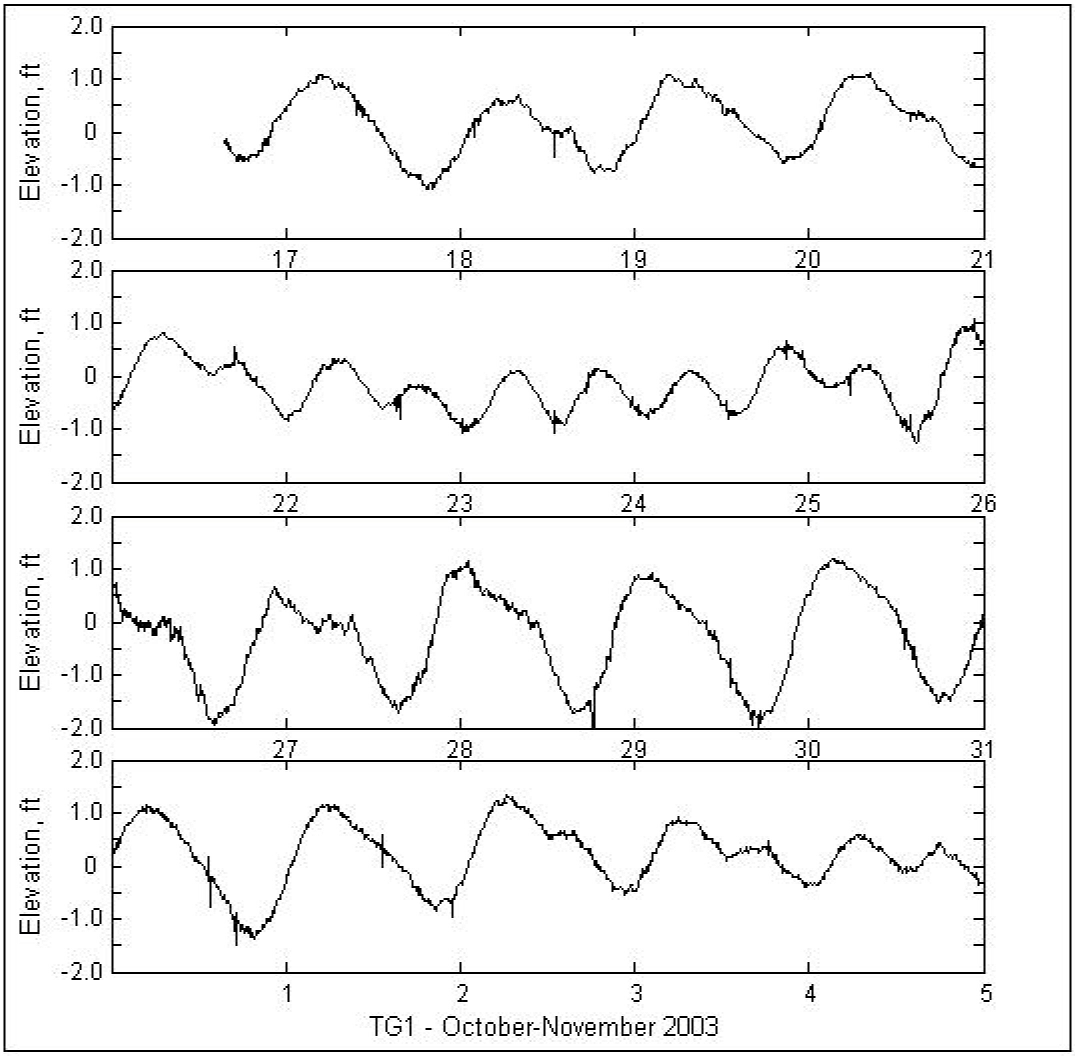
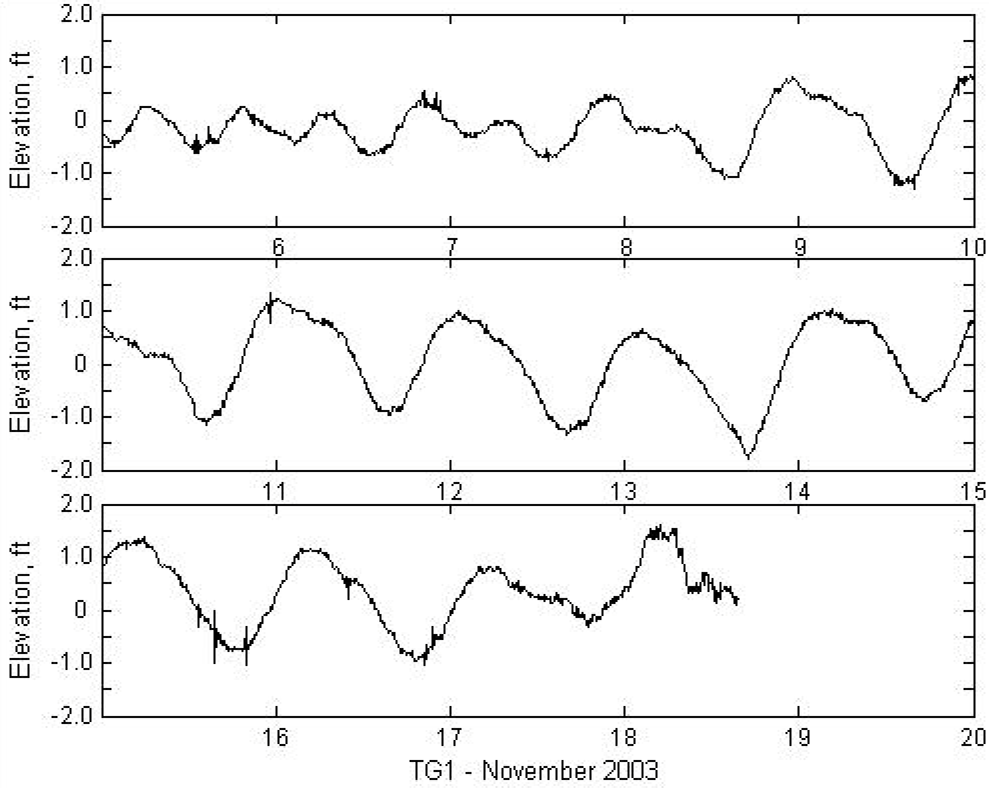


Figure 1. Study area with possible data collection sites indicated.

Appendix B Water-level Measurements Plots

Contents


2.0
1.0
0
-1.0
-2.0
Elevation, ft
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
1
2
3
4
5
TG1 - October-November 2003



Elevation, ft
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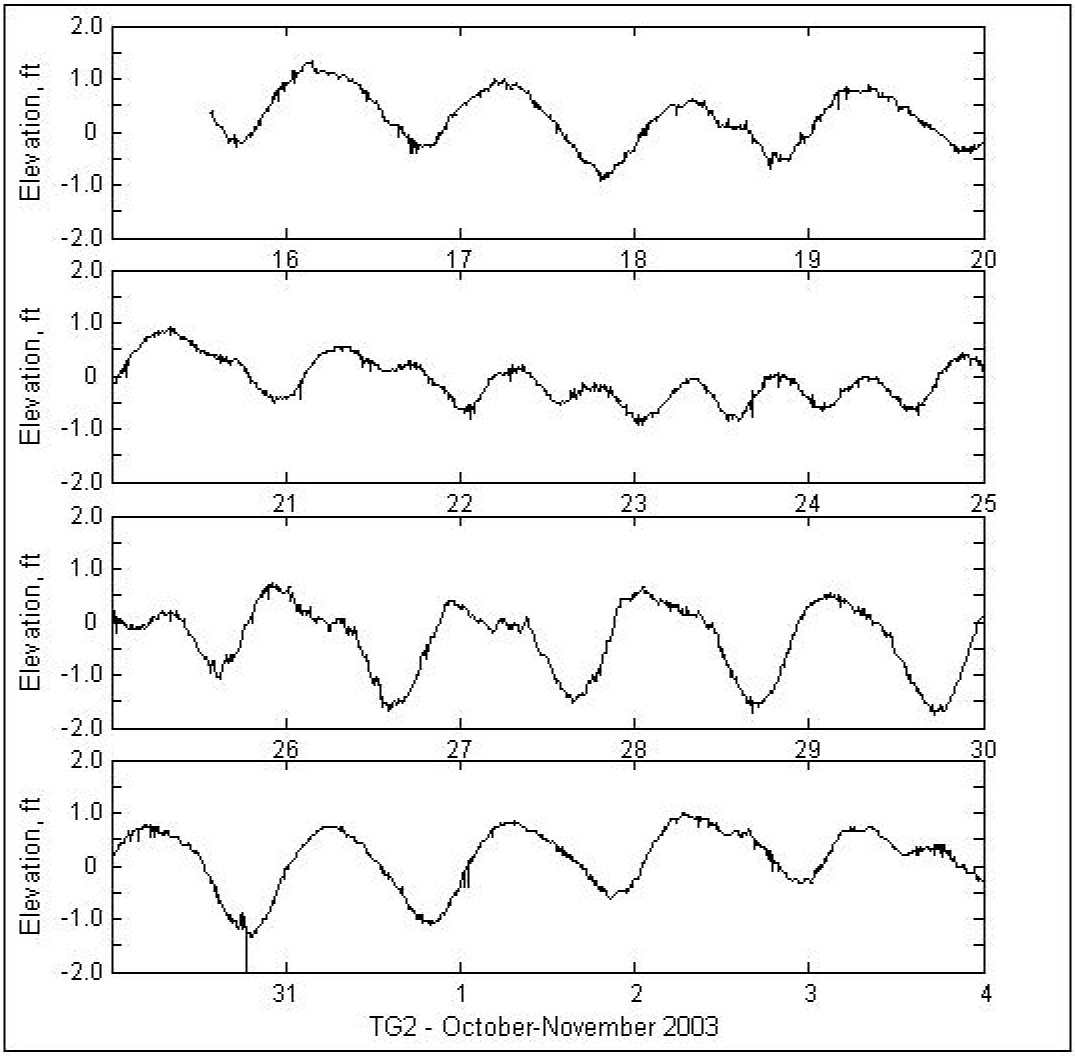
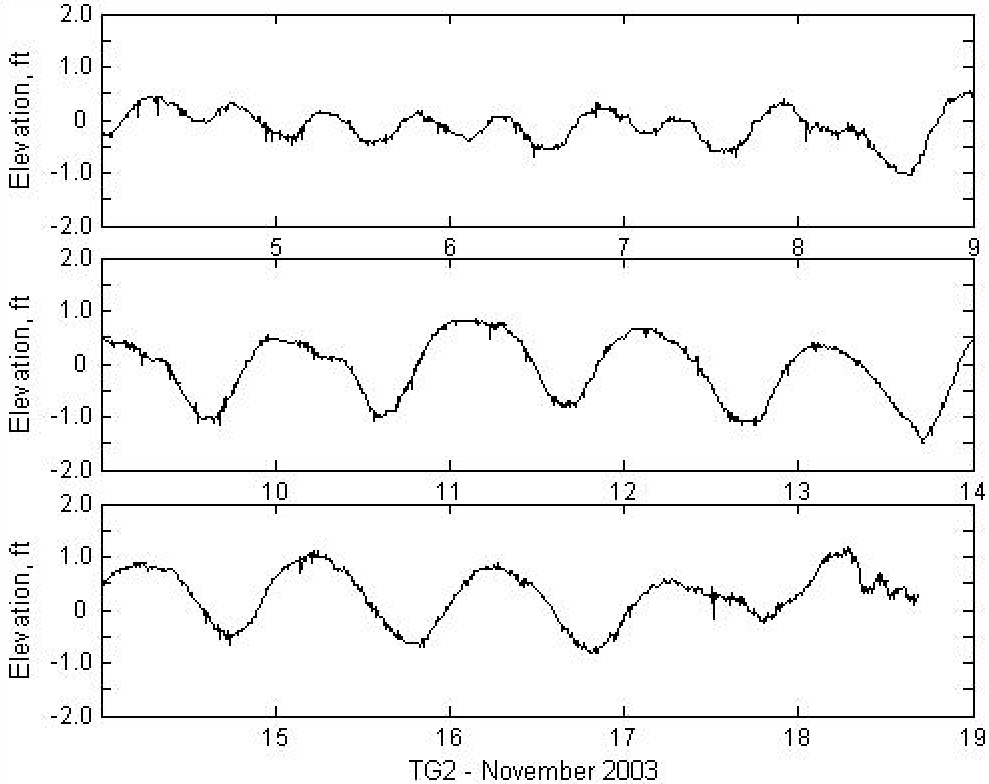
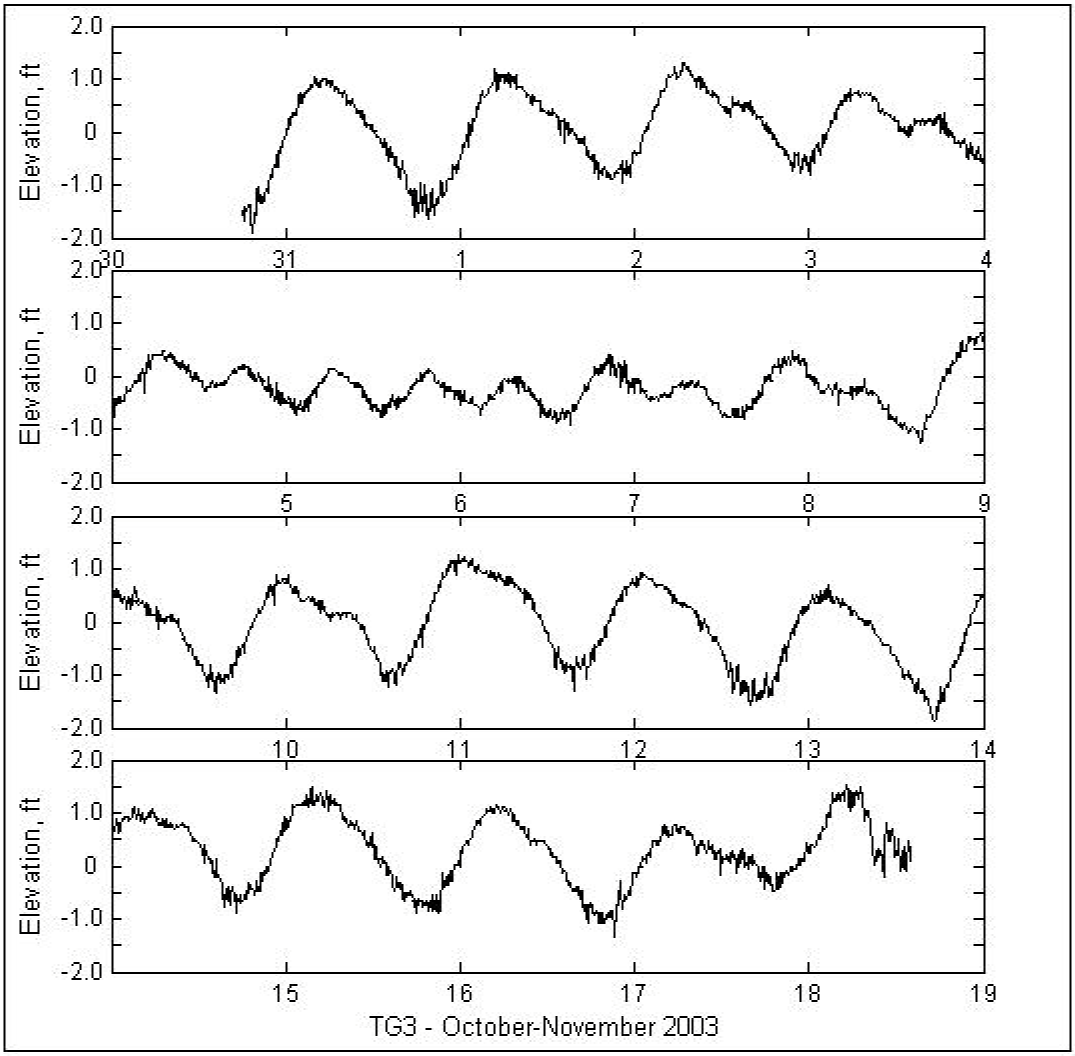
1.0
0
-1.0
-2.0
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
TG1 - November 2003



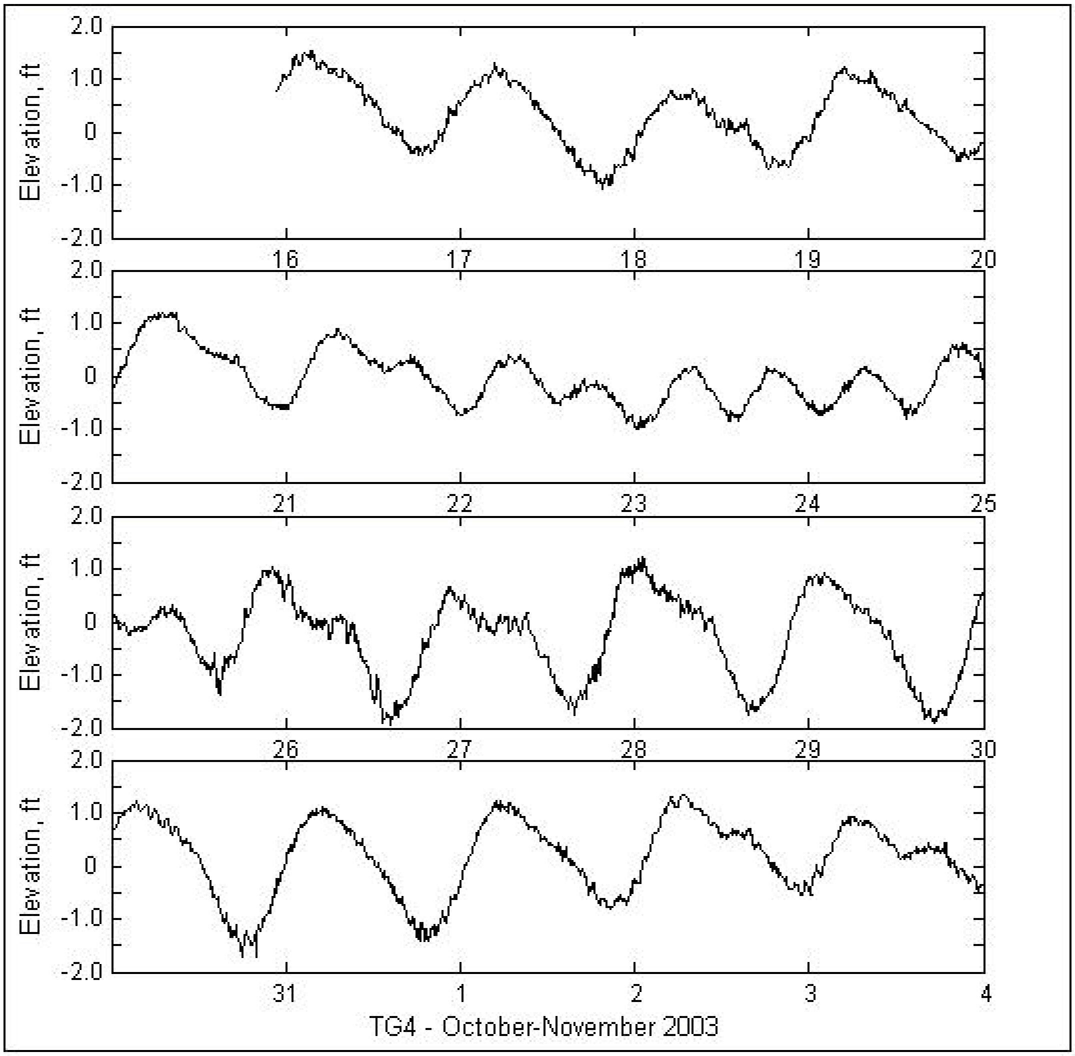
2.0
1.0
0
-1.0
-2.0
Elevation, ft
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
1
2
3
4
TG2 - October-November 2003



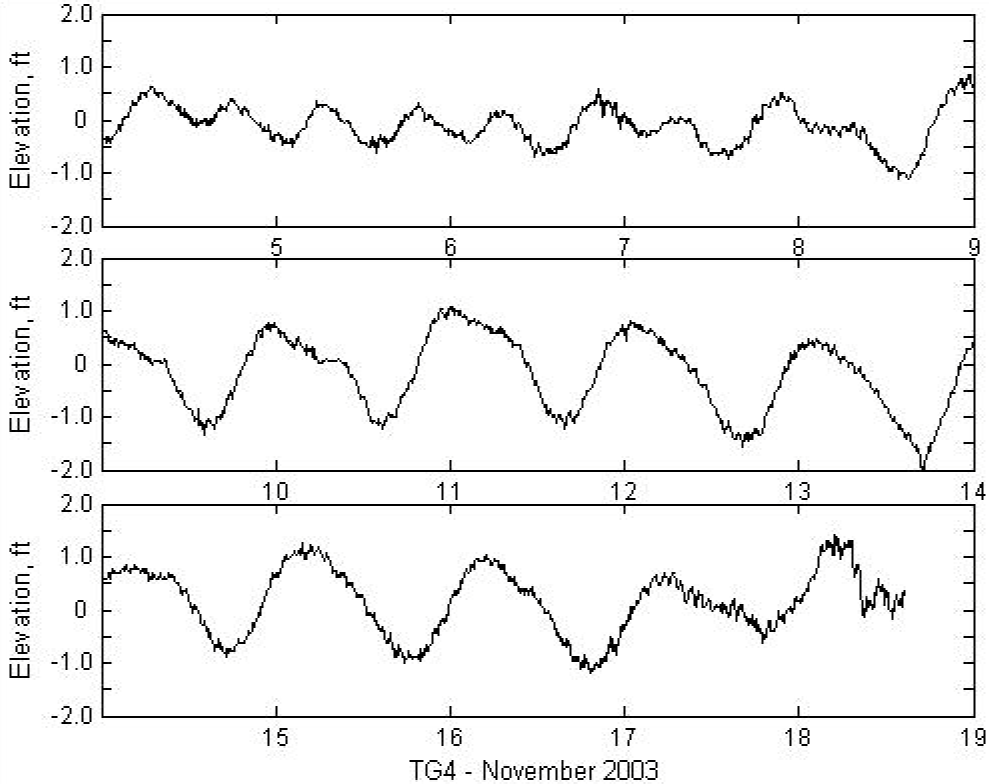
2.0
1.0
0
-1.0
-2.0
Elevation, ft
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
TG2 - November 2003



Elevation, ft
2.0
1.0
0
-1.0
-2.0
30
31
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
TG3 - October-November 2003

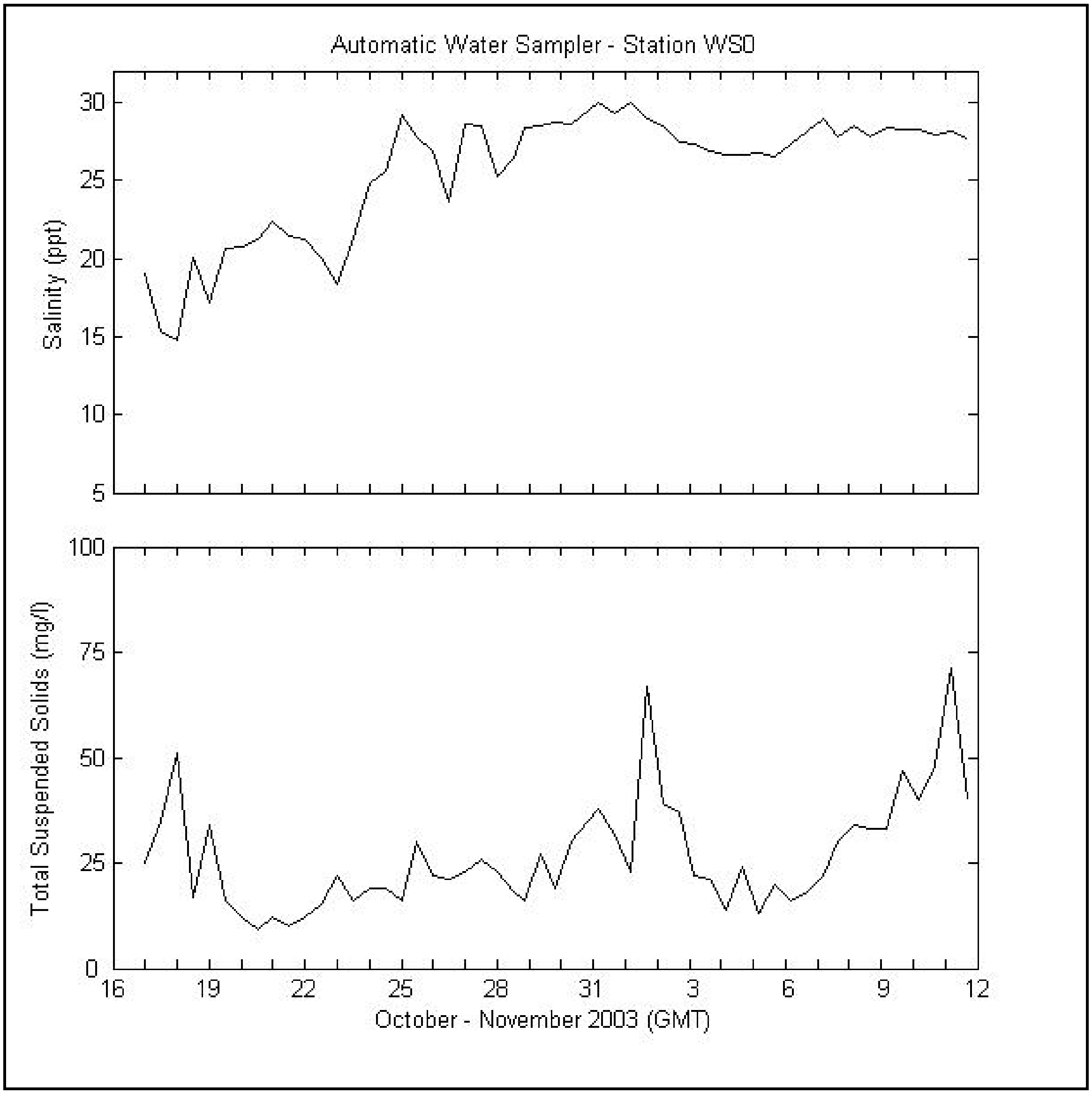


Elevation, ft
2.0
1.0
0
-1.0
-2.0
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
1
2
3
4
TG4 - October-November 2003

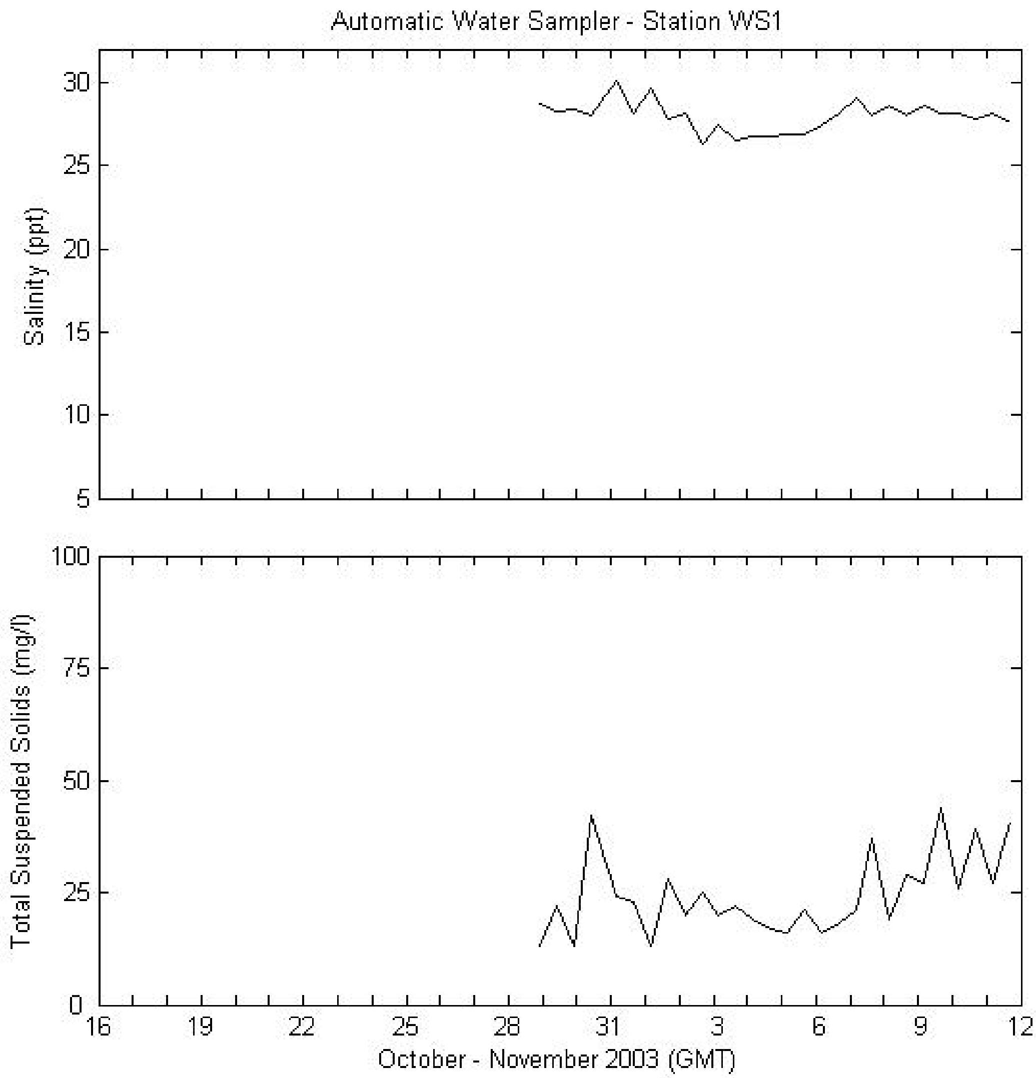

Elevation, ft
2.0
1.0
0
-1.0
-2.0
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
TG4 - November 2003

Appendix C Plots of Salinities and Total Suspended Solids Concentrations of the Automatic Water Sampler Samples

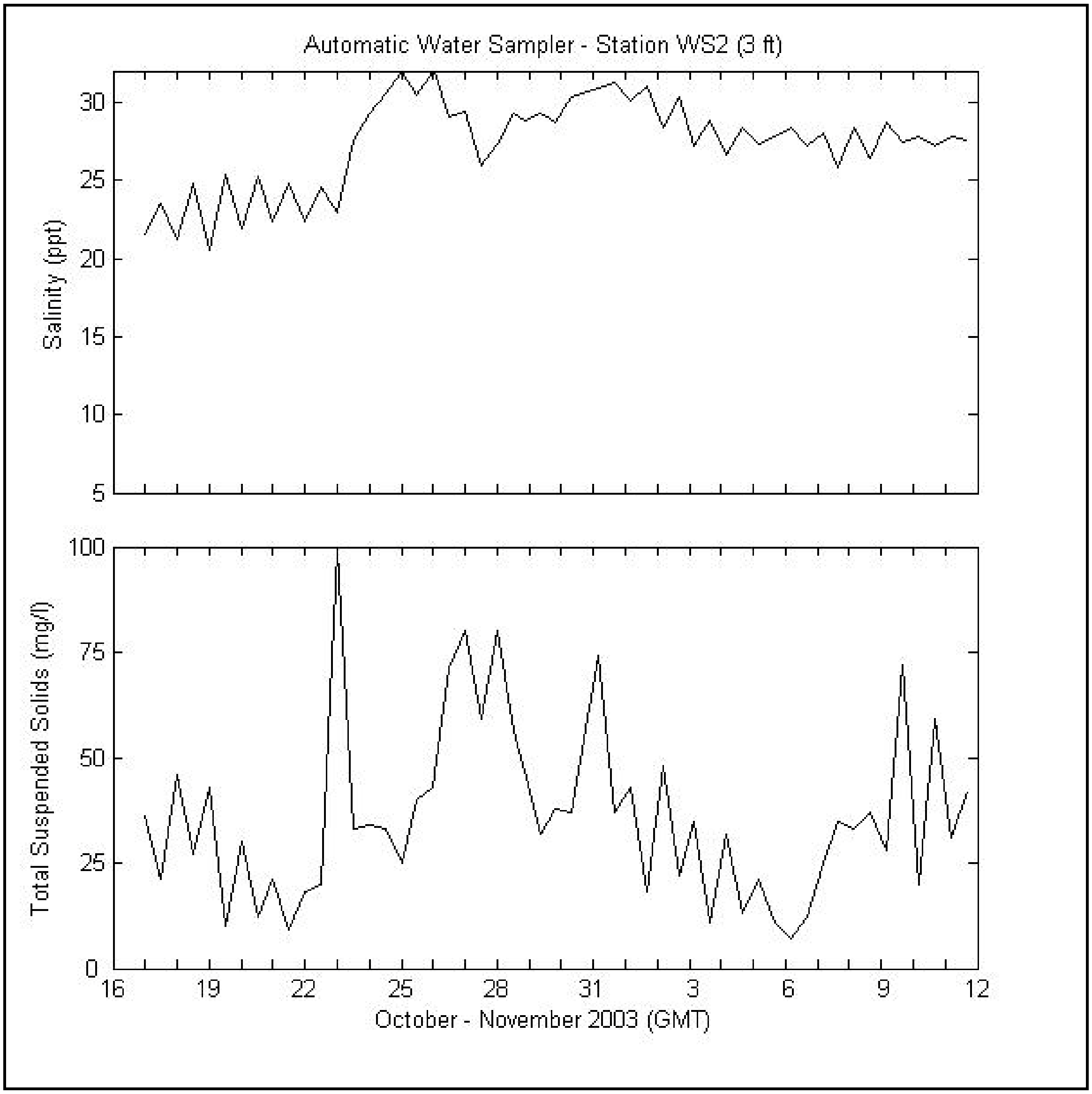
Contents

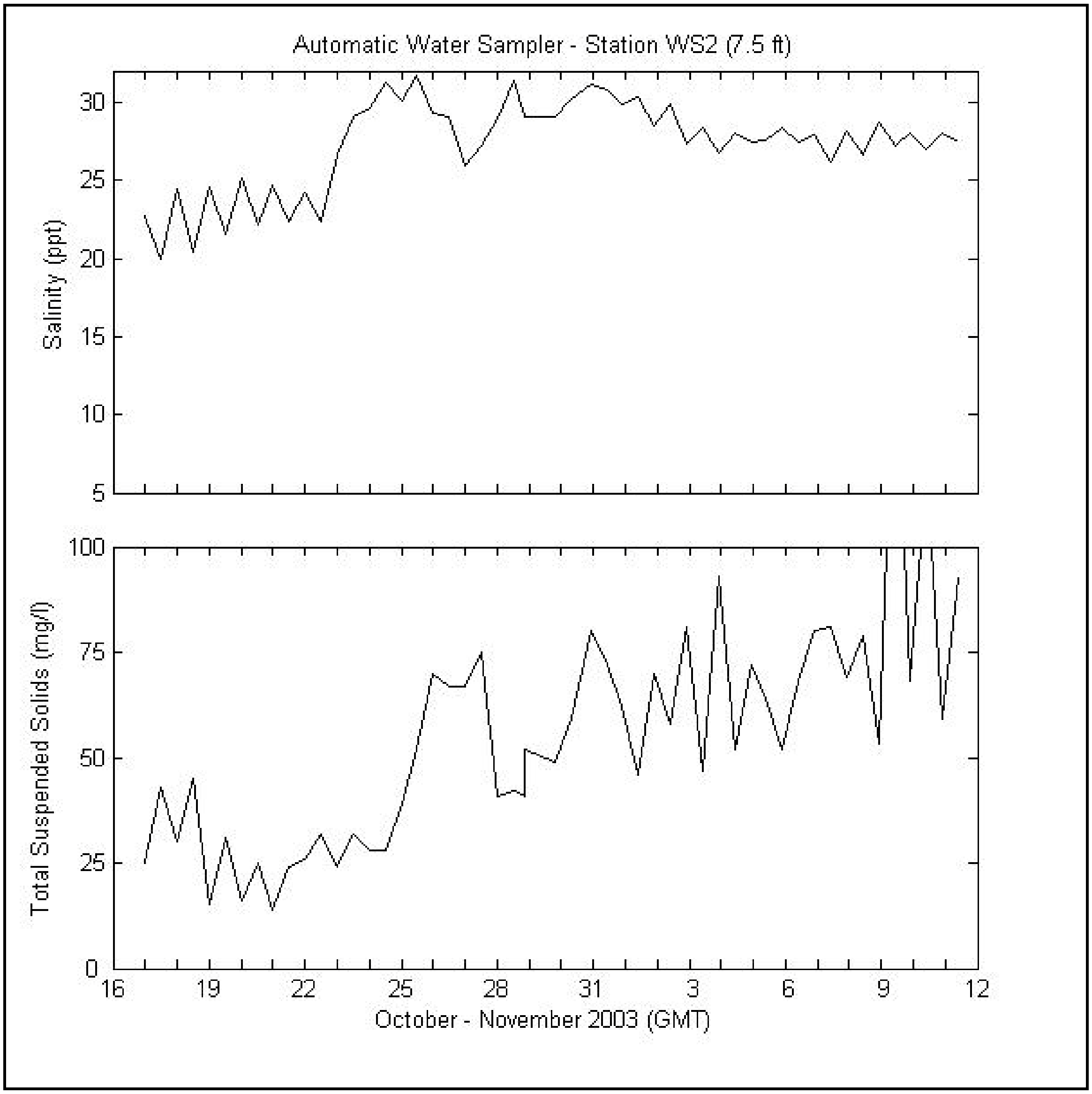


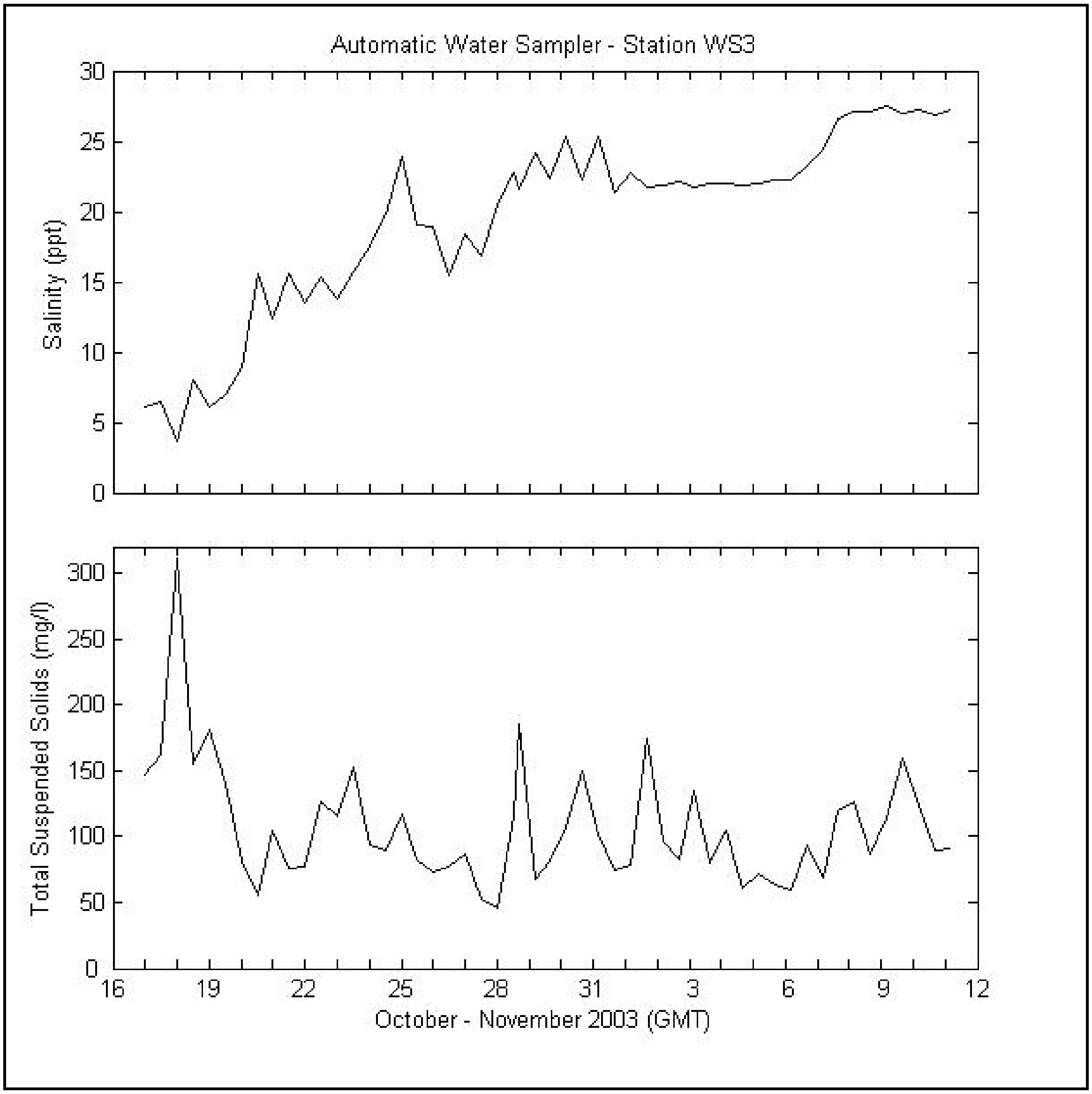
Automatic Water Sampler - Station WS0
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)



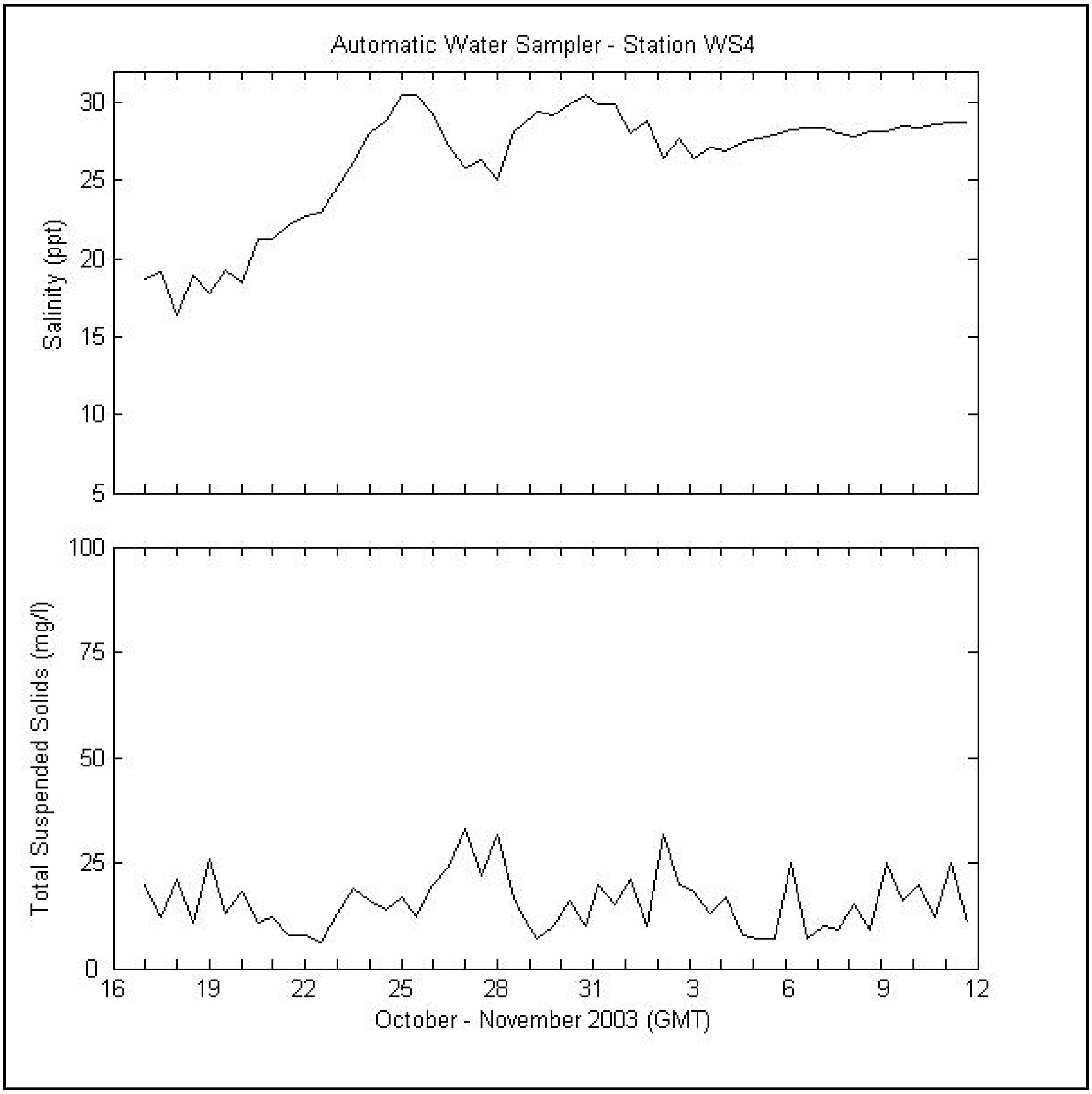
Automatic Water Sampler - Station WS1
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)


Automatic Water Sampler - Station WS2 (3 ft)
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)

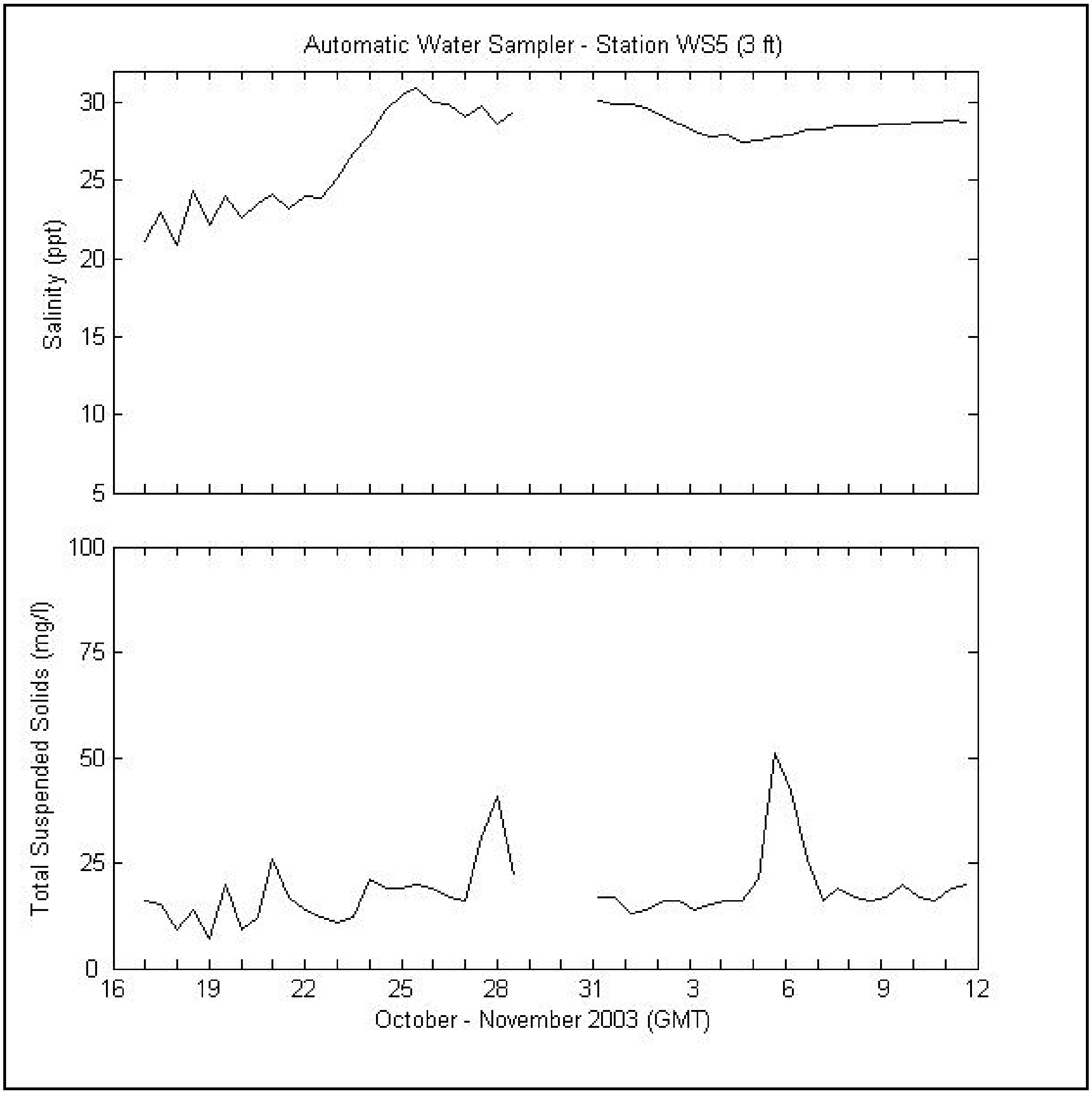

Automatic Water Sampler - Station WS2 (7.5 ft)
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)



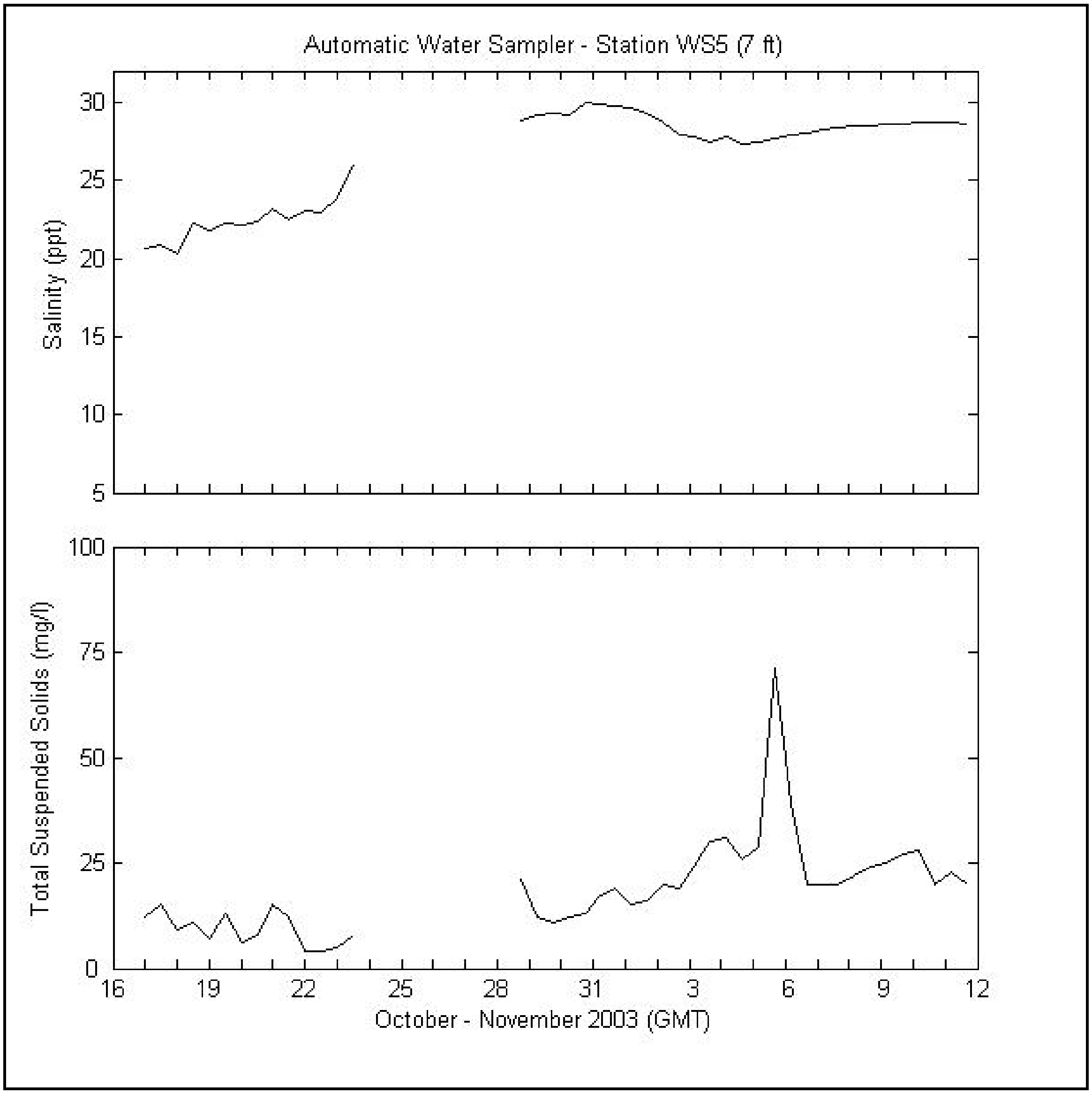
Automatic Water Sampler - Station WS3
Salinity (ppt)
30
25
20
15
10
5
0
Total Suspended Solids (mg/l)
300
250
200
150
100
50
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)



Automatic Water Sampler - Station WS4
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)



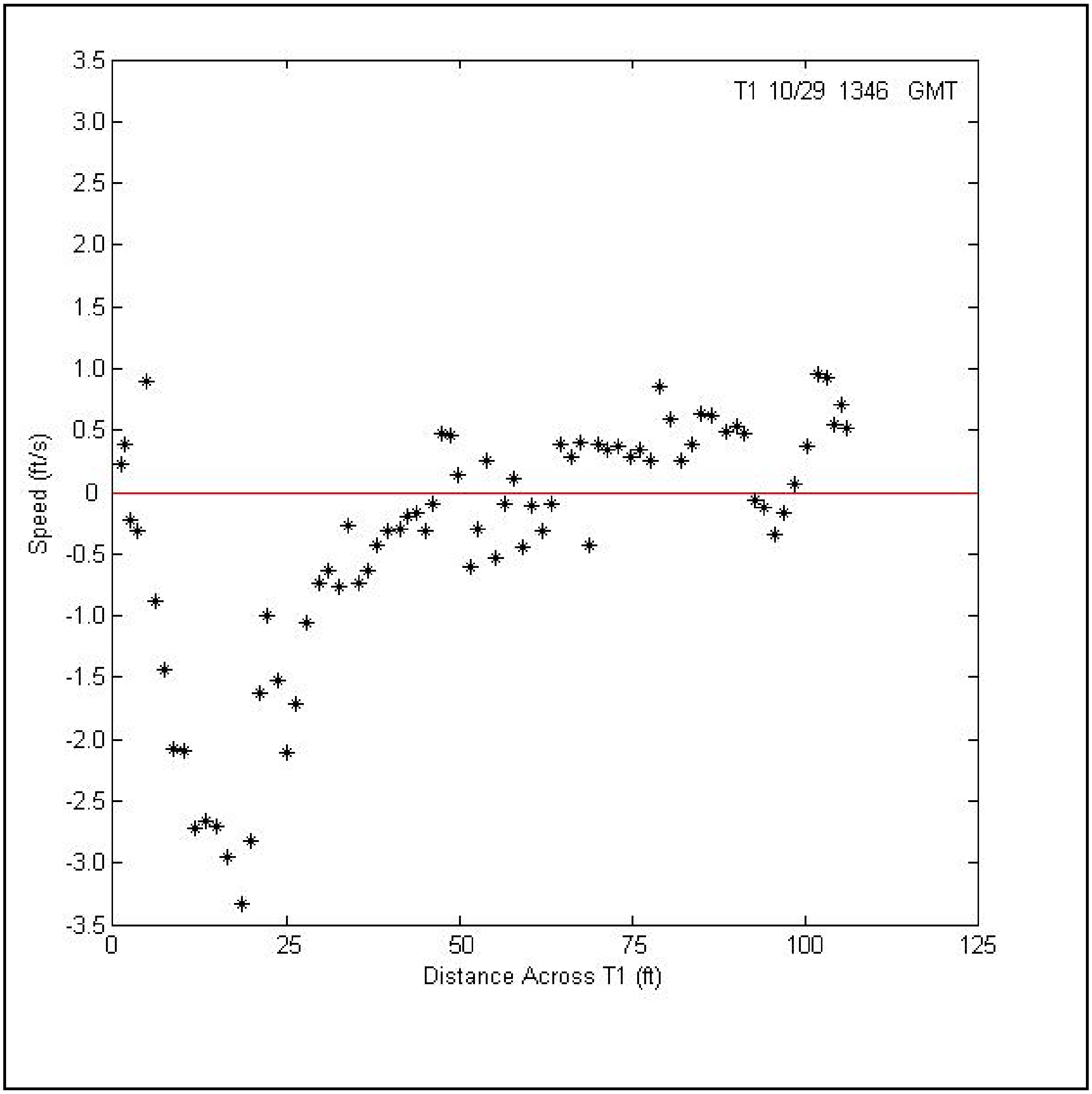
Automatic Water Sampler - Station WS5 (3 ft)
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)

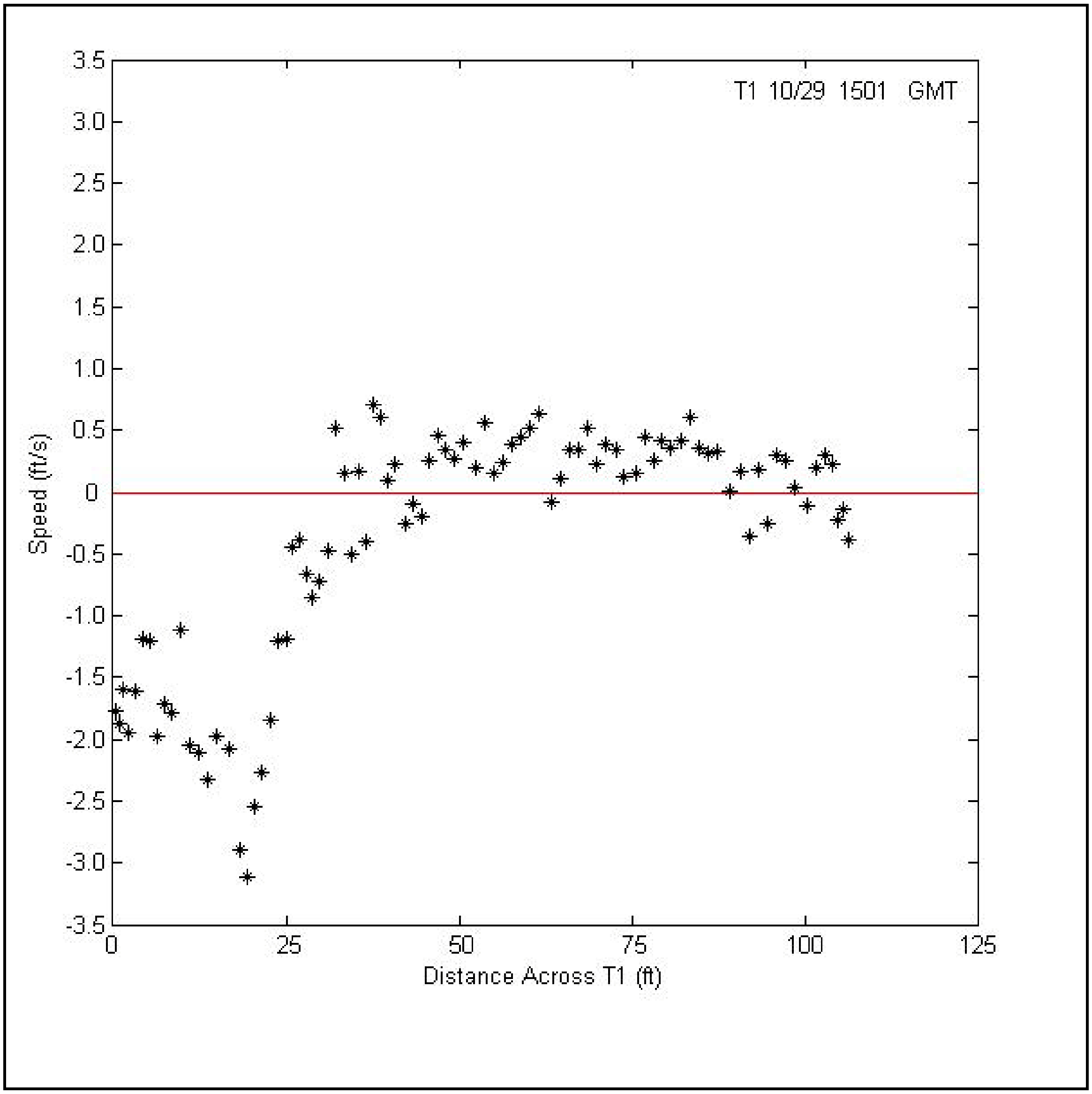


Automatic Water Sampler - Station WS5 (7 ft)
Salinity (ppt)
30
25
20
15
10
5
Total Suspended Solids (mg/l)
100
75
50
25
0
16
19
22
25
28
31
3
6
9
12
October - November 2003 (GMT)

Appendix D Transect Current Surveys, Depth-averaged Current Plots

Contents


T1 10/29 1346 GMT
Speed (ft/s)
Distance Across T1 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125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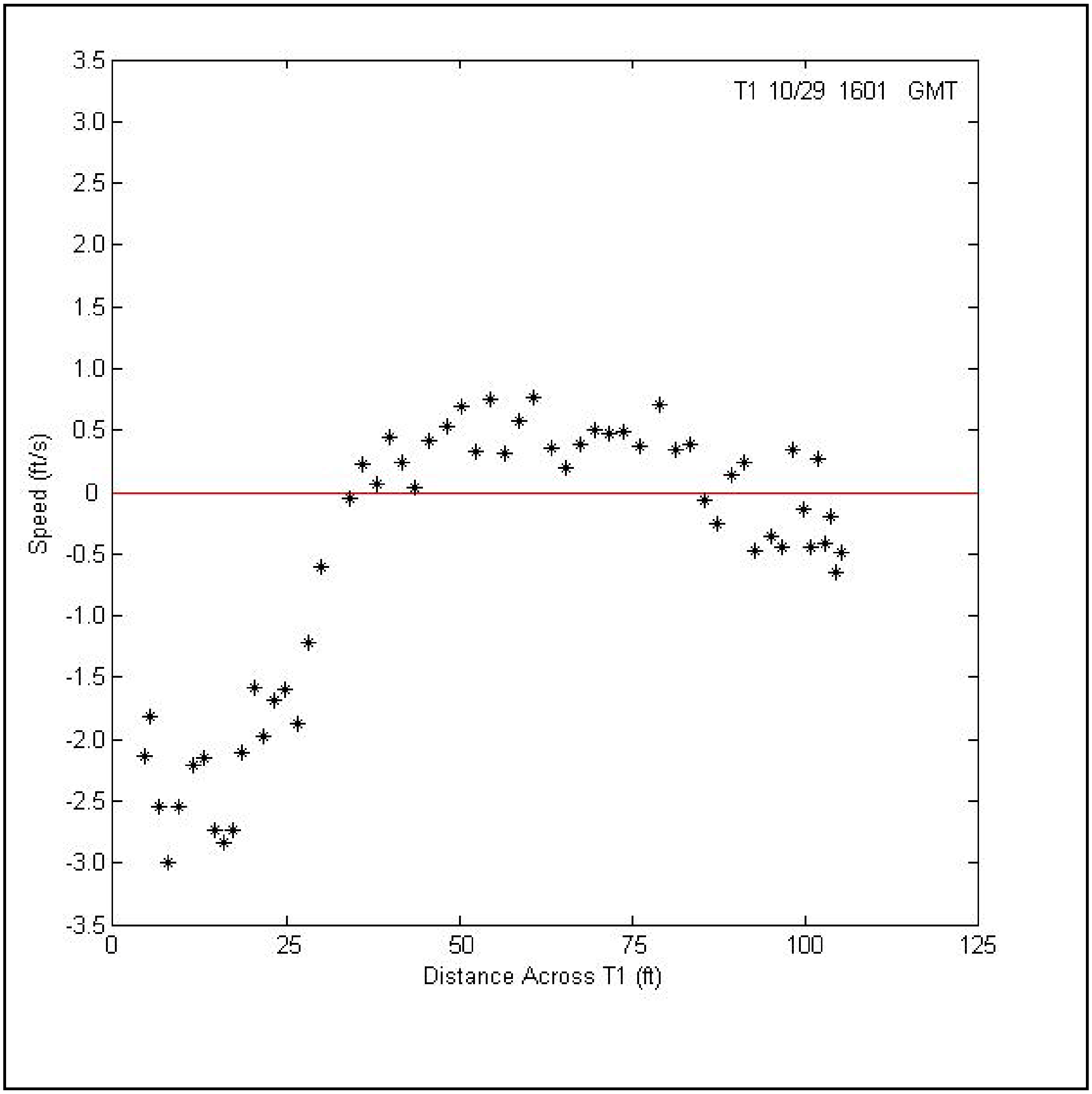
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)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Speed (ft/s)
Distance Across T1 (ft)
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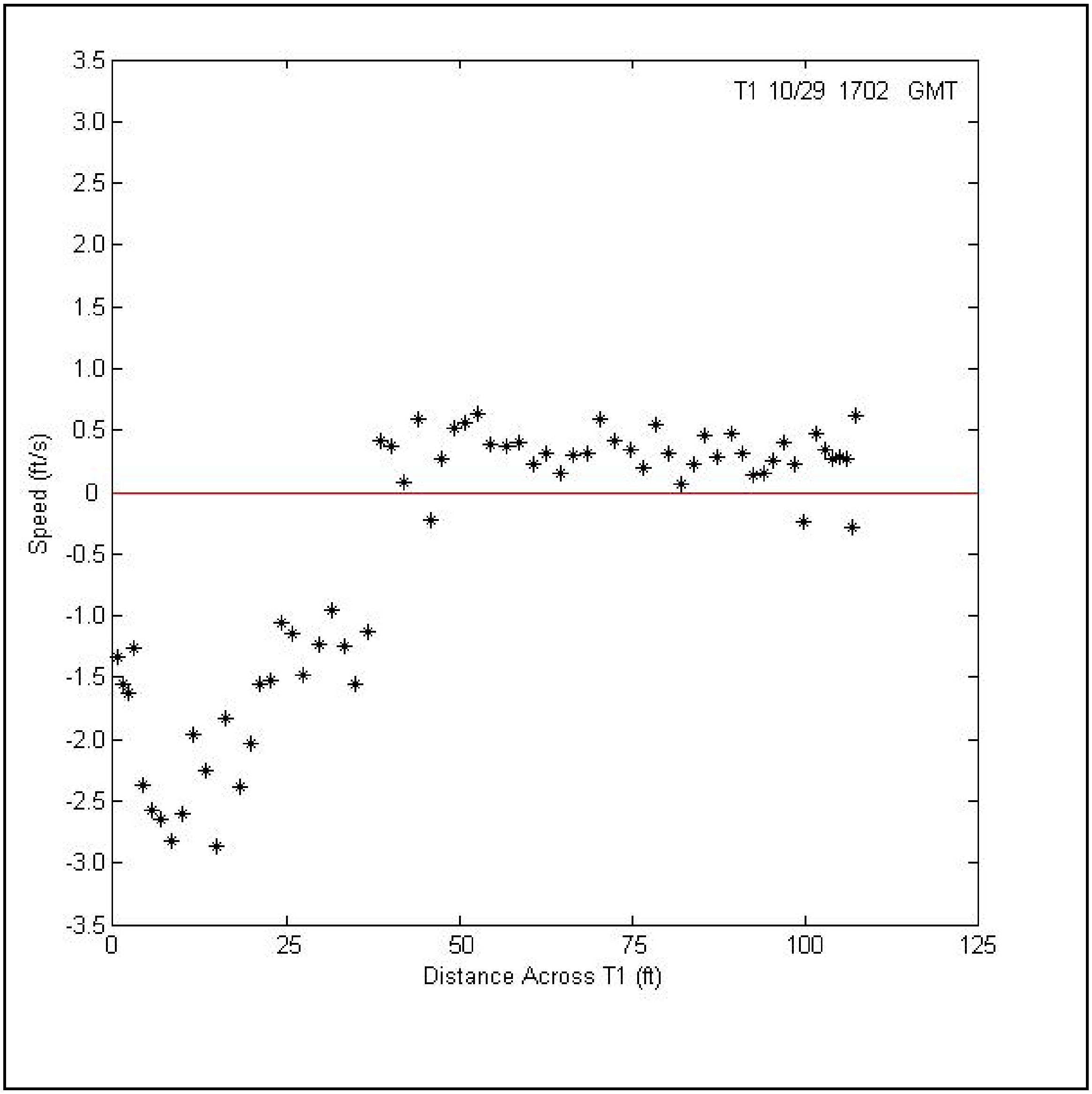
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125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Speed (ft/s)
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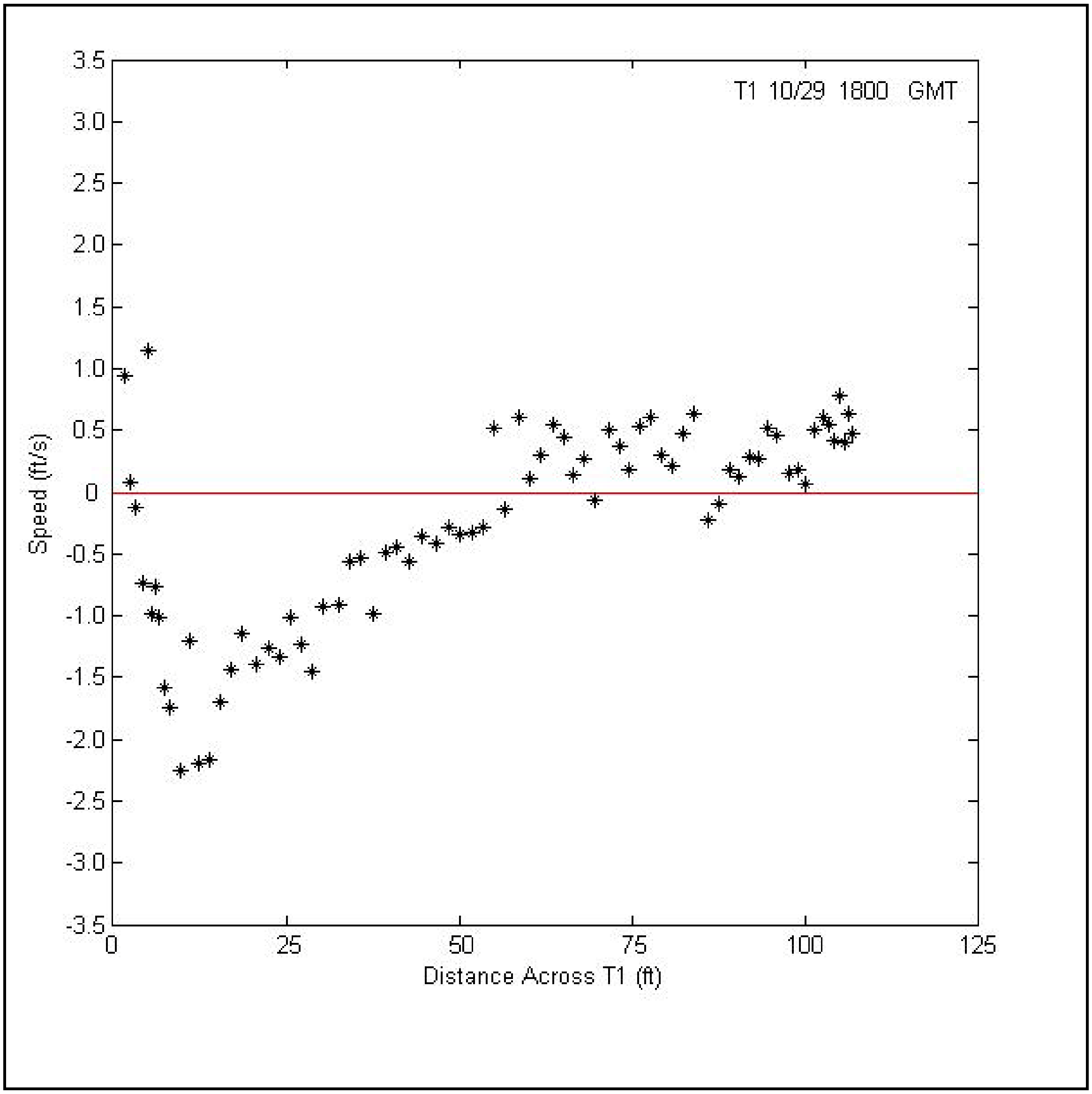
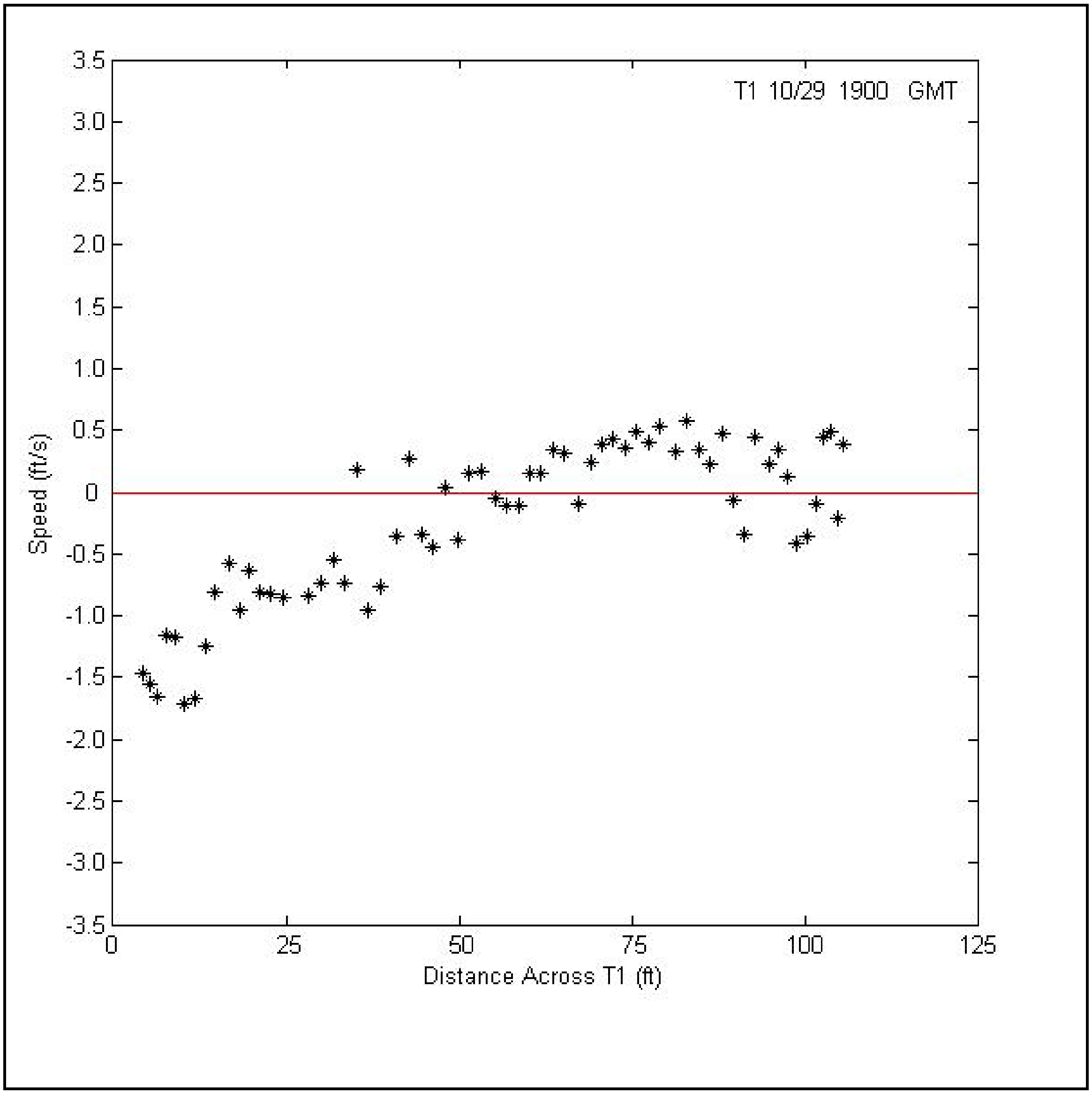
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/29 1800 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/29 1900 GMT
Speed (ft/s)
Distance Across T1 (ft)
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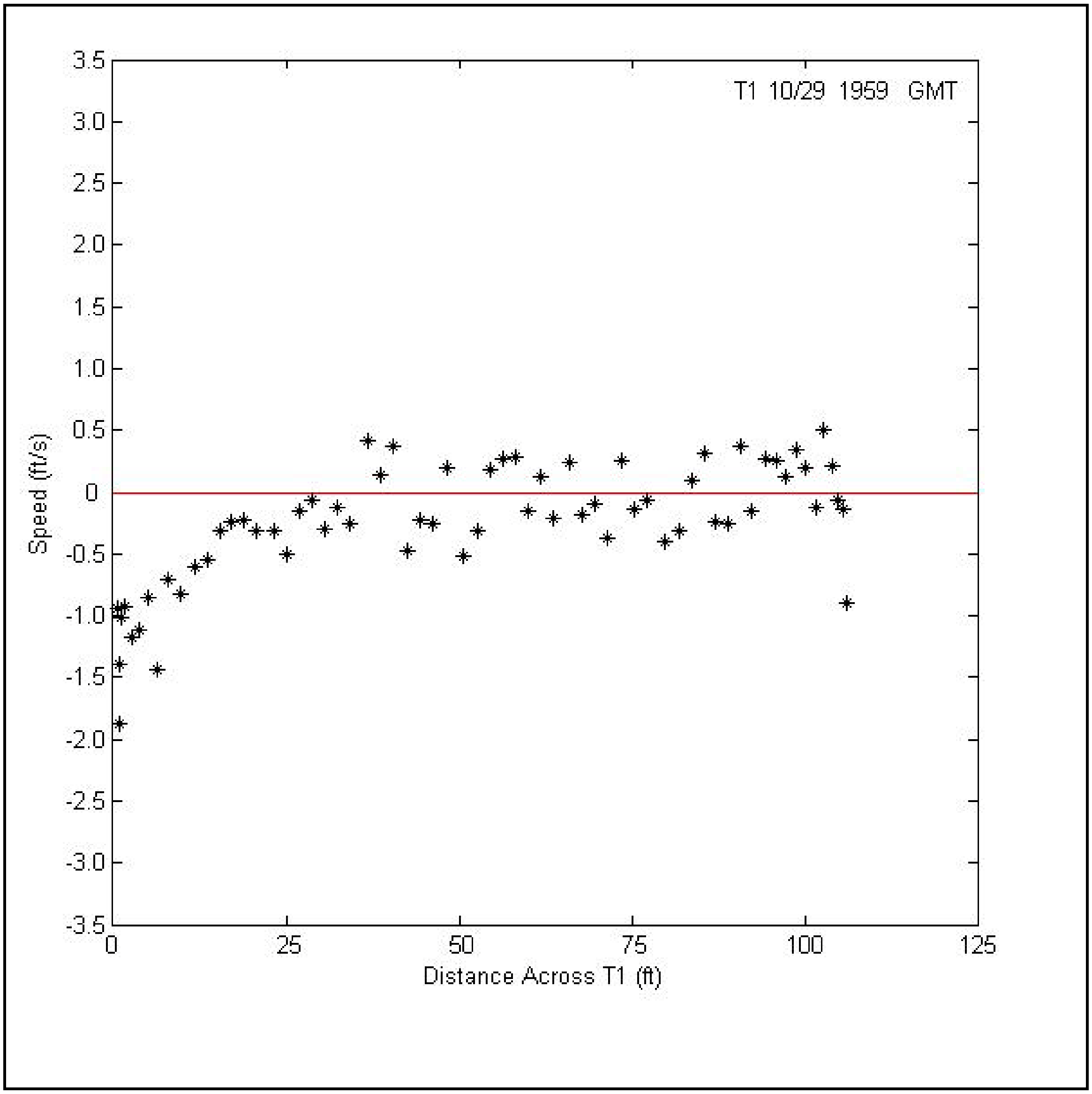
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125



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Speed (ft/s)
Distance Across T1 (ft)
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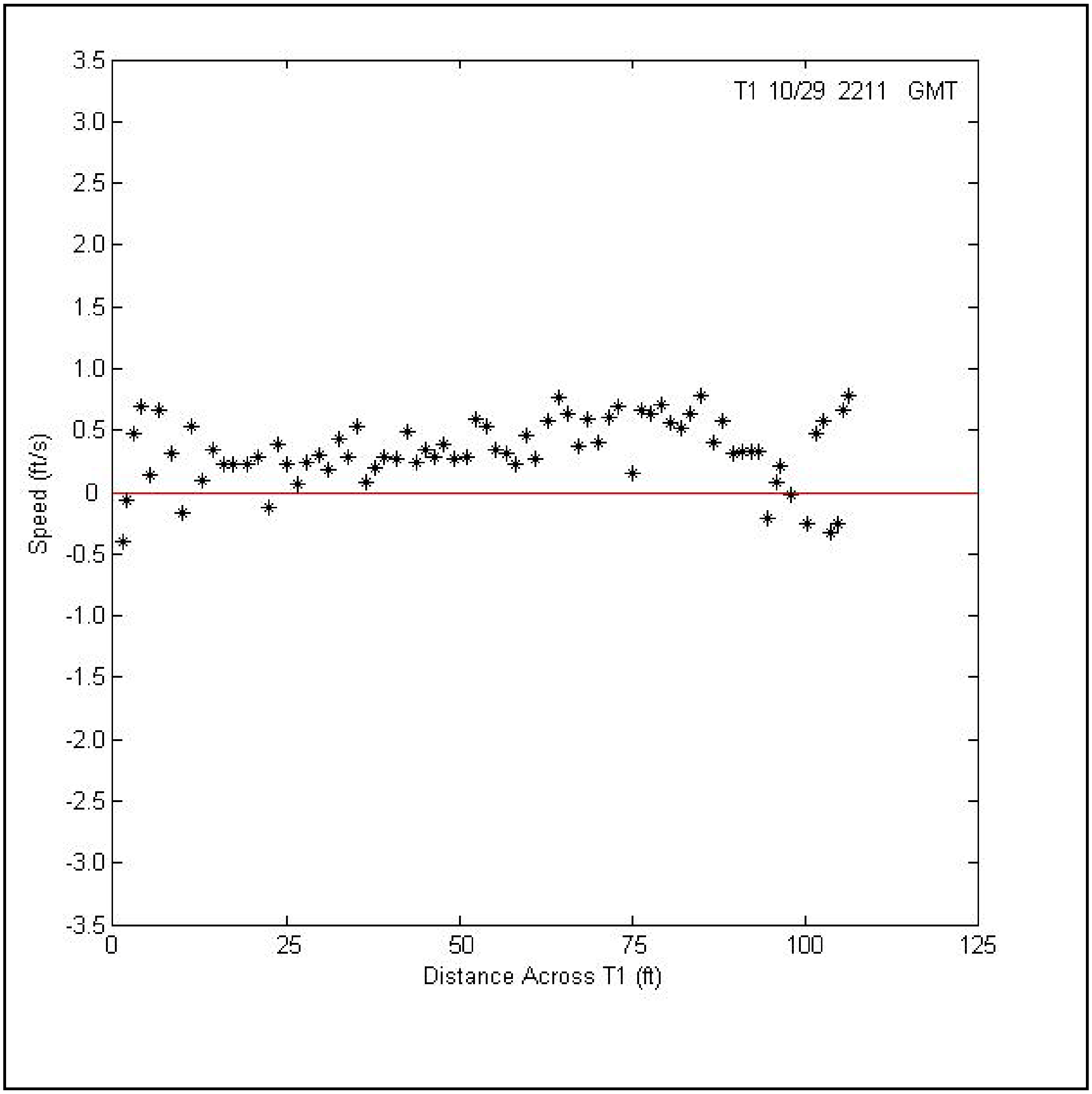
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125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Speed (ft/s)
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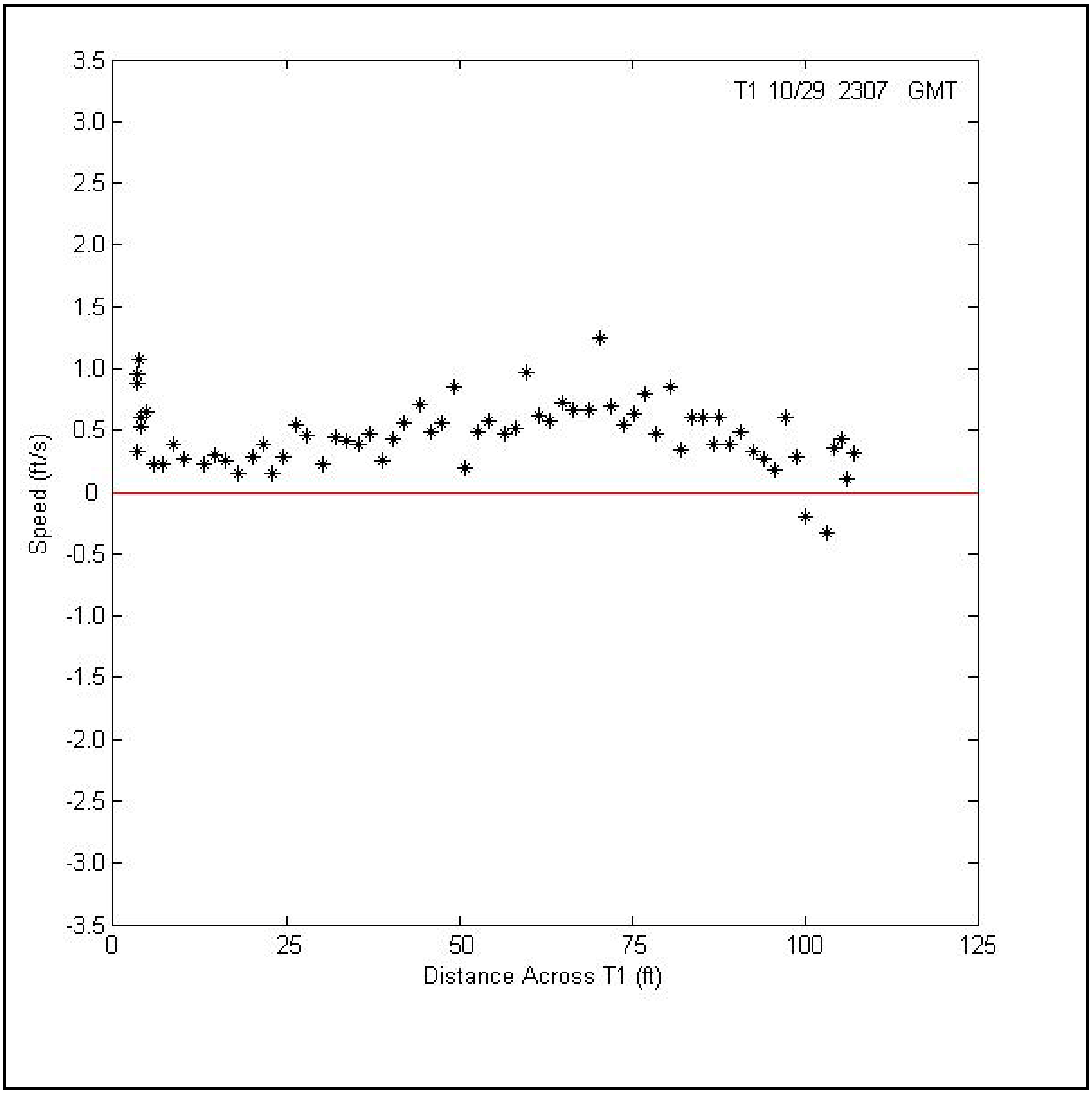
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/29 2307 GMT
Speed (ft/s)
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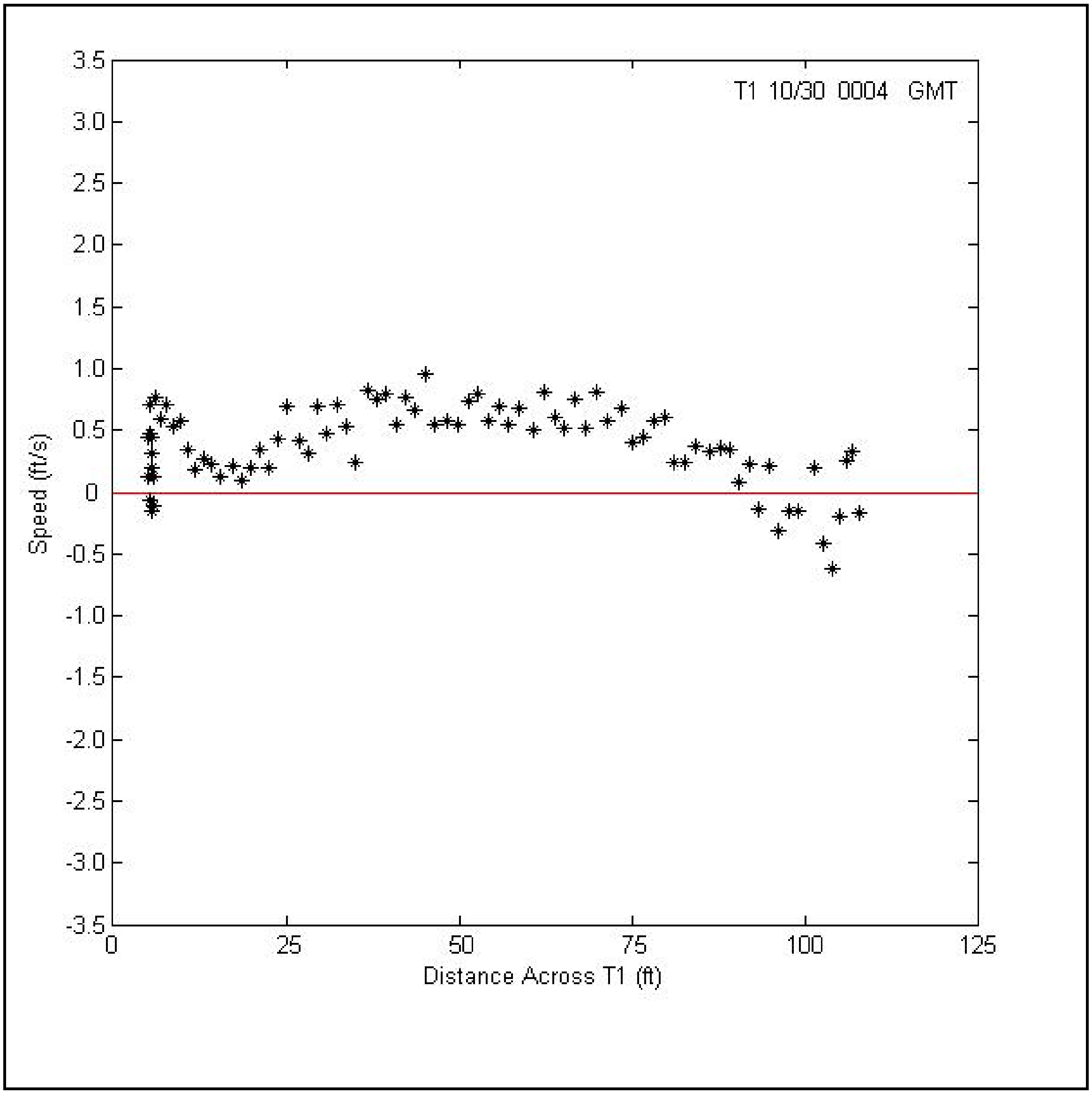
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/30 0004 GMT
Speed (ft/s)
Distance Across T1 (ft)
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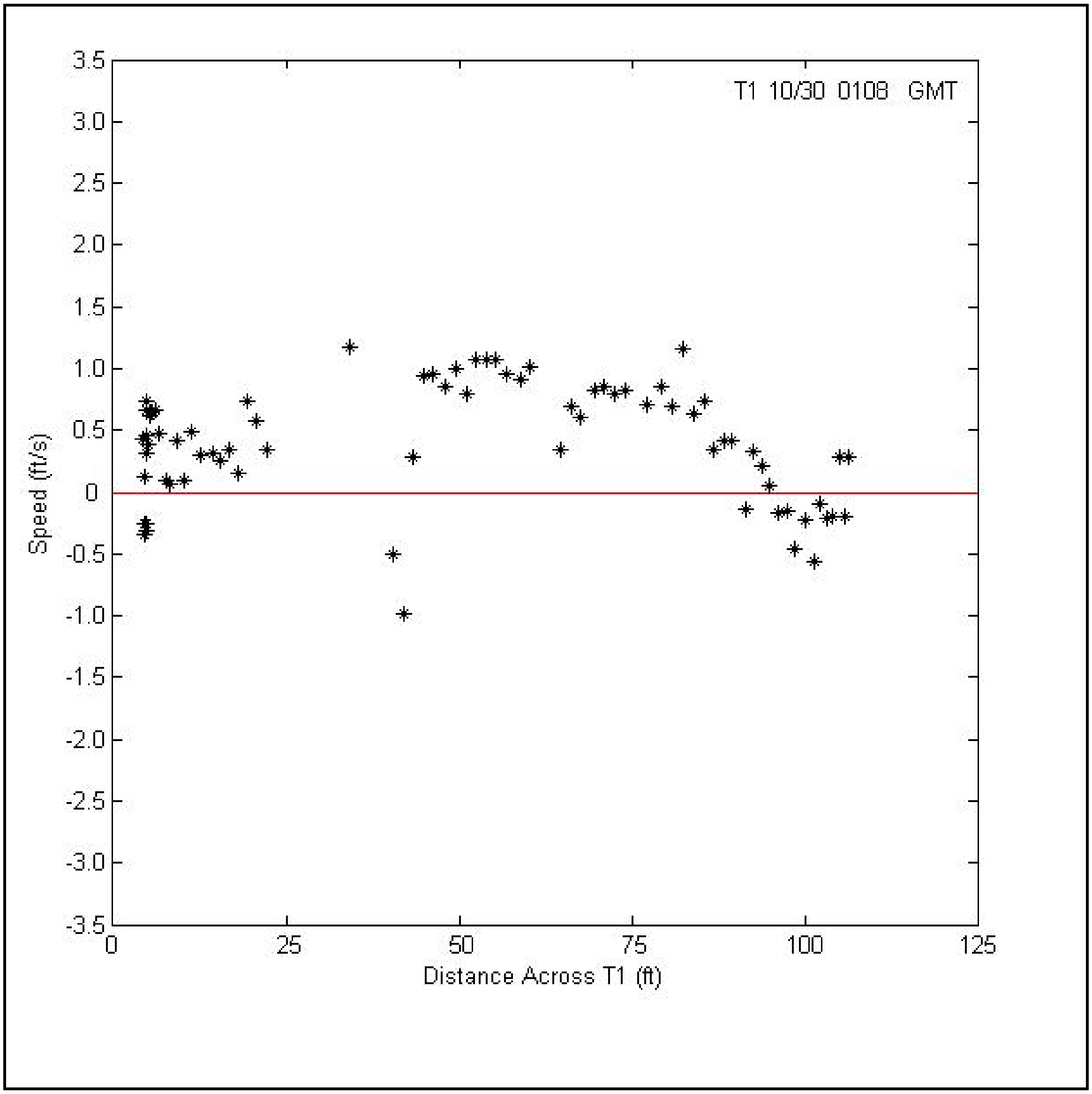
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125



T1 10/30 0108 GMT
Speed (ft/s)
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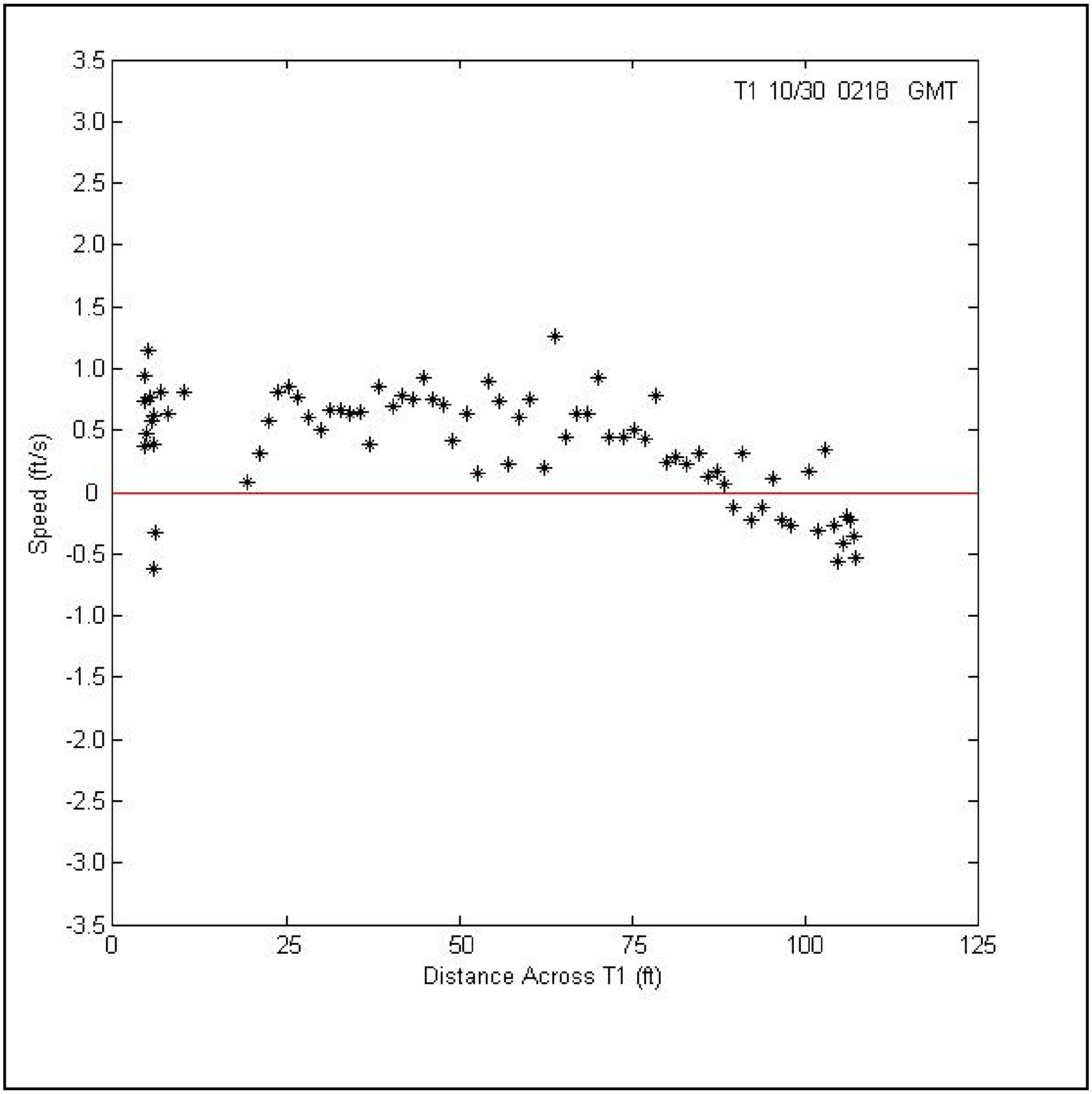
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/30 0218 GMT
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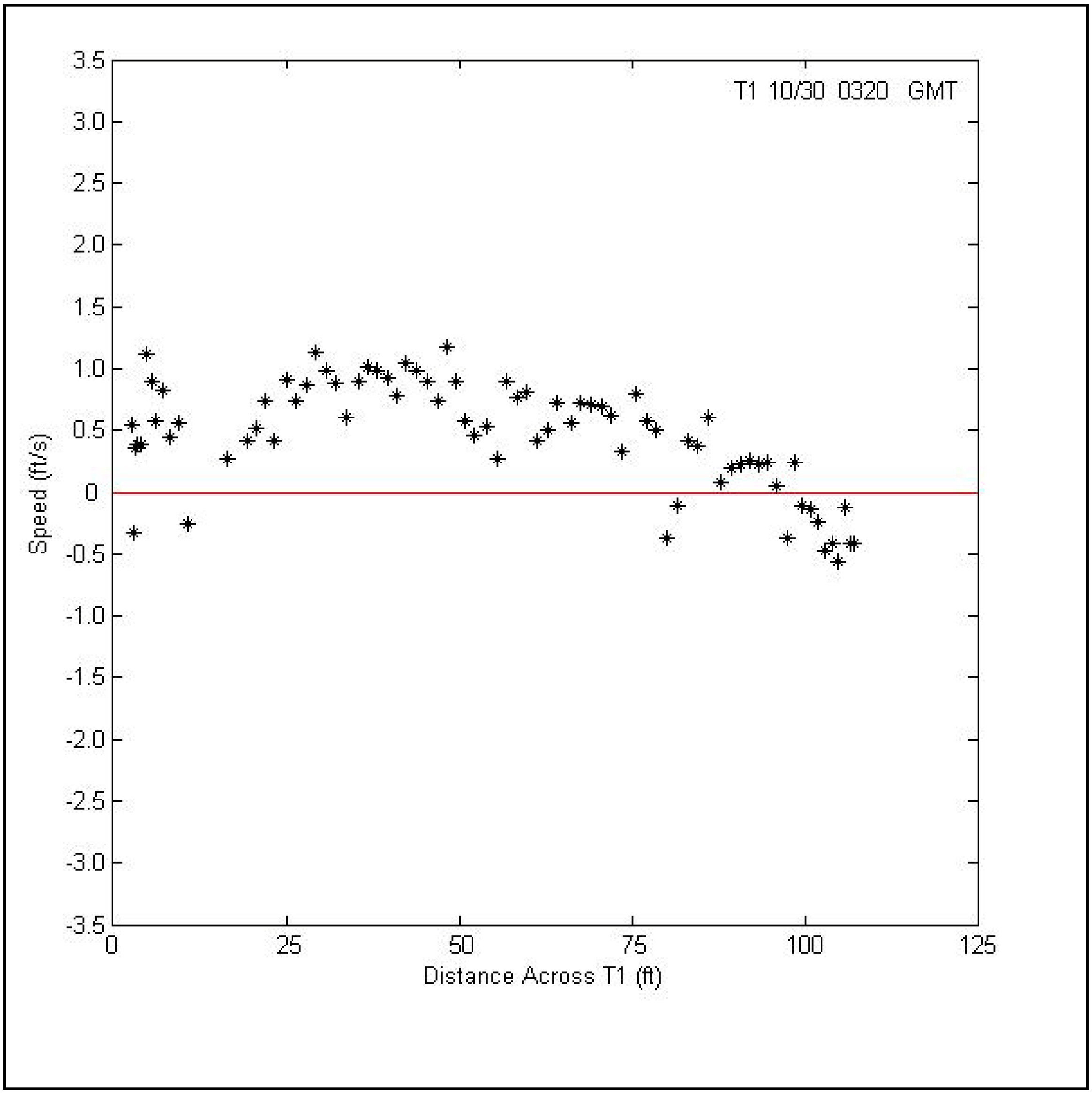
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/30 0320 GMT
Speed (ft/s)
Distance Across T1 (ft)
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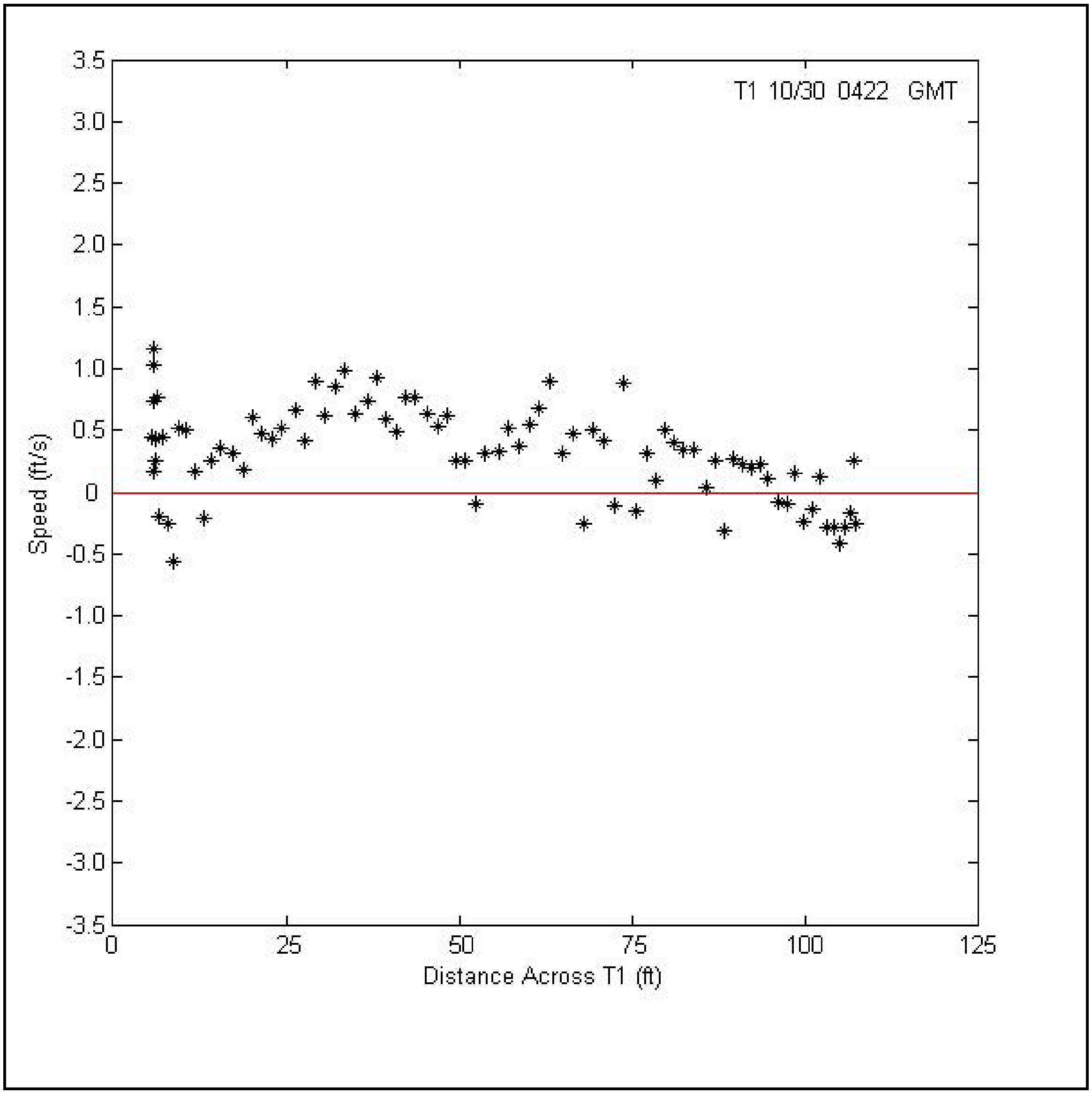
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125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Speed (ft/s)
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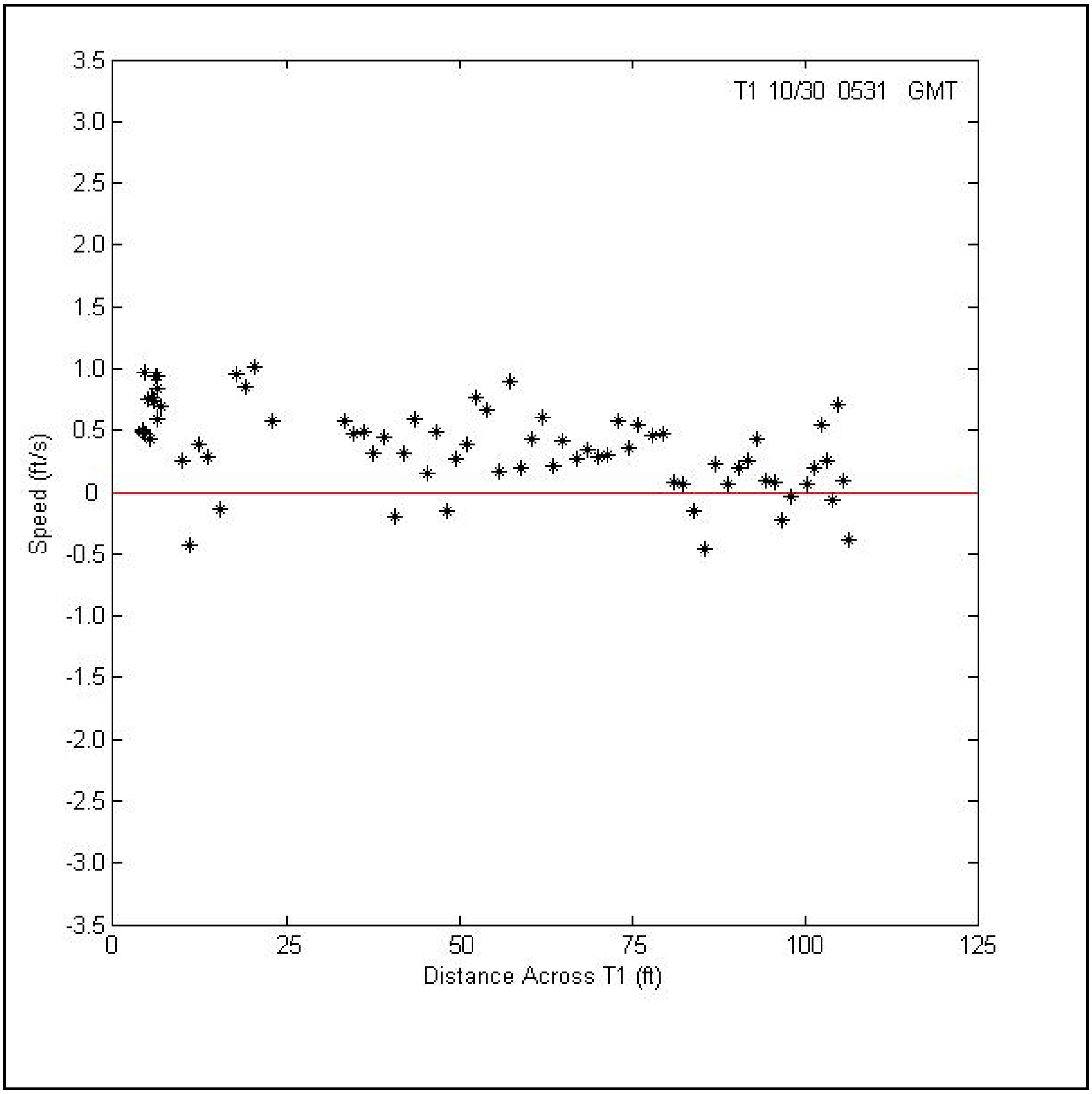
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)



T1 10/30 0531 GMT
Speed (ft/s)
Distance Across T1 (ft)
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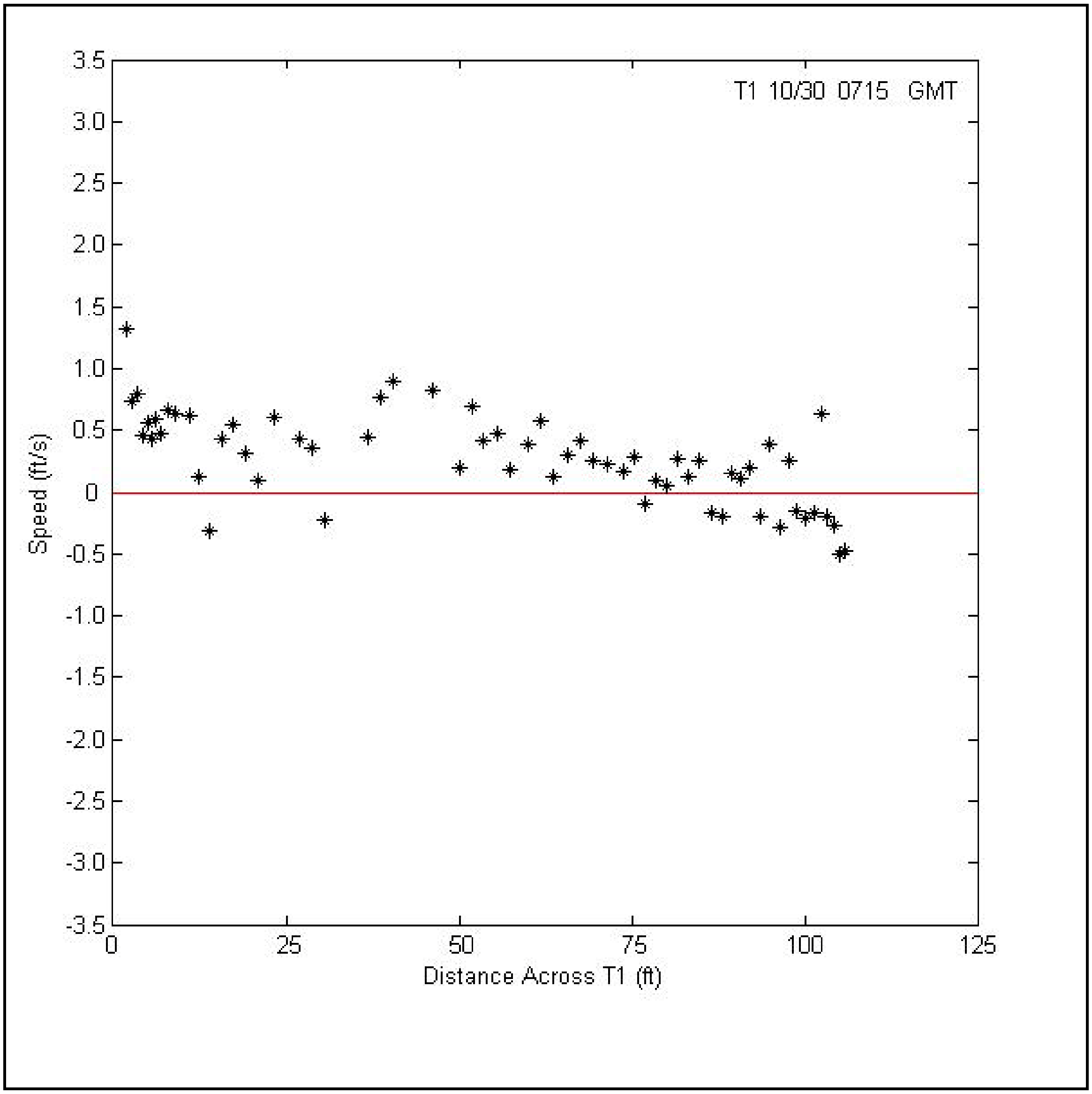
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T1 10/30 0715 GMT
Speed (ft/s)
Distance Across T1 (ft)
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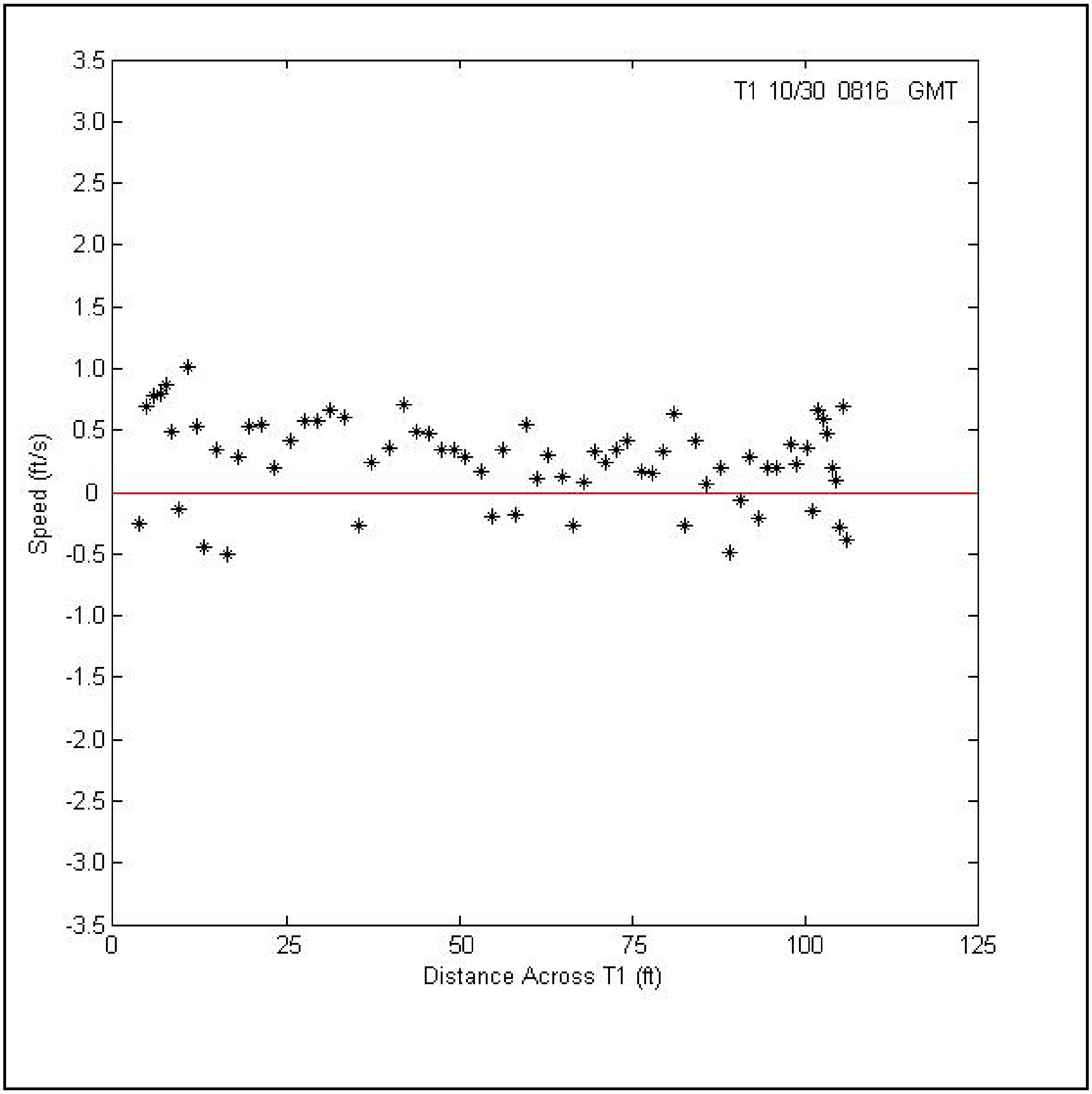
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125



T1 10/30 0816 GMT
Speed (ft/s)
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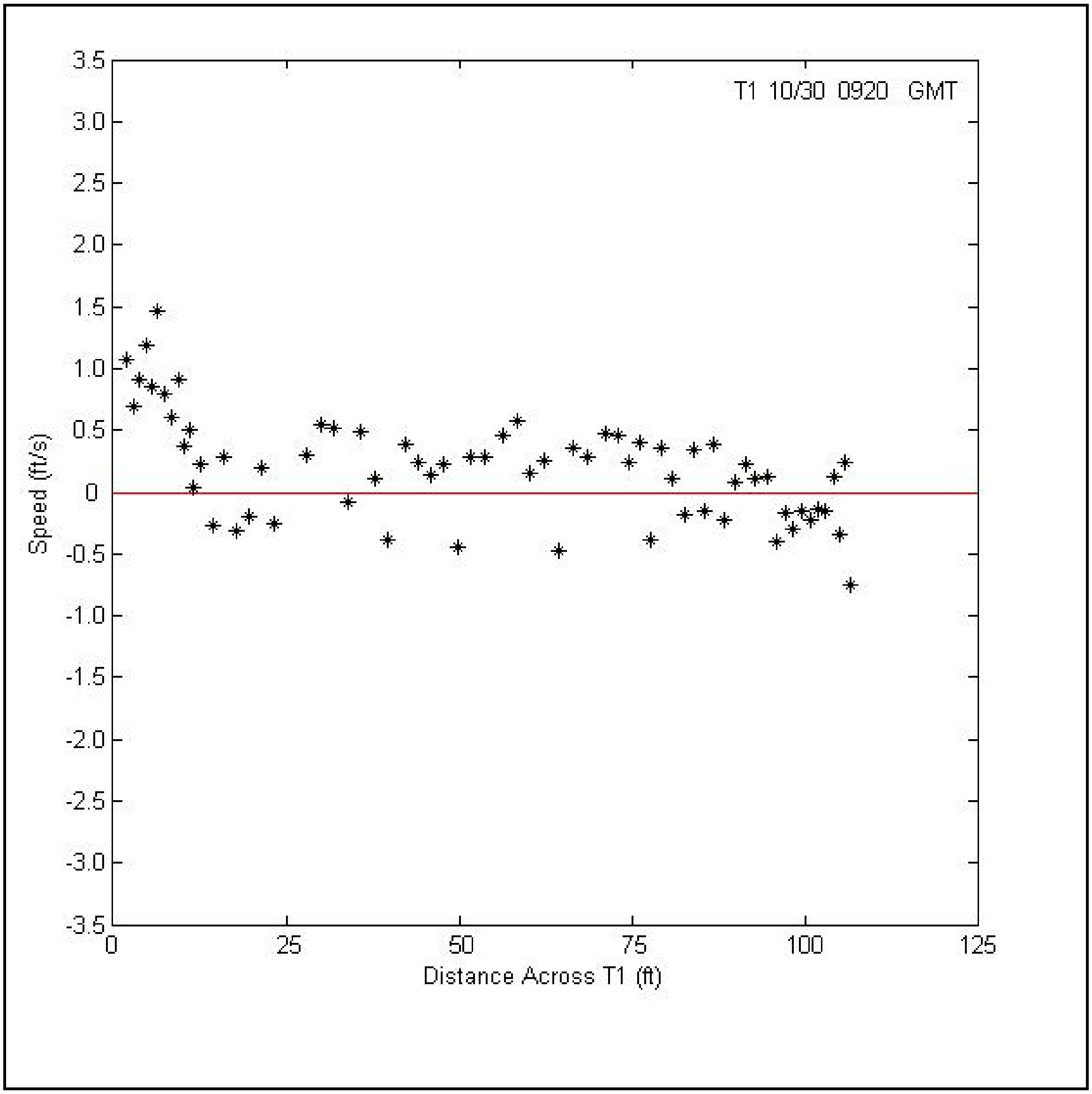
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/30 0920 GMT
Speed (ft/s)
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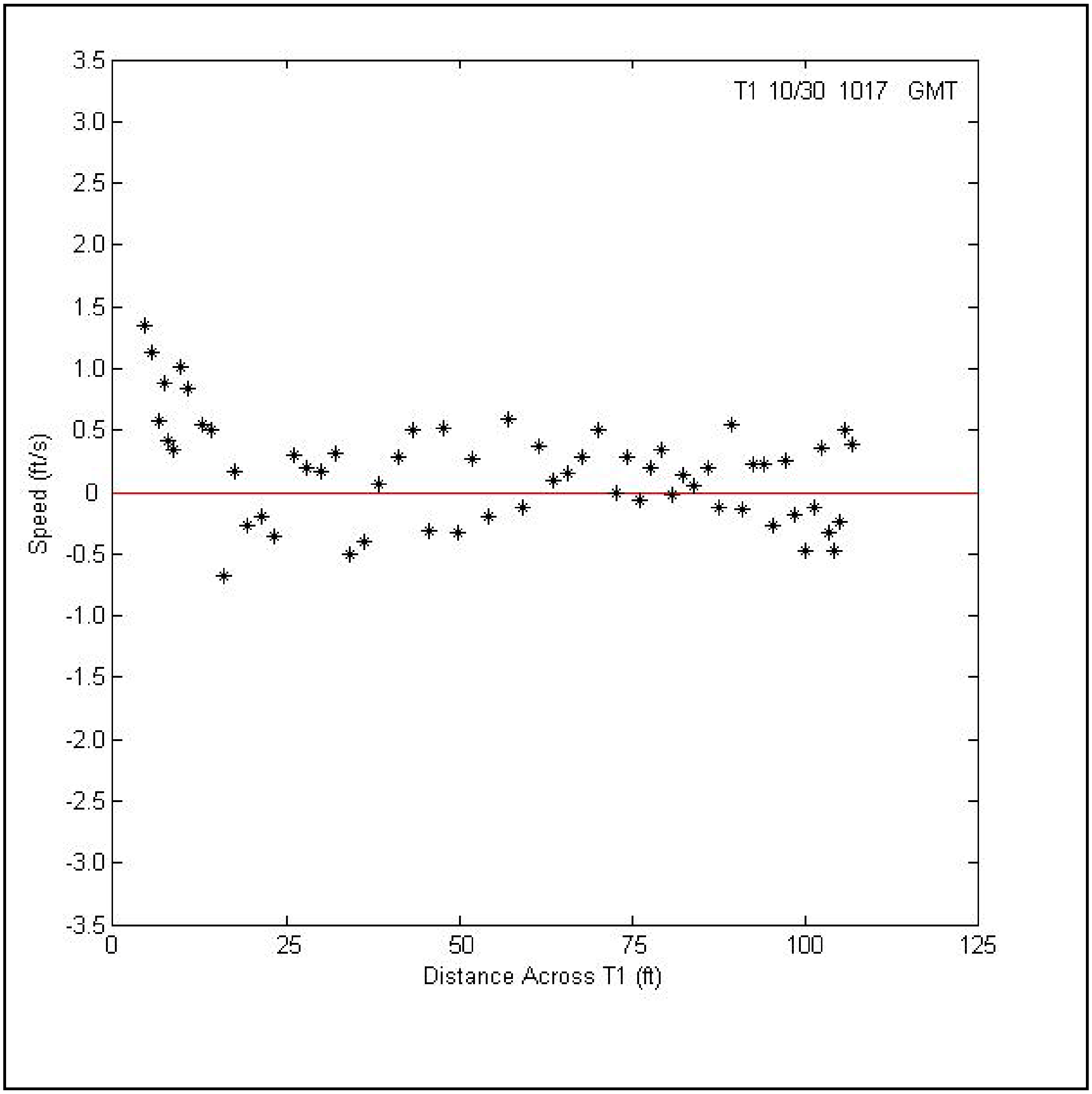
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)



T1 10/30 1017 GMT
Speed (ft/s)
Distance Across T1 (ft)
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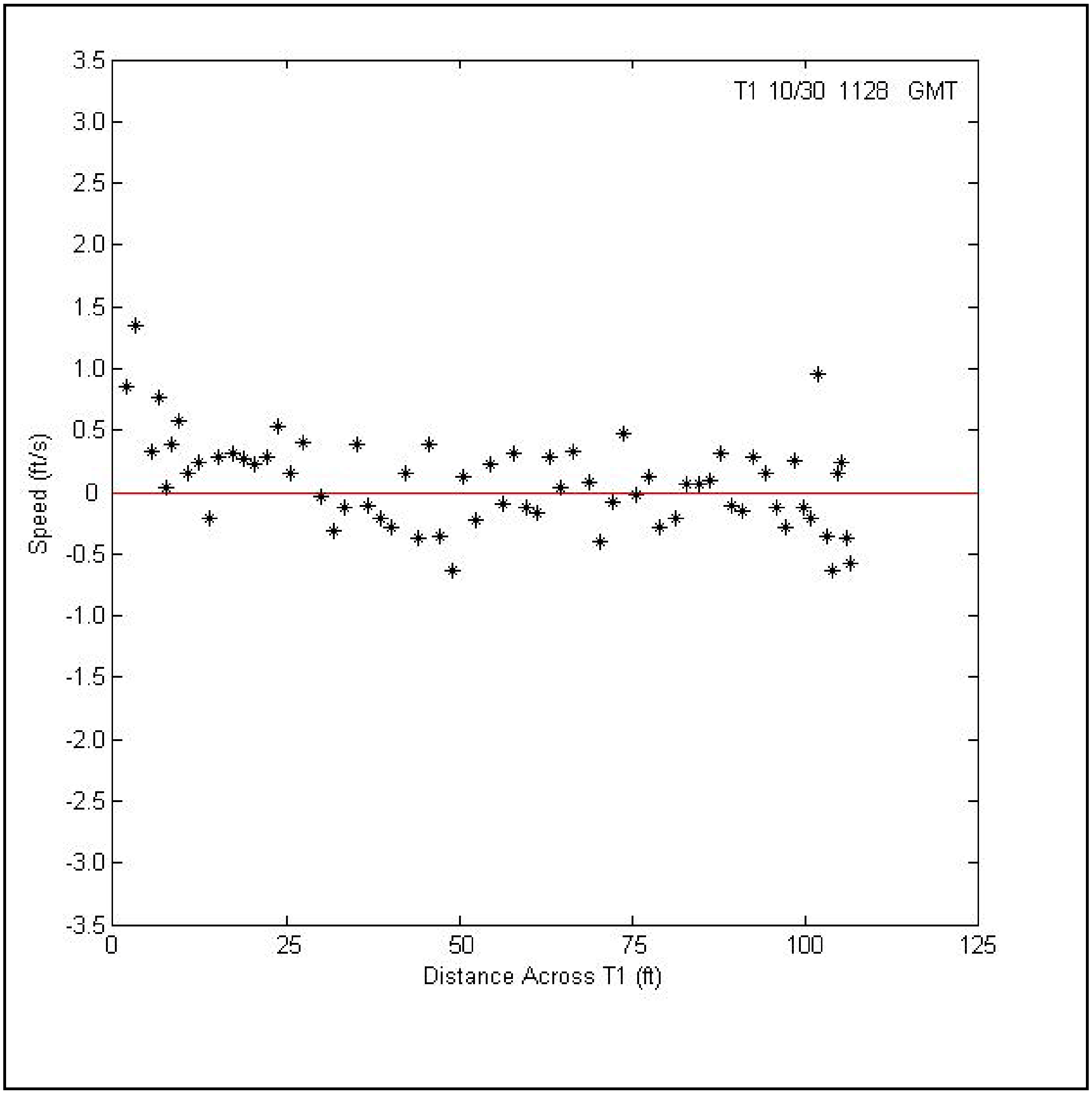
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125



T1 10/30 1128 GMT
Speed (ft/s)
Distance Across T1 (ft)
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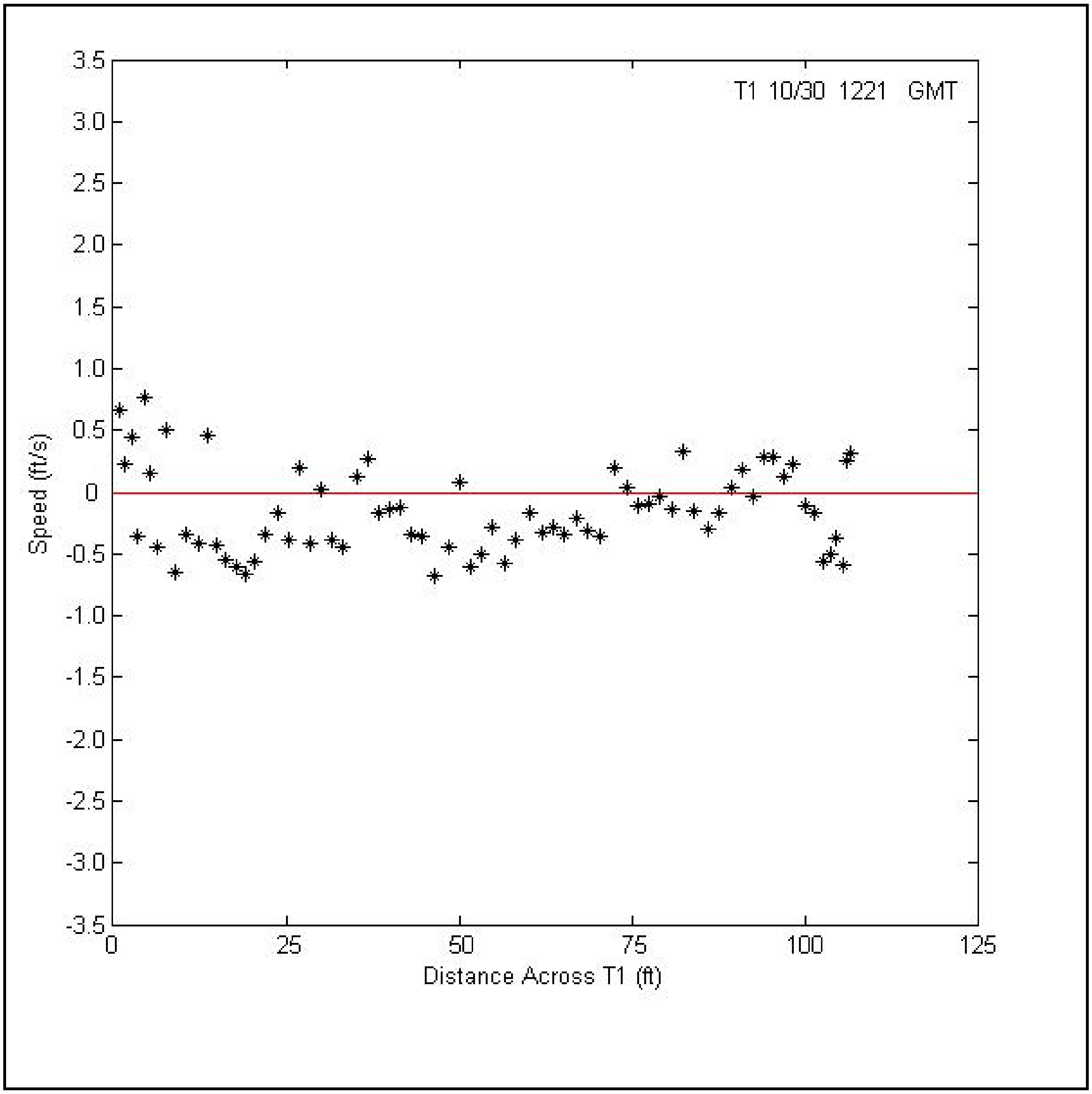
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125



T1 10/30 1221 GMT
Speed (ft/s)
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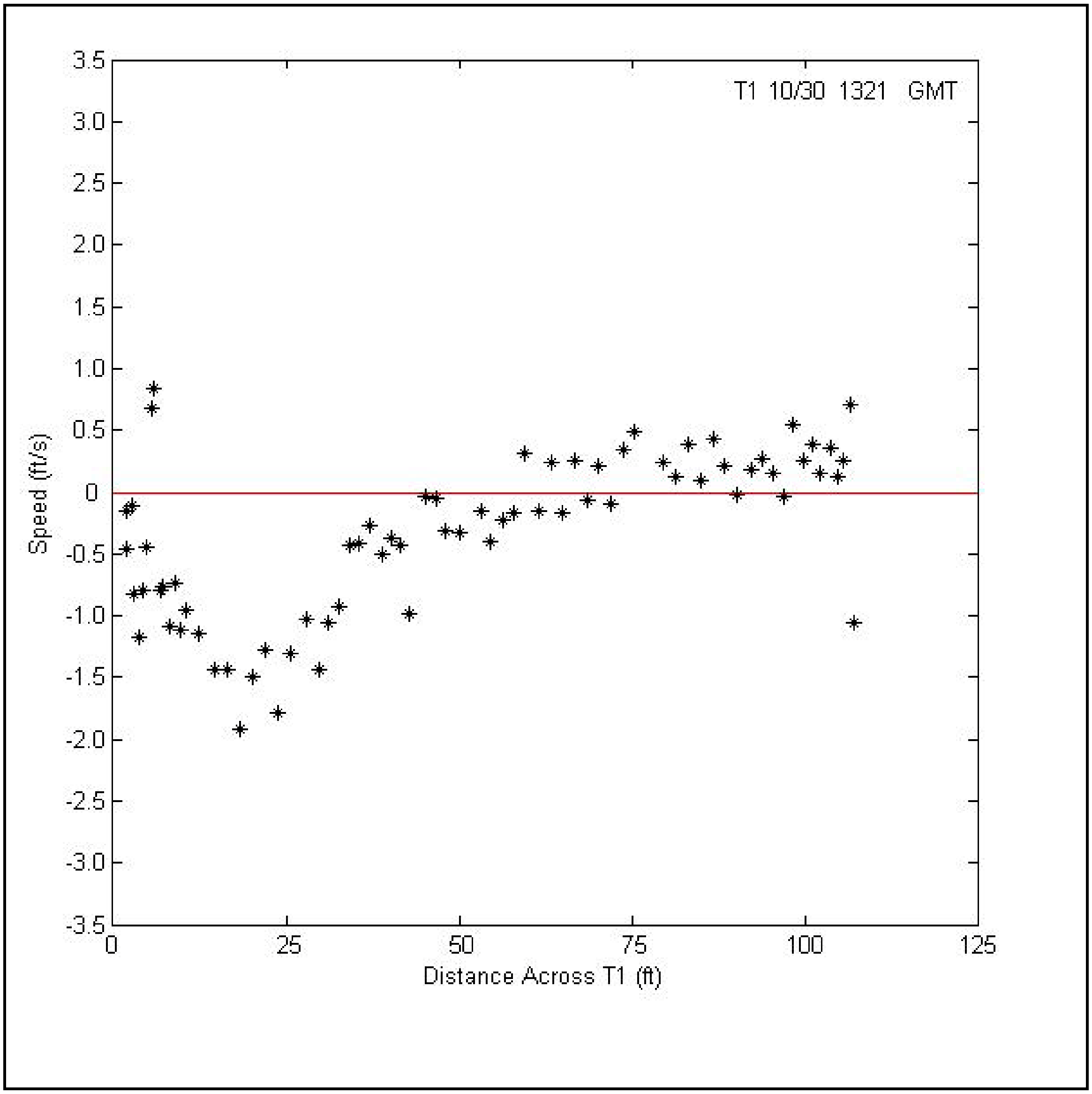
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T1 10/30 1321 GMT
Speed (ft/s)
Distance Across T1 (ft)
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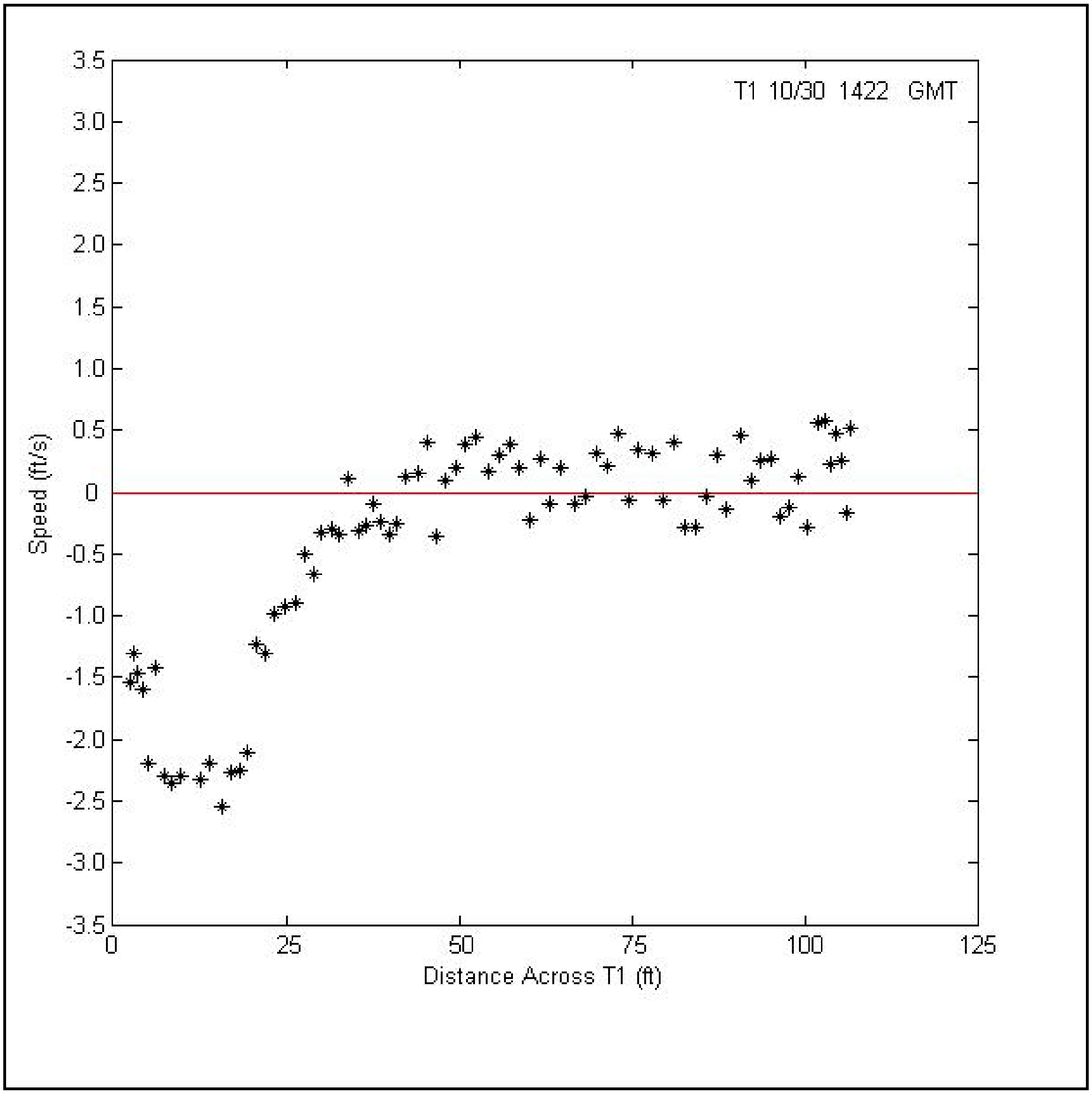
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125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Speed (ft/s)
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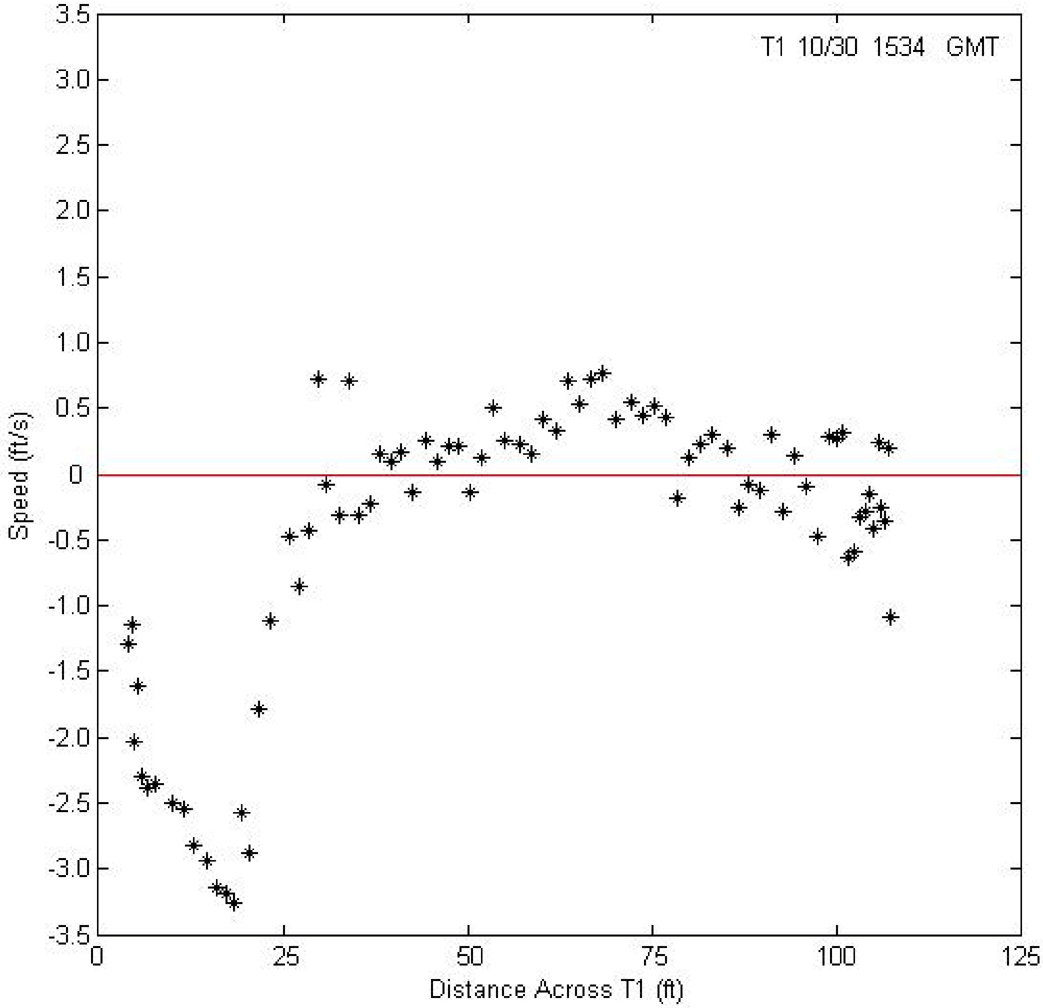
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)



T1 10/30 1534 GMT
Speed (ft/s)
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2.5
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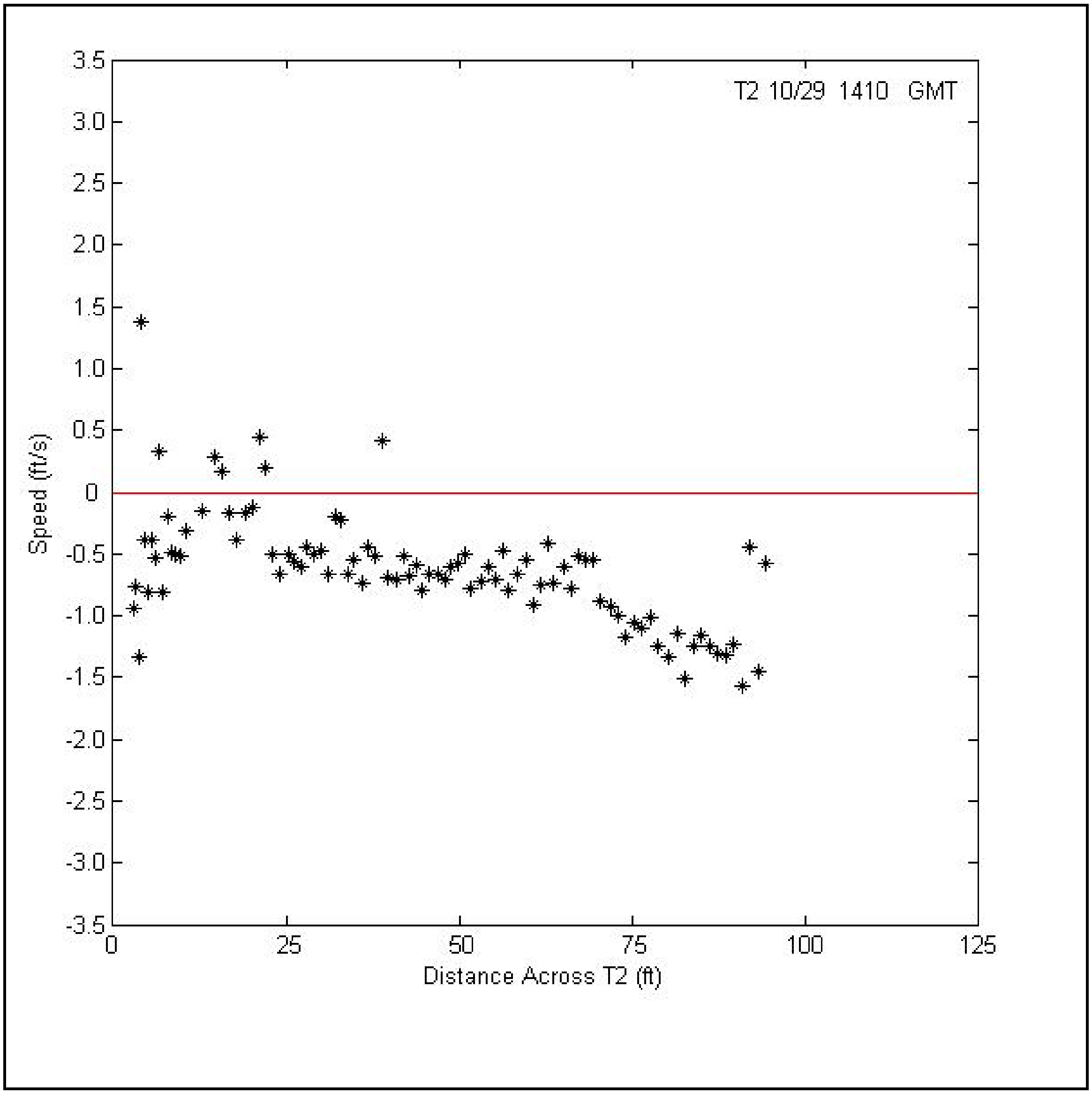
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T1 (ft)


T2 10/29 1410 GMT
Speed (ft/s)
Distance Across T2 (ft)
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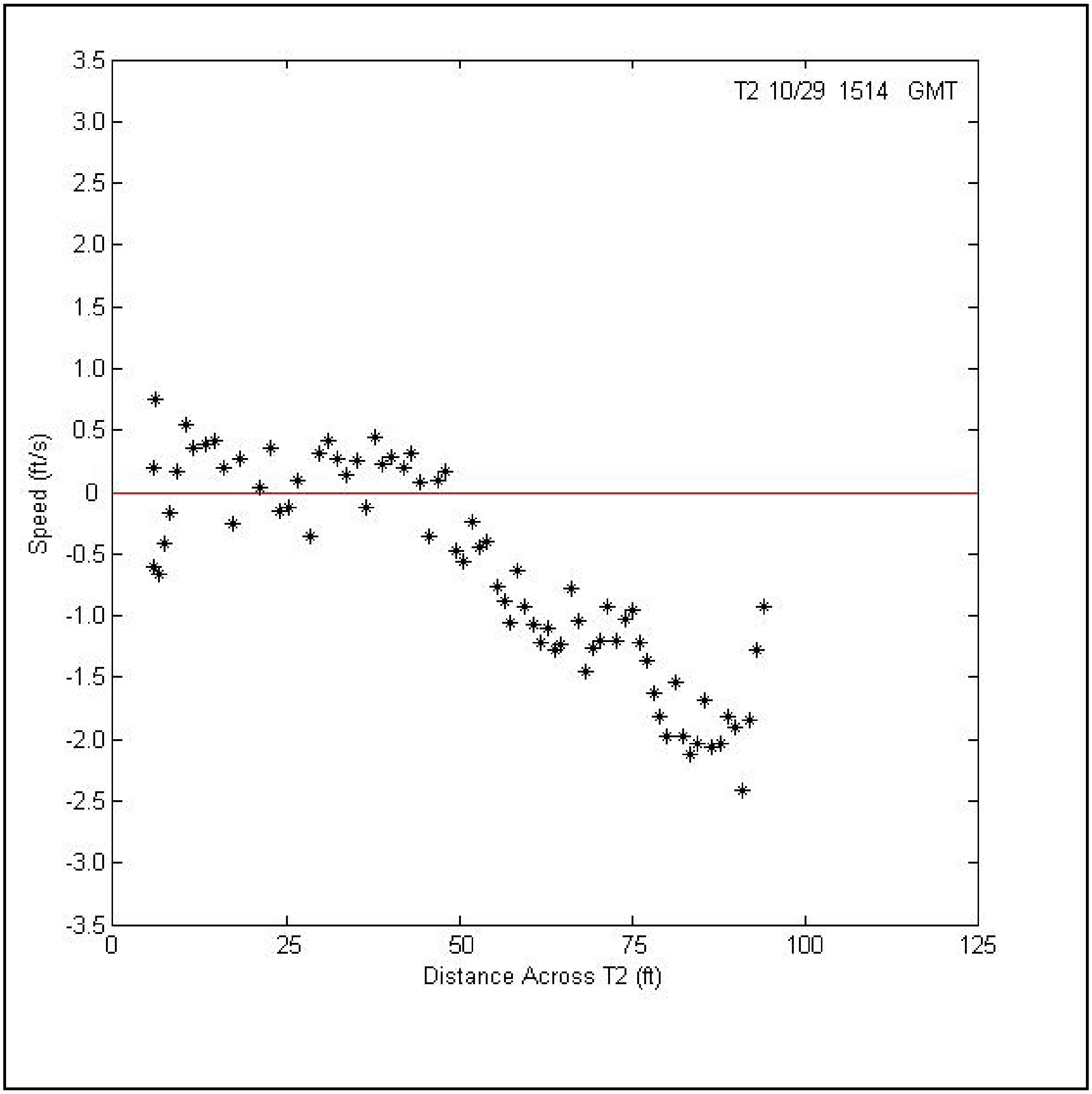
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/29 1514 GMT
Speed (ft/s)
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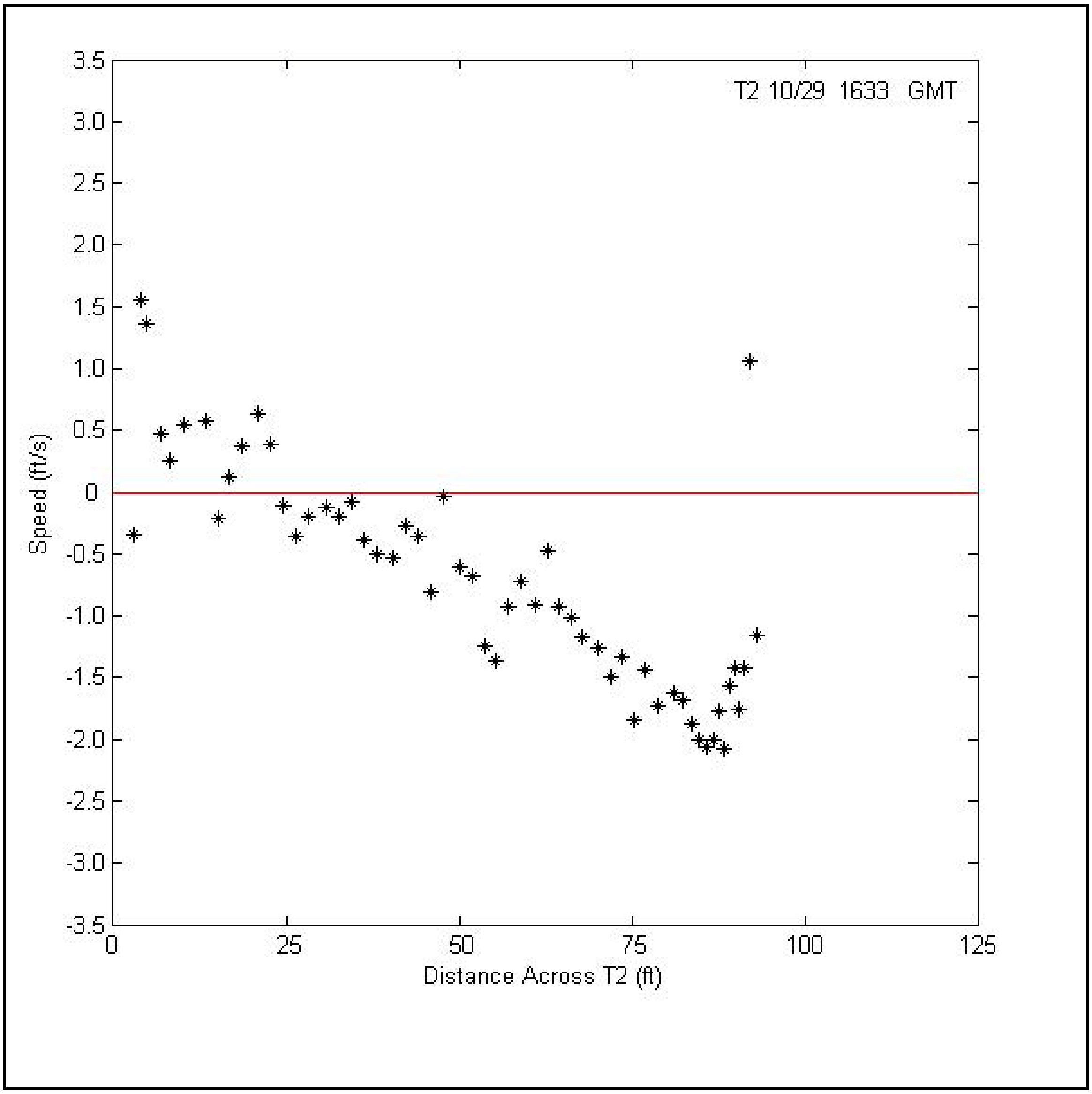
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)



T2 10/29 1633 GMT
Speed (ft/s)
Distance Across T2 (ft)
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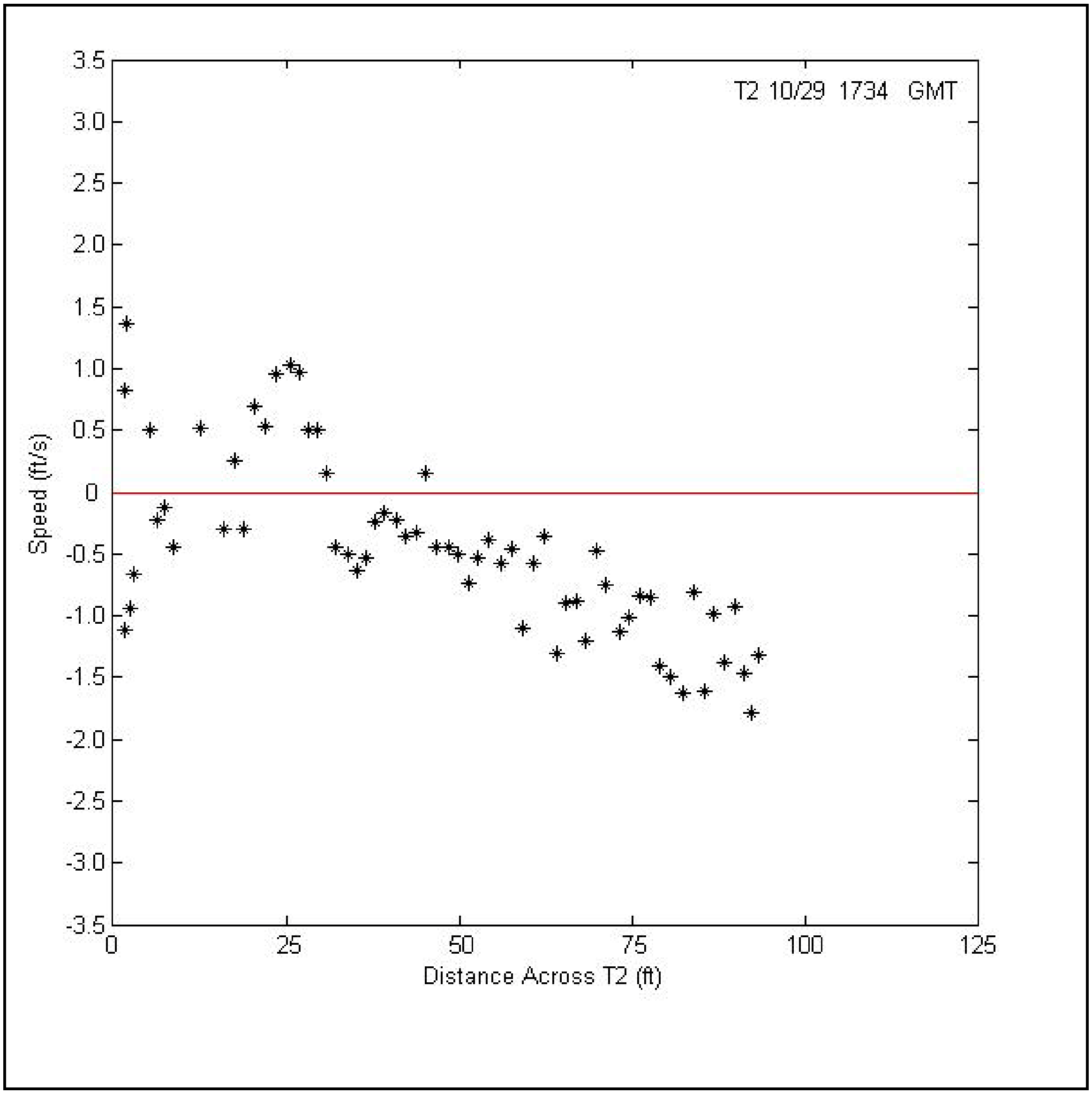
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/29 1734 GMT
Speed (ft/s)
Distance Across T2 (ft)
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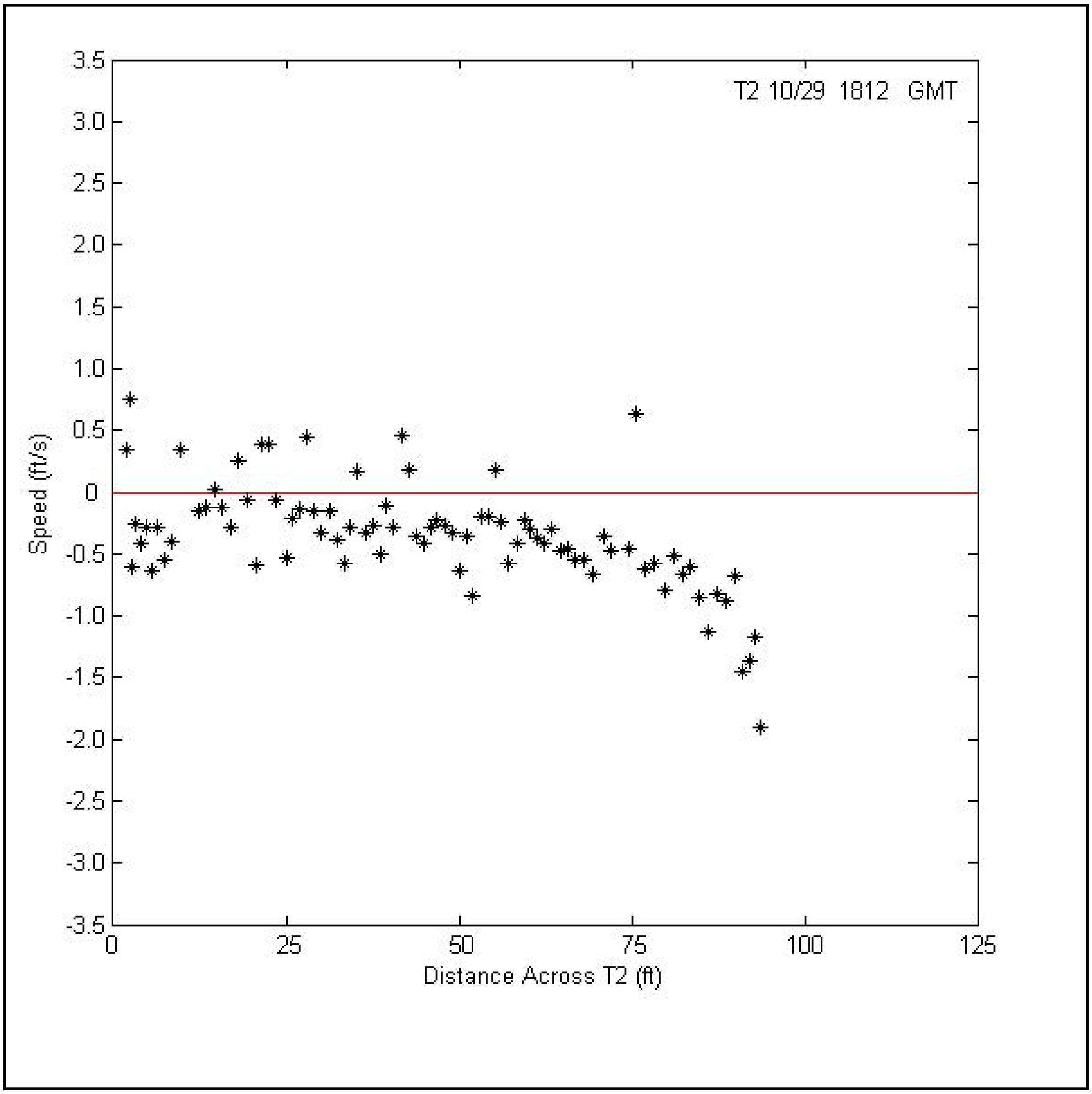
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/29 1812 GMT
Speed (ft/s)
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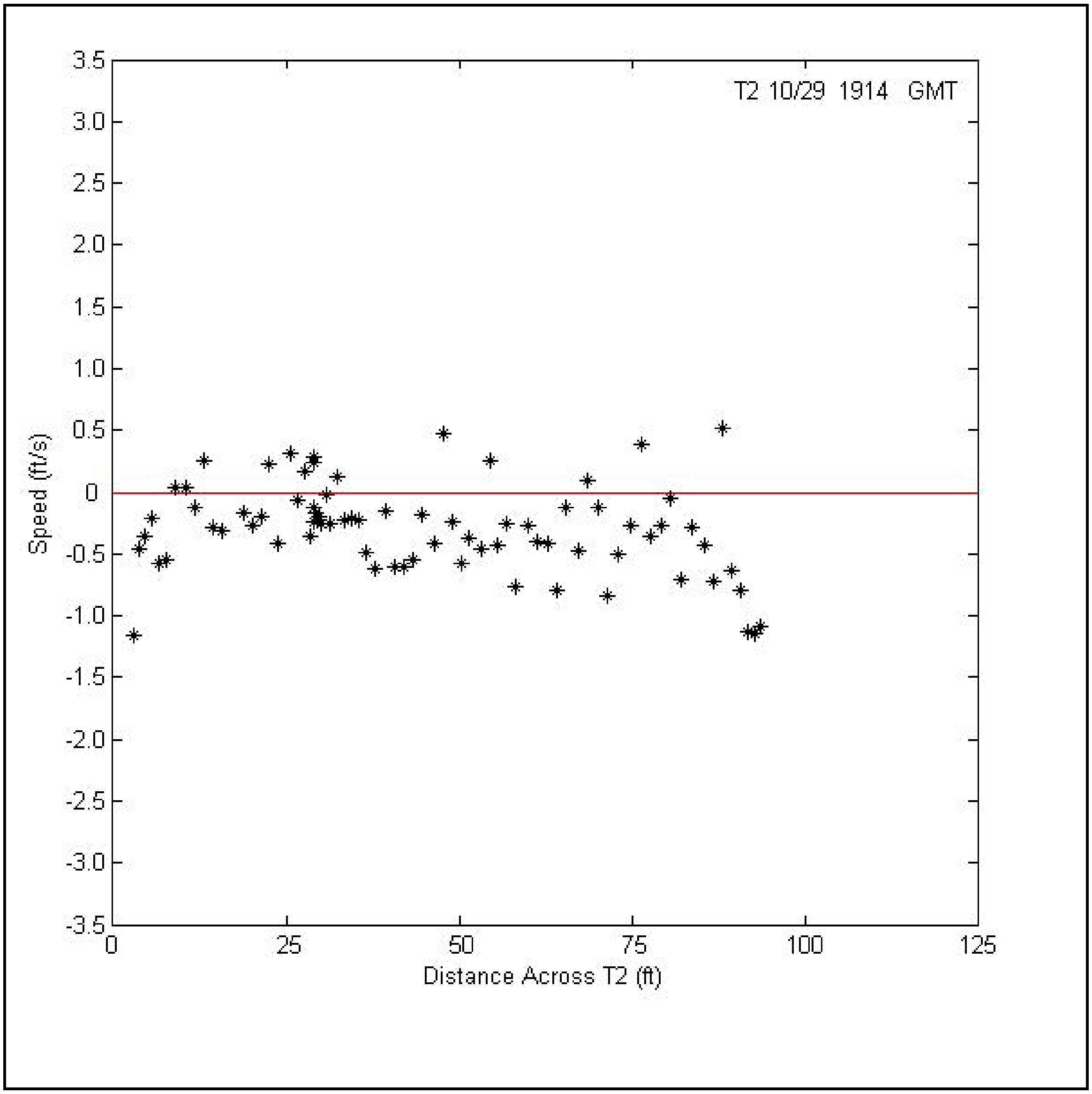
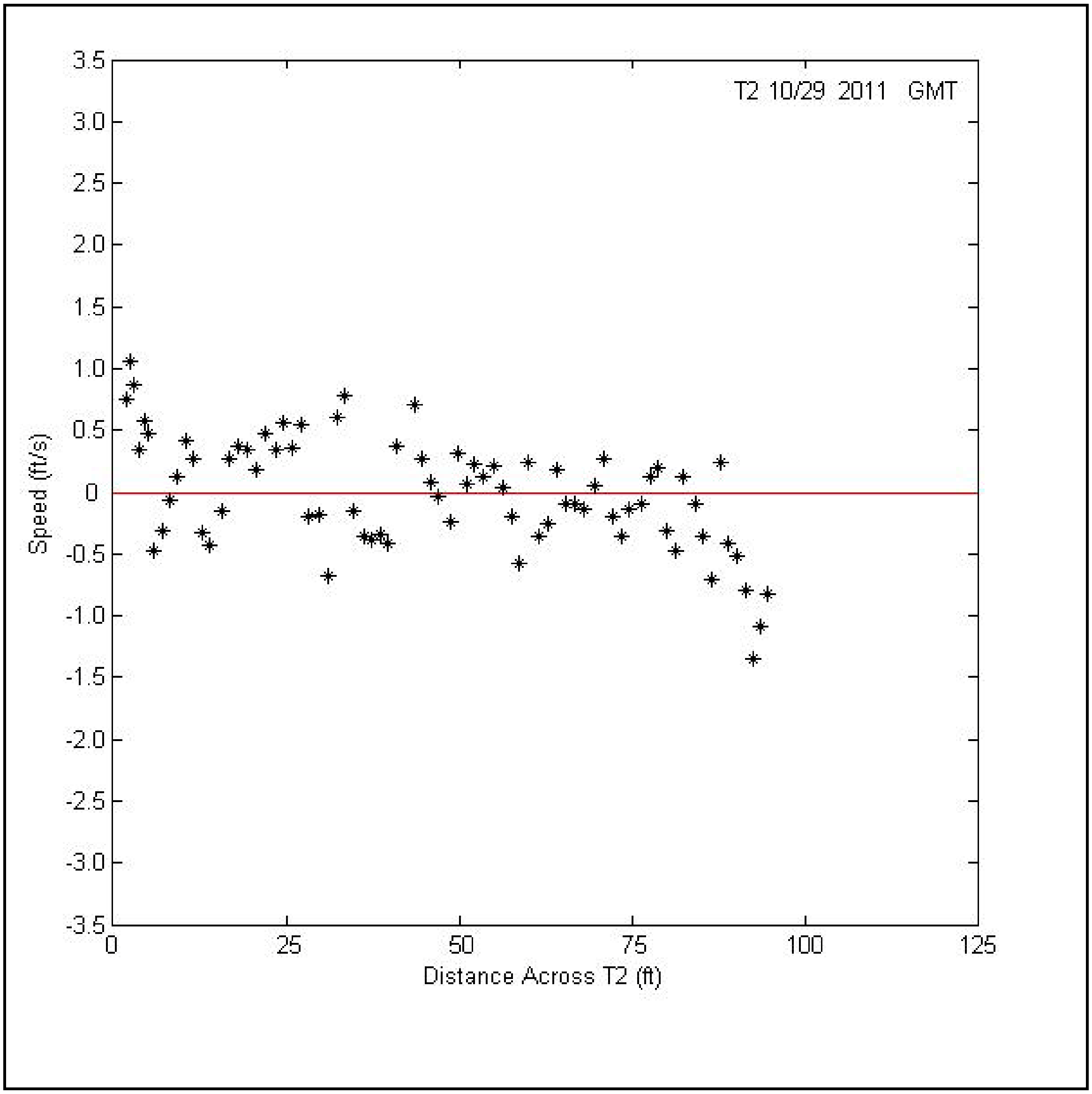
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)



T2 10/29 1914 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)



T2 10/29 2011 GMT
Speed (ft/s)
Distance Across T2 (ft)
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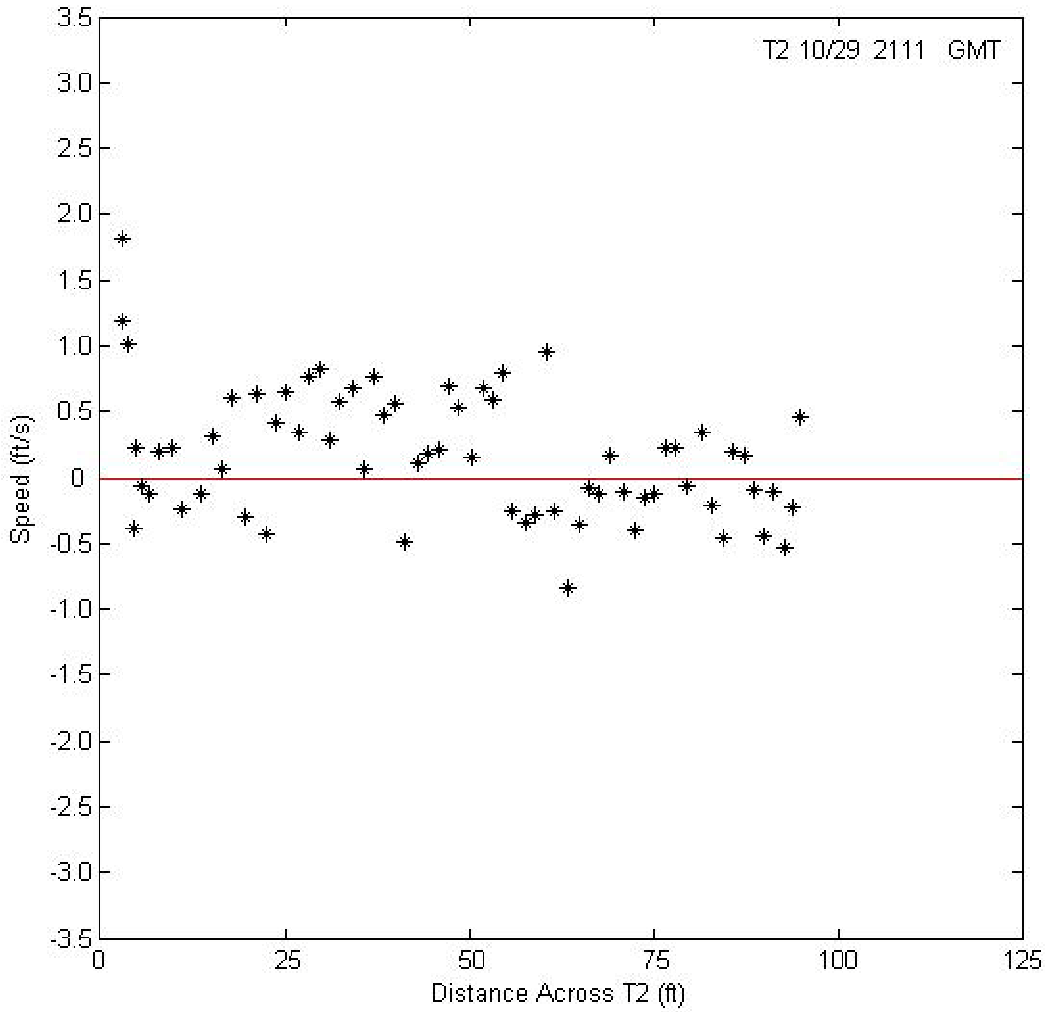
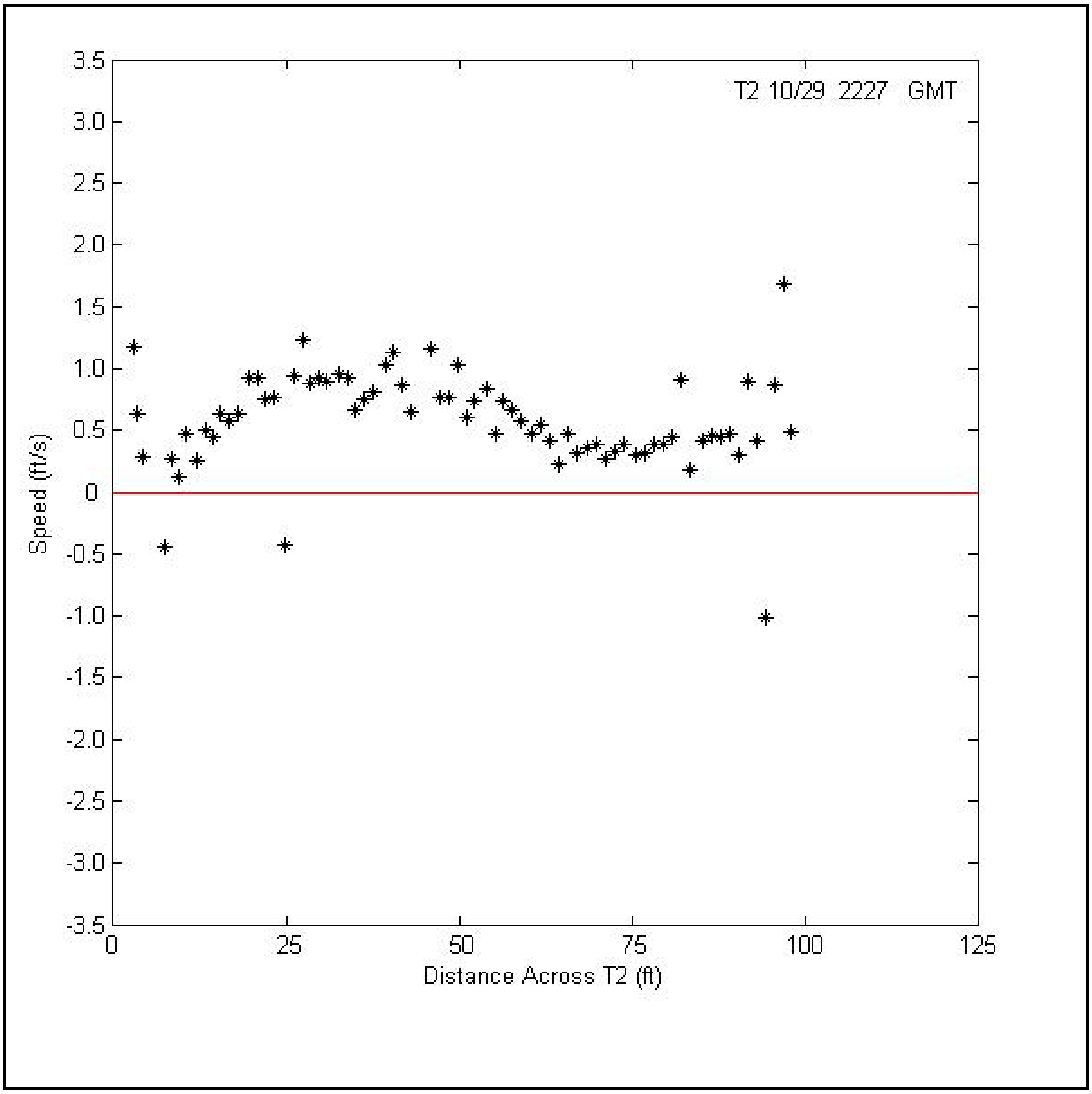
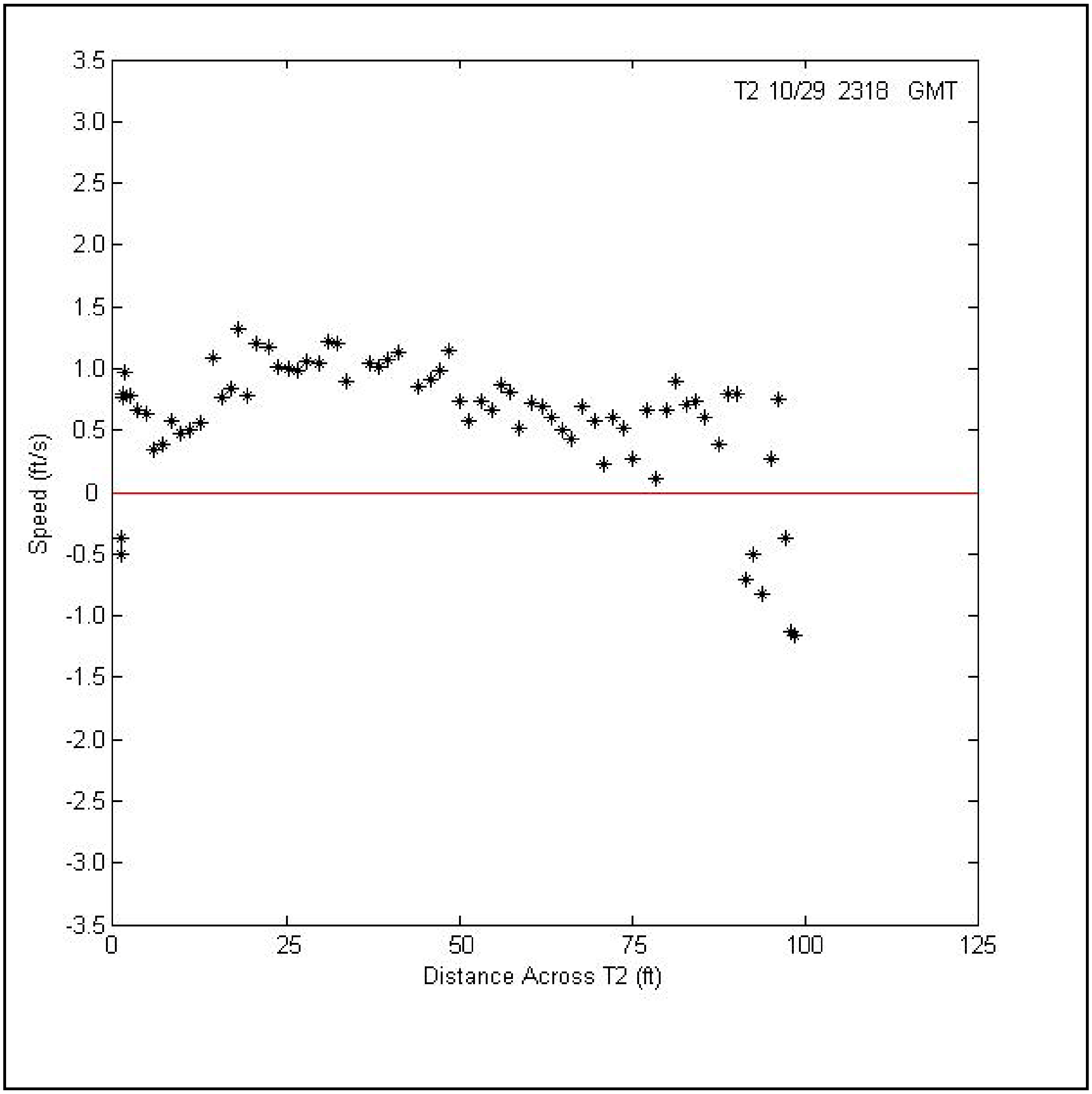
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/29 2111 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T2 10/29 2227 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T2 10/29 2318 GMT
Speed (ft/s)
Distance Across T2 (ft)
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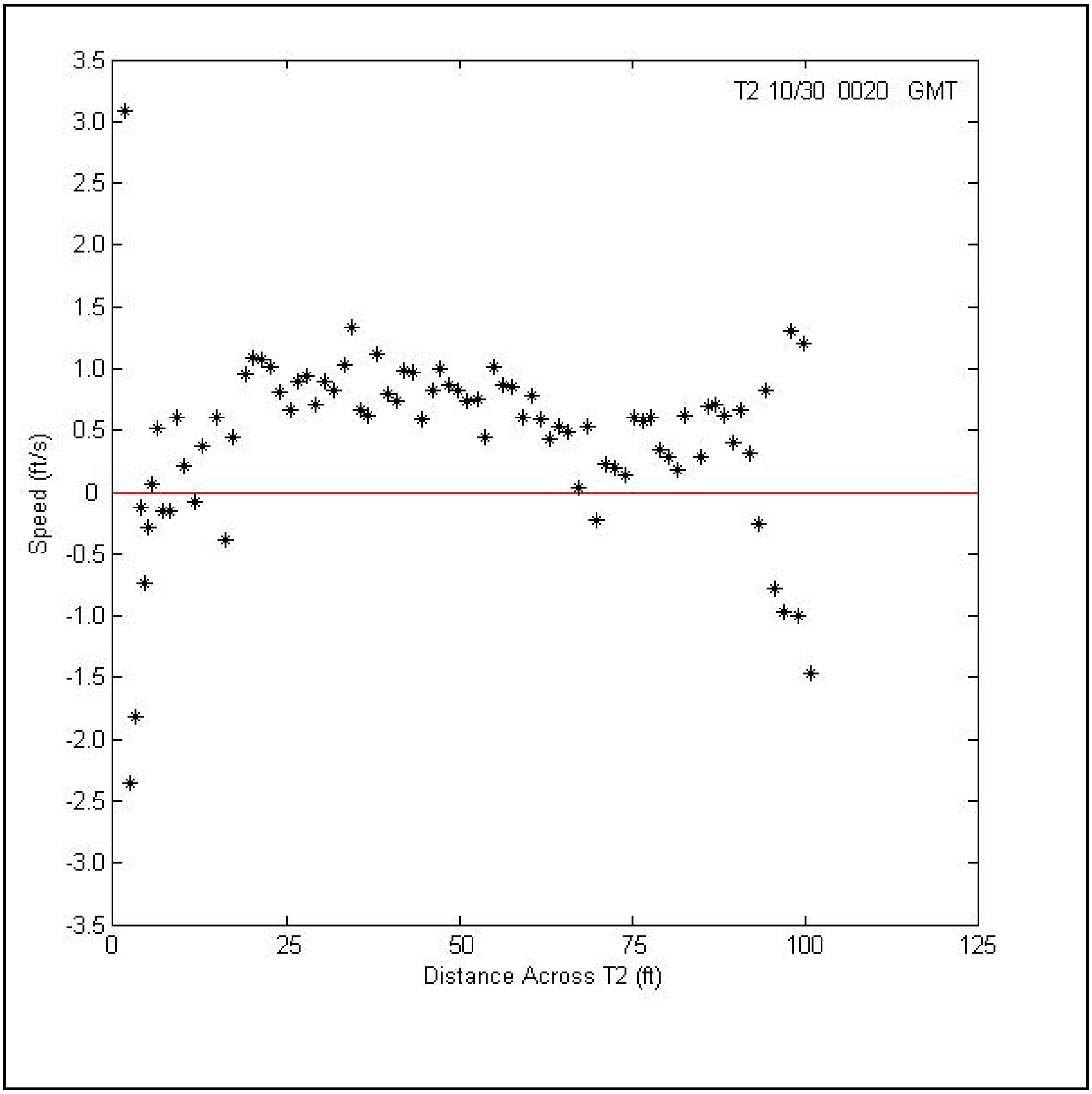
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/30 0020 GMT
Speed (ft/s)
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1.5
1.0
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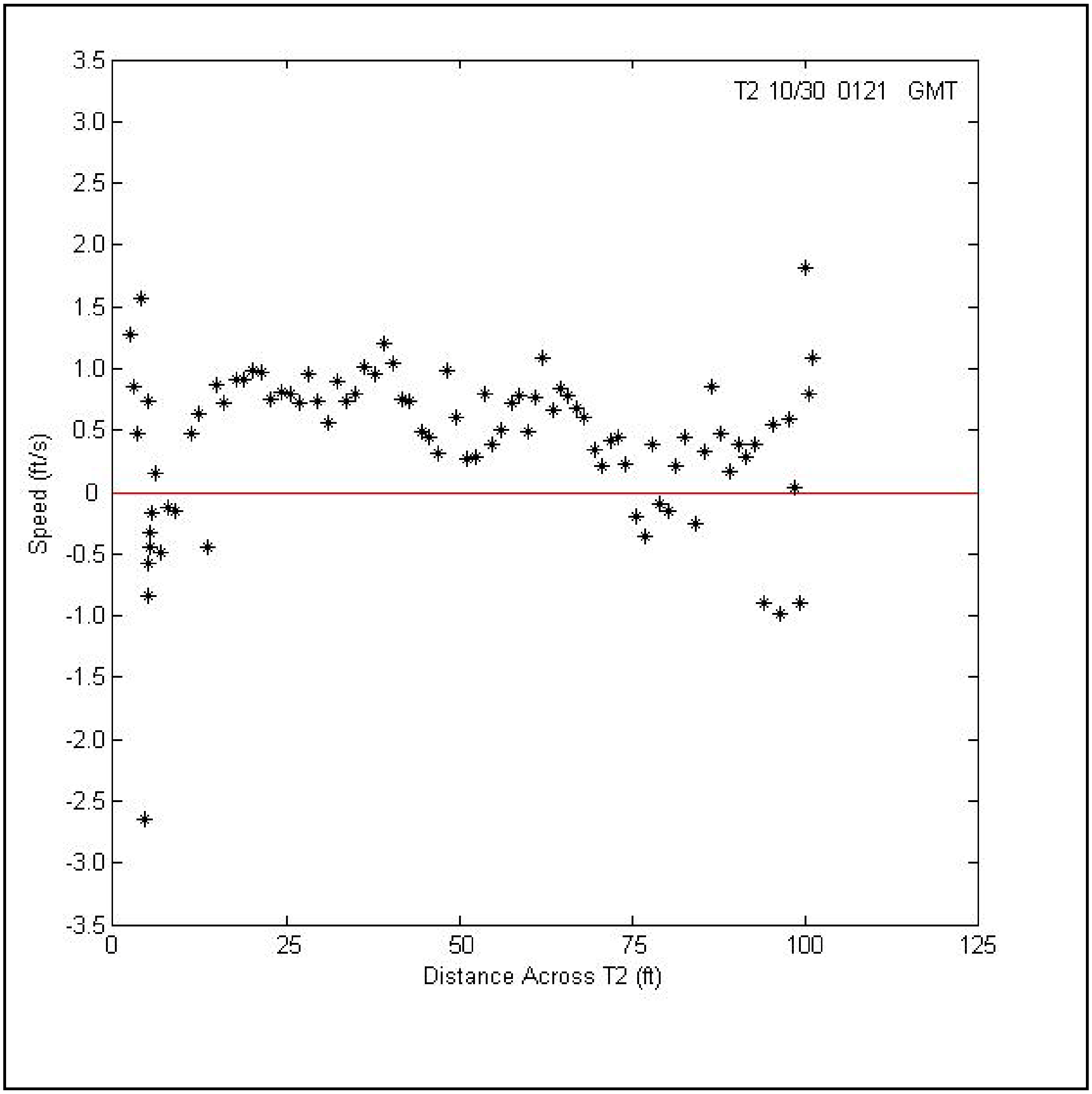
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)



T2 10/30 0121 GMT
Speed (ft/s)
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2.5
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1.5
1.0
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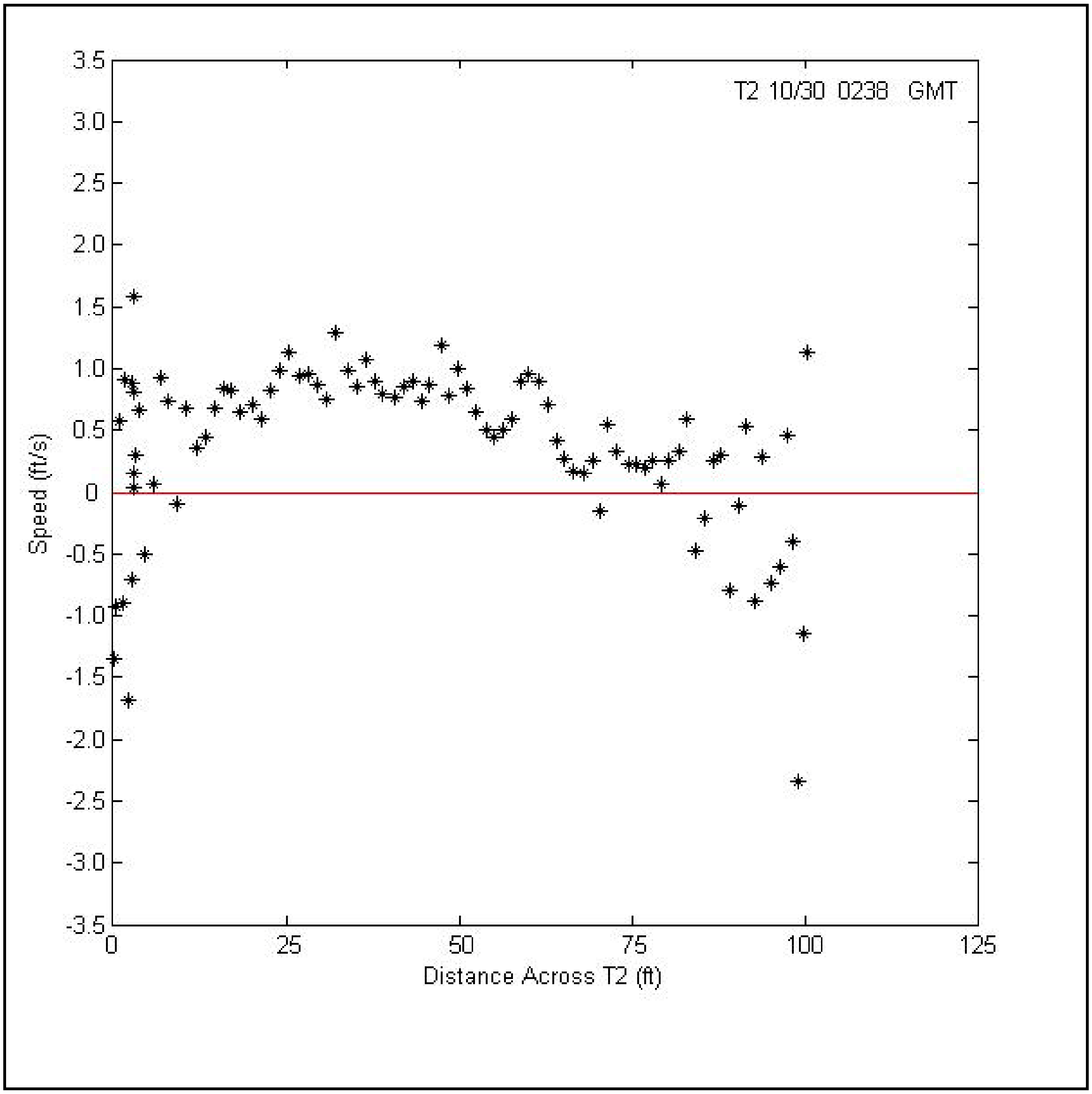
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)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Speed (ft/s)
Distance Across T2 (ft)
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1.5
1.0
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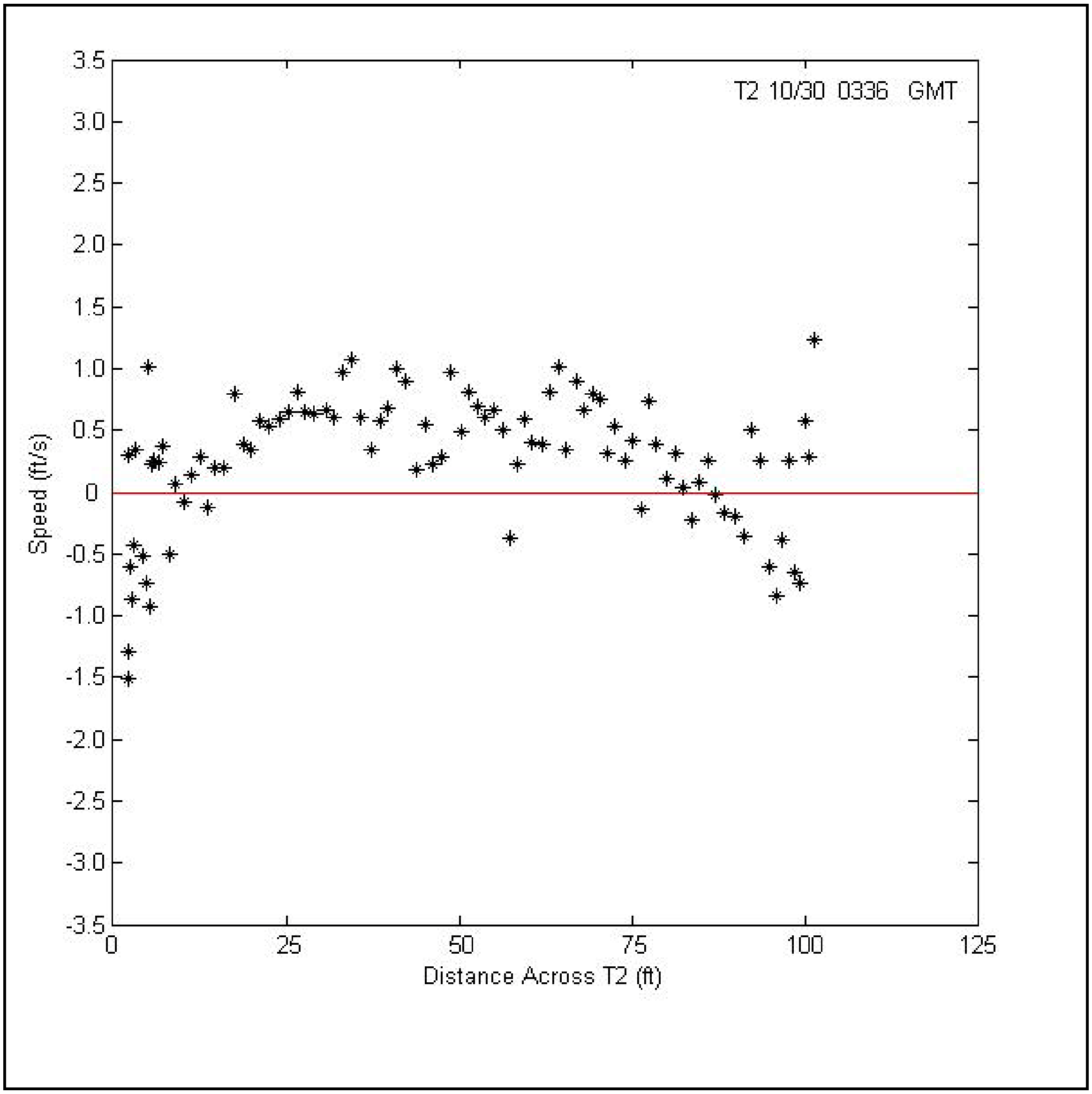
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/30 0336 GMT
Speed (ft/s)
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-0.5
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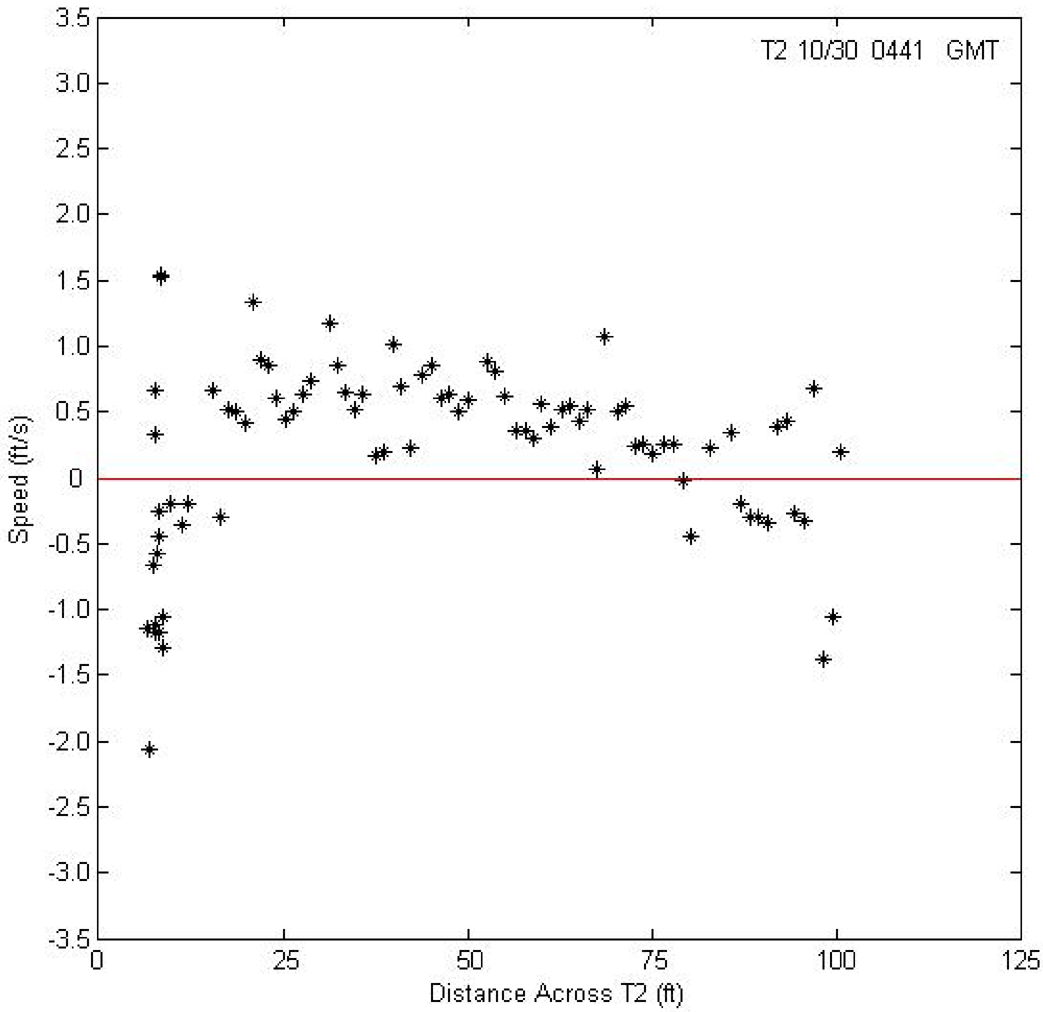
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T2 10/30 0441 GMT
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-0.5
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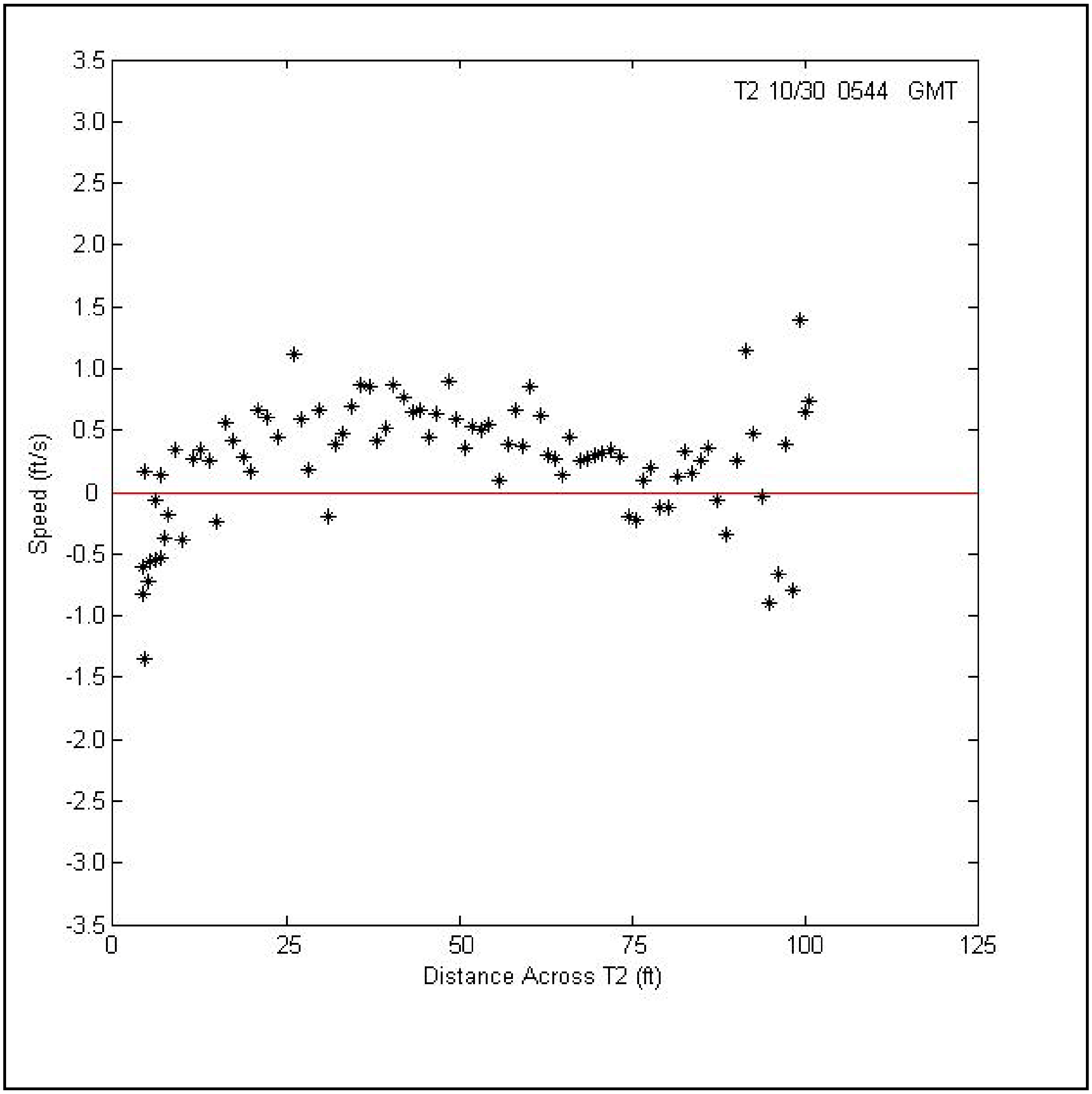
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T2 10/30 0544 GMT
Speed (ft/s)
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1.0
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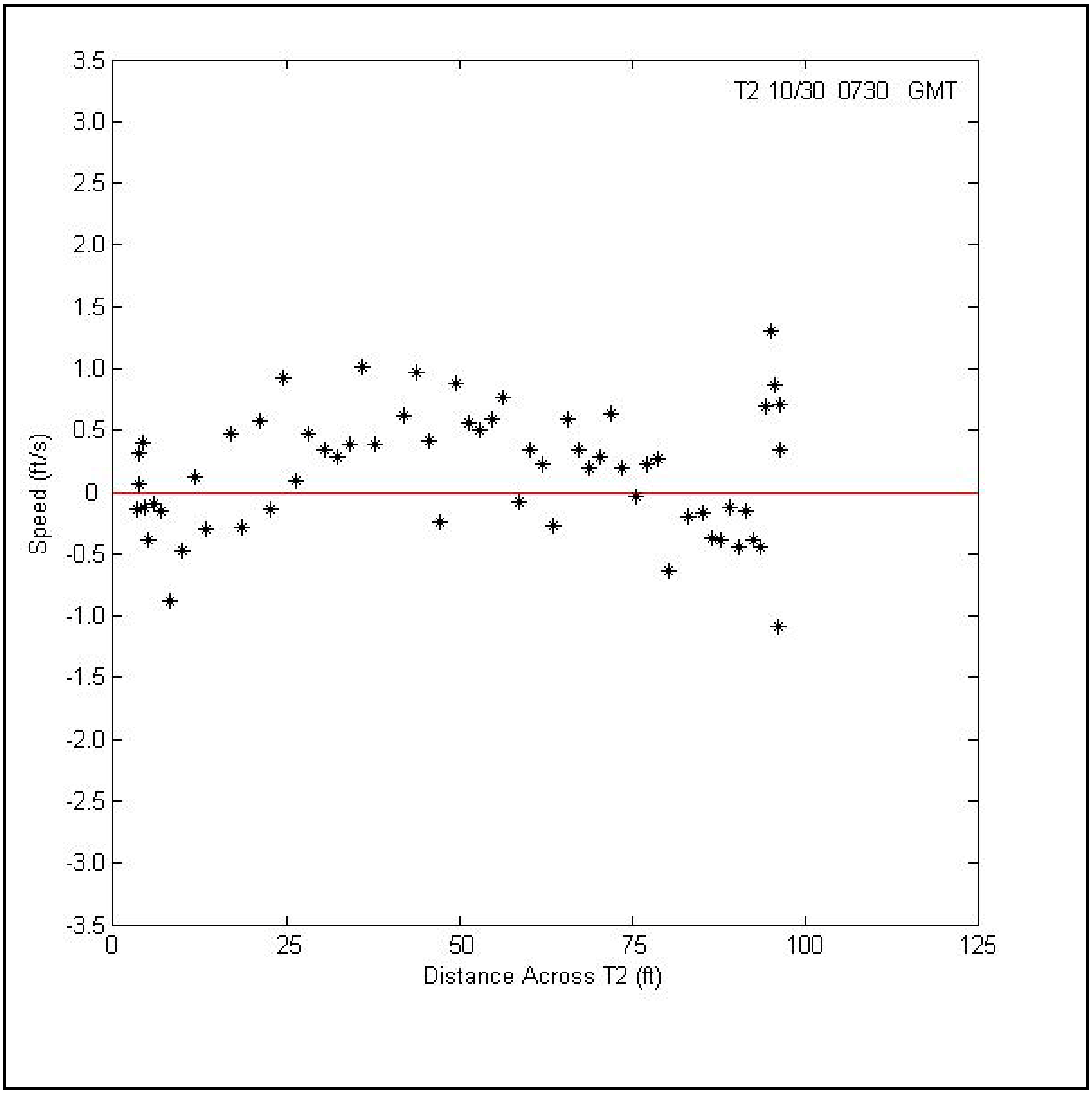
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)



T2 10/30 0730 GMT
Speed (ft/s)
Distance Across T2 (ft)
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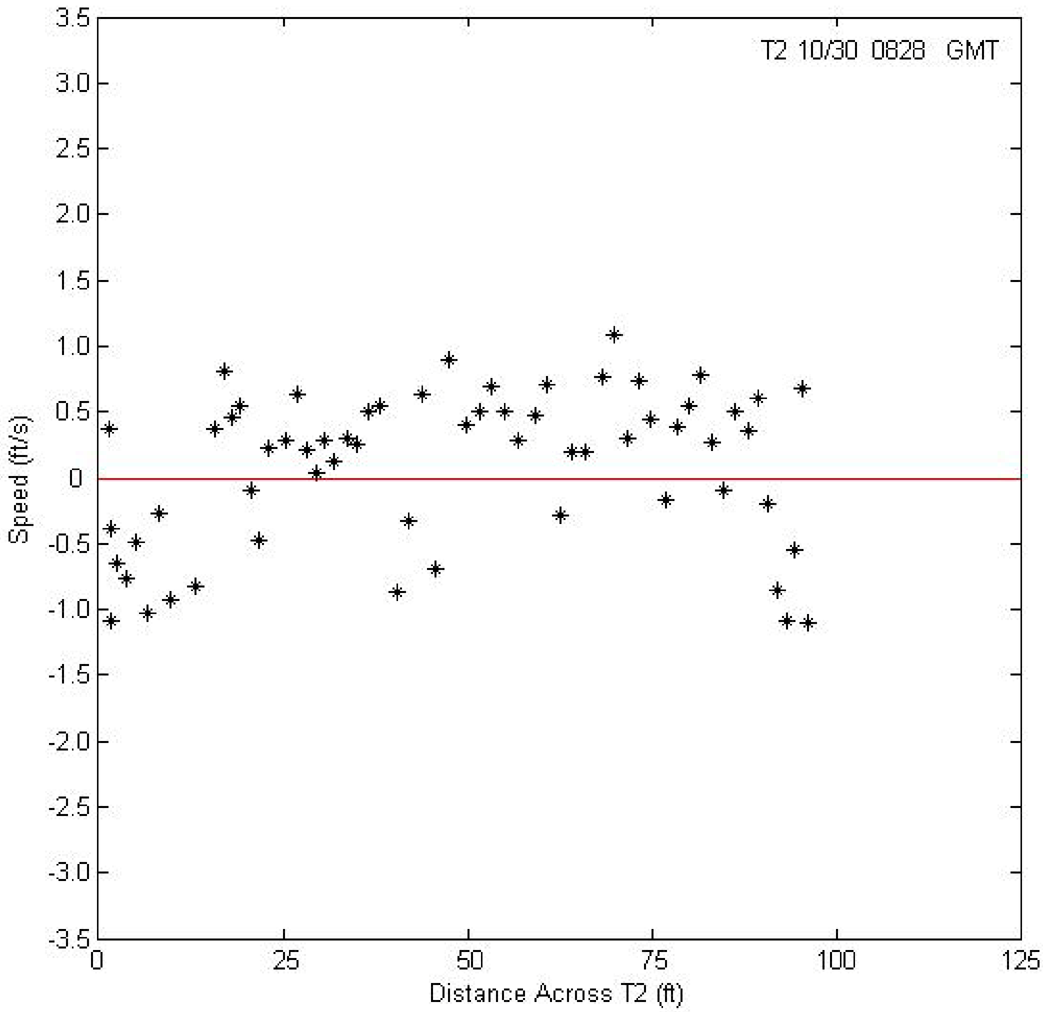
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/30 0828 GMT
Speed (ft/s)
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1.0
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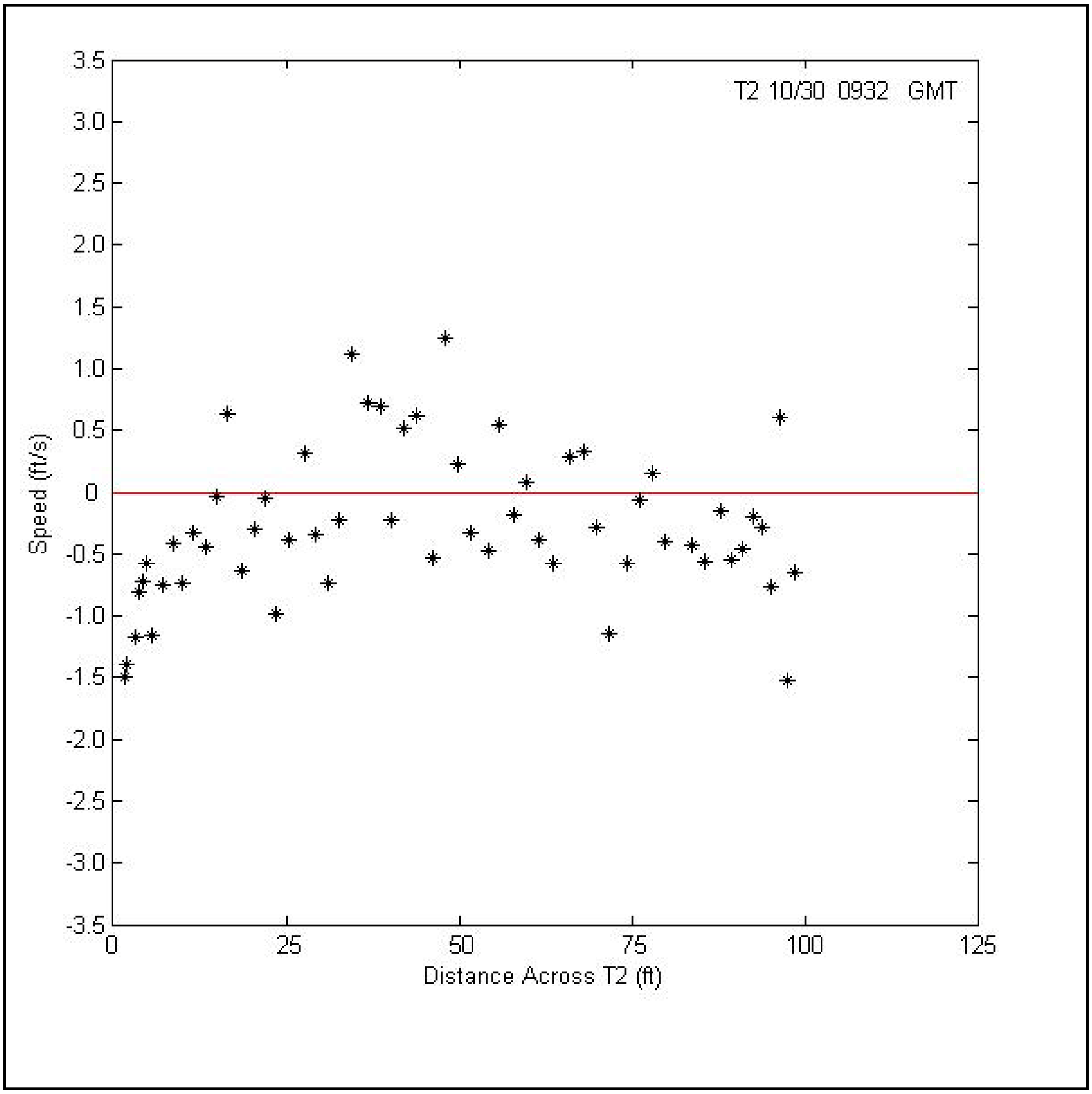
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T2 10/30 0932 GMT
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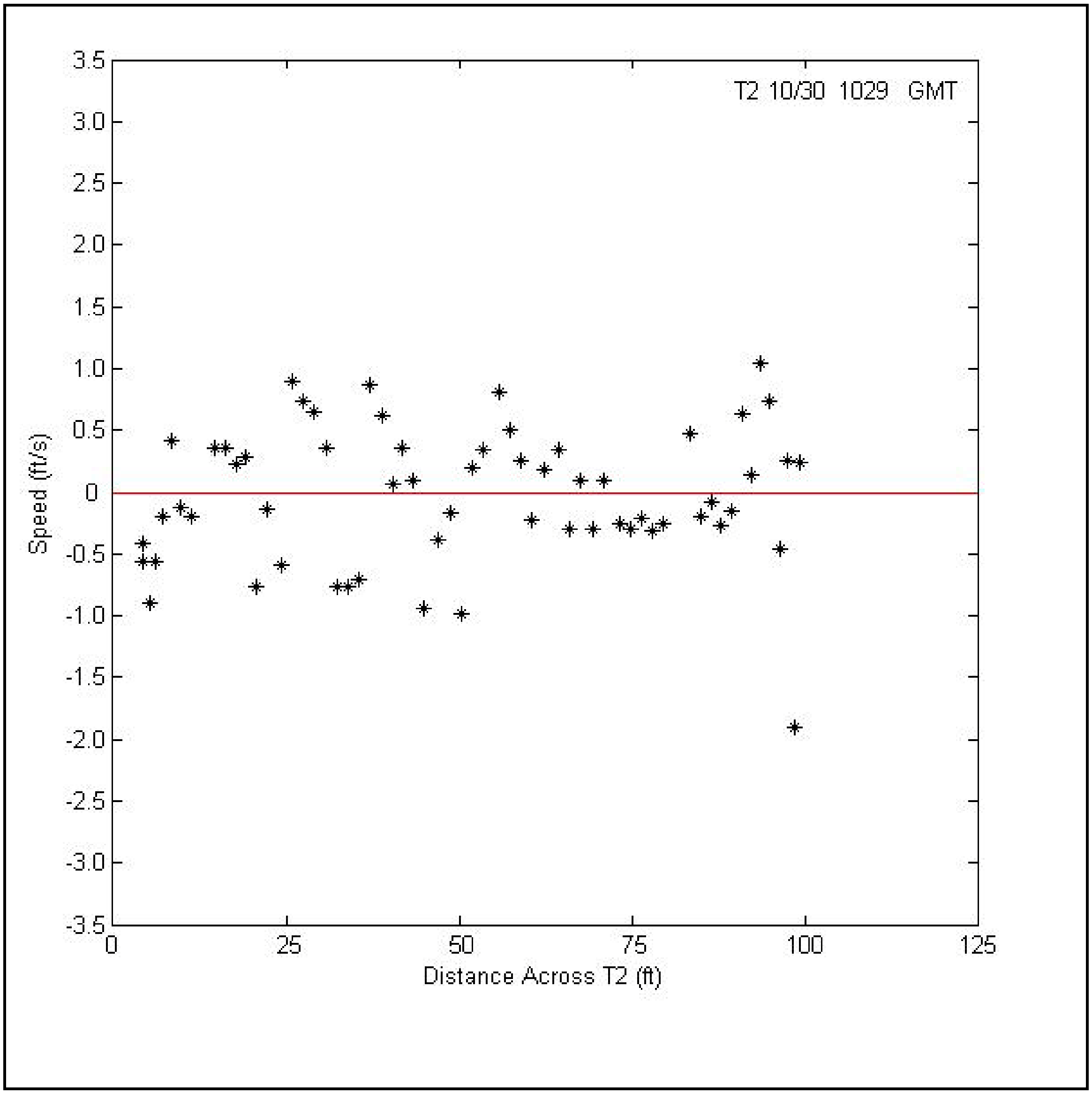
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T2 10/30 1029 GMT
Speed (ft/s)
Distance Across T2 (ft)
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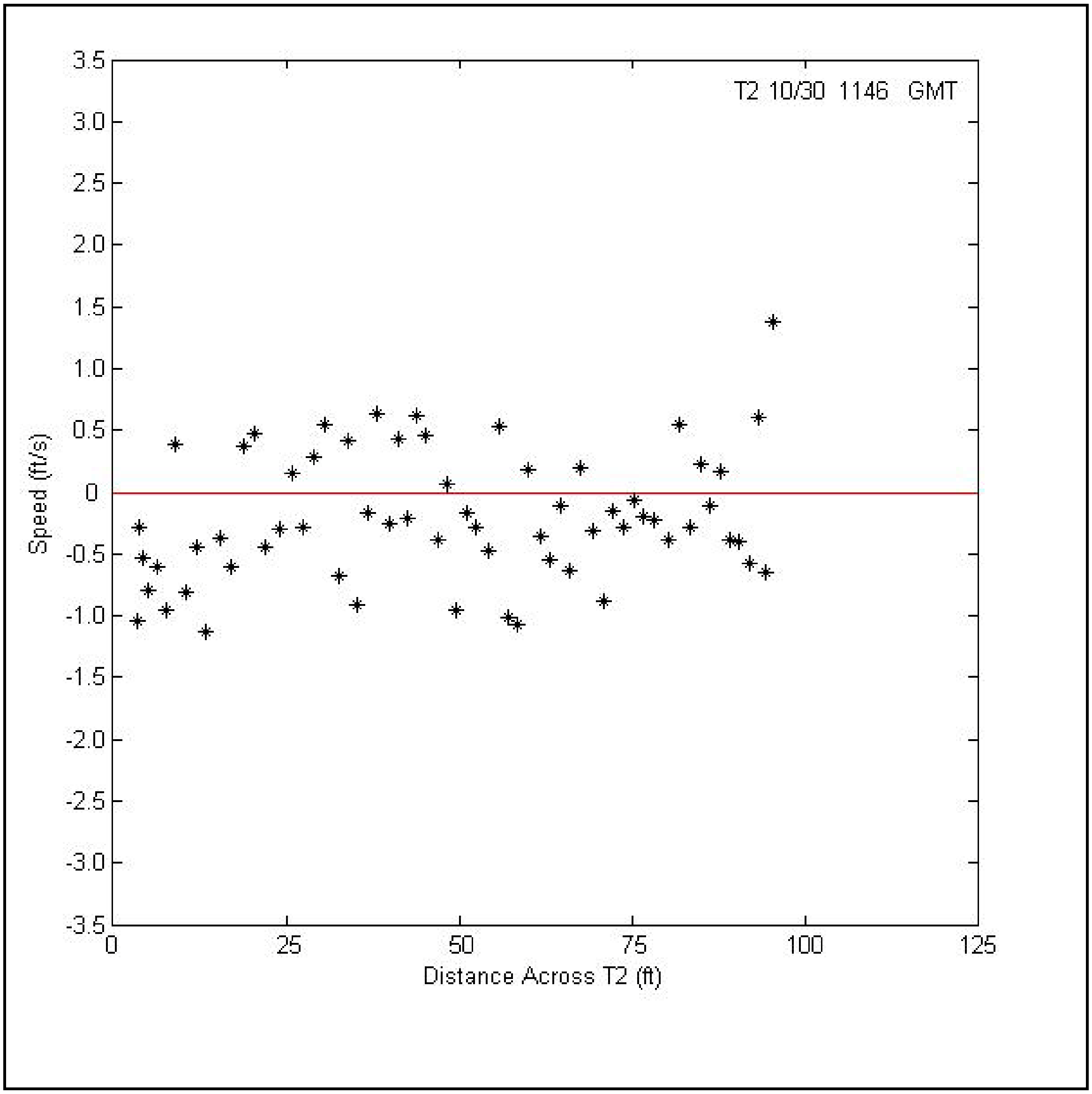
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/30 1146 GMT
Speed (ft/s)
Distance Across T2 (ft)
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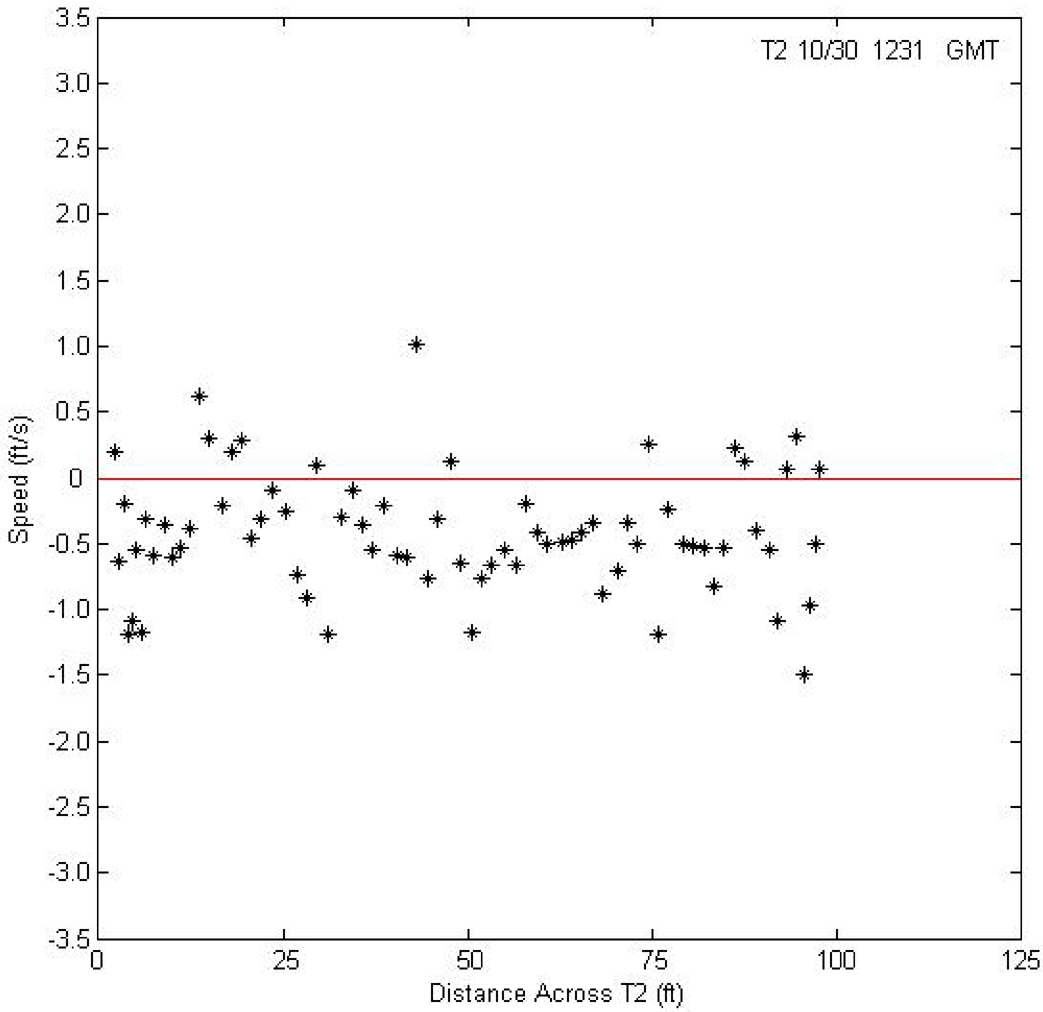
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125



T2 10/30 1231 GMT
Speed (ft/s)
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1.5
1.0
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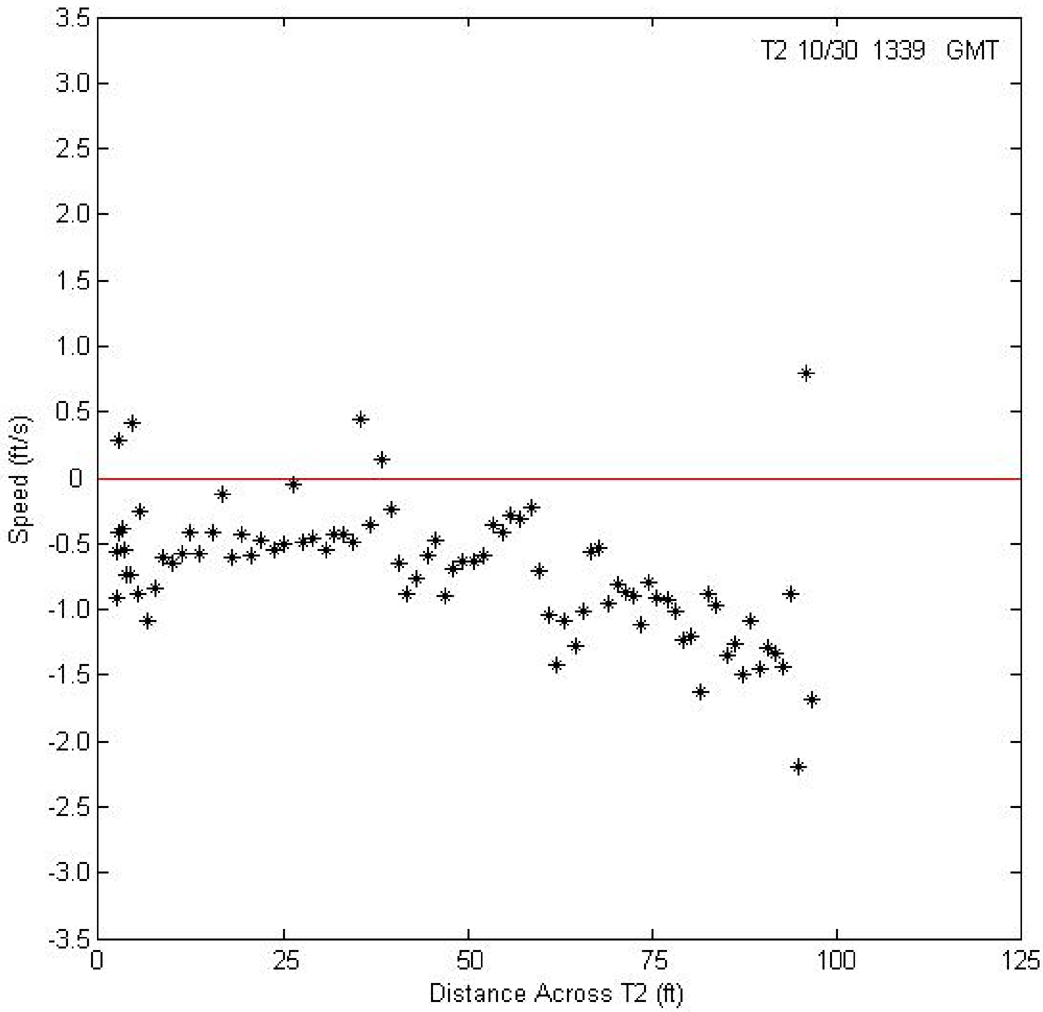
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)



T2 10/30 1339 GMT
Speed (ft/s)
Distance Across T2 (ft)
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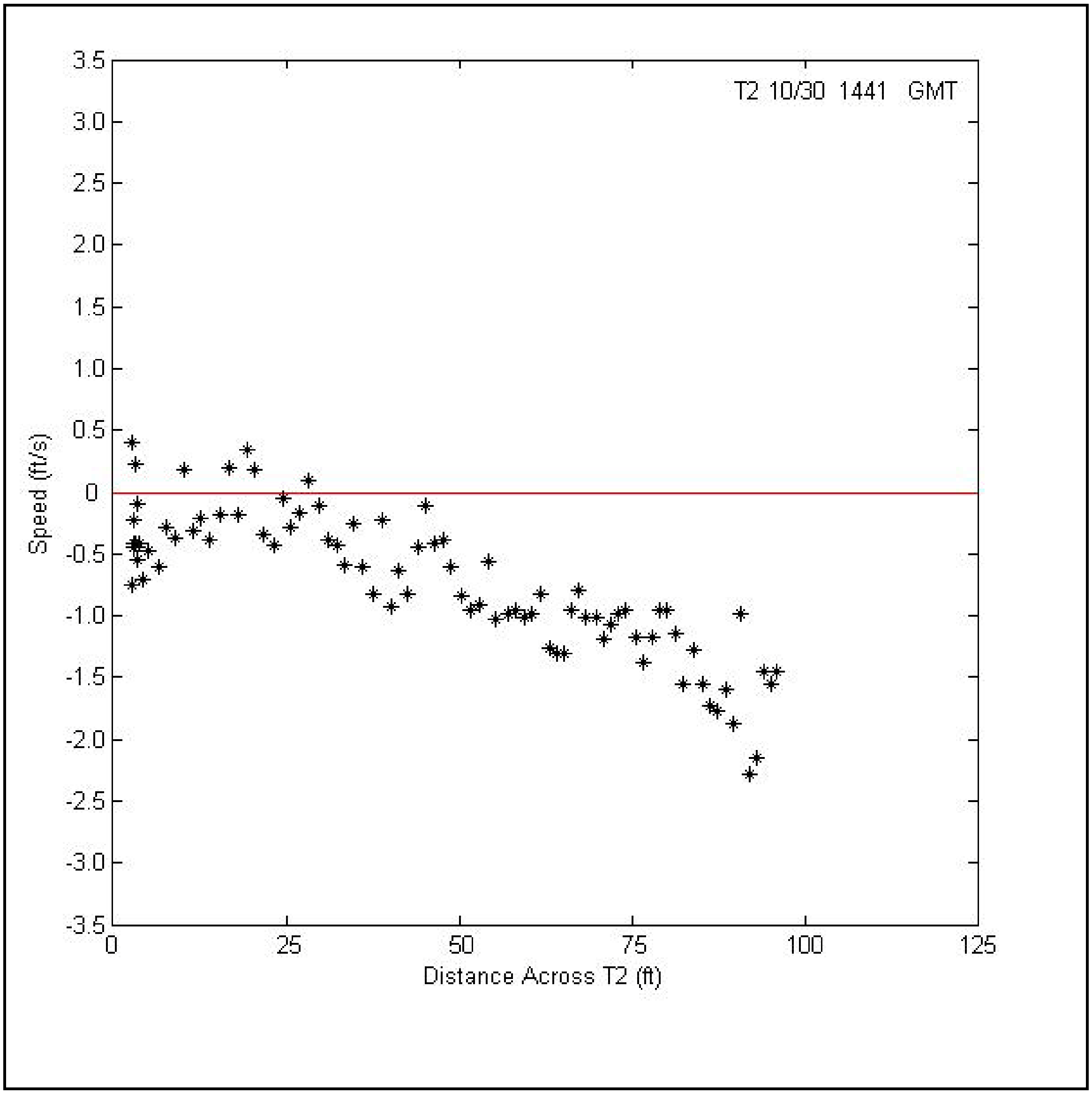
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/30 1441 GMT
Speed (ft/s)
Distance Across T2 (ft)
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1.5
1.0
0.5
0
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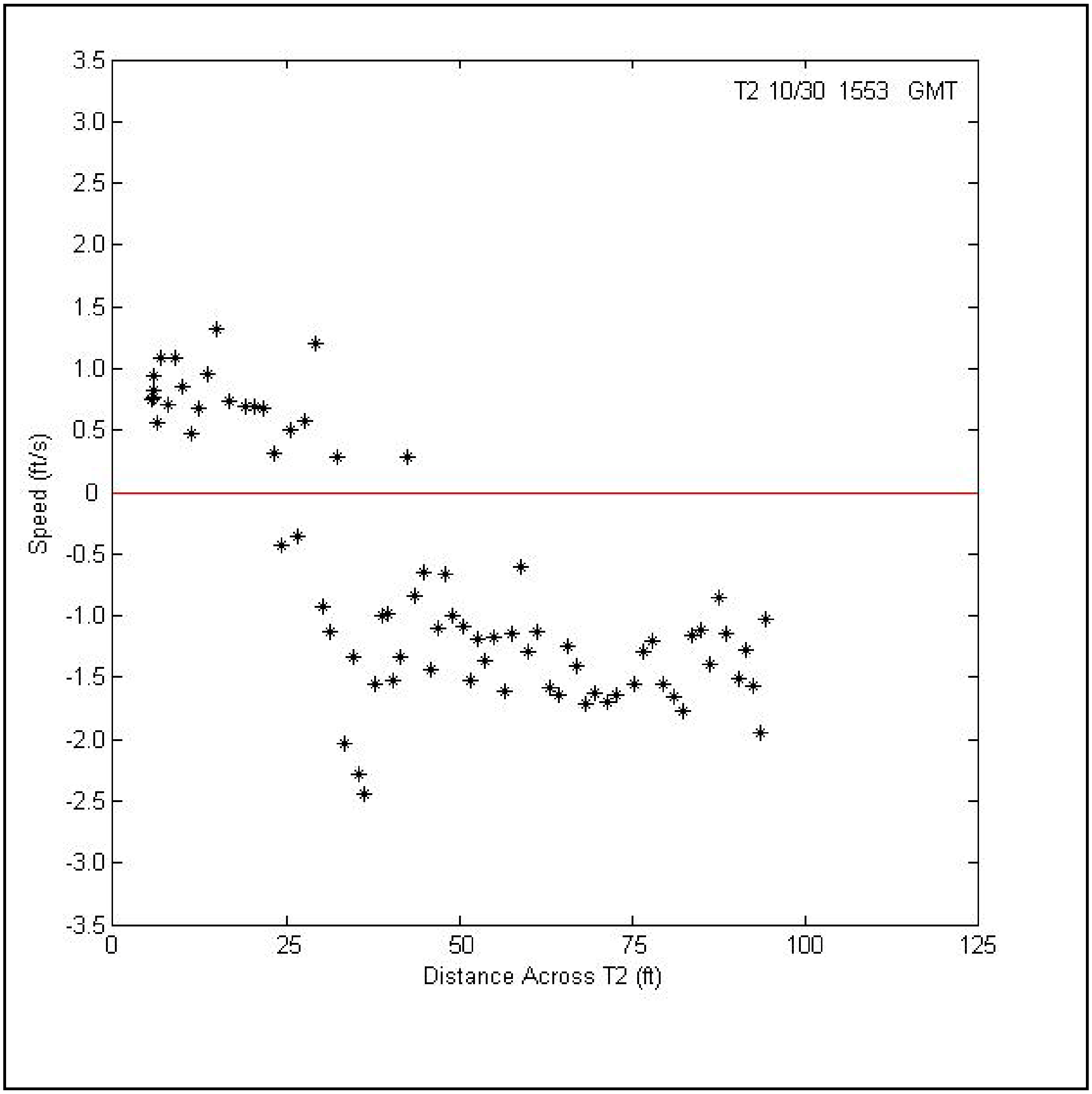
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125


T2 10/30 1553 GMT
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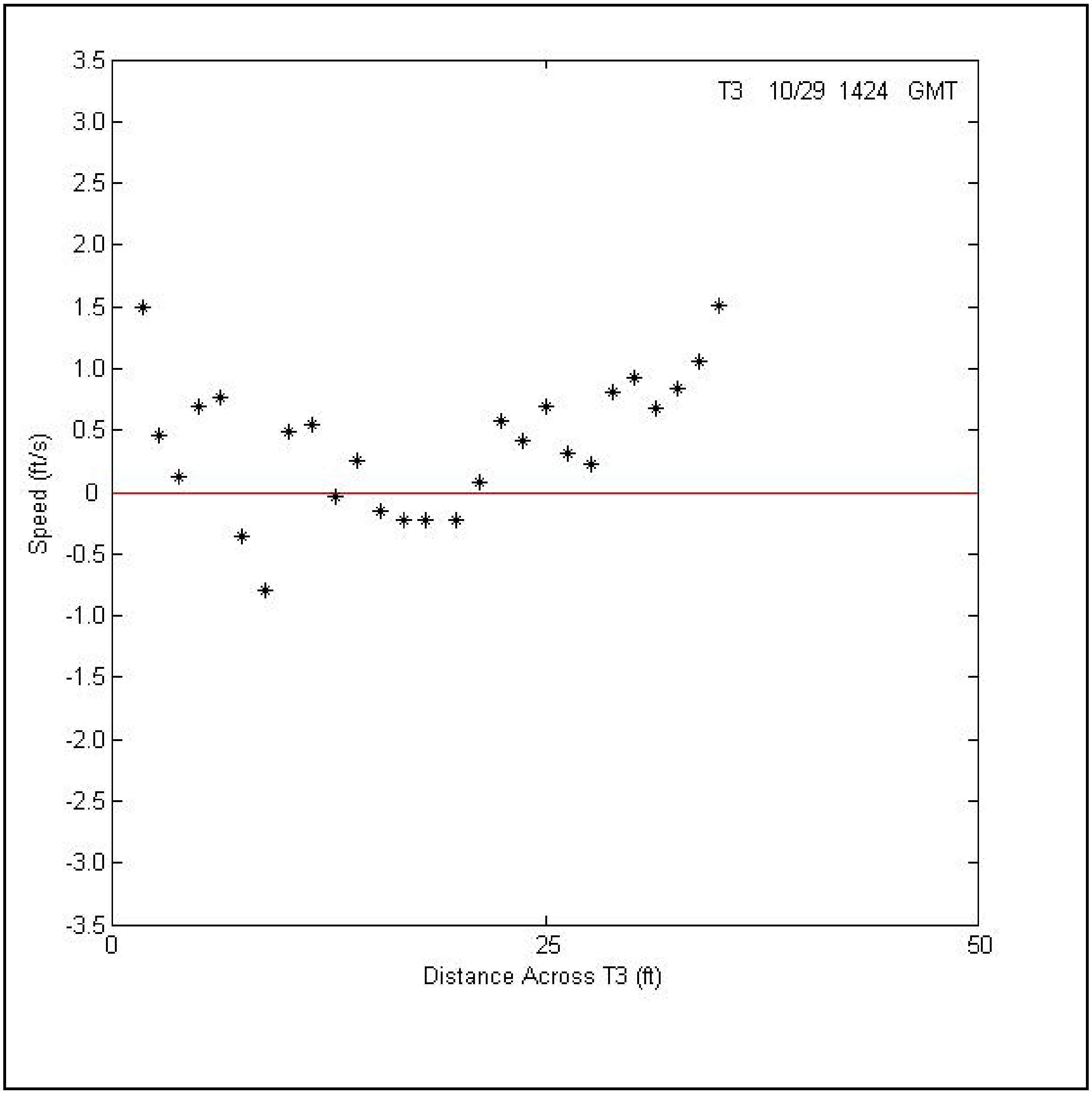
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
Distance Across T2 (ft)


T3 10/29 1424 GMT
Speed (ft/s)
Distance Across T3 (ft)
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1.5
1.0
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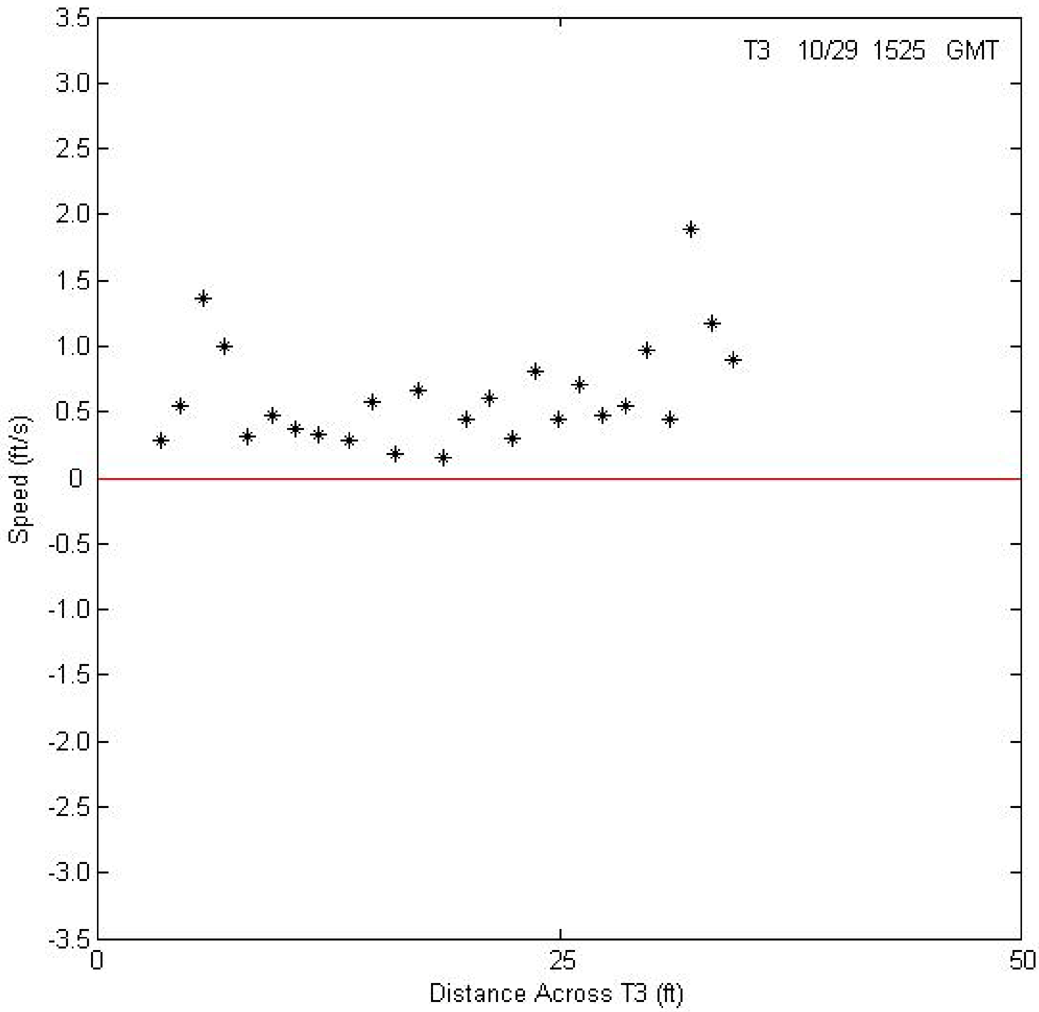
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50


T3 10/29 1525 GMT
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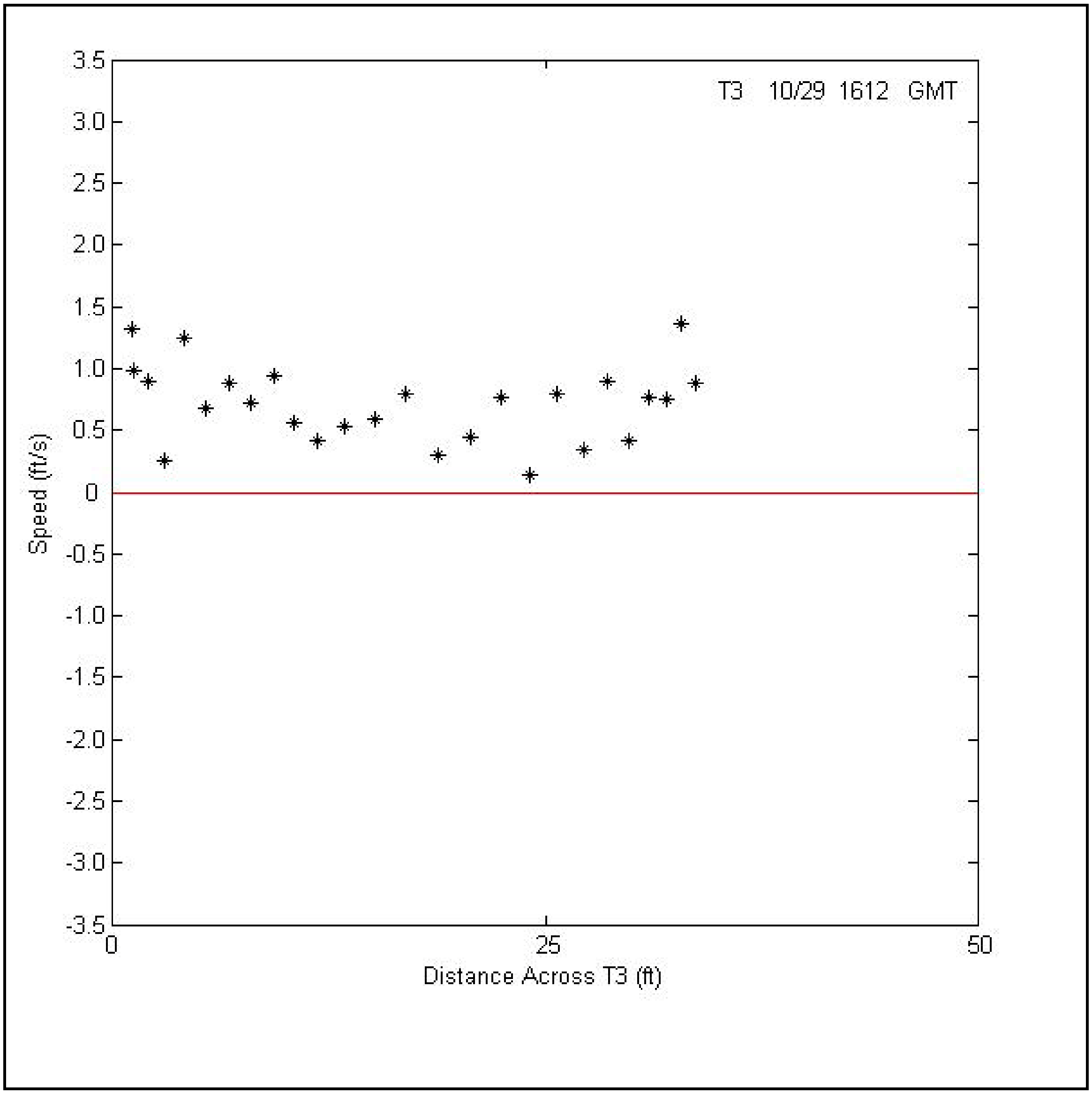
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
Distance Across T3 (ft)


T3 10/29 1612 GMT
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1.0
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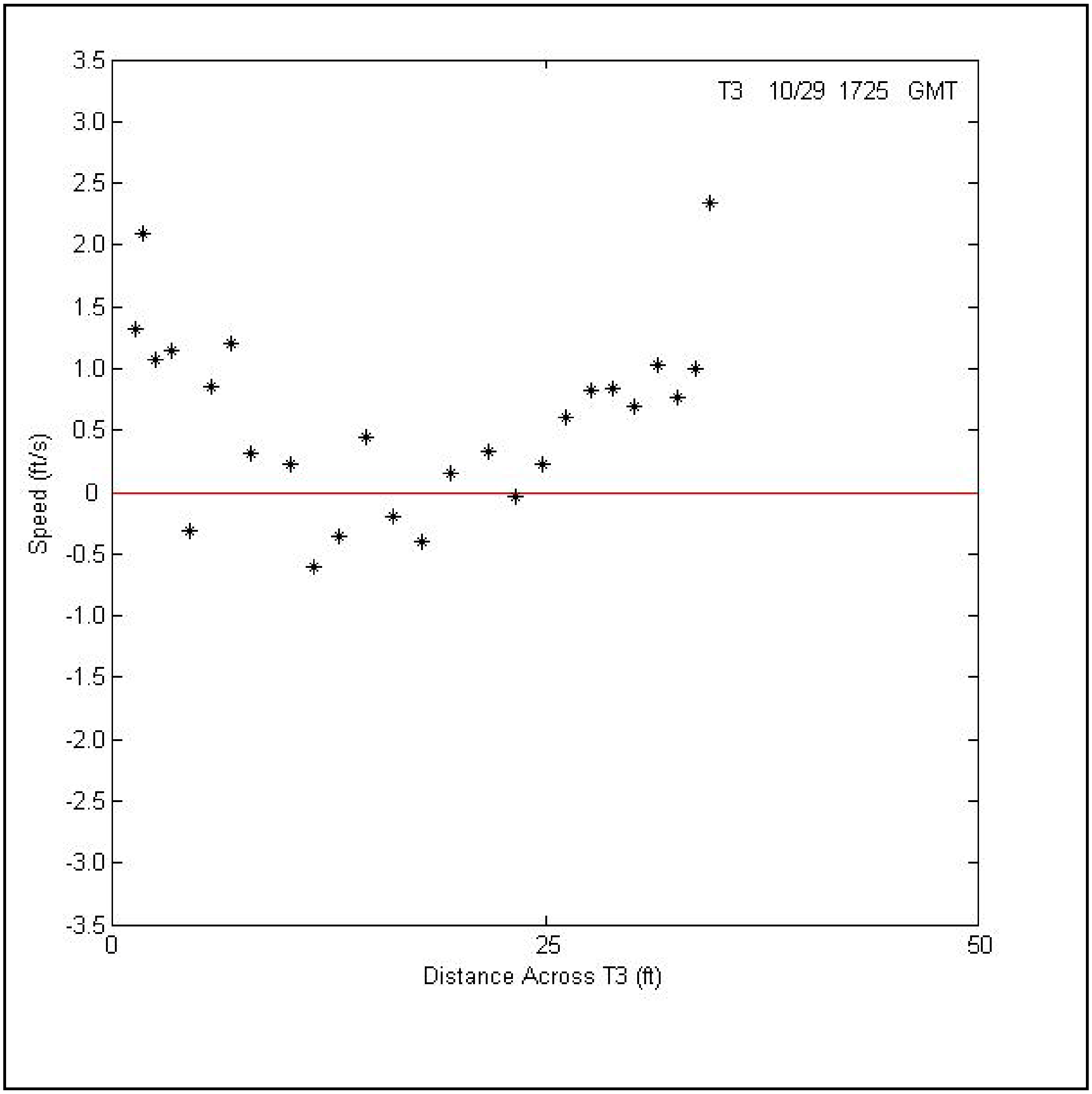
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)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1.5
1.0
0.5
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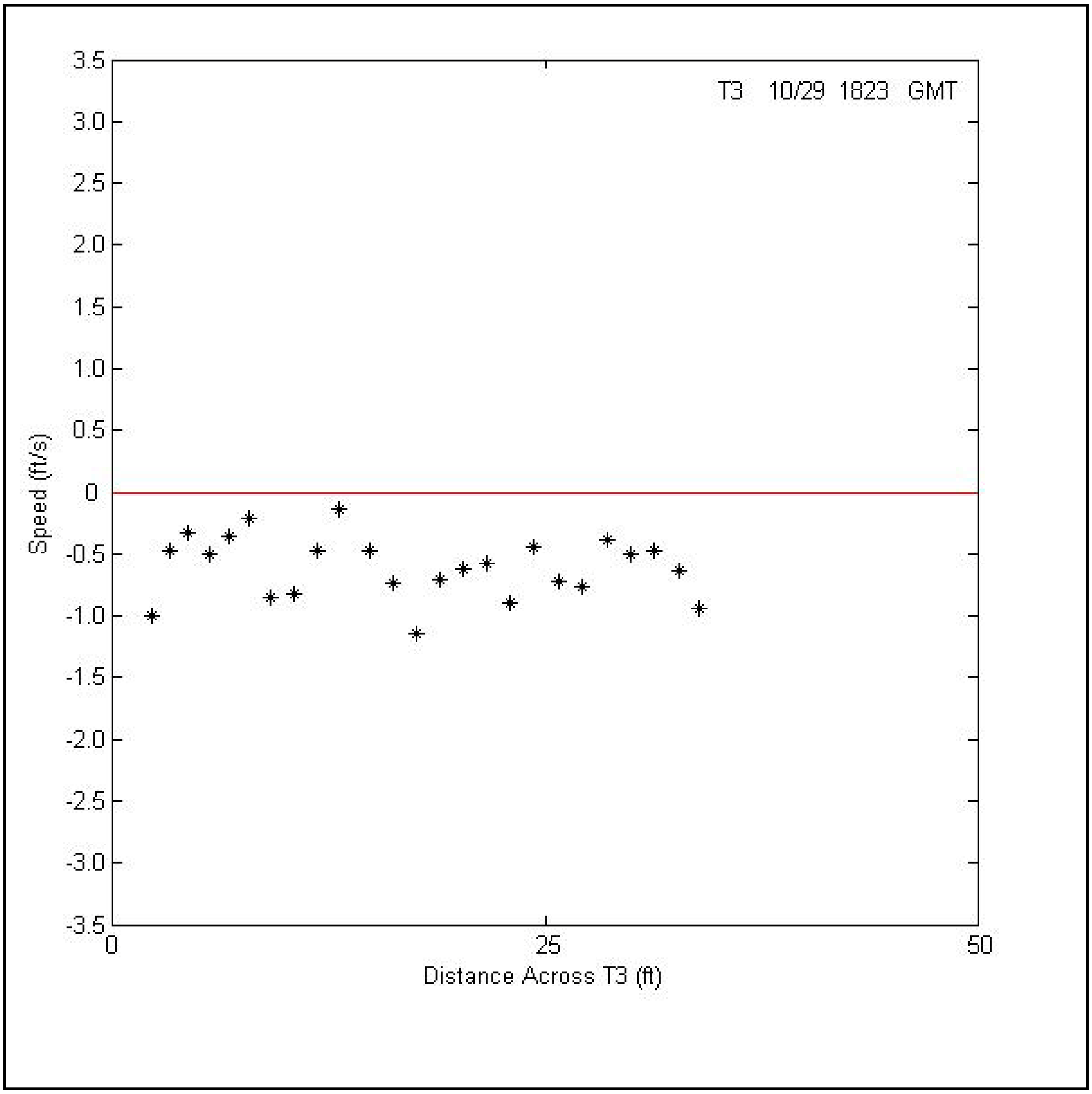
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)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-1.5
-2.0
-2.5
-3.0
-3.5
0
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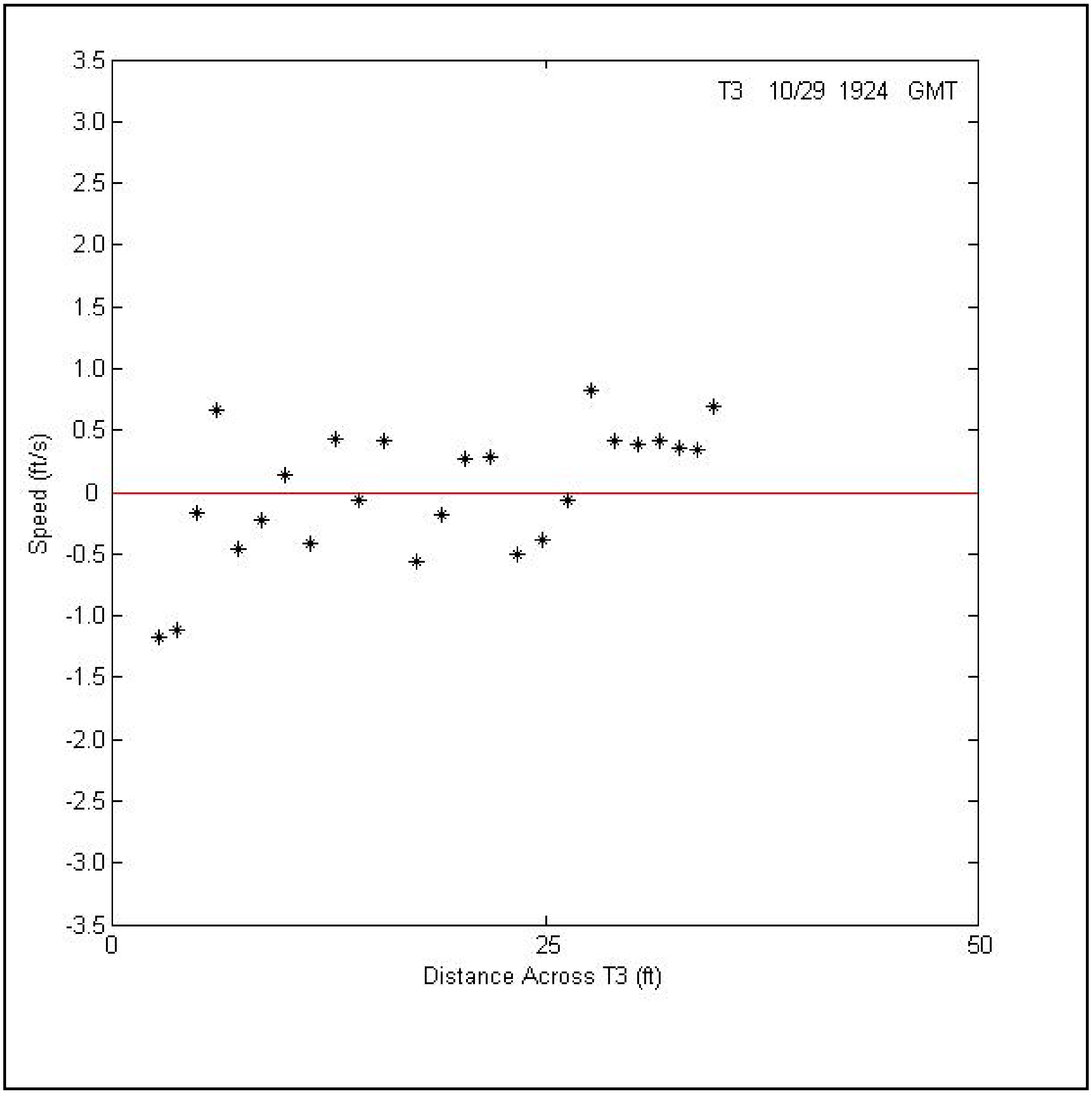
50
Distance Across T3 (ft)



T3 10/29 1924 GMT
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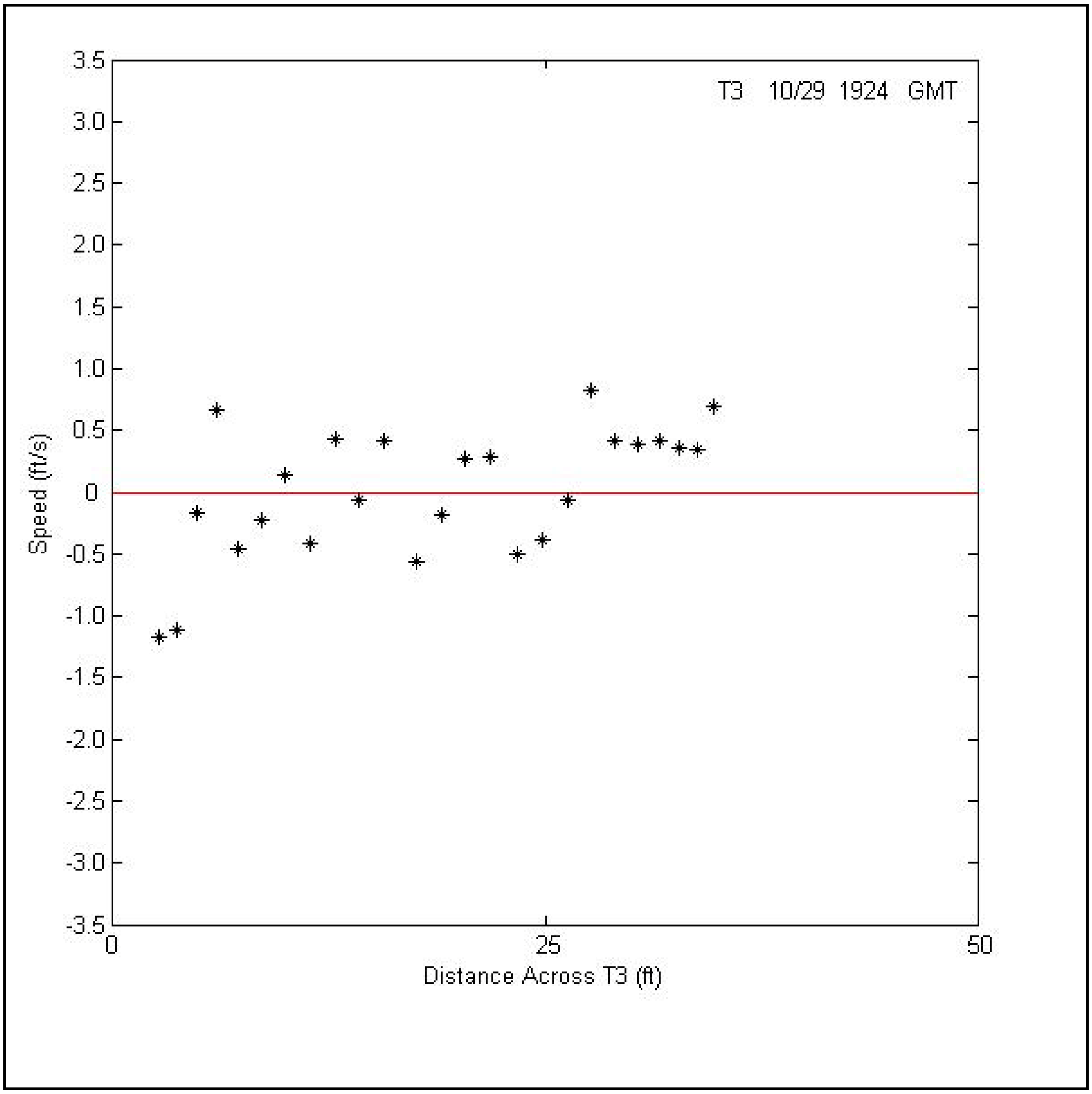
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
Distance Across T3 (ft)


T3 10/29 1924 GMT
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1.5
1.0
0.5
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-1.5
-2.0
-2.5
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-3.5
0
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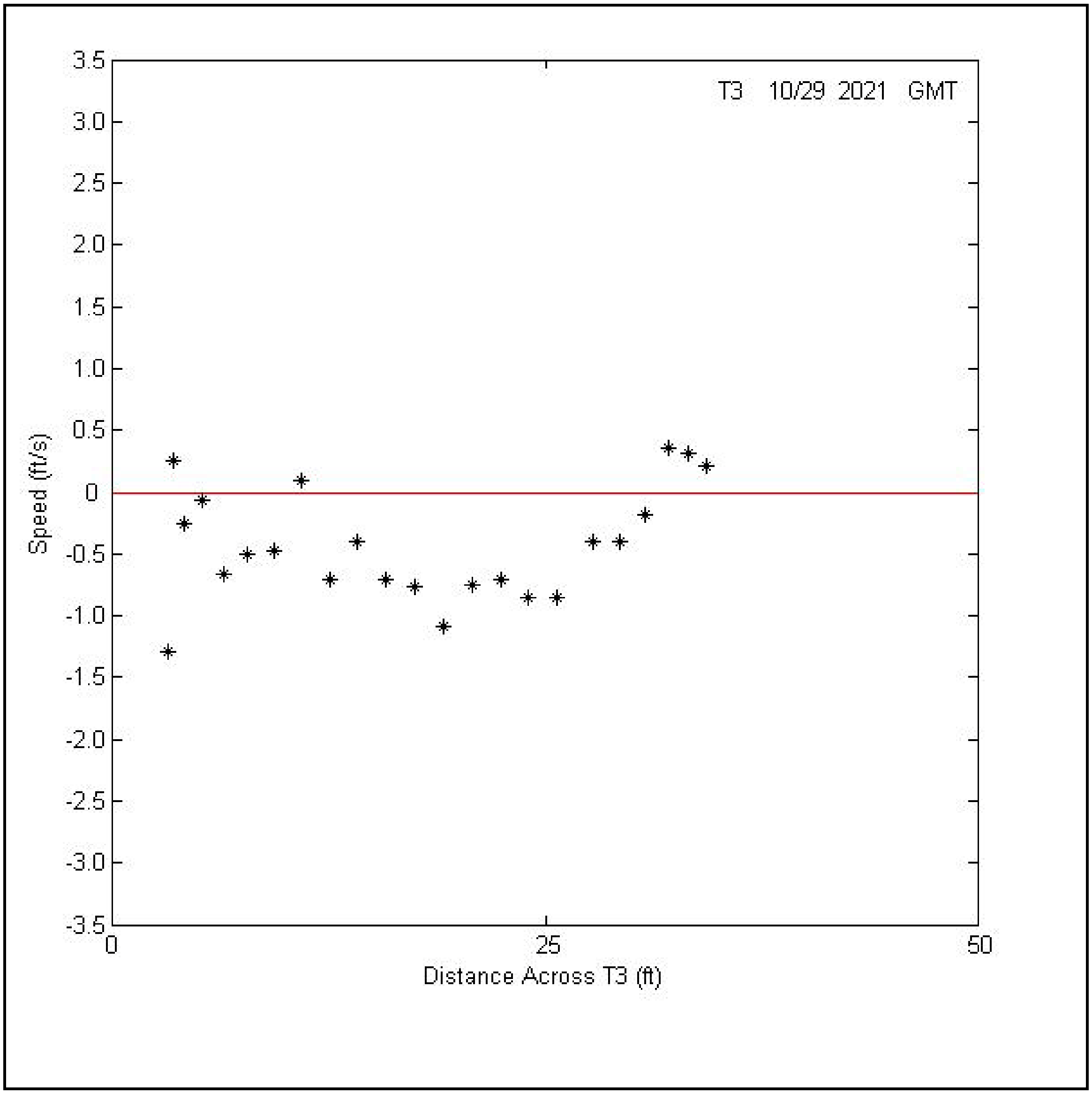
50
Distance Across T3 (ft)


T3 10/29 2021 GMT
Speed (ft/s)
Distance Across T3 (ft)
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1.5
1.0
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-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
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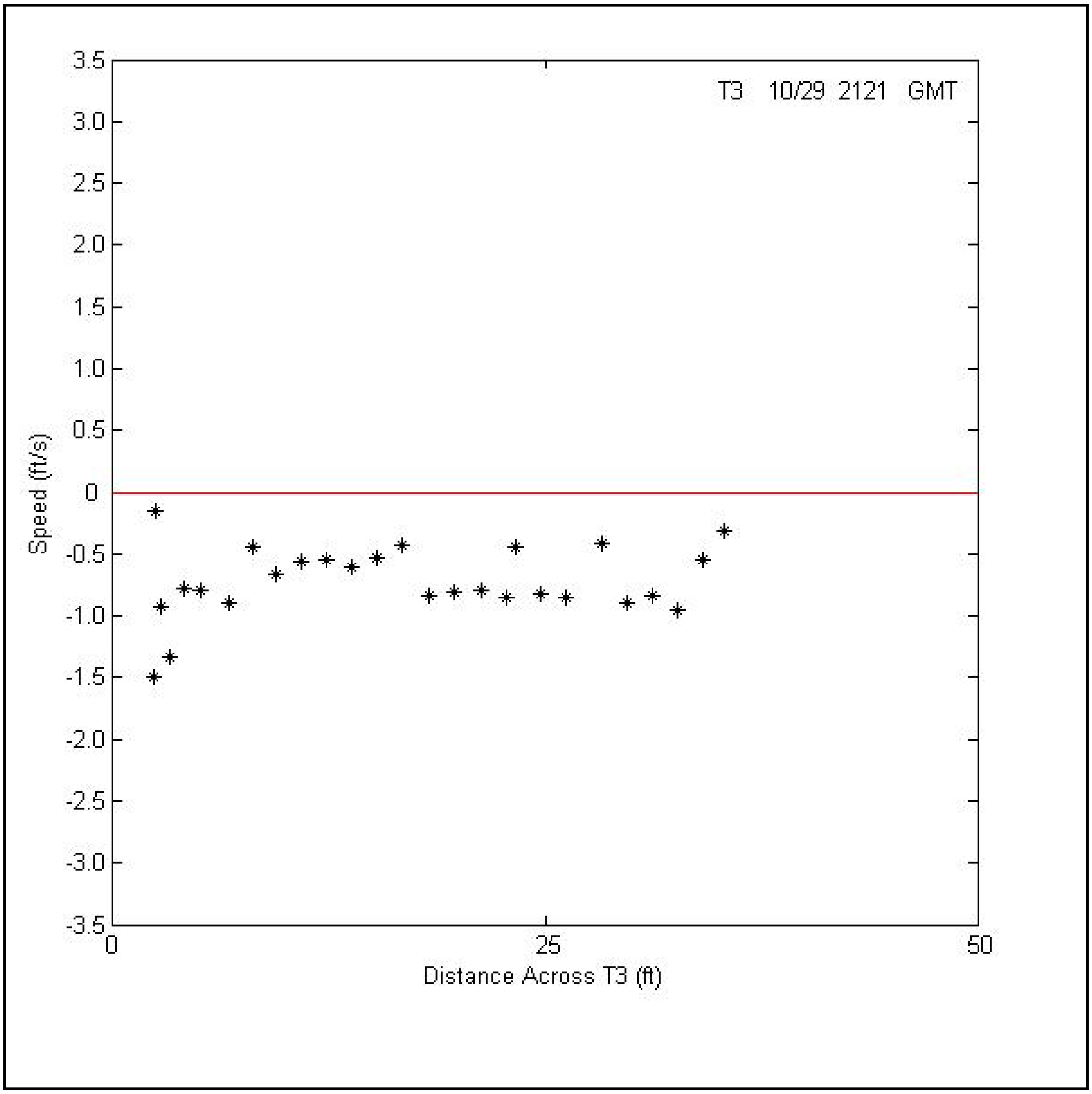
T3 10/29 2121 GMT
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1.5
1.0
0.5
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-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
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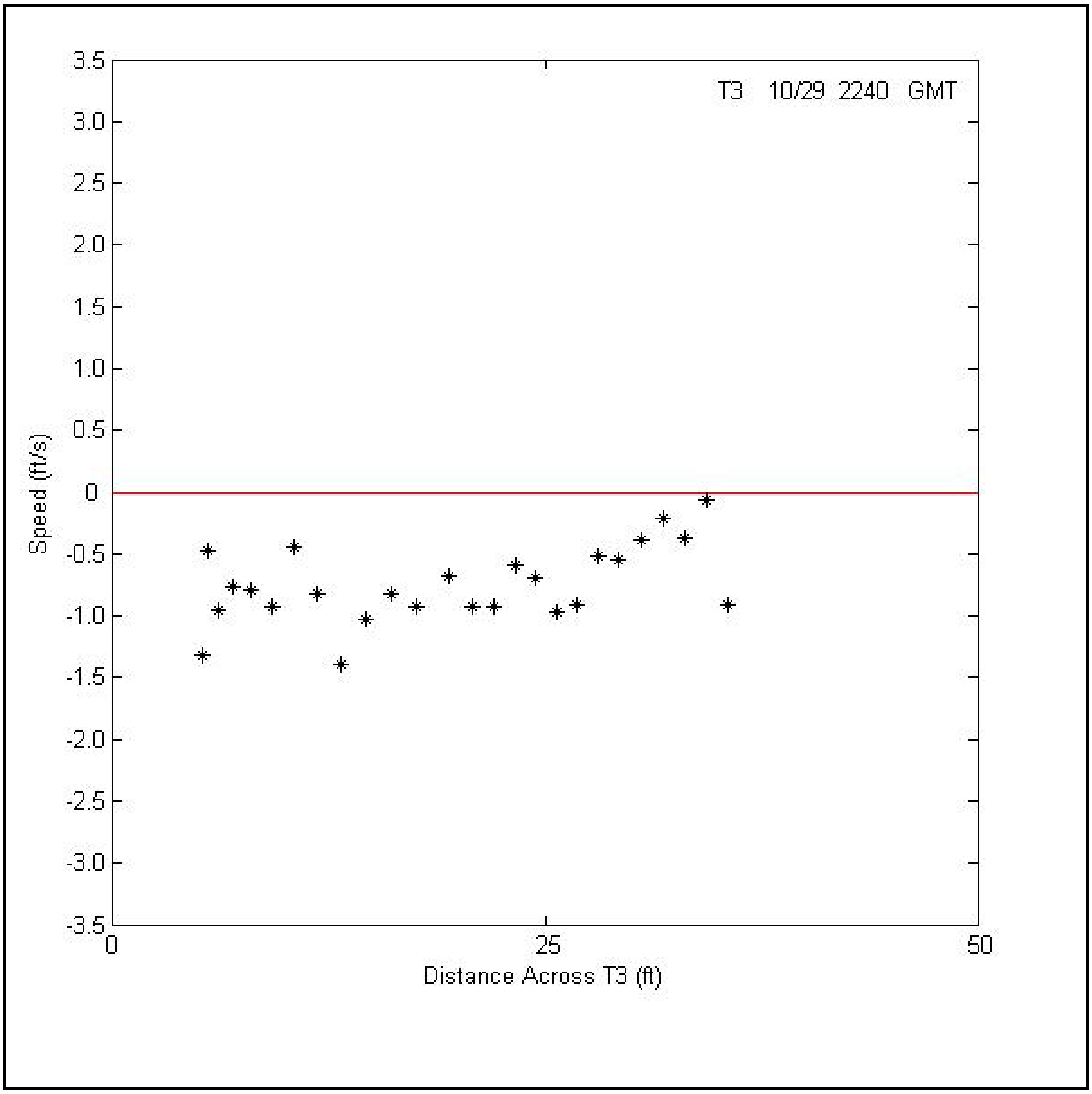
50
Distance Across T3 (ft)


T3 10/29 2240 GMT
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1.0
0.5
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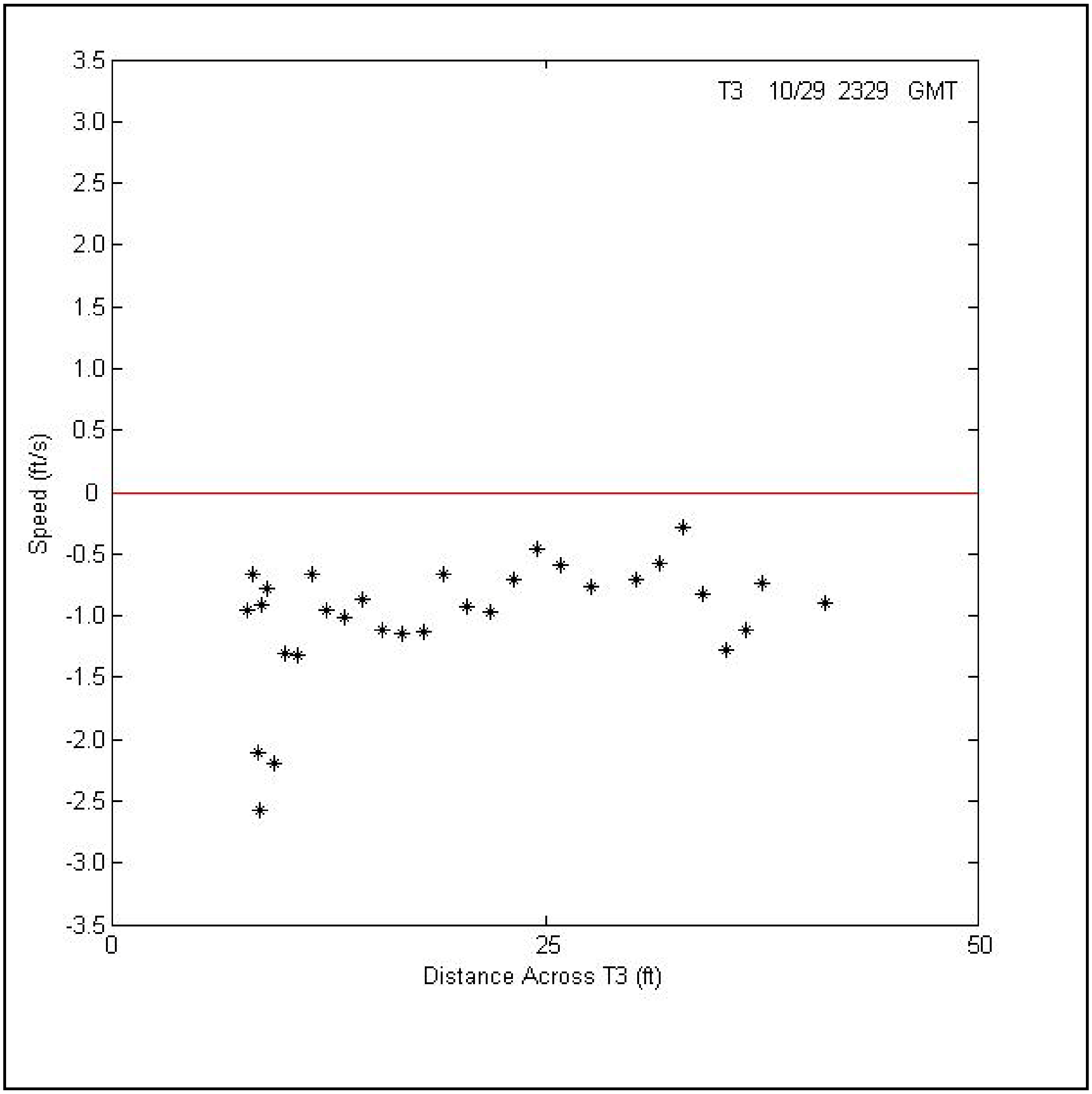
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)


T3 10/29 2329 GMT
Speed (ft/s)
Distance Across T3 (ft)
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1.5
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-1.5
-2.0
-2.5
-3.0
-3.5
0
25
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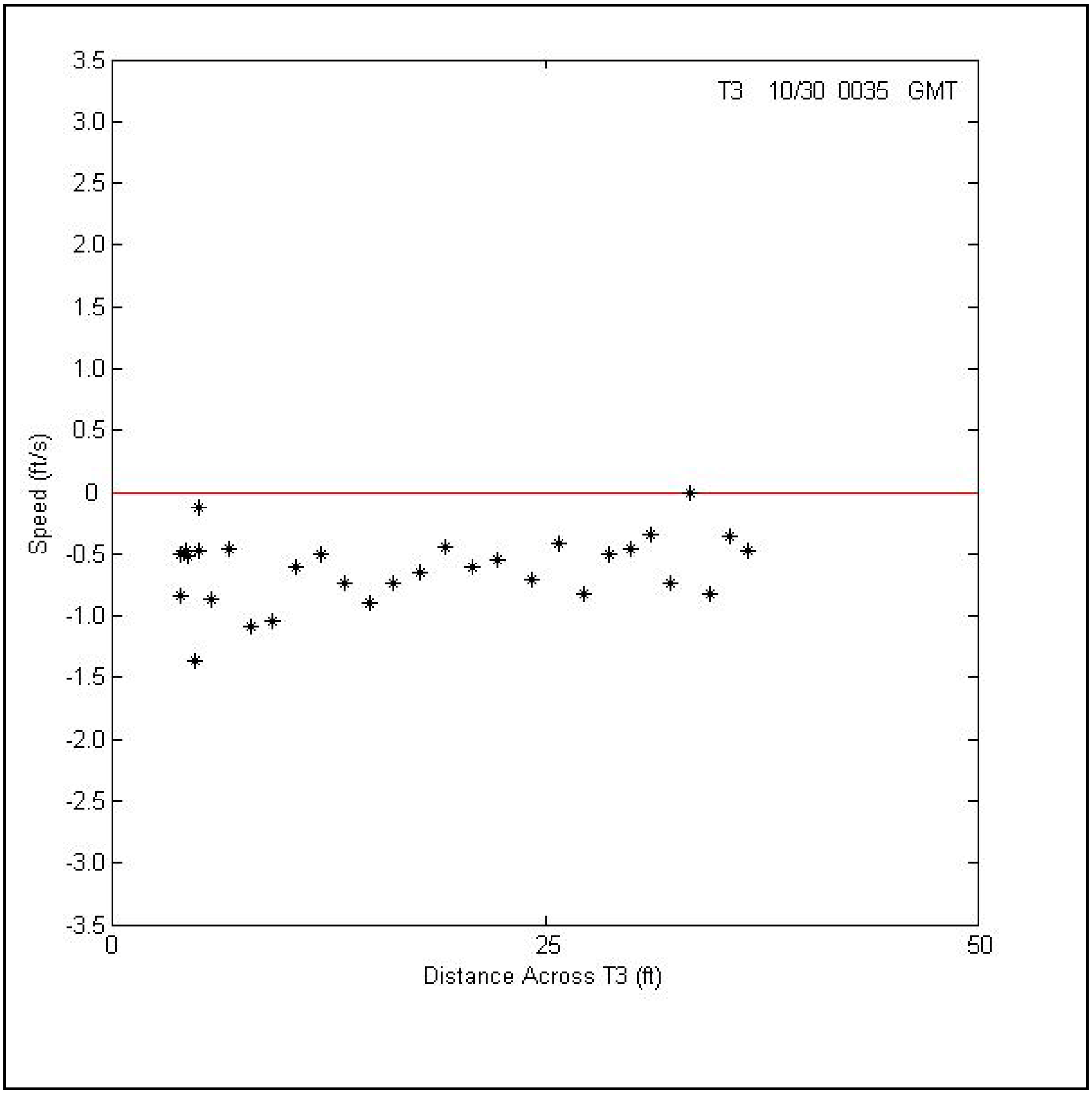

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-0.5
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-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
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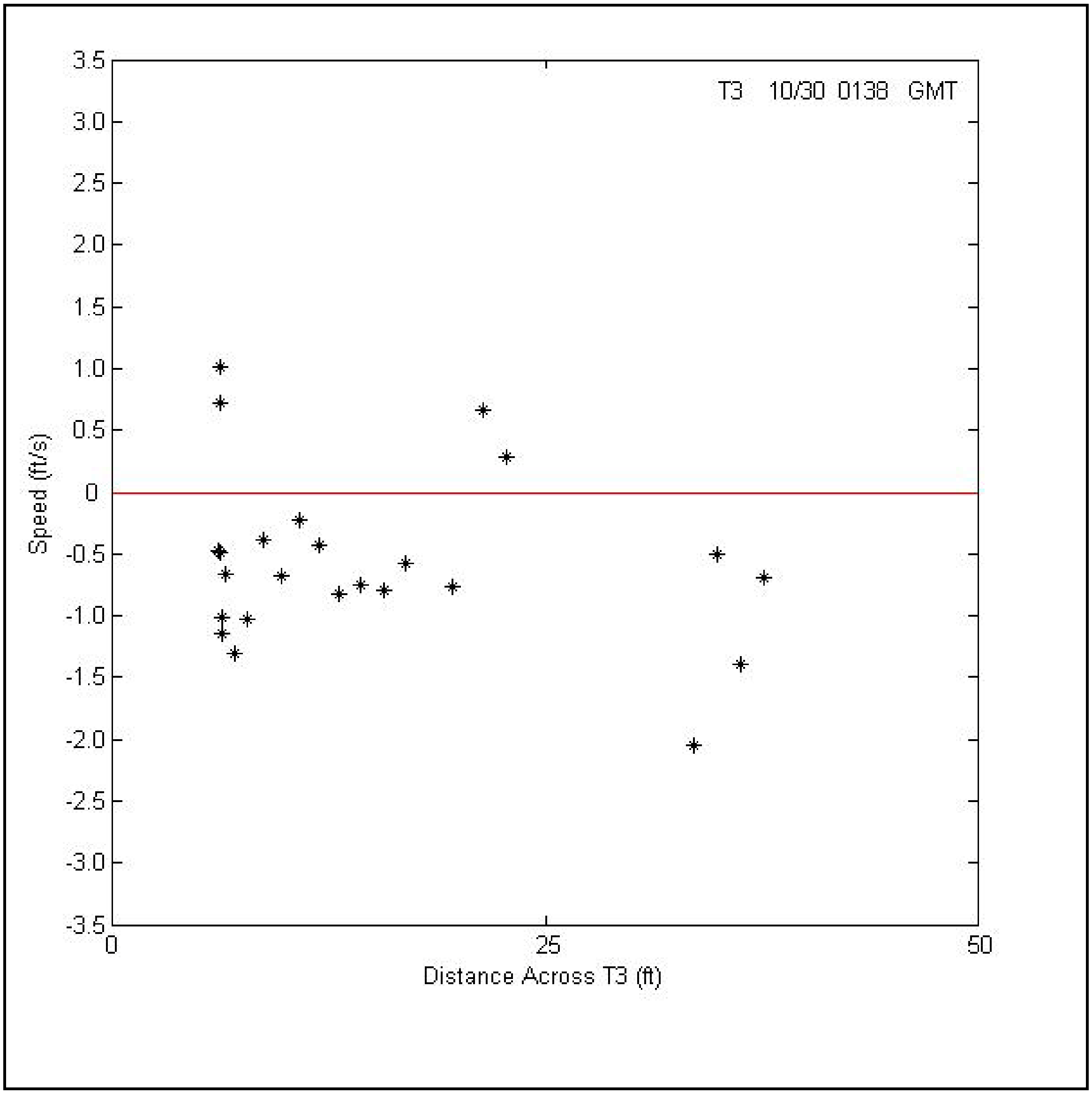
50
Distance Across T3 (ft)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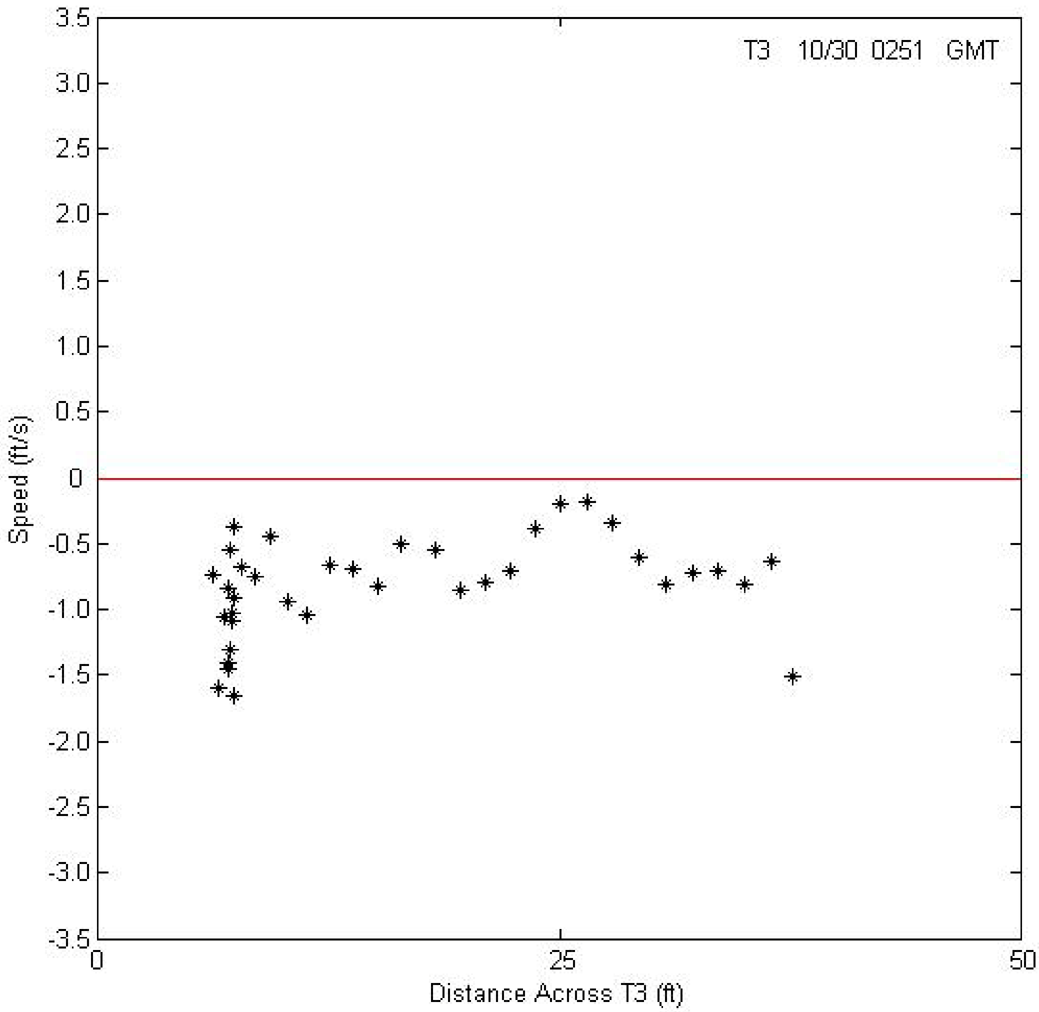
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)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1.0
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-0.5
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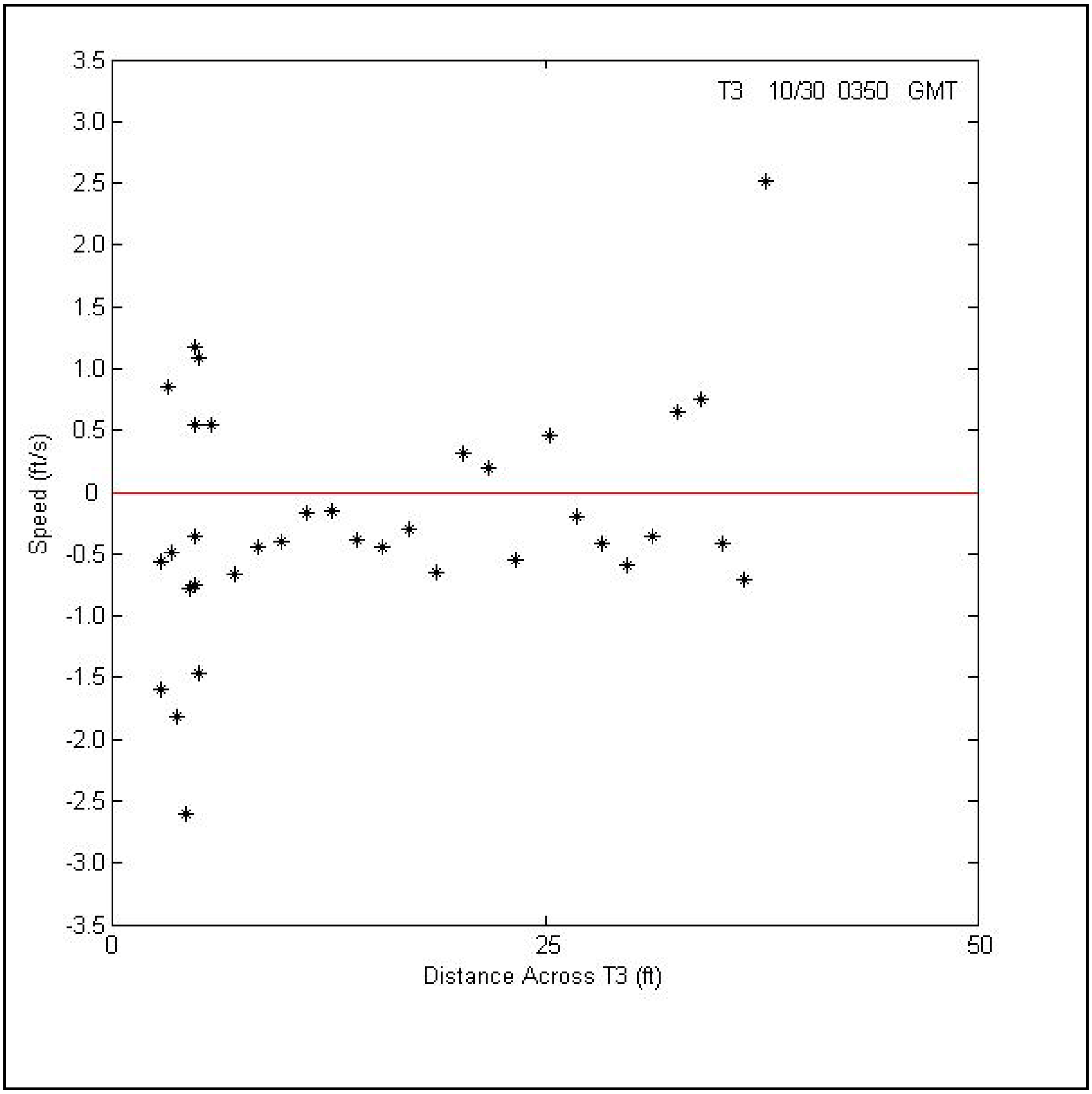
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
Distance Across T3 (ft)


T3 10/30 0350 GMT
Speed (ft/s)
Distance Across T3 (ft)
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1.5
1.0
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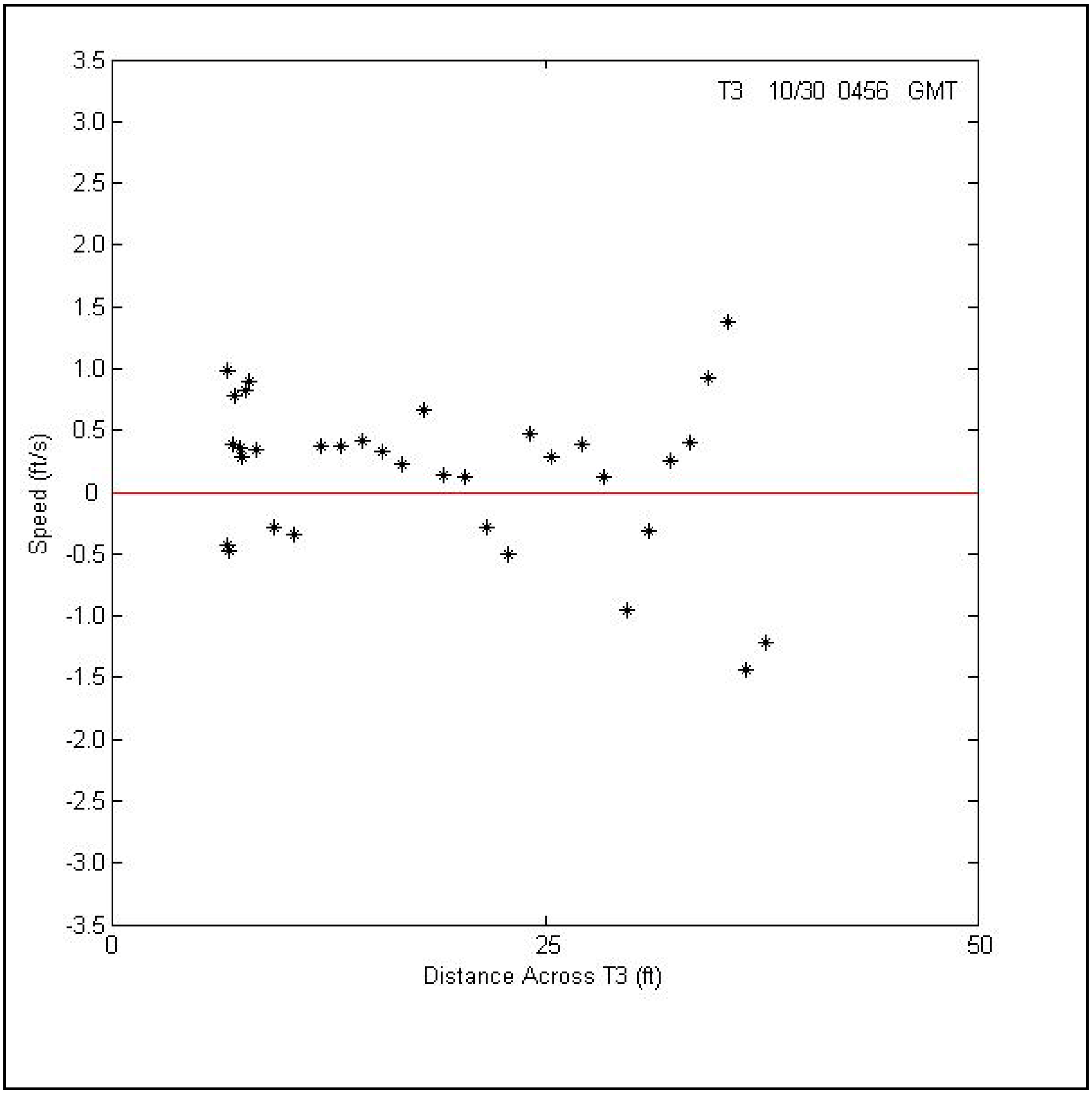
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50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0.5
0
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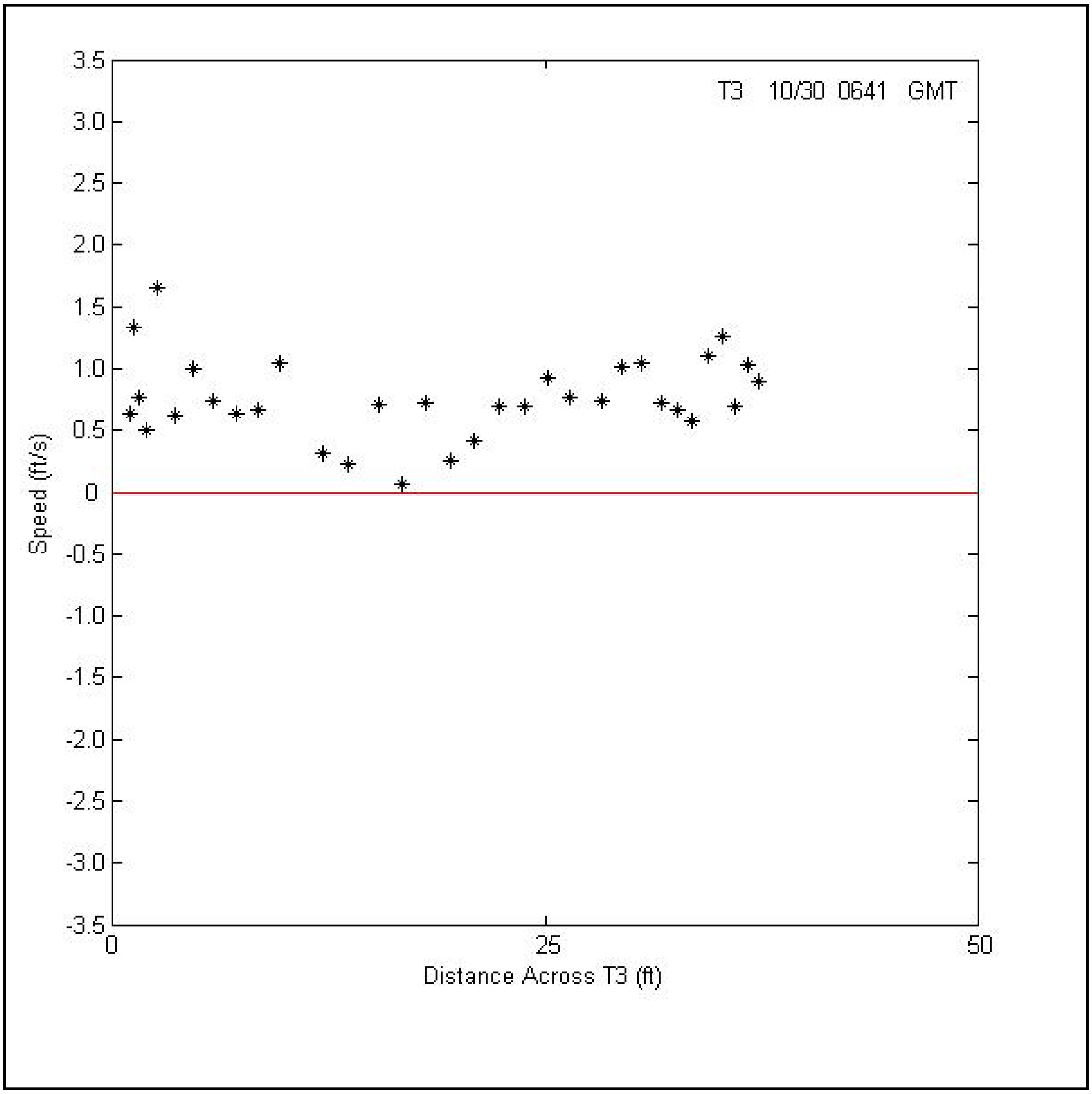
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)


T3 10/30 0641 GMT
Speed (ft/s)
Distance Across T3 (ft)
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1.0
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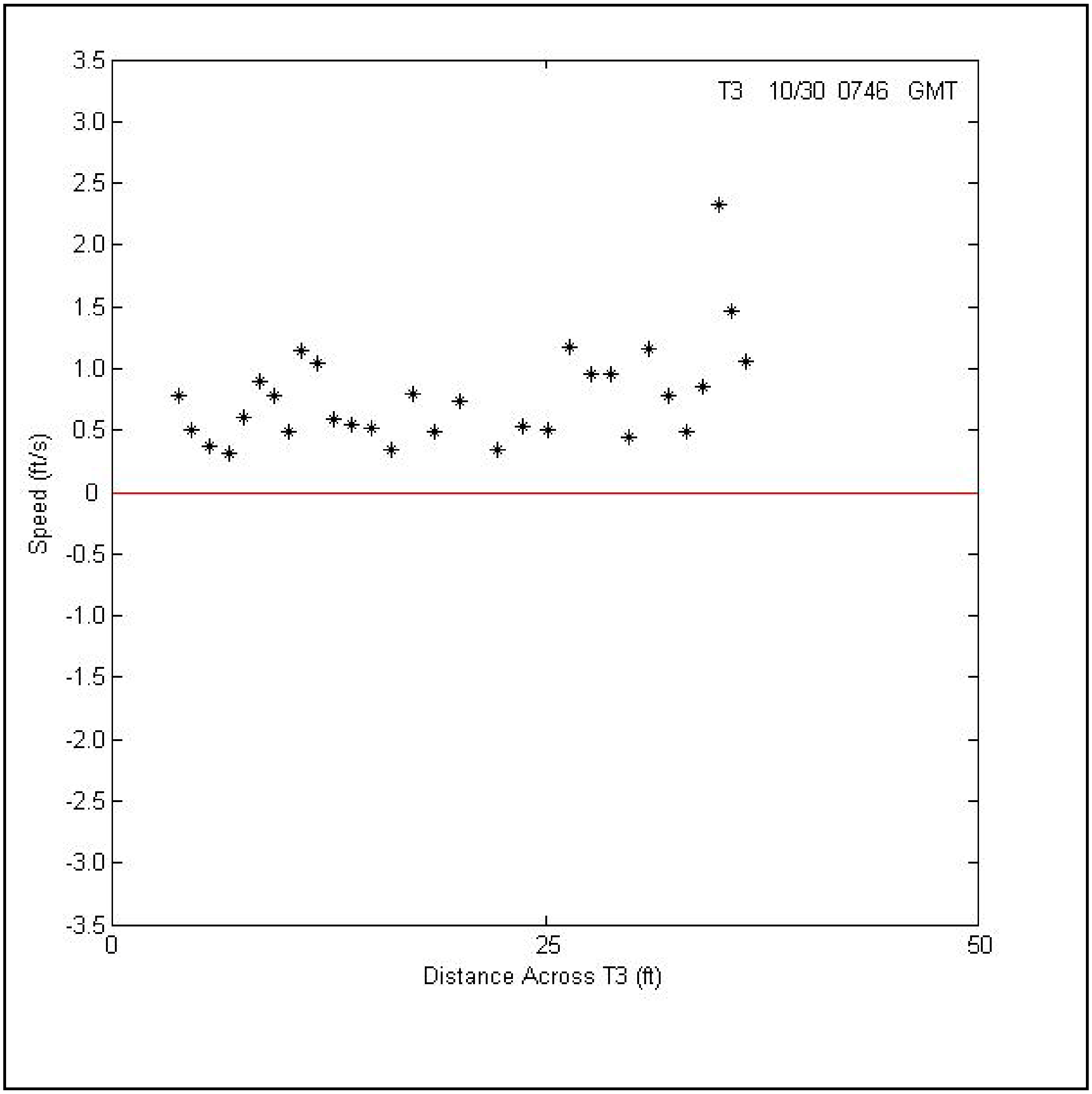
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50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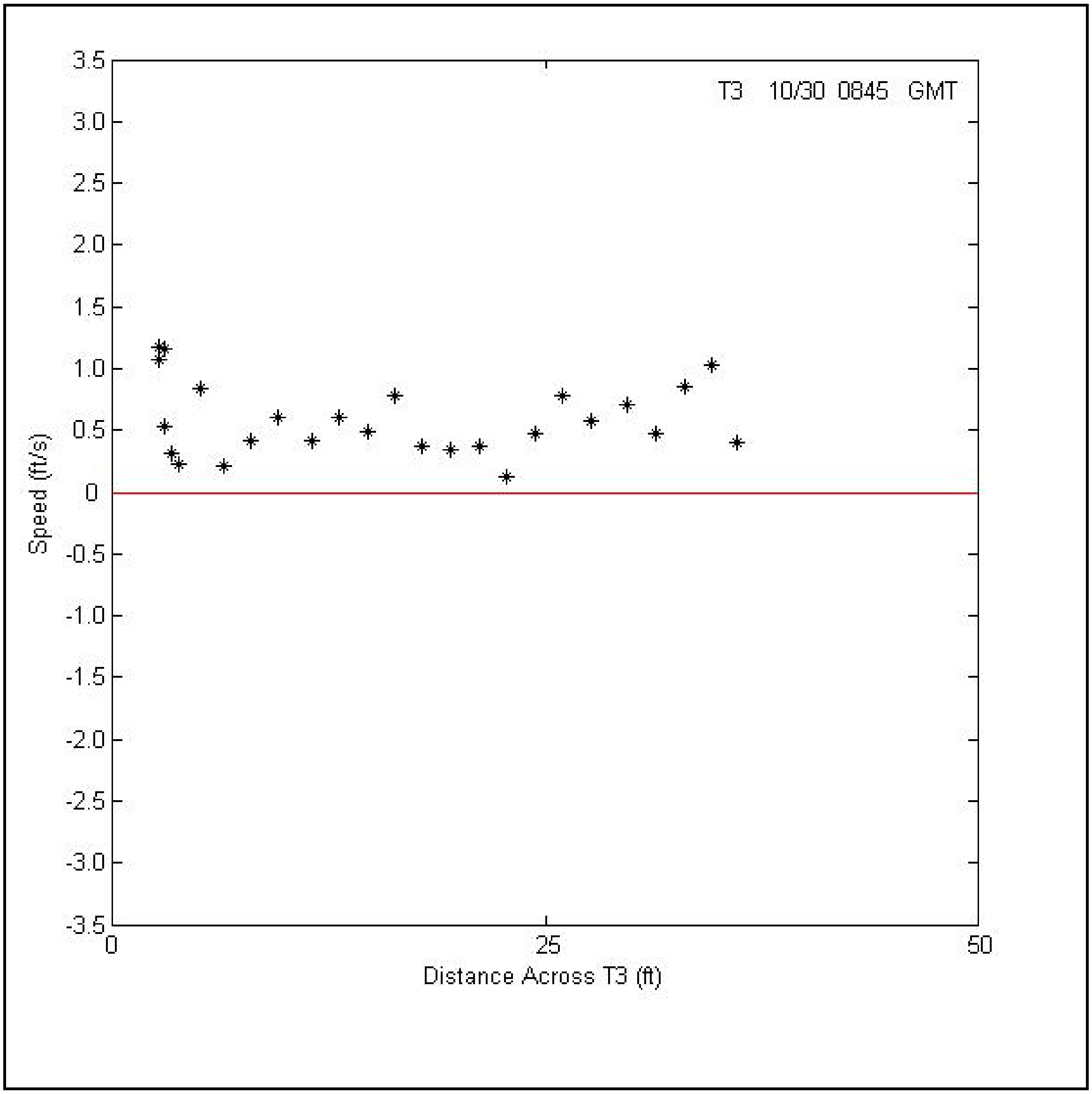
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)



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Speed (ft/s)
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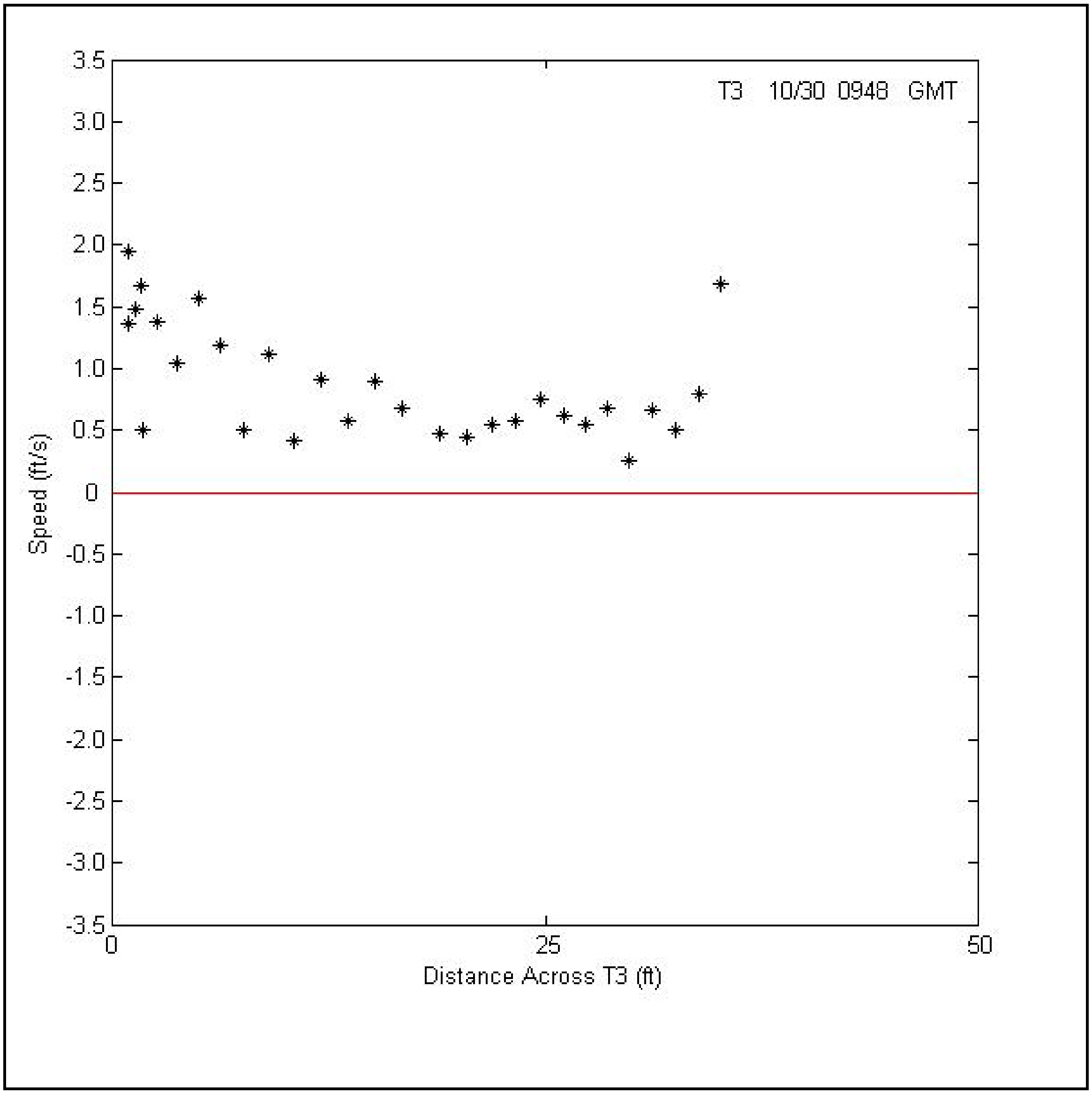
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)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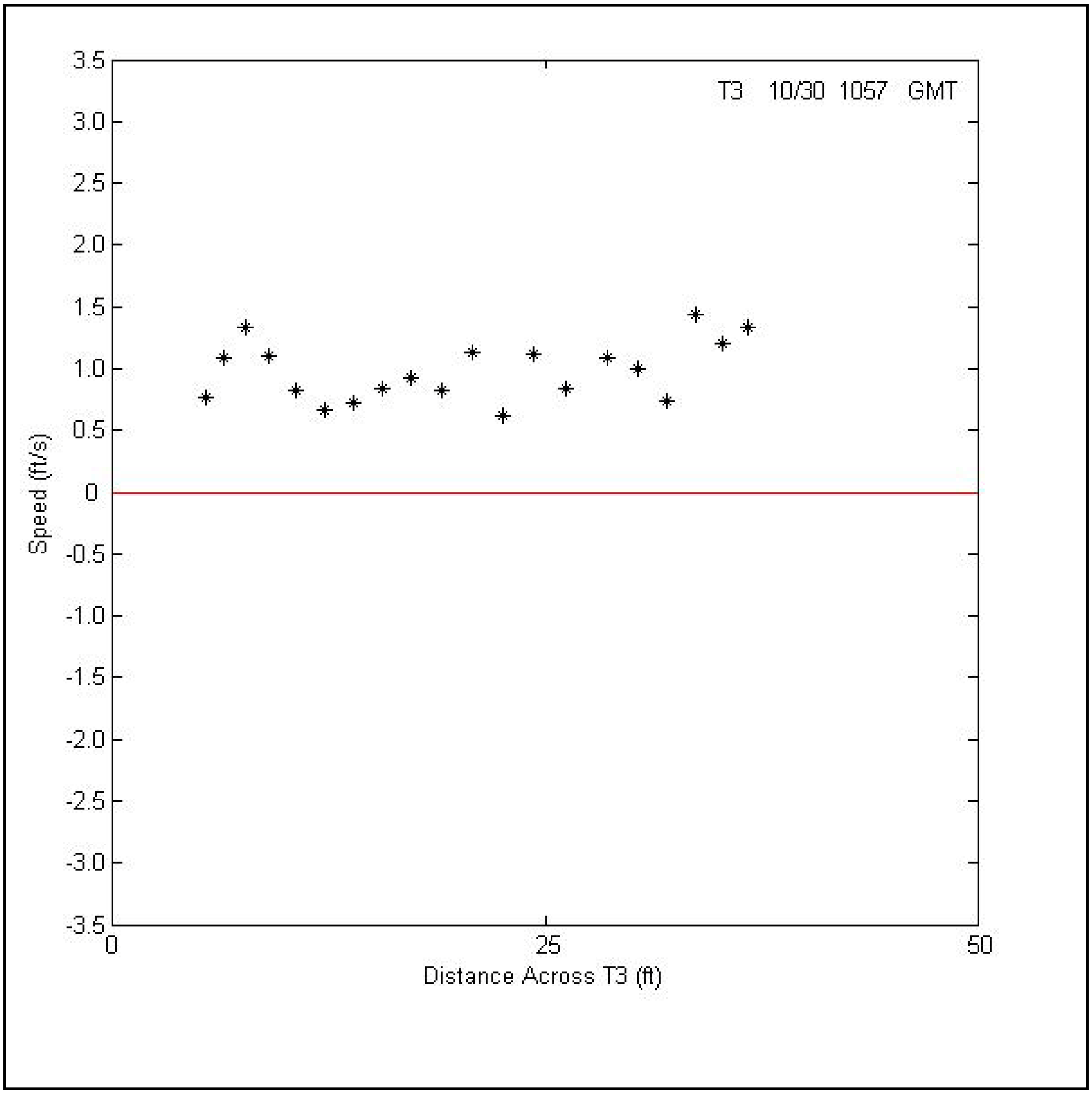
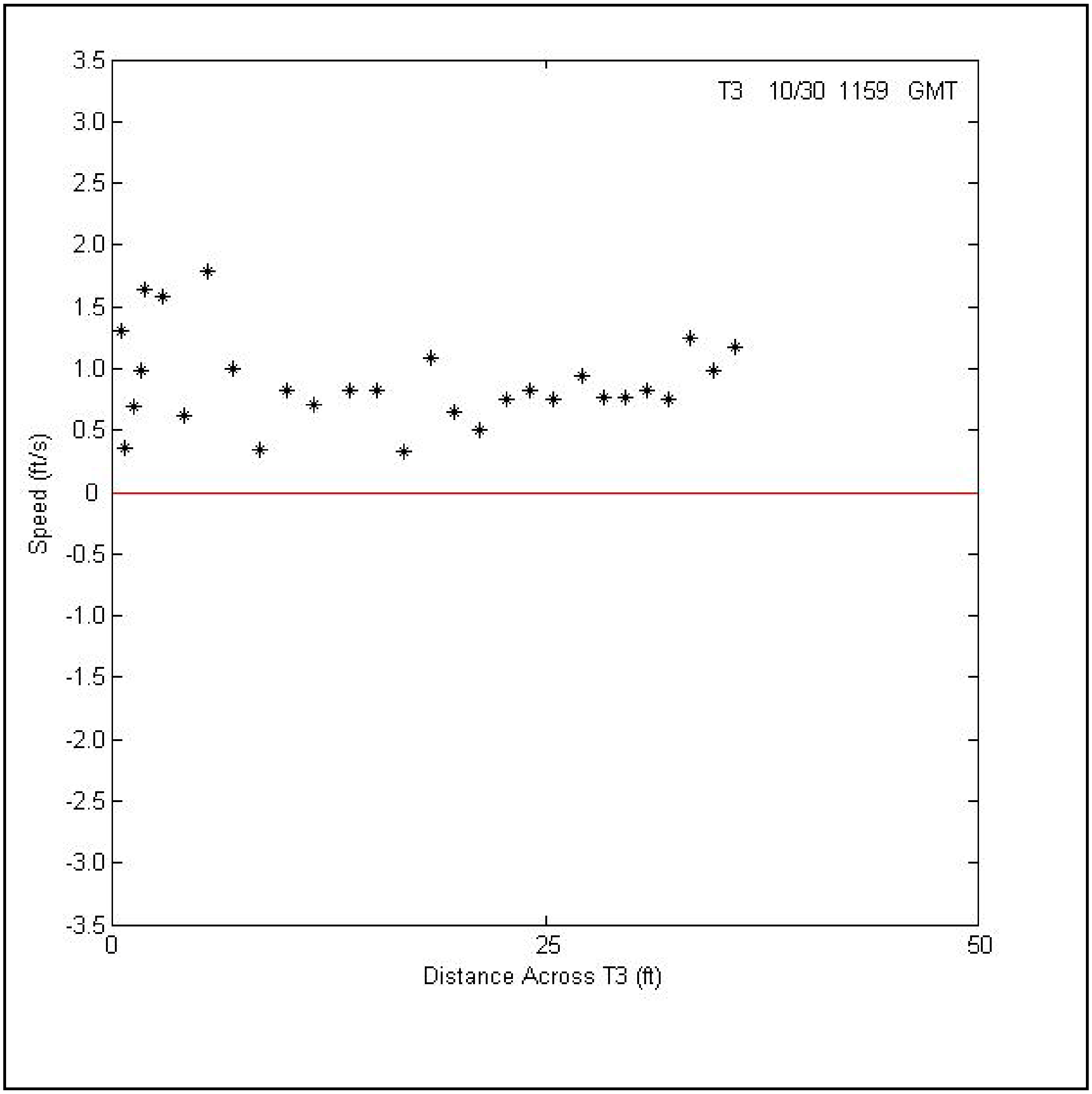
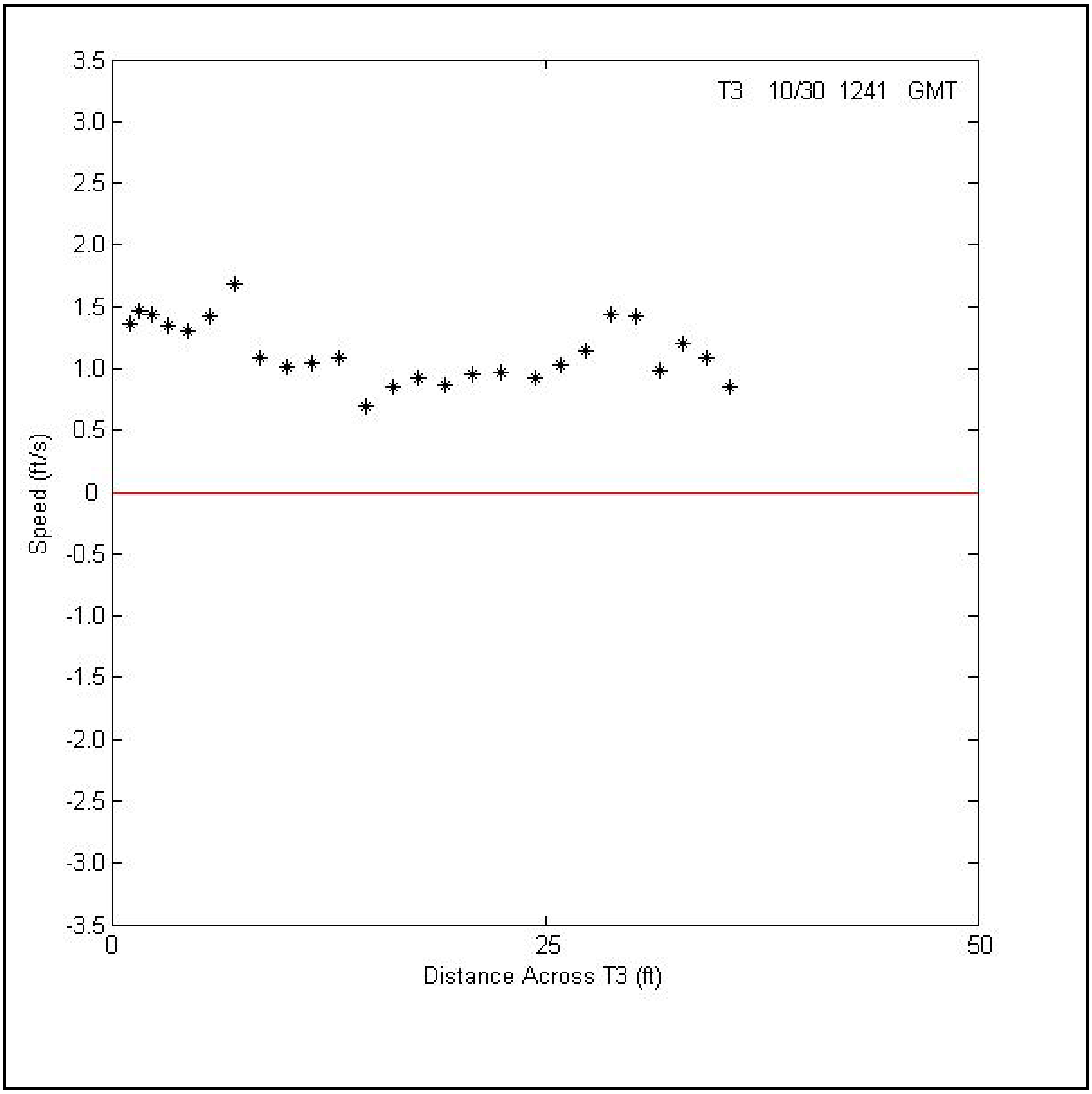
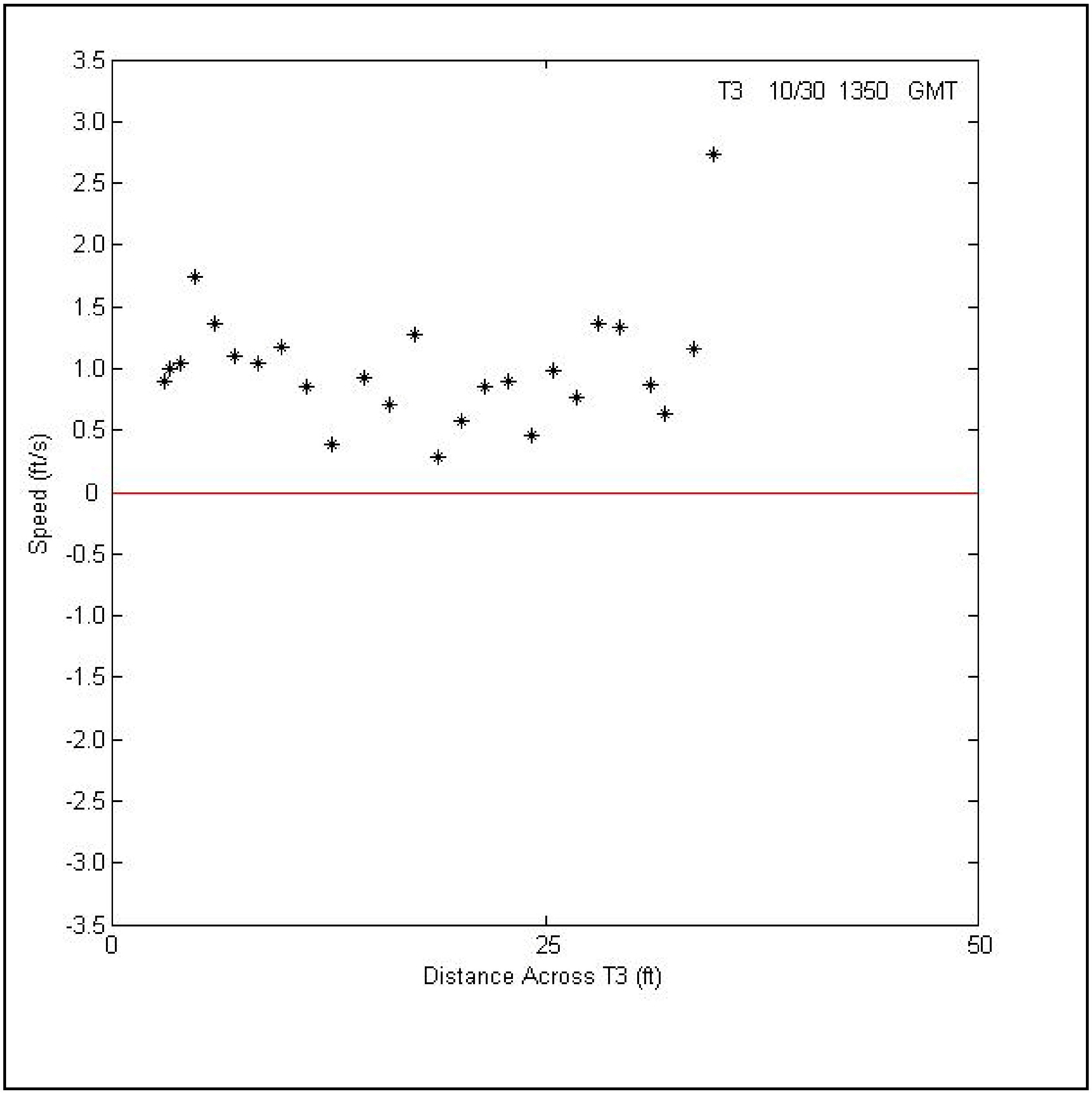
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)

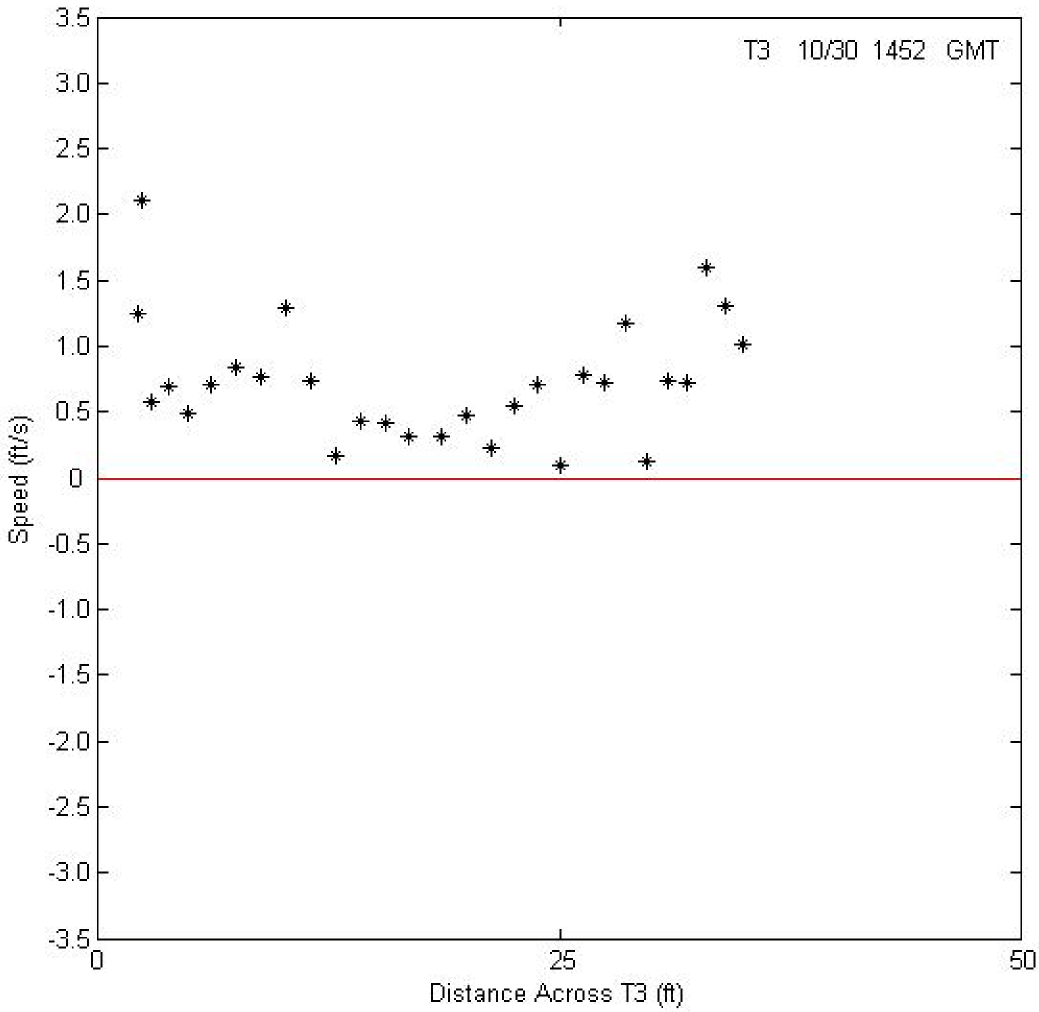

T3 10/30 1057 GMT
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
Distance Across T3 (ft)

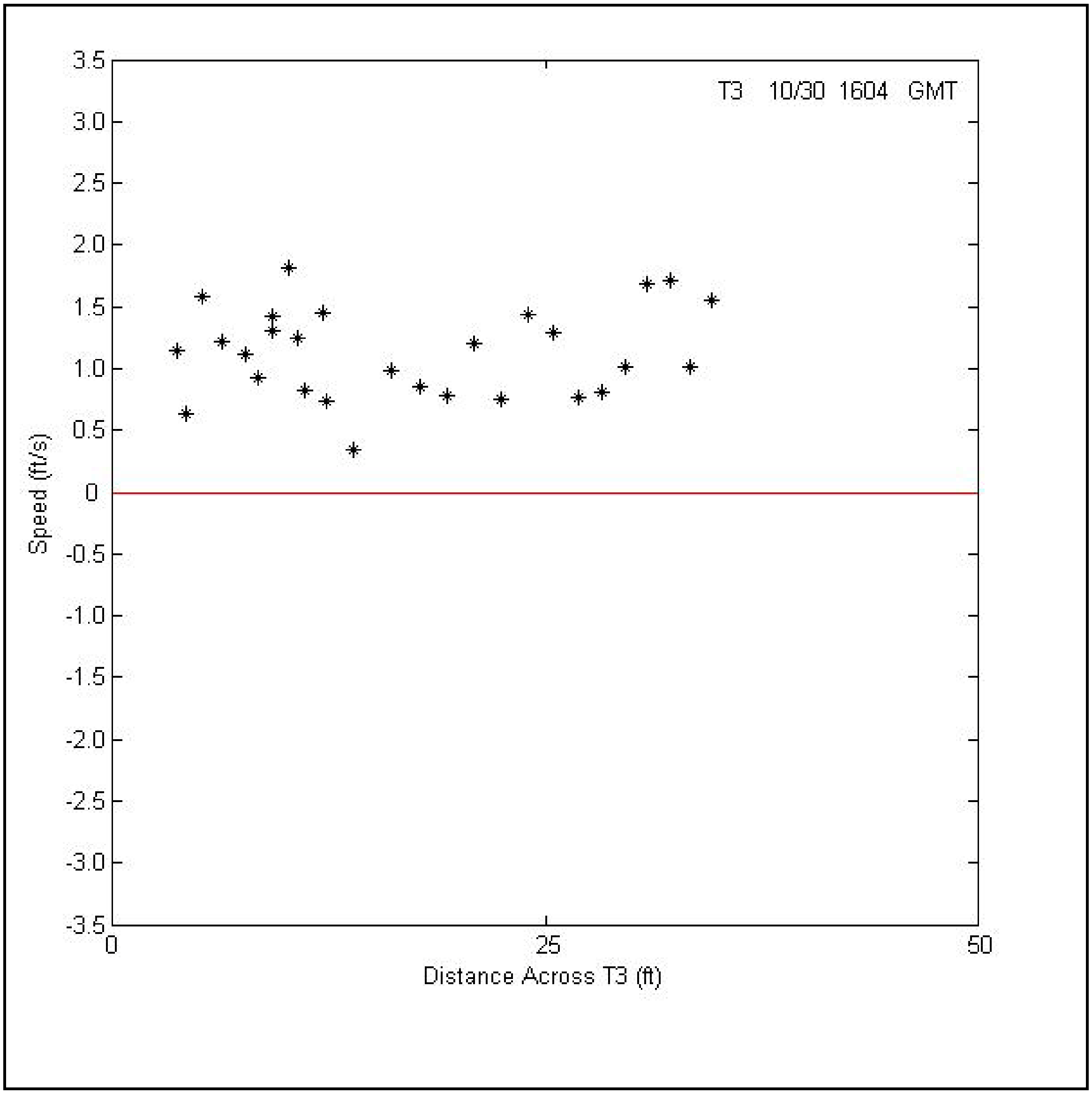


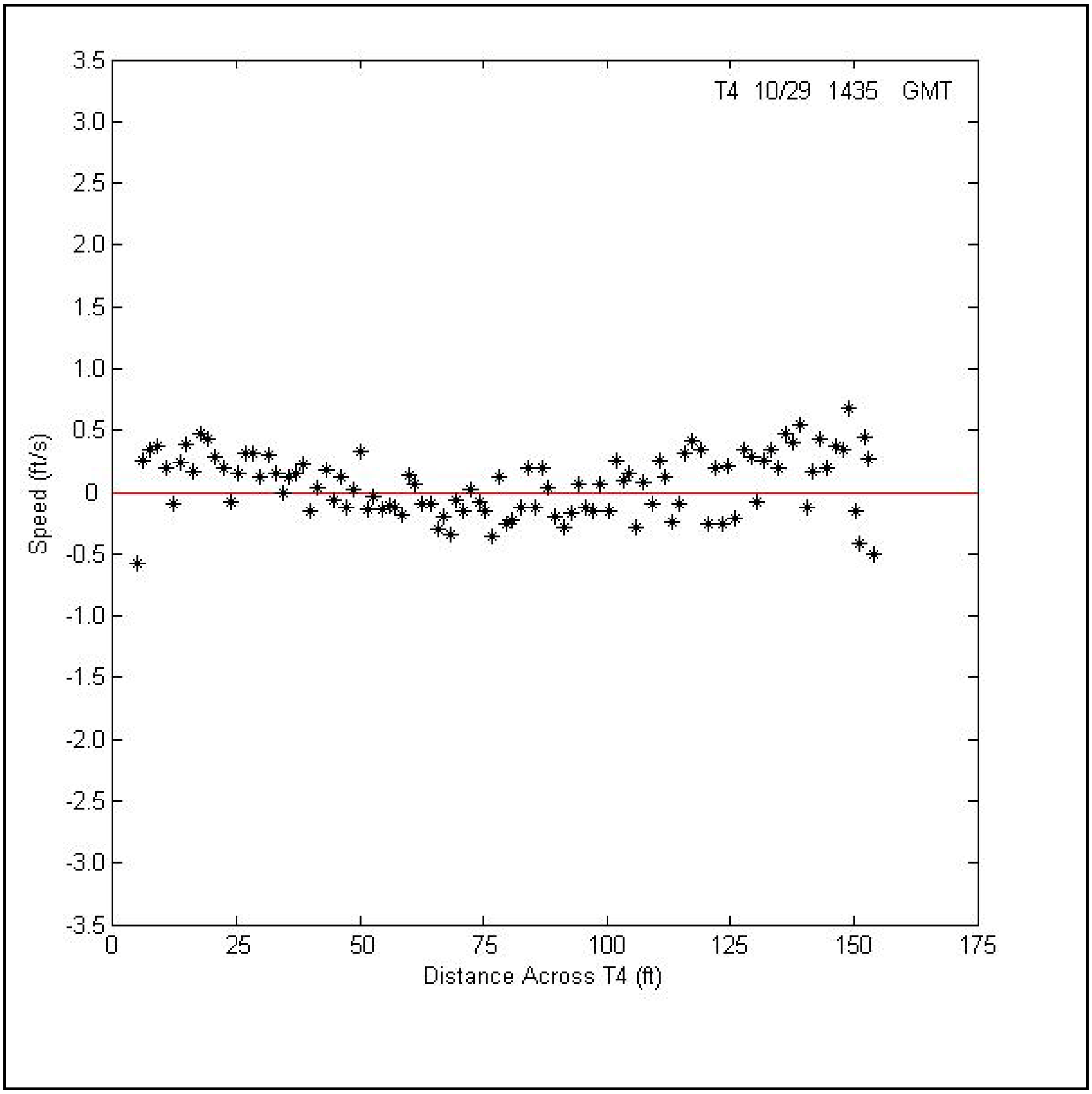
T3 10/30 1159 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)

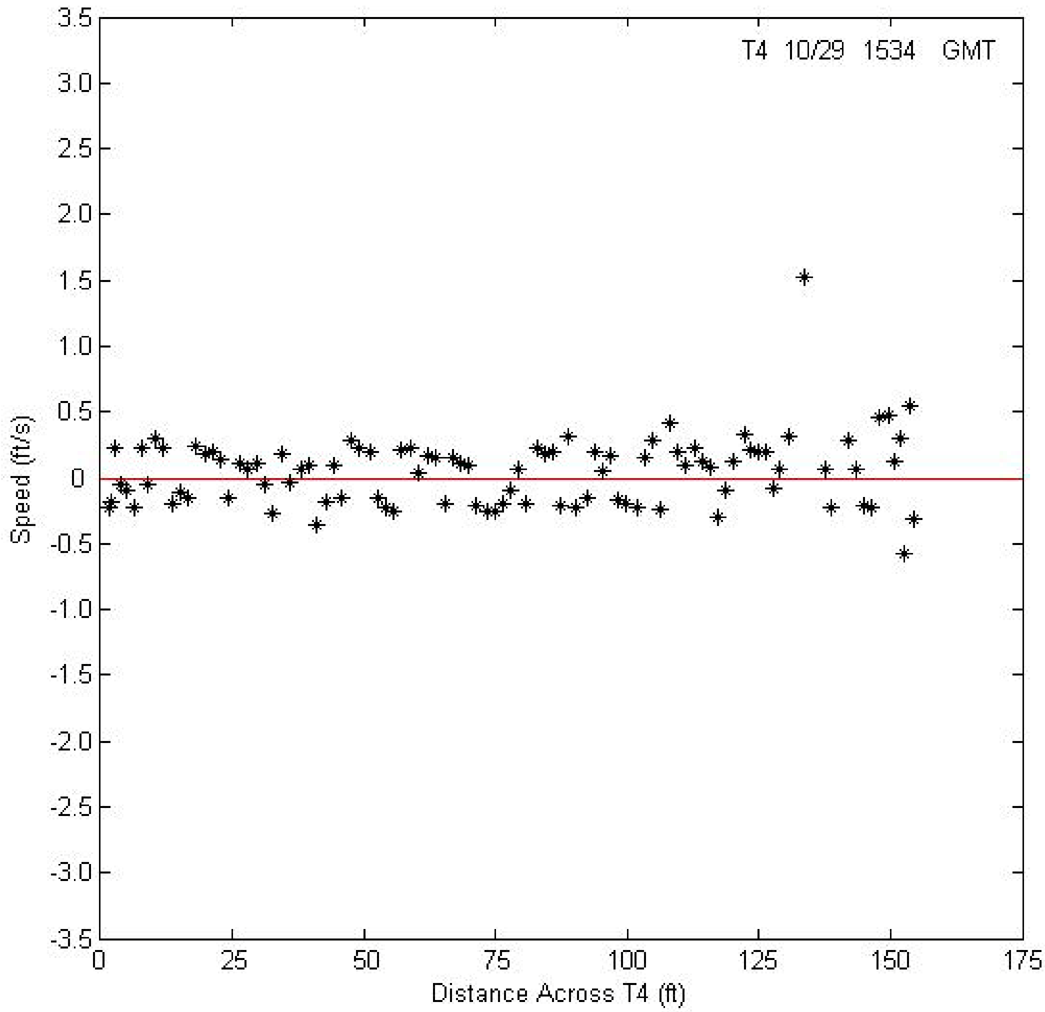

T3 10/30 1241 GMT
Speed (ft/s)
Distance Across T3 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50

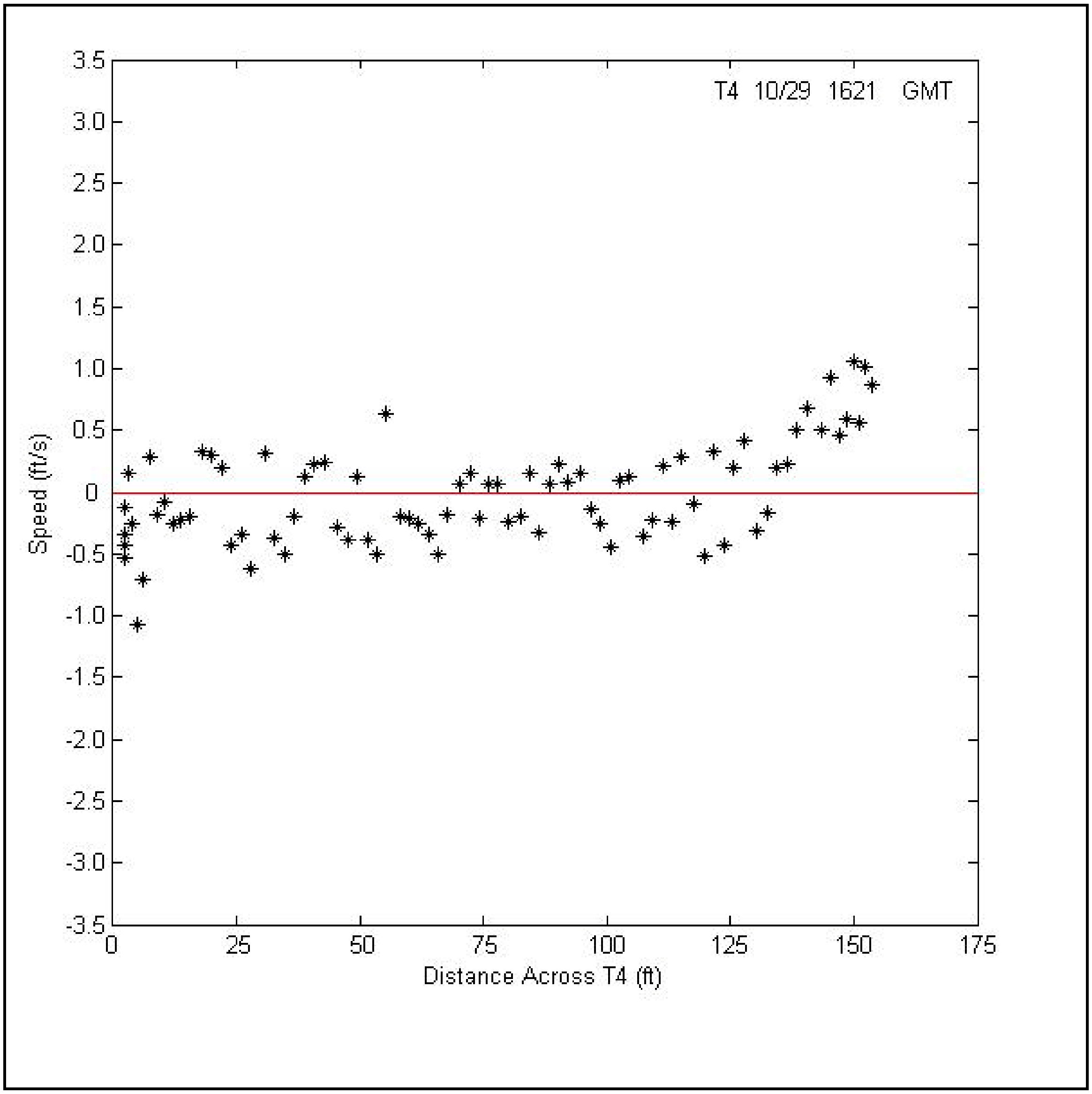

T3 10/30 1350 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)

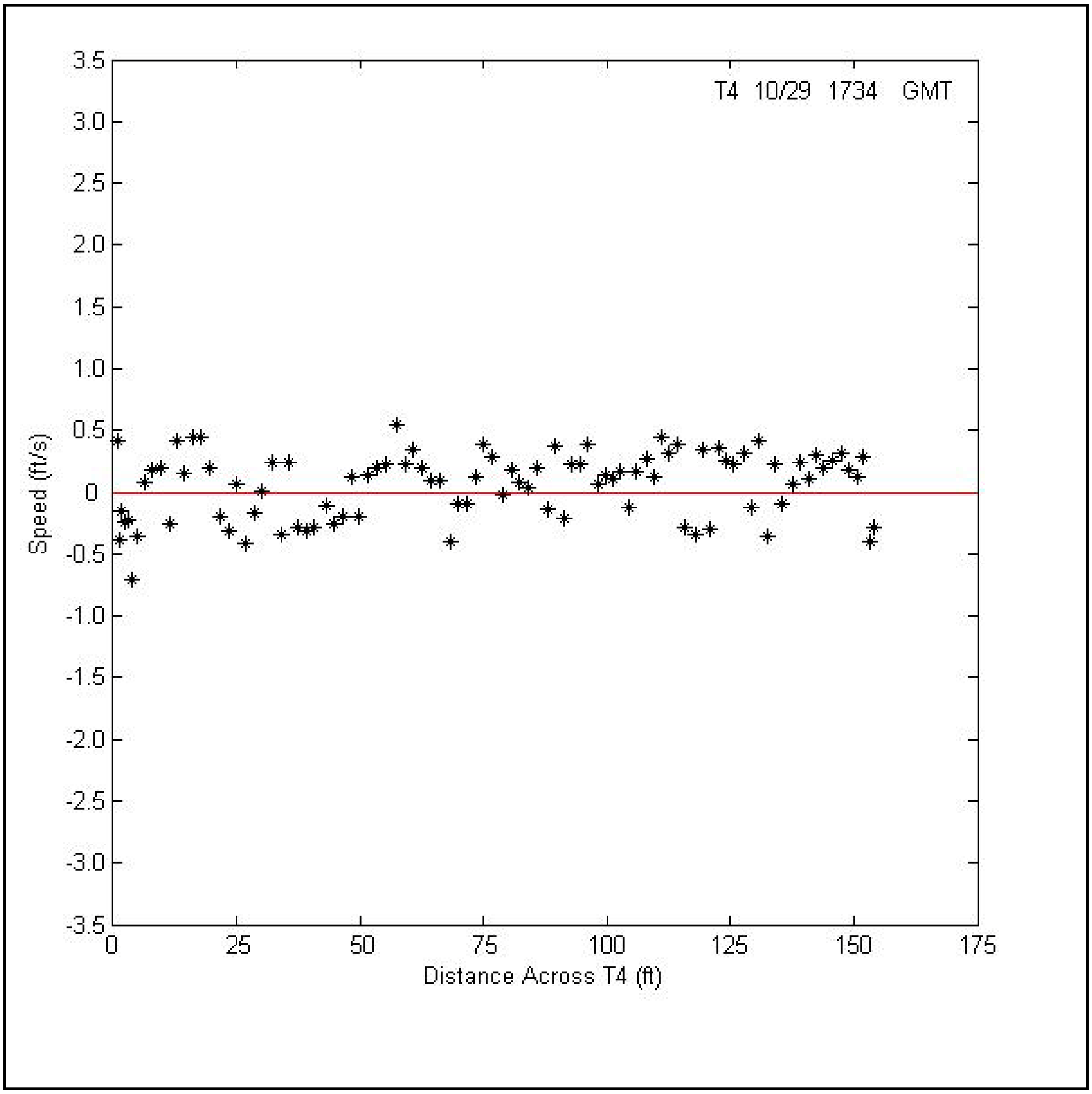

T3 10/30 1452 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
Distance Across T3 (ft)

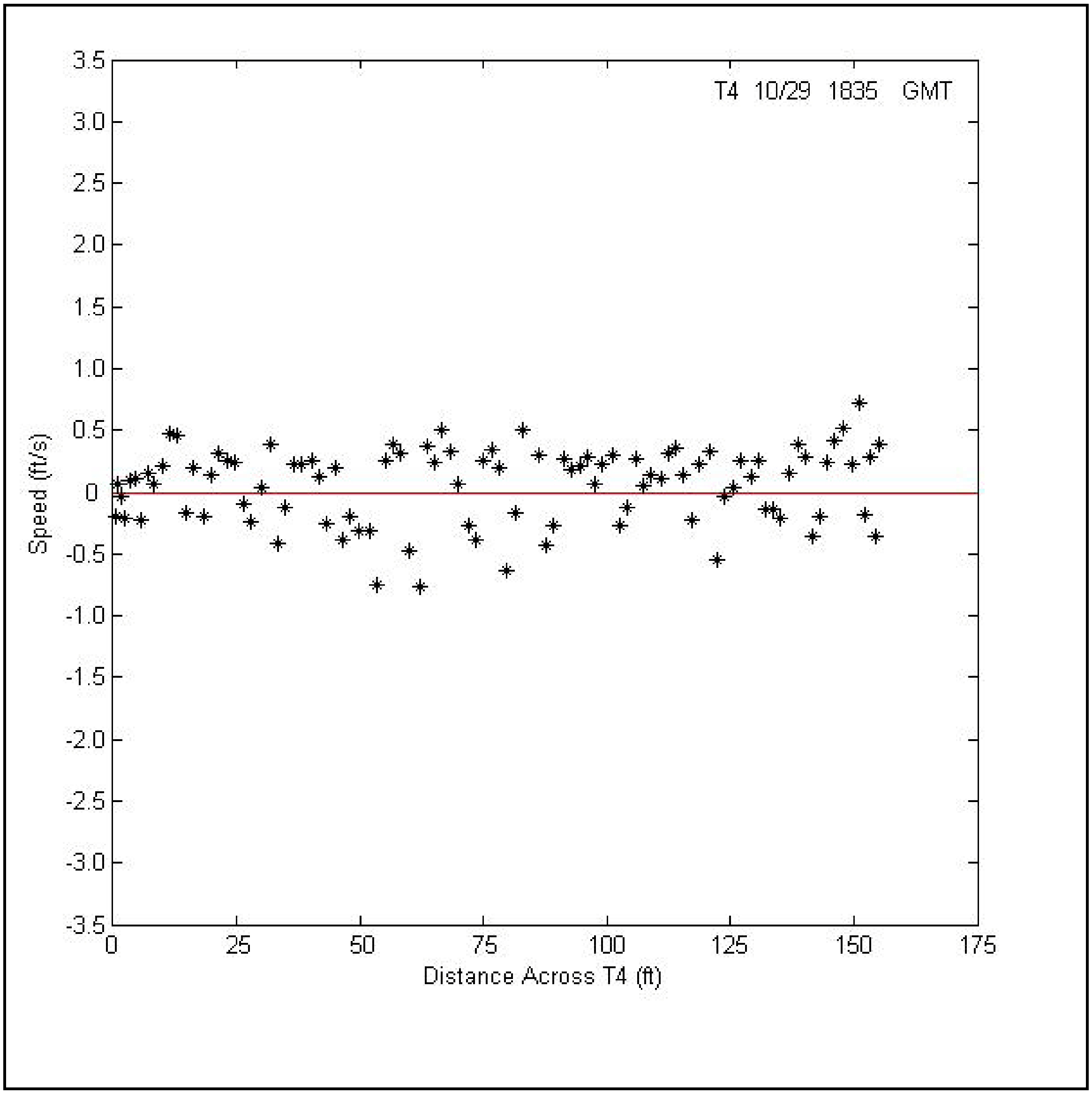

T3 10/30 1604 GMT
Speed (ft/s)
Distance Across T3 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50

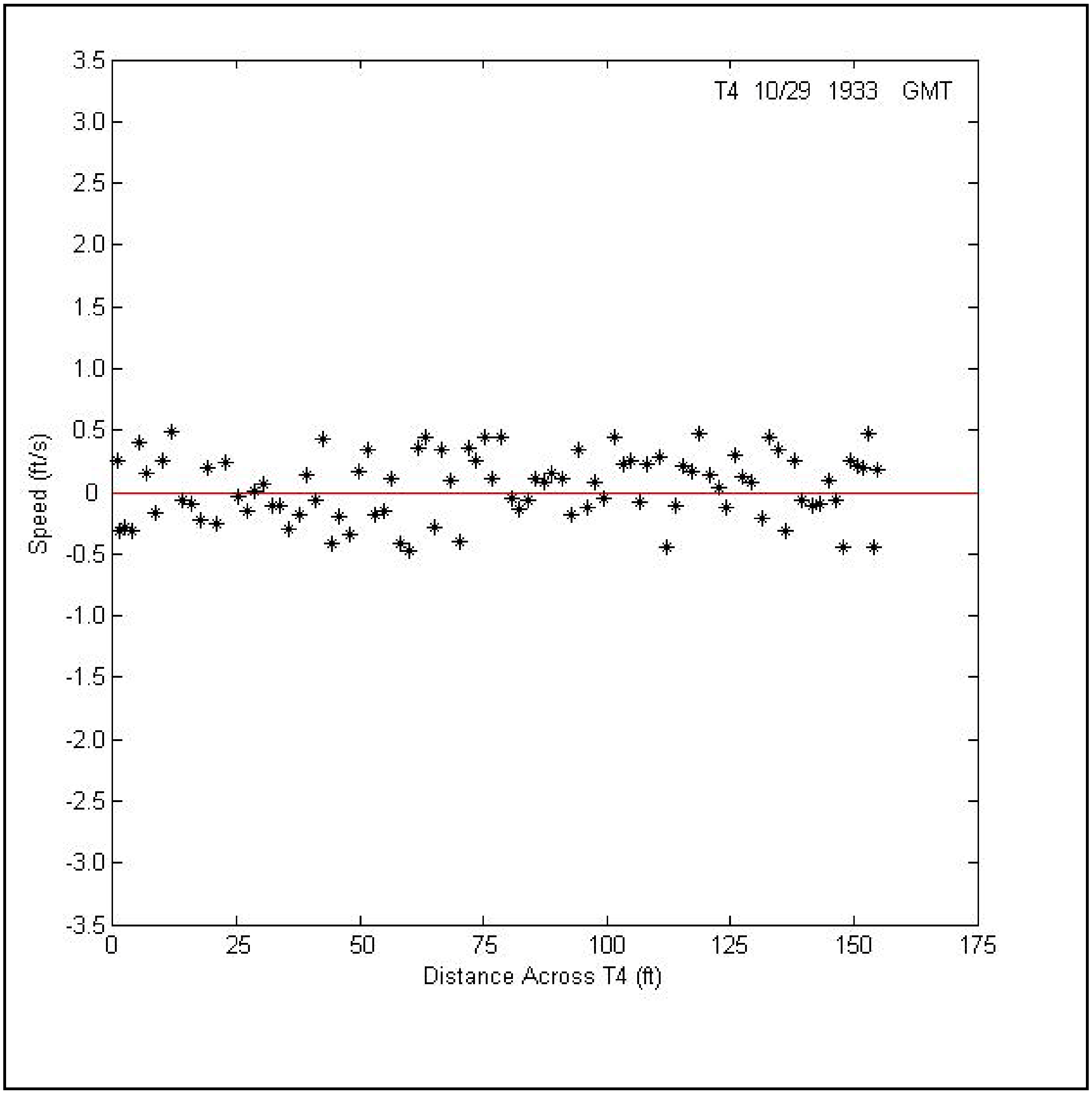

T4 10/29 1435 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

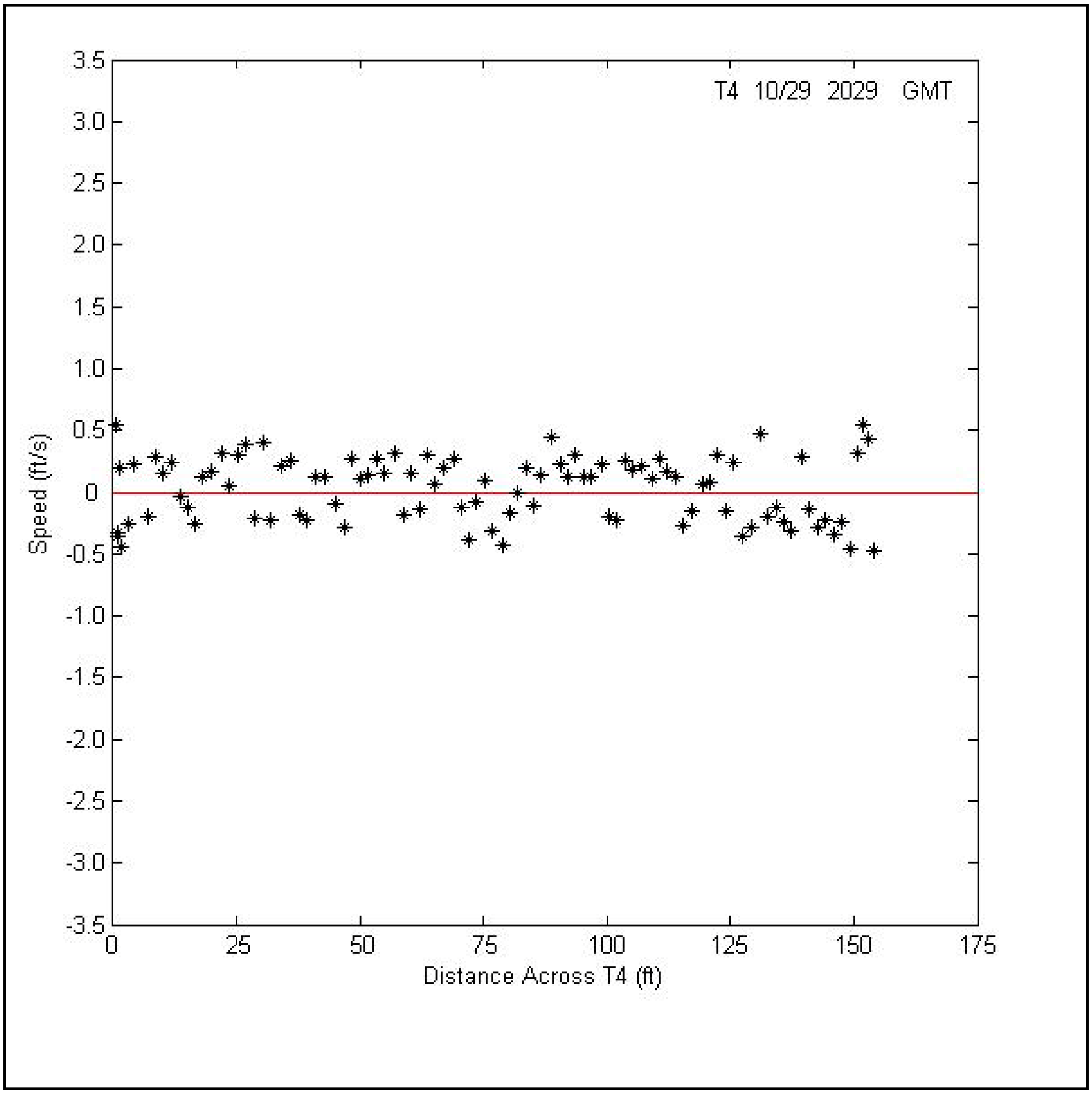

T4 10/29 1534 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)


T4 10/29 1621 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

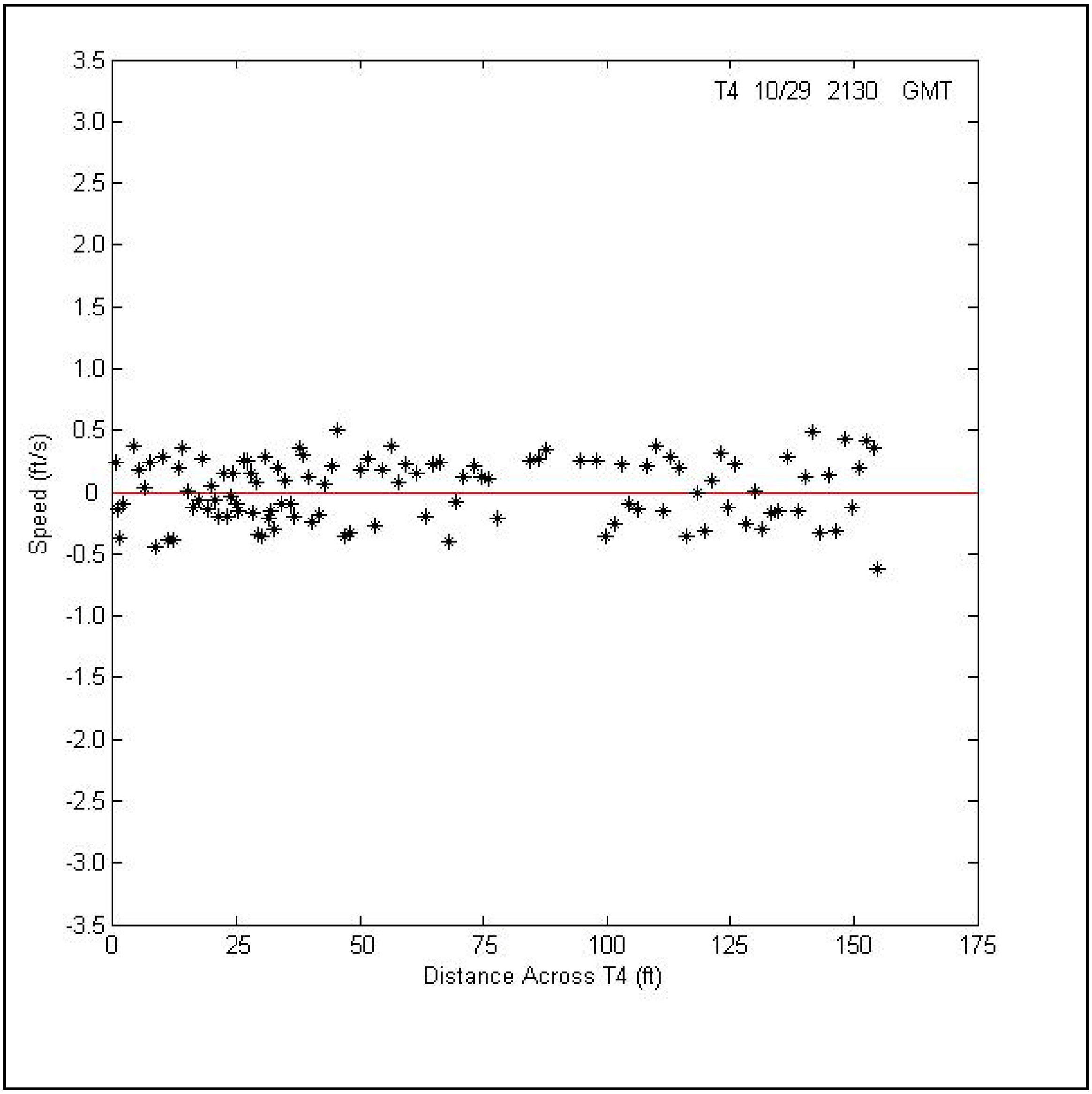

T4 10/29 1734 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

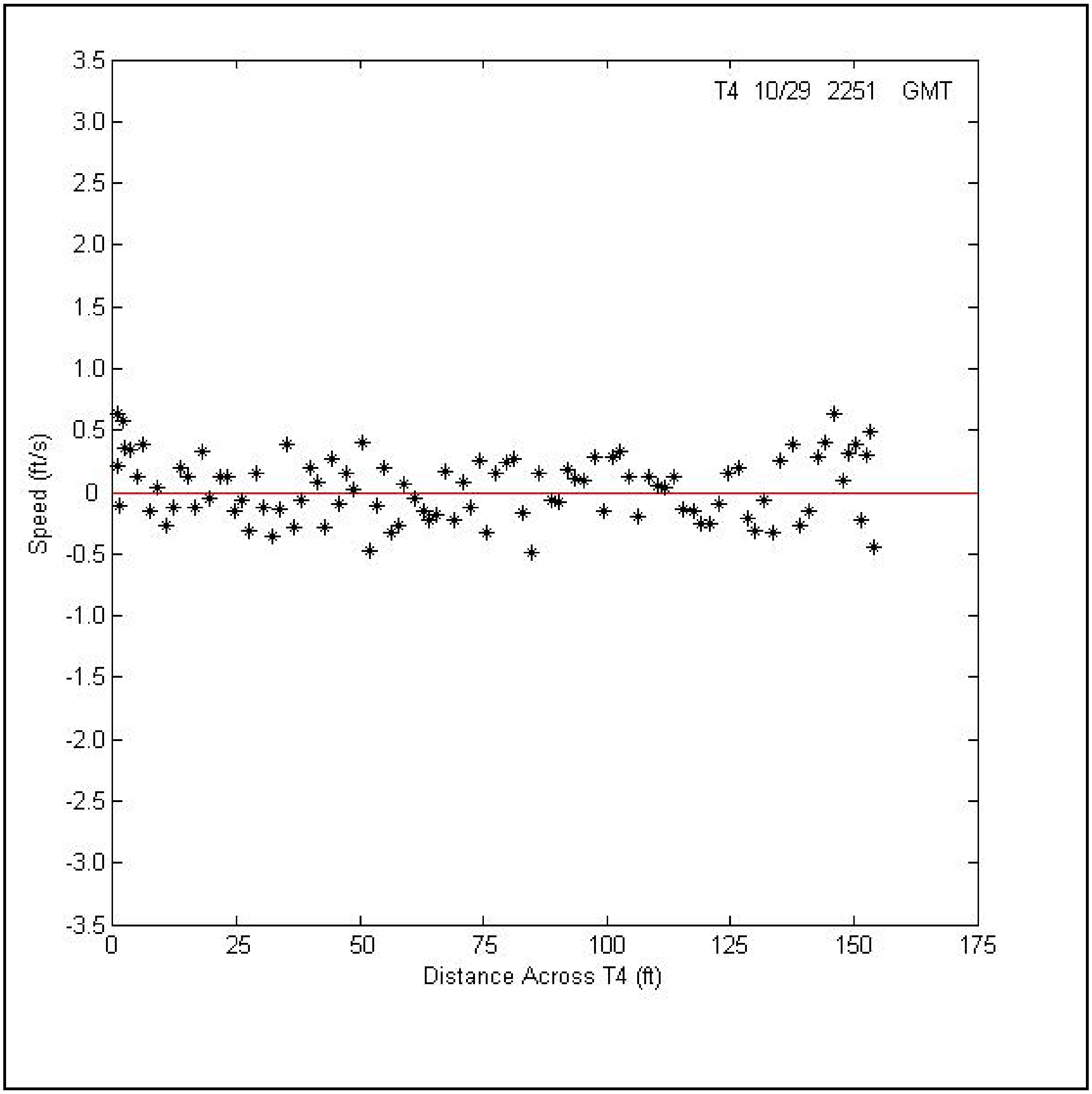

T4 10/29 1835 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)


T4 10/29 1933 GMT
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

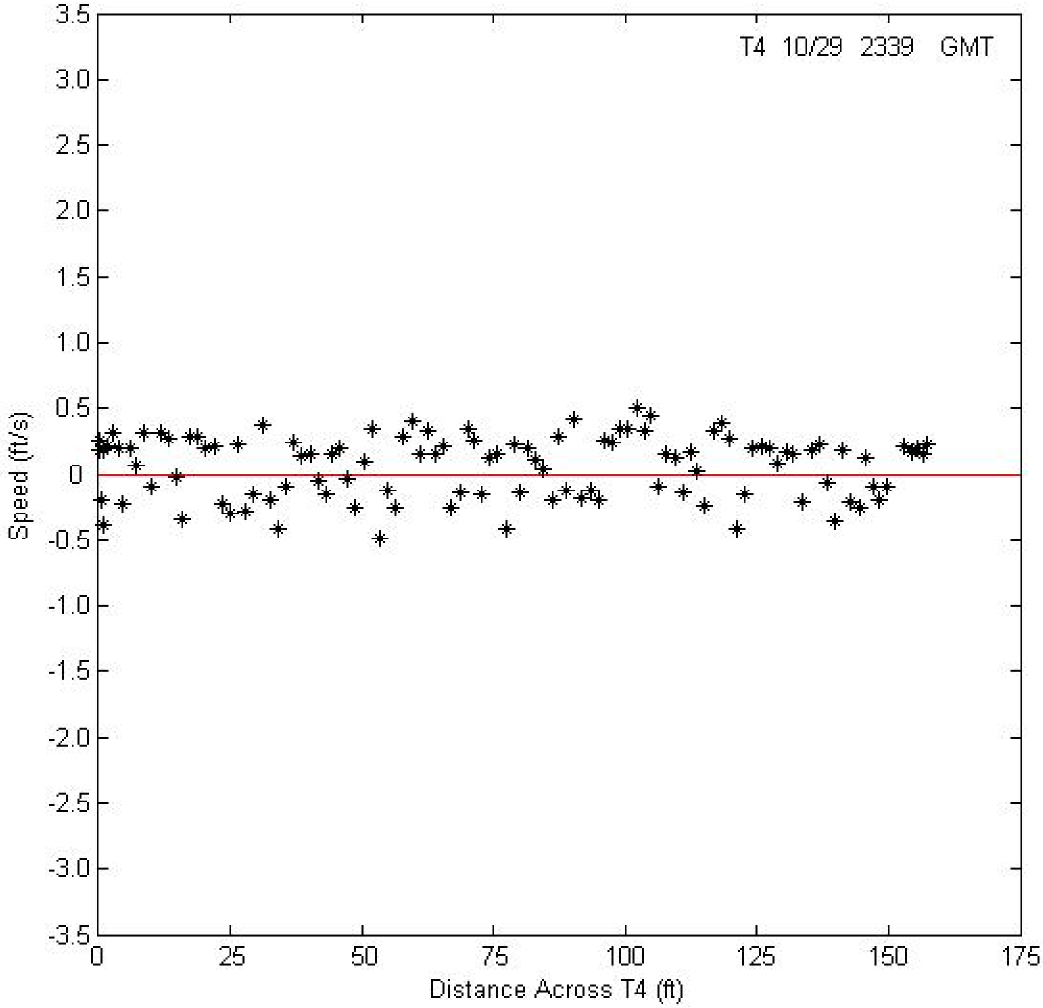


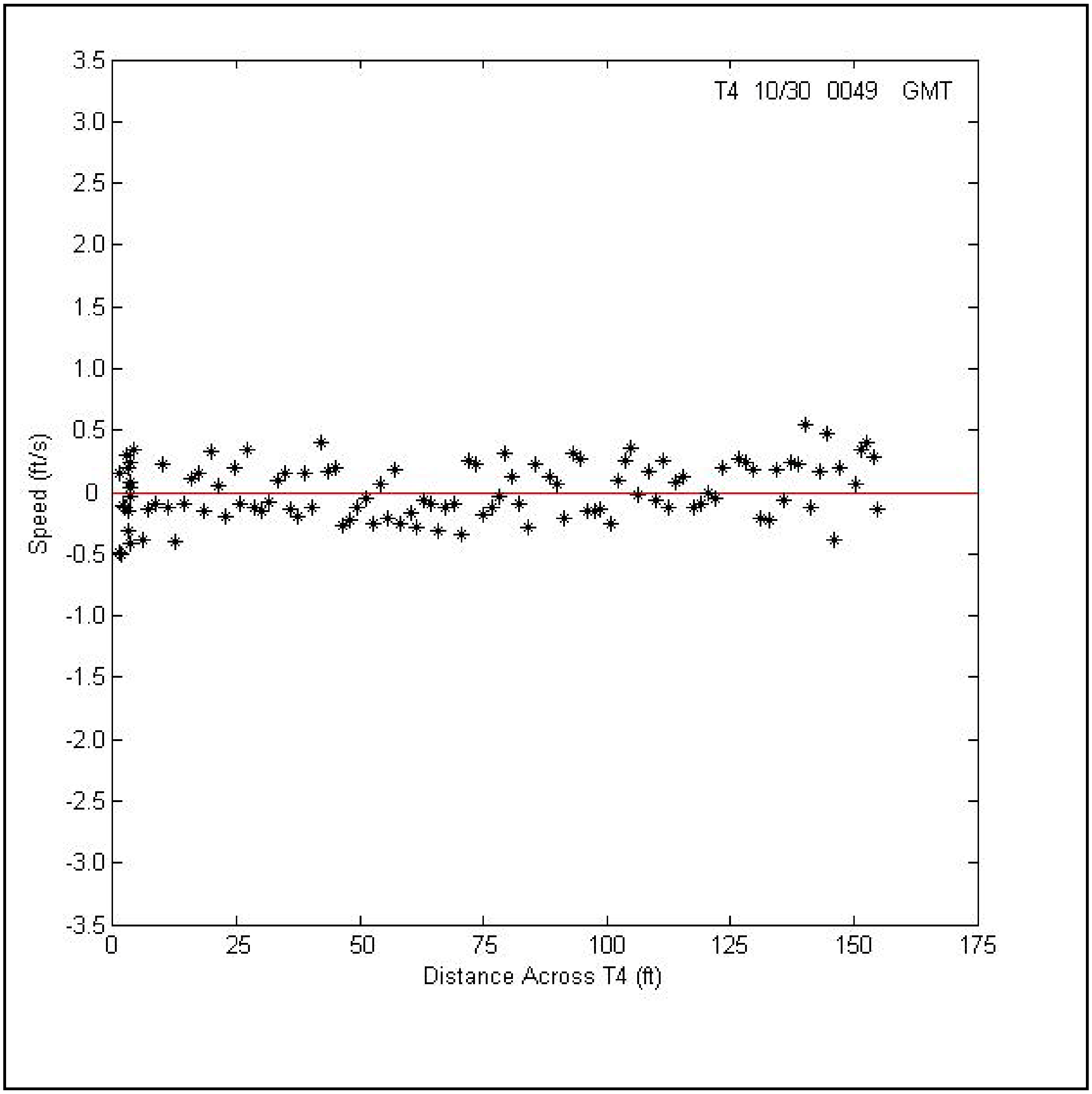
T4 10/29 2029 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175


T4 10/29 2130 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

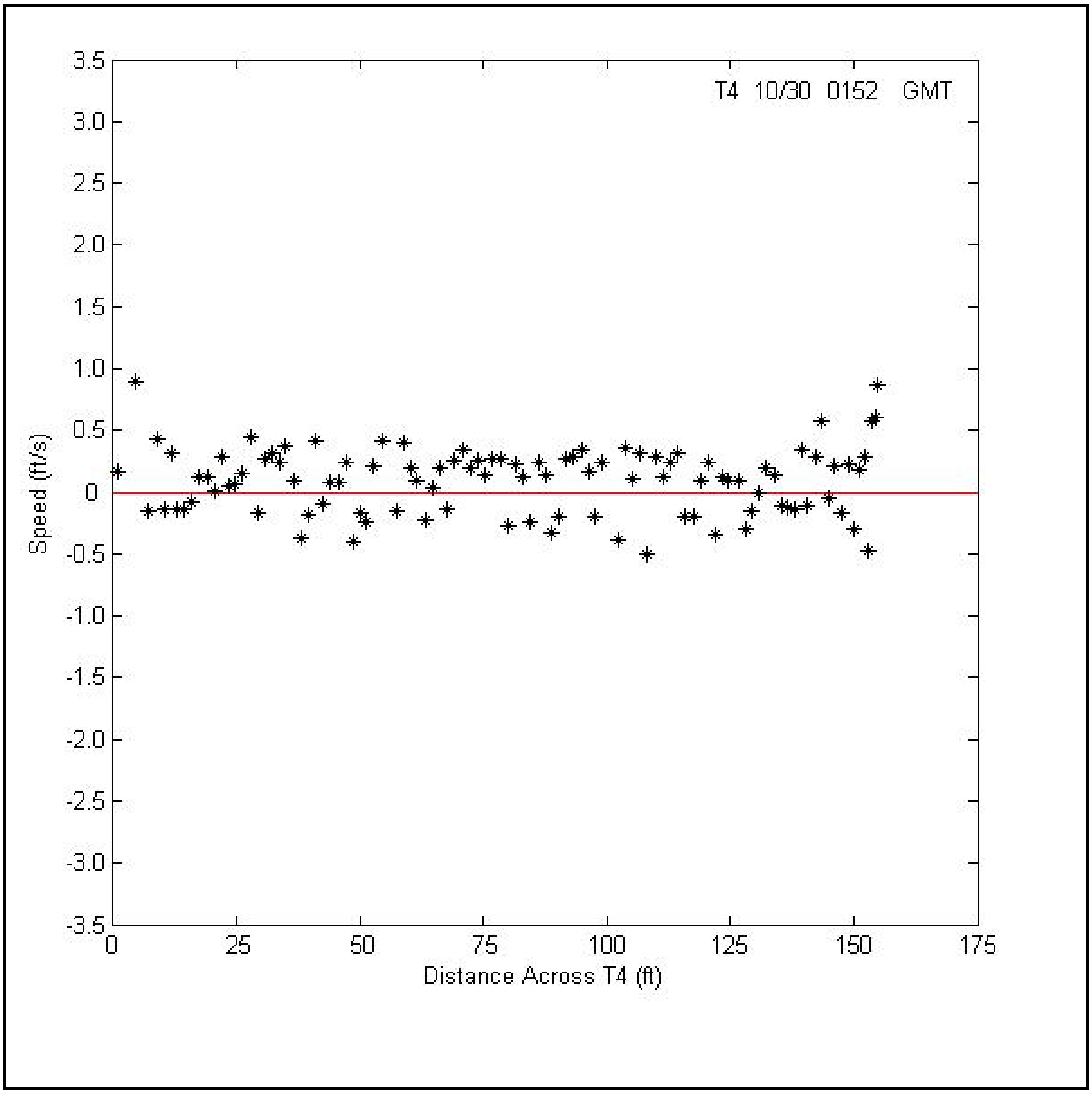


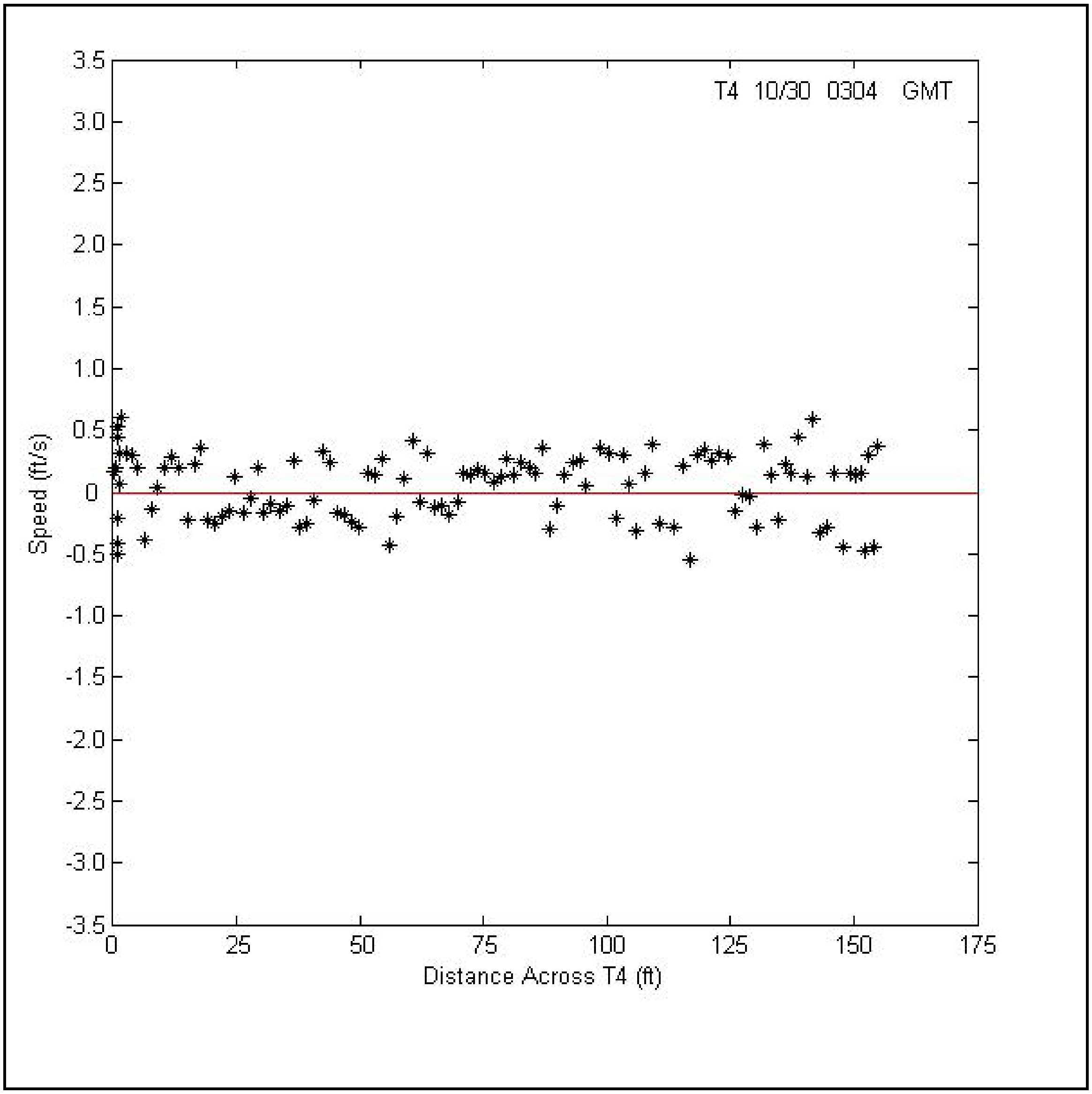
T4 10/29 2251 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

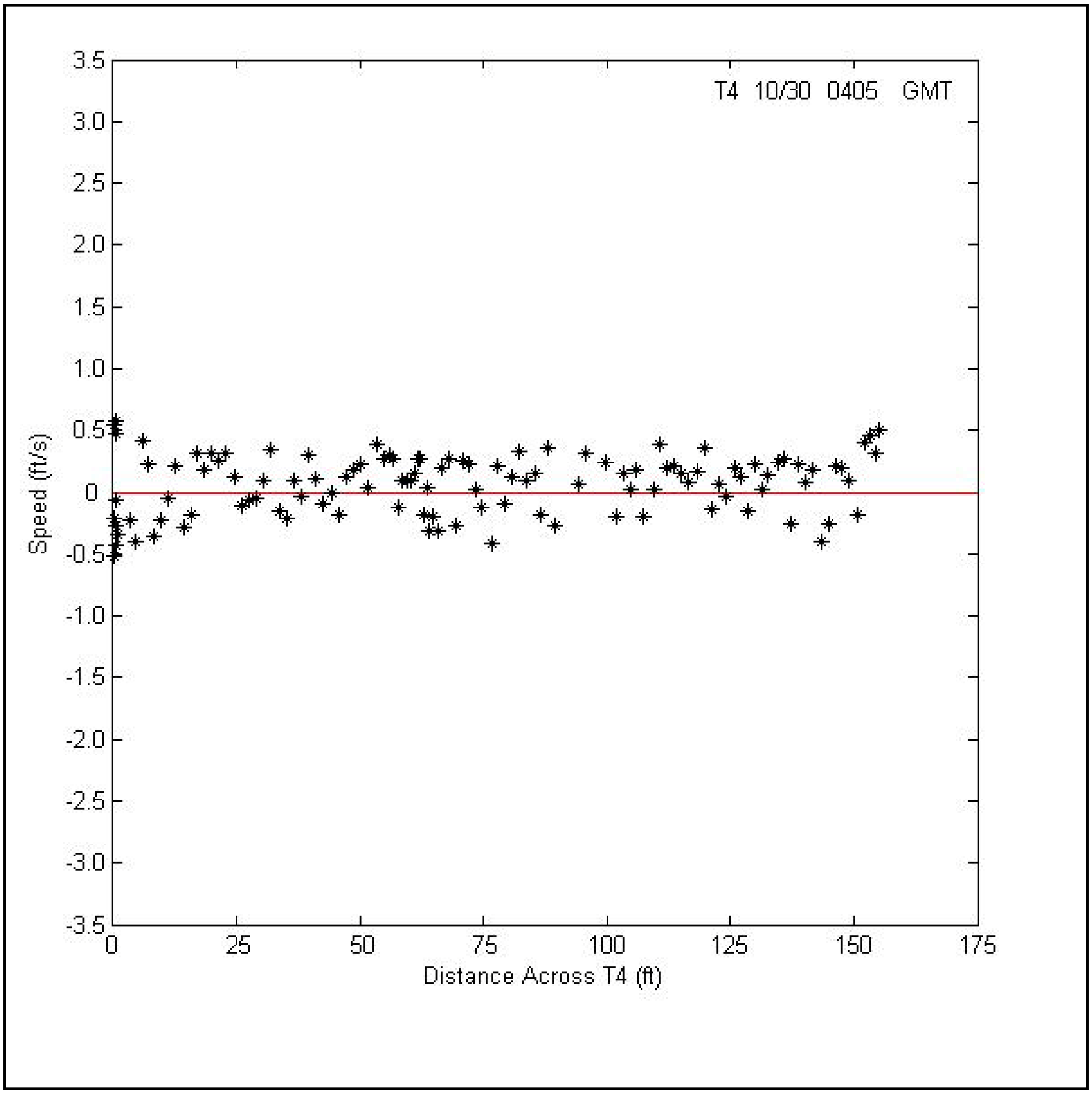

T4 10/29 2339 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

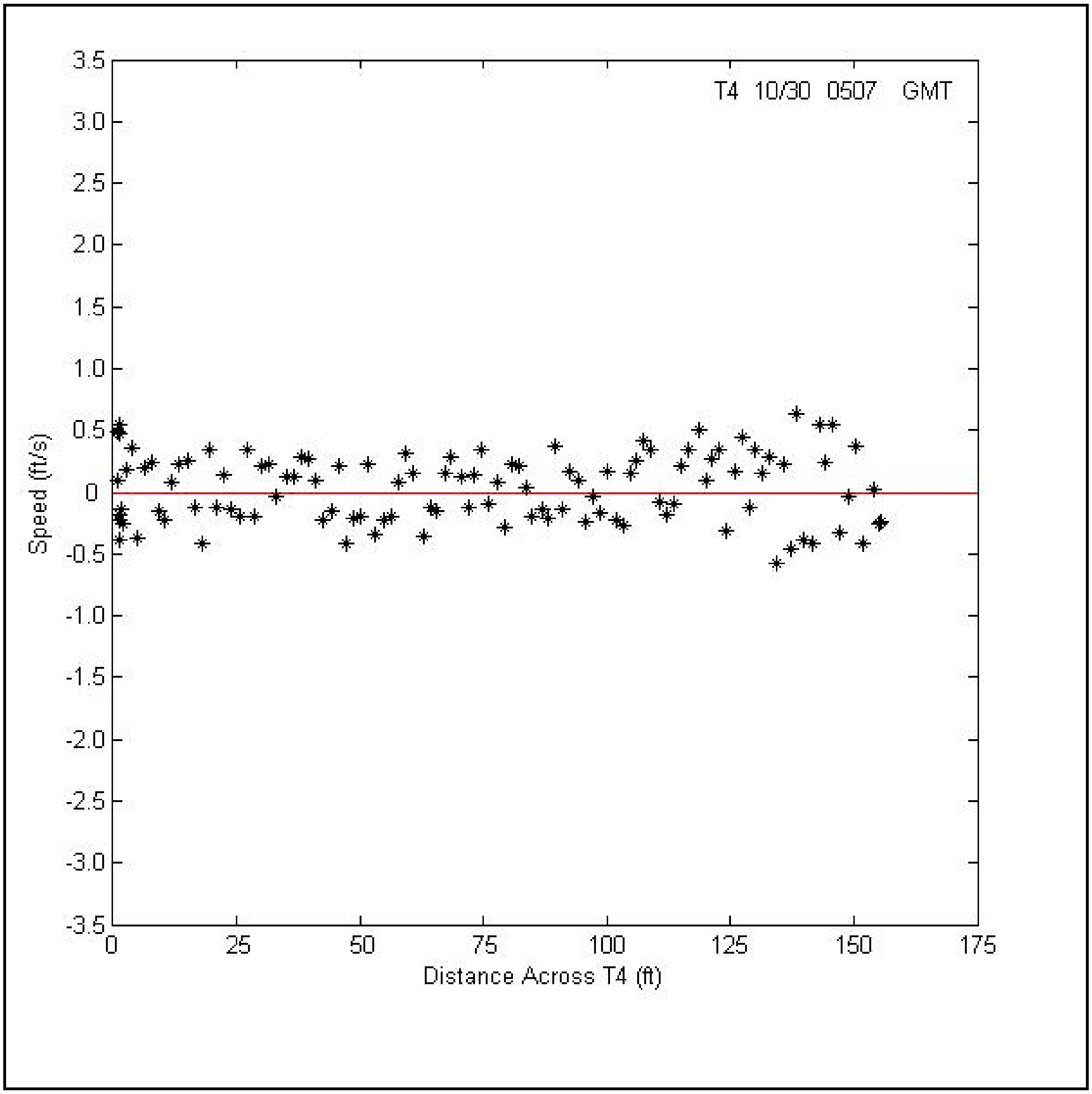


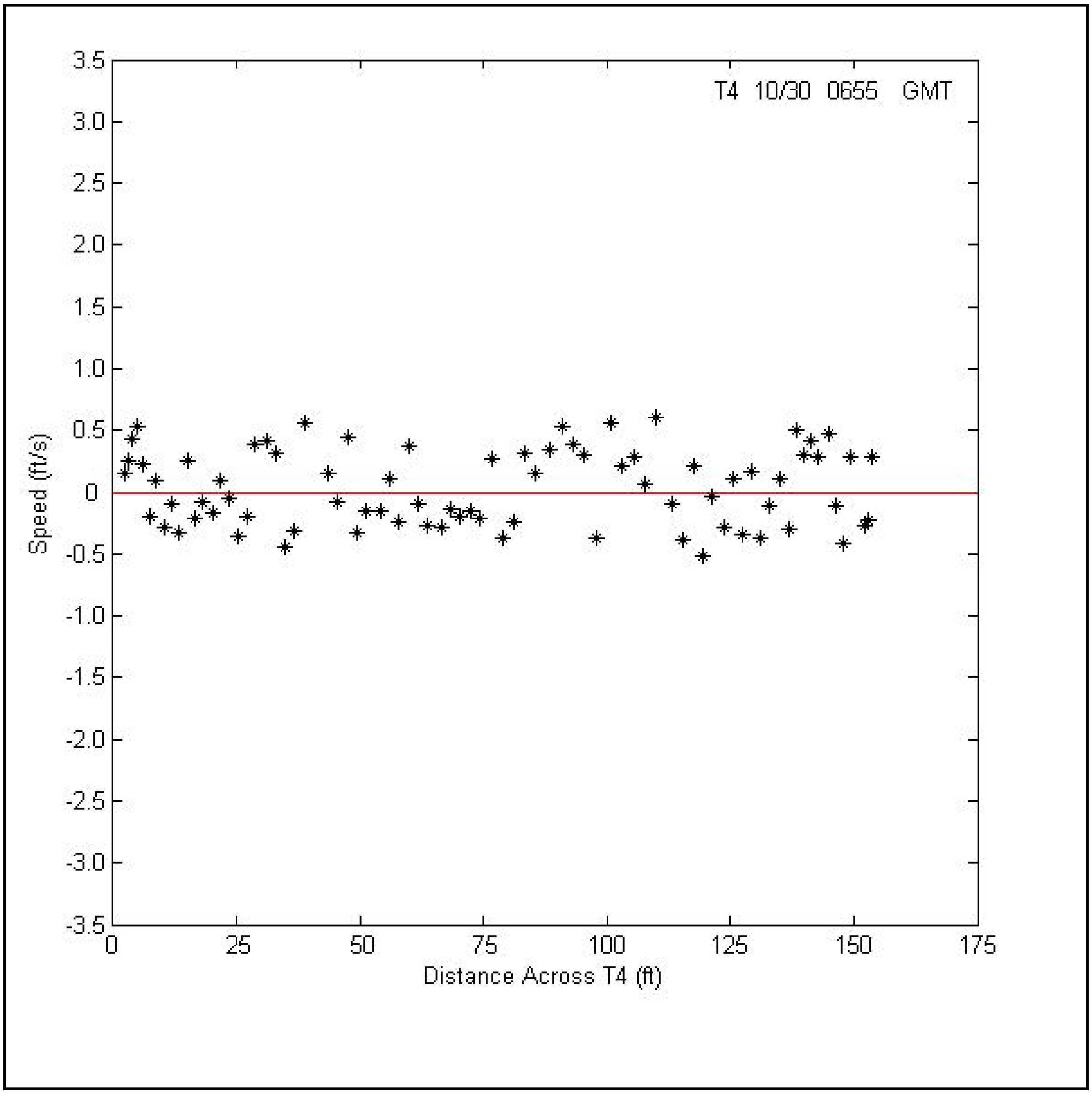
T4 10/30 0049 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

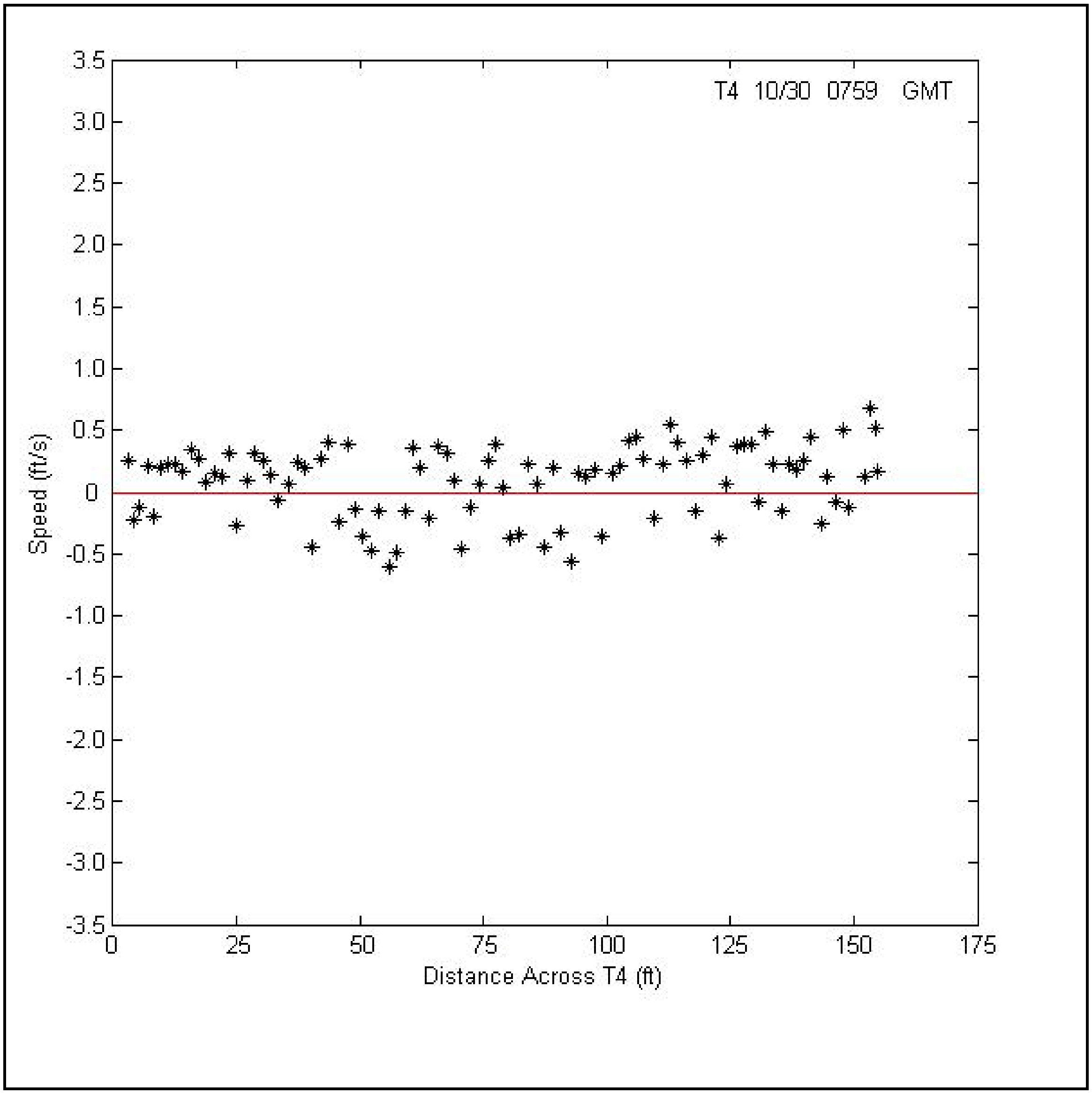

T4 10/30 0152 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175


T4 10/30 0304 GMT
Speed (ft/s)
Distance Across T4 (ft)

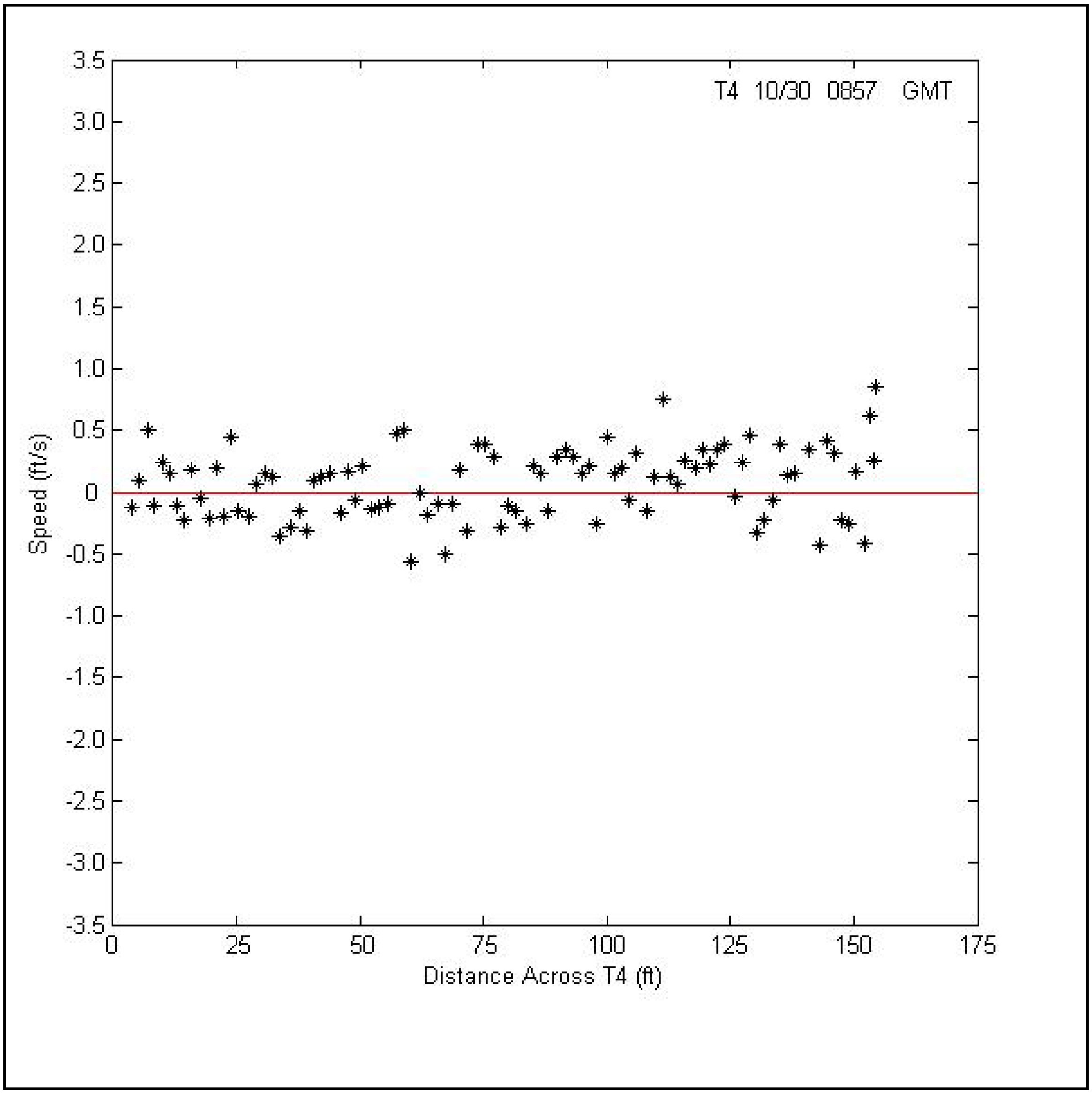

T4 10/30 0405 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

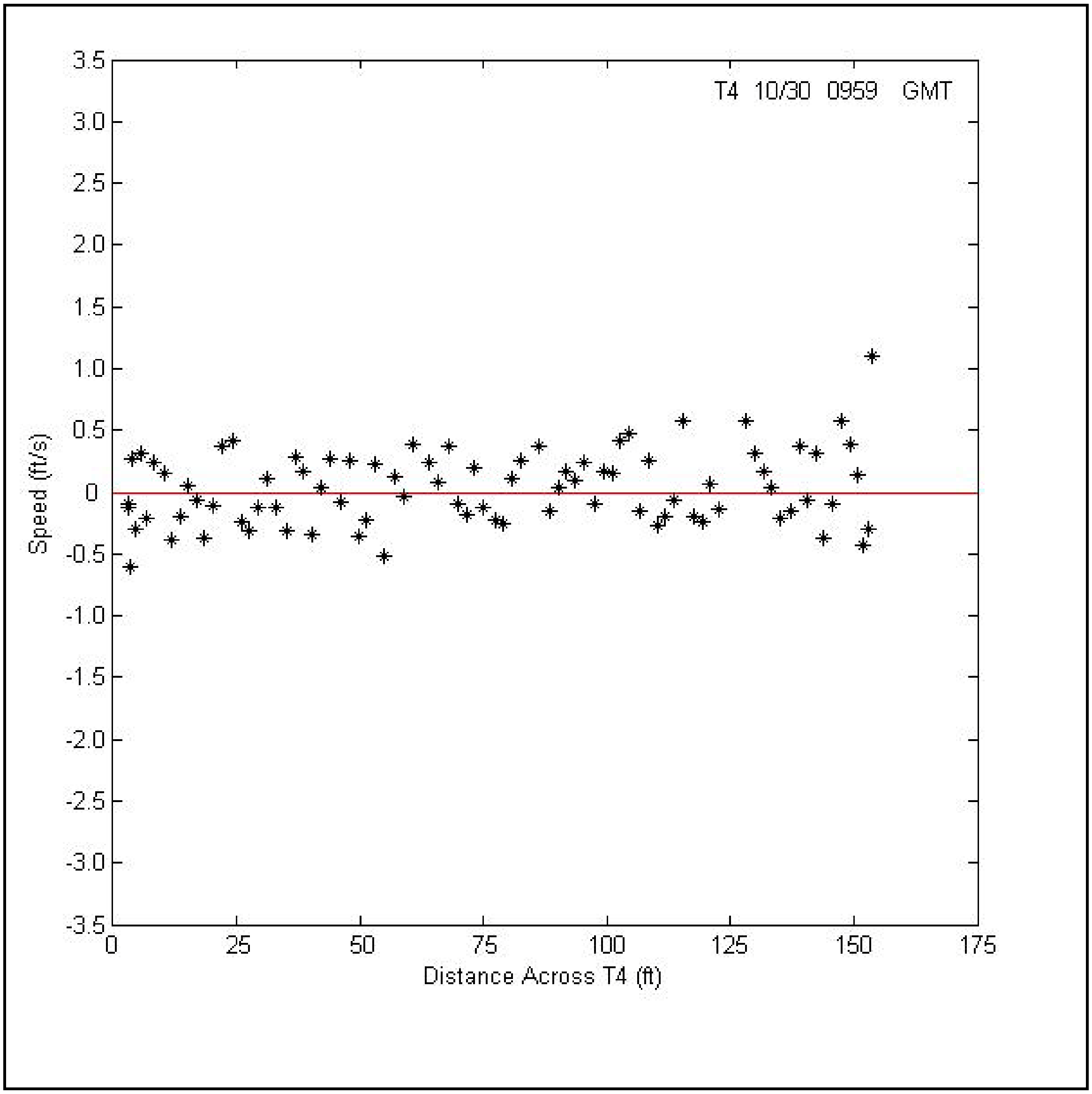

T4 10/30 0507 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

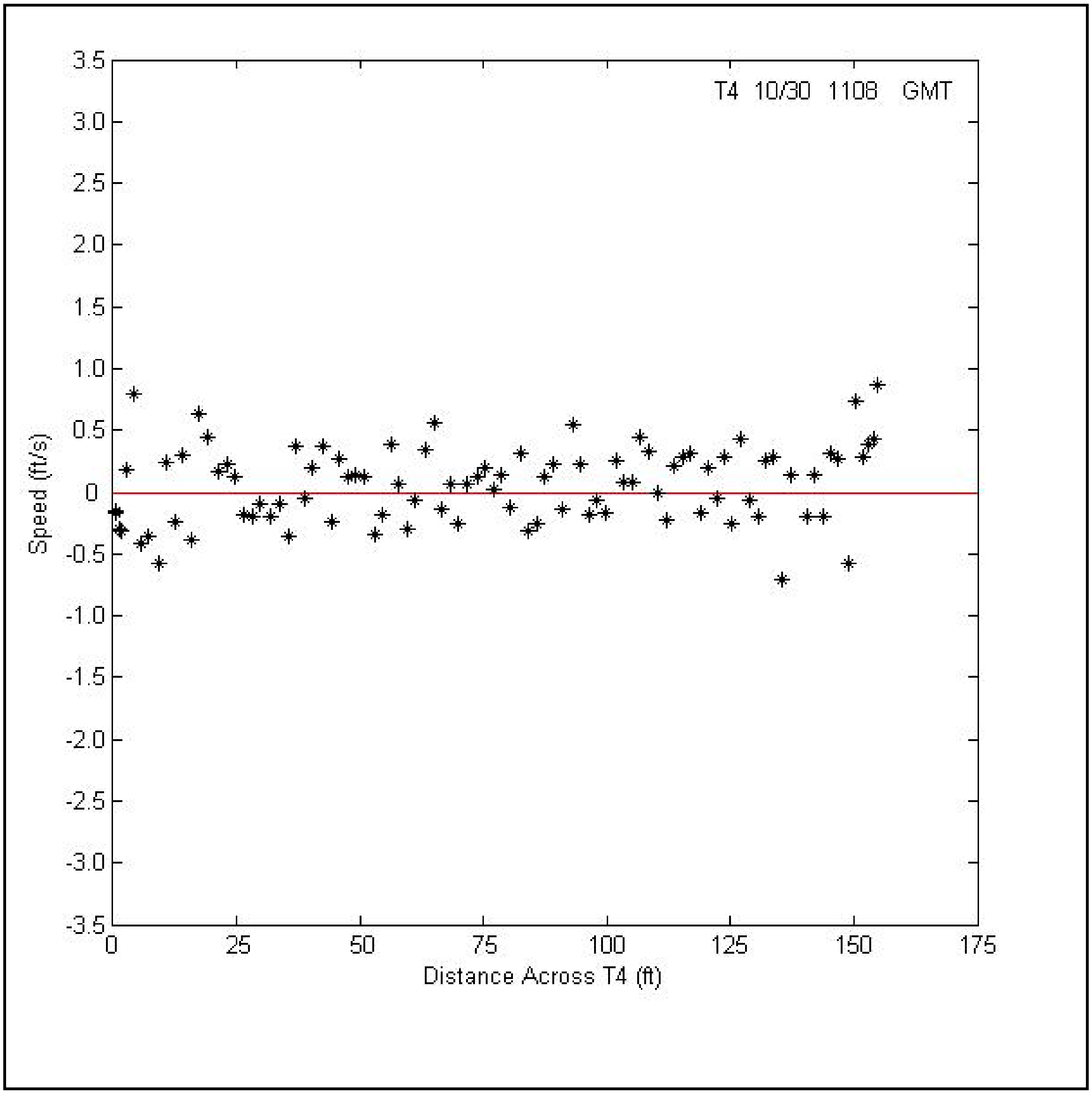

T4 10/30 0655 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

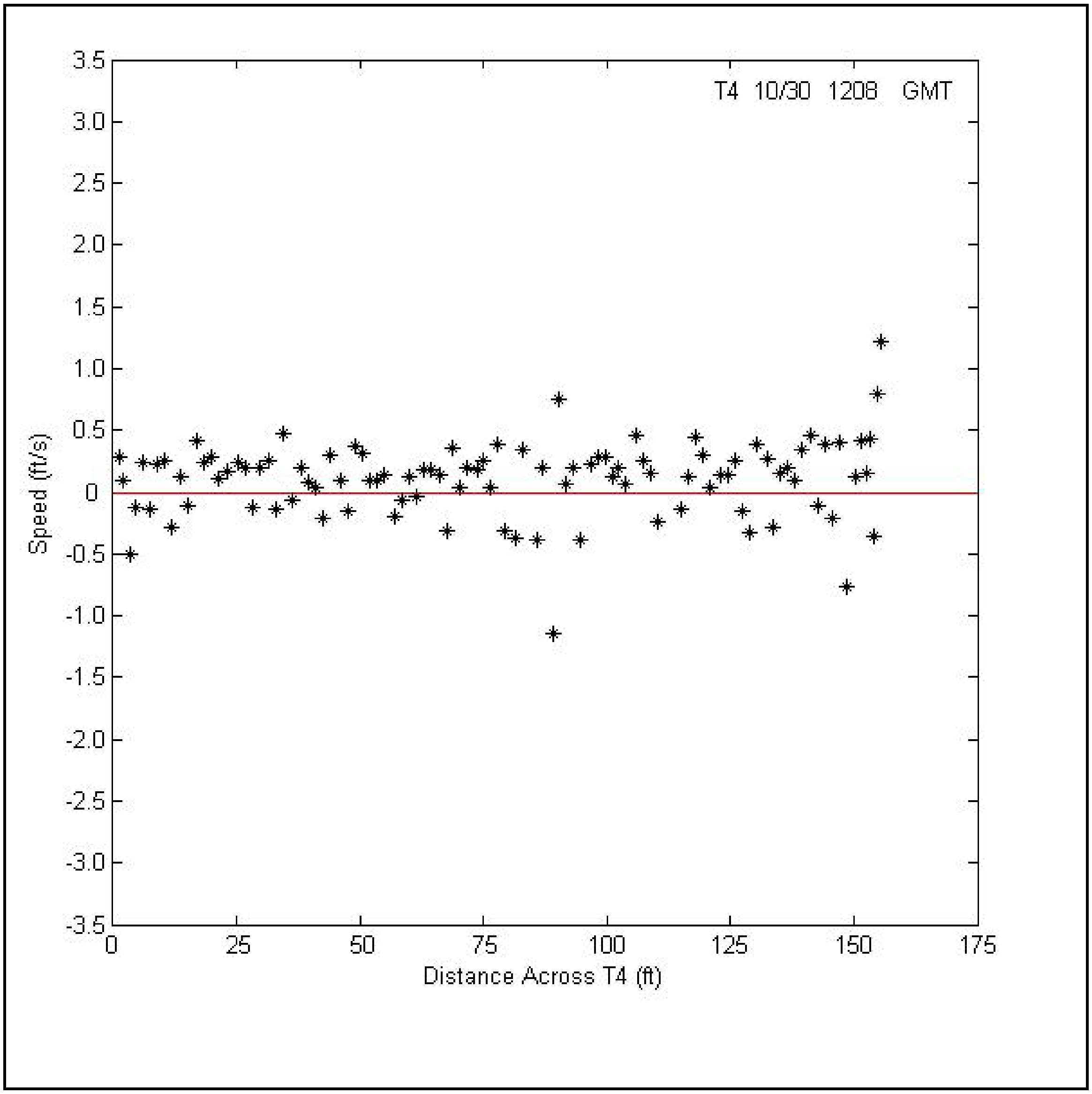


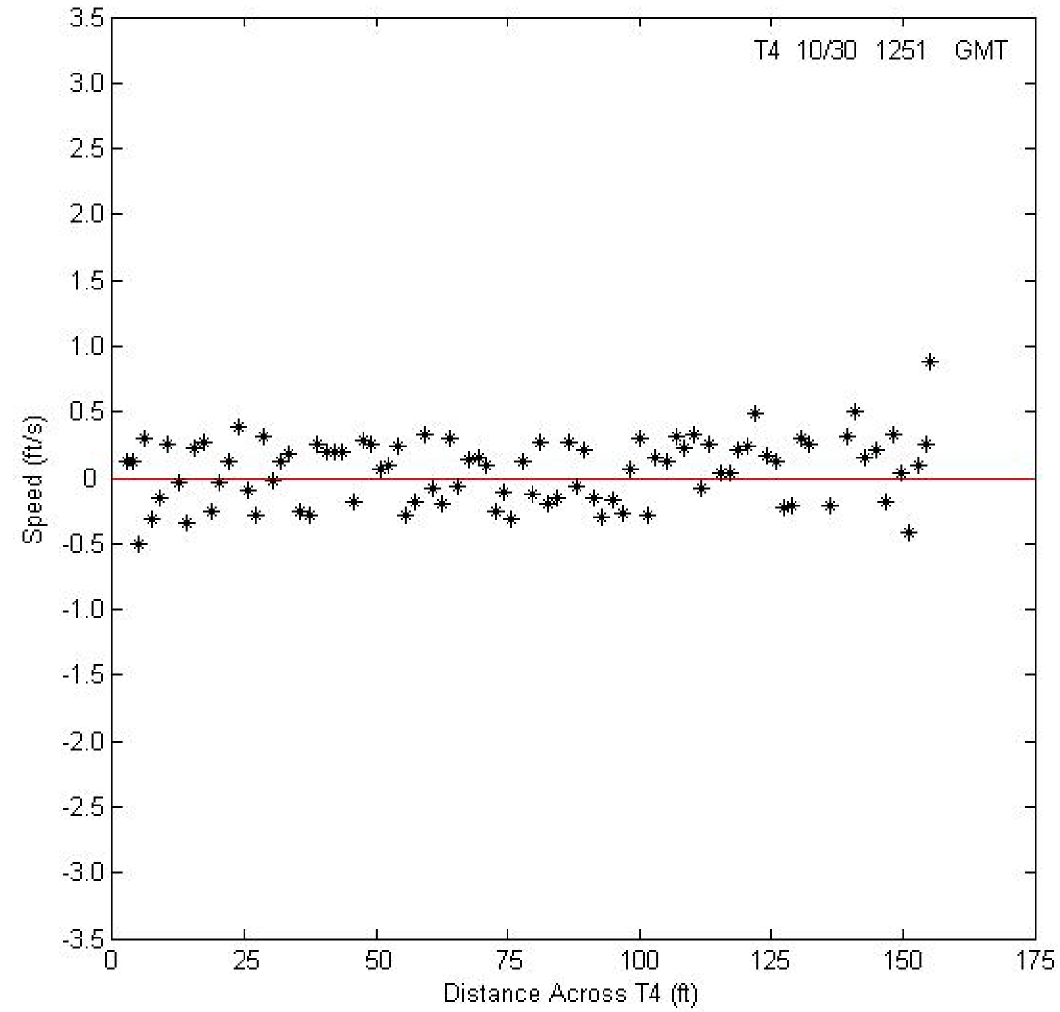
T4 10/30 0759 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

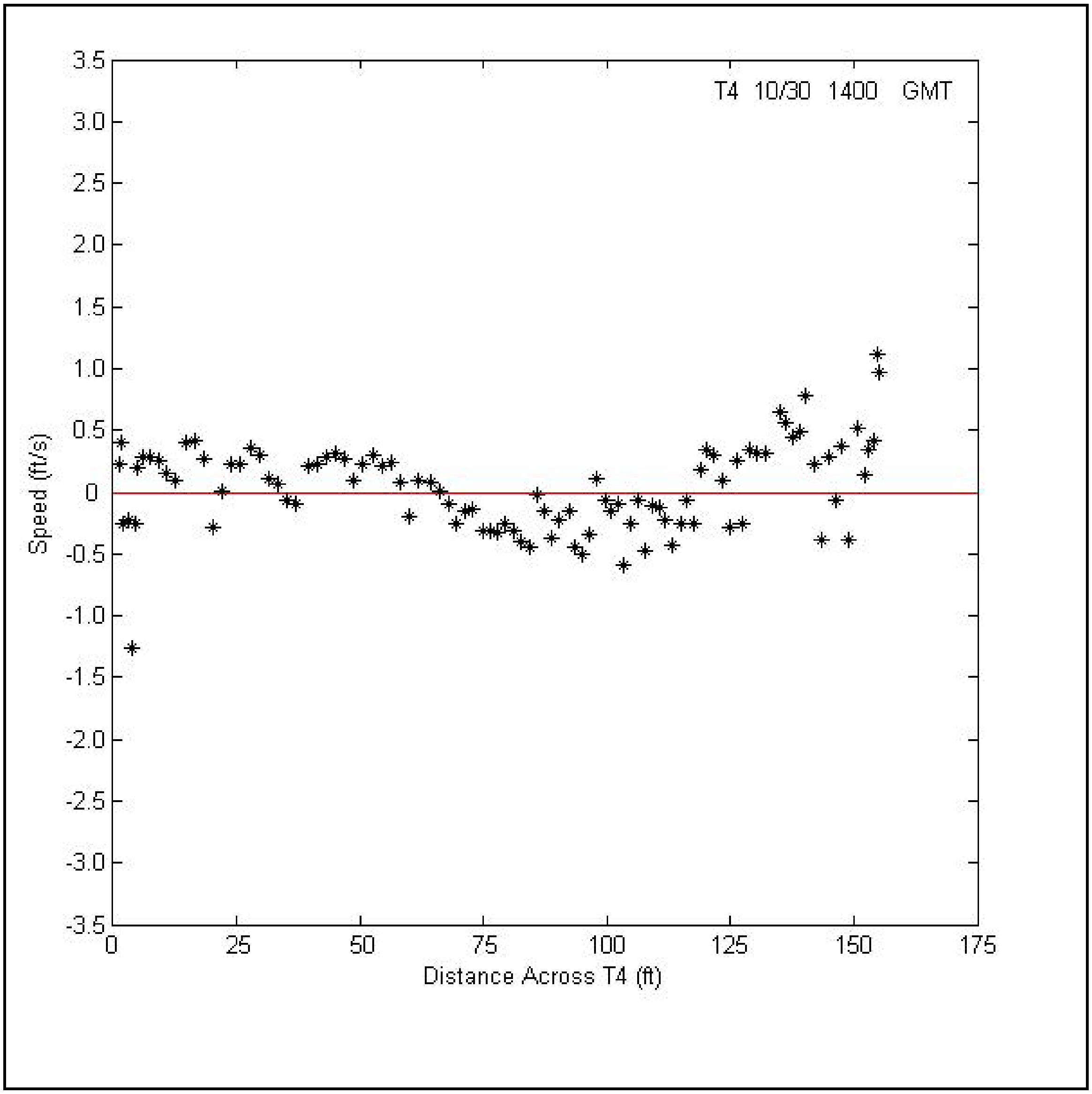

T4 10/30 0857 GMT
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

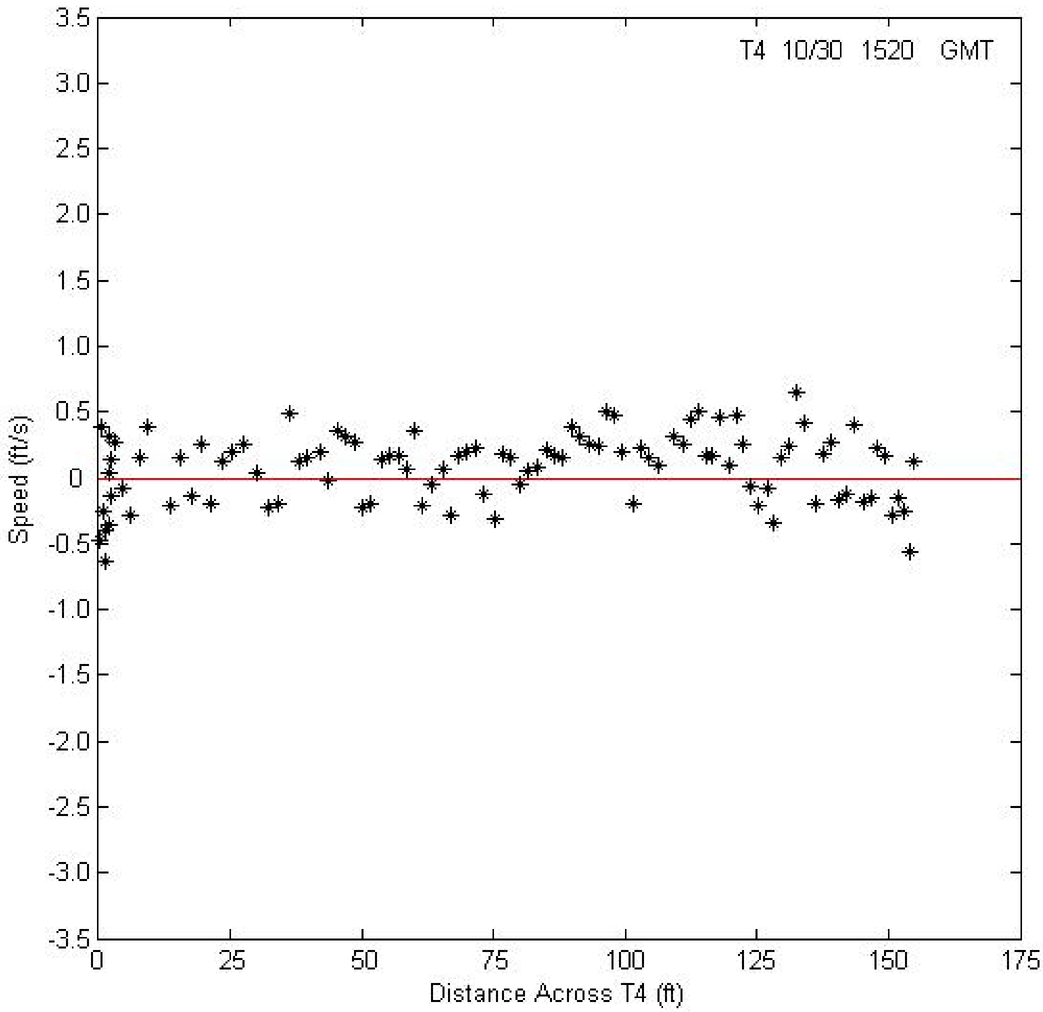

T4 10/30 0959 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175


T4 10/30 1108 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175

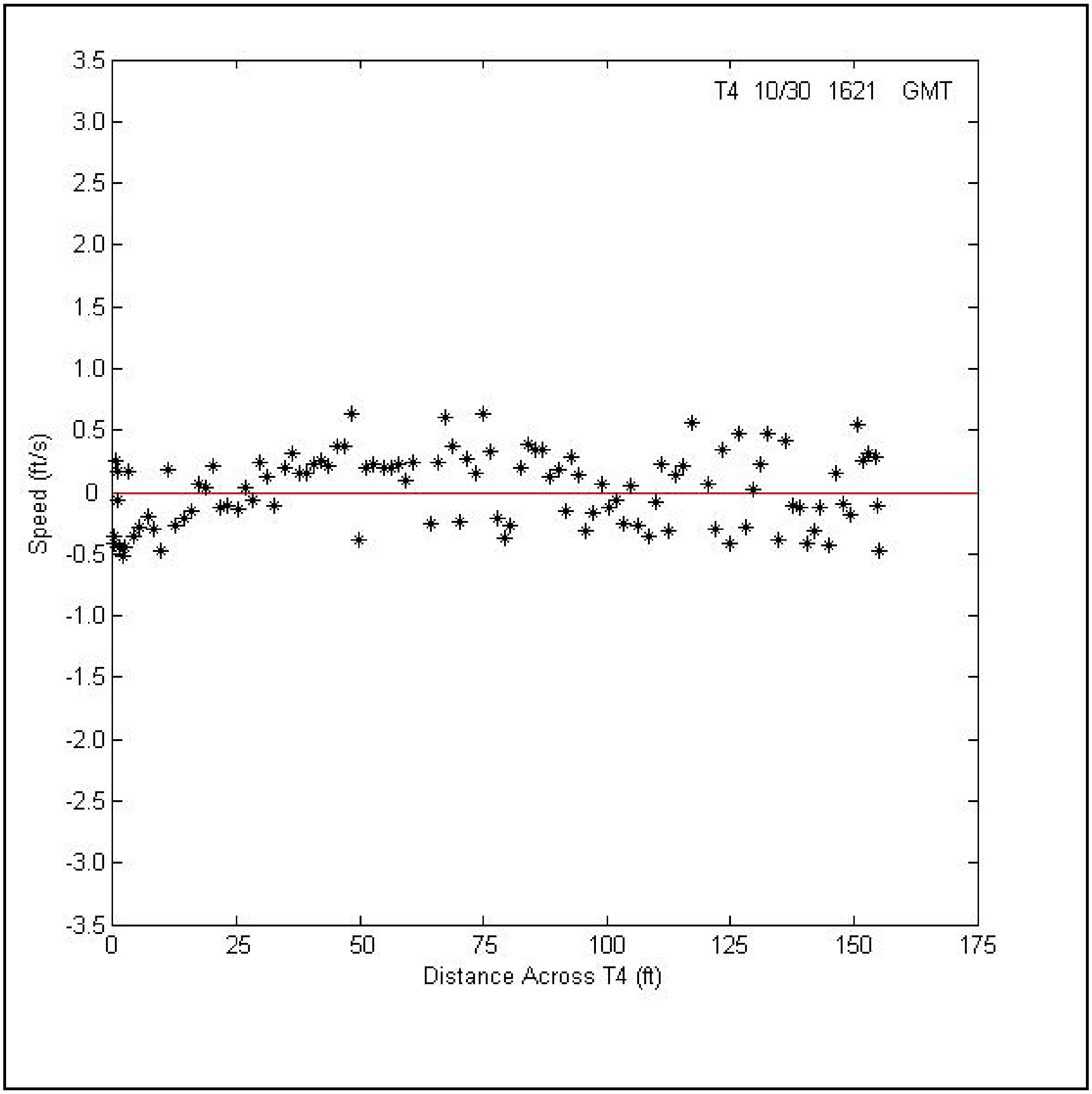

T4 10/30 1208 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)


T4 10/30 1251 GMT
Speed (ft/s)
Distance Across T4 (ft)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175


T4 10/30 1400 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

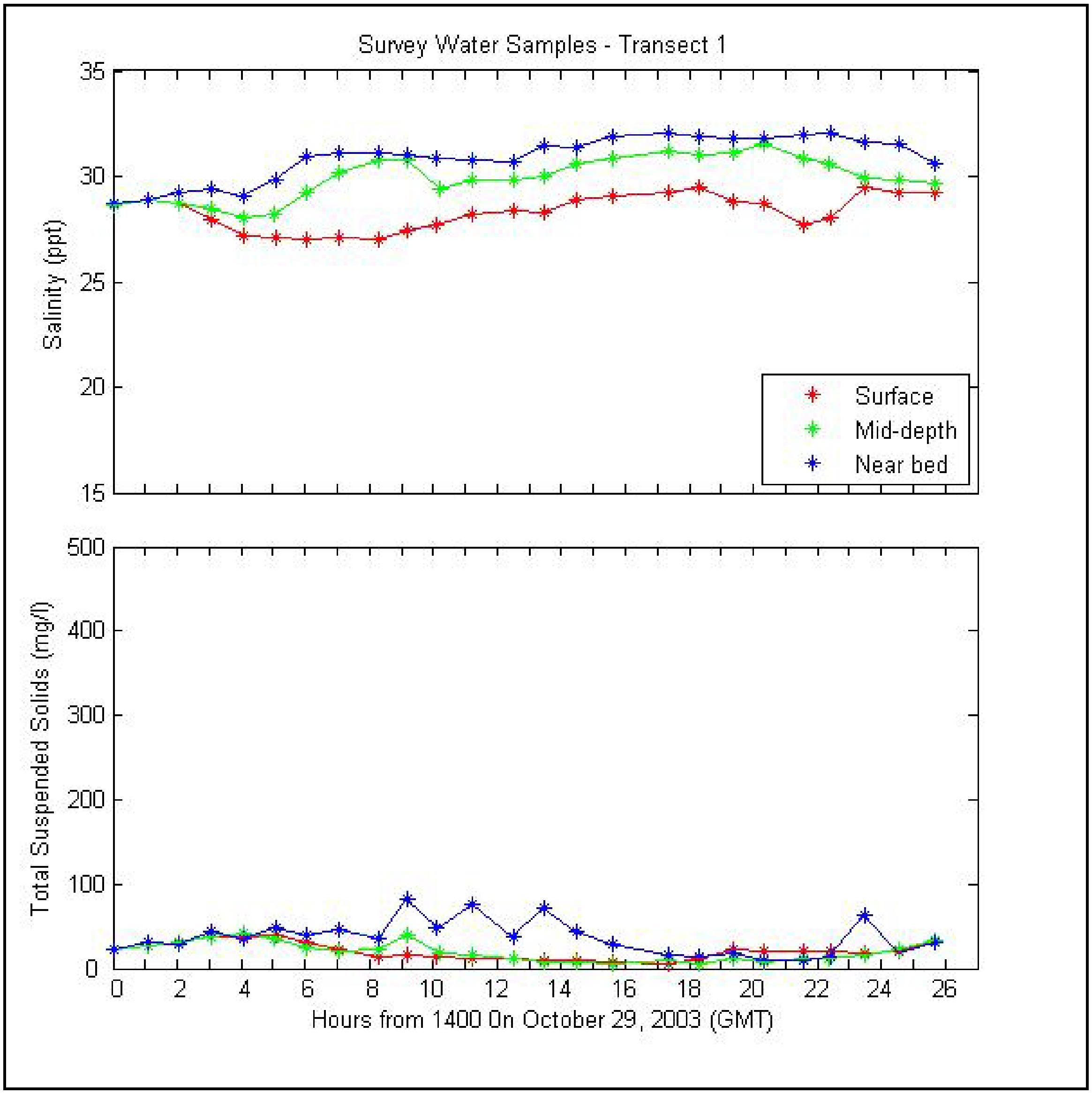


T4 10/30 1520 GMT
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Speed (ft/s)
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

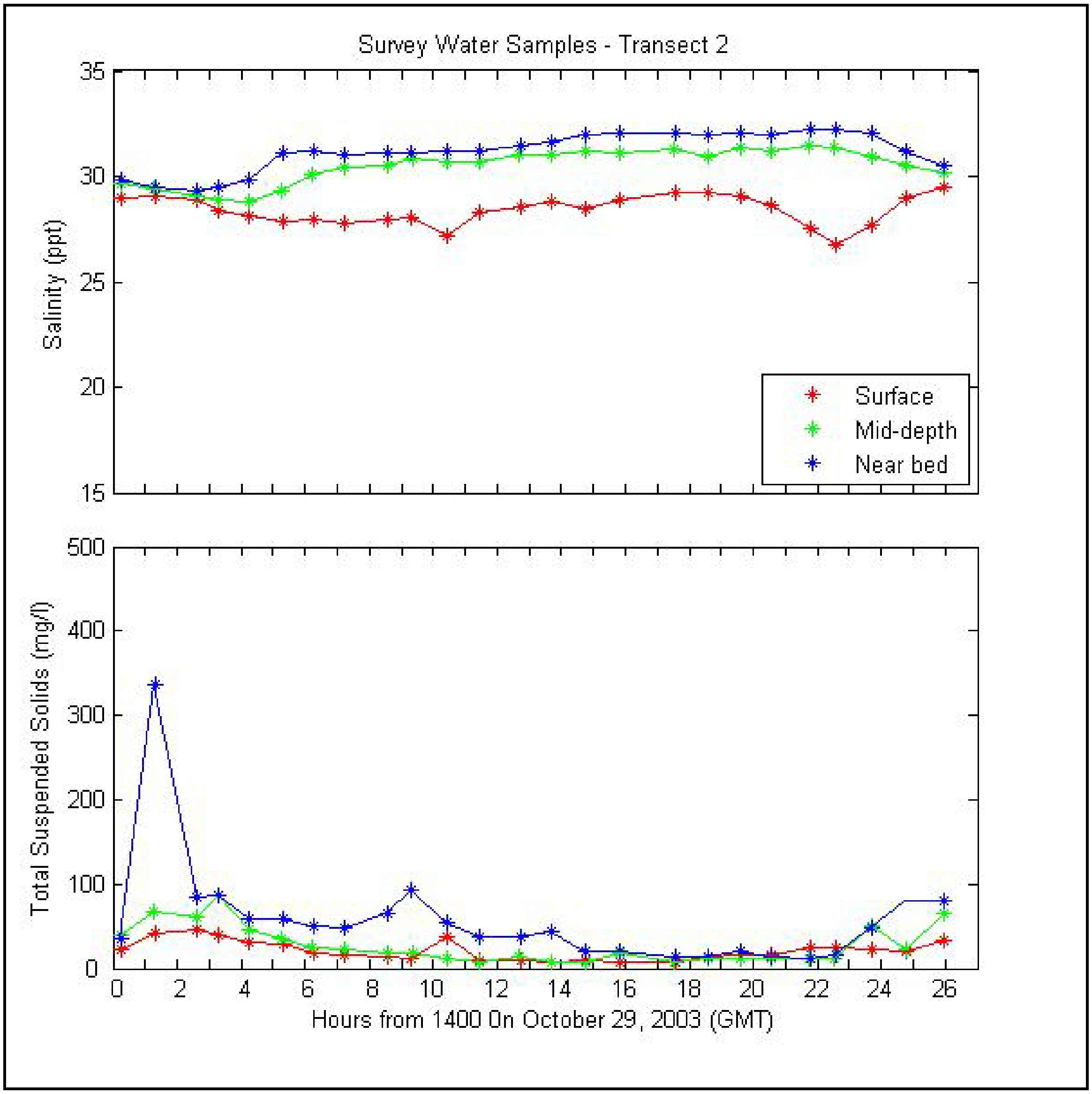

T4 10/30 1621 GMT
Speed (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
Distance Across T4 (ft)

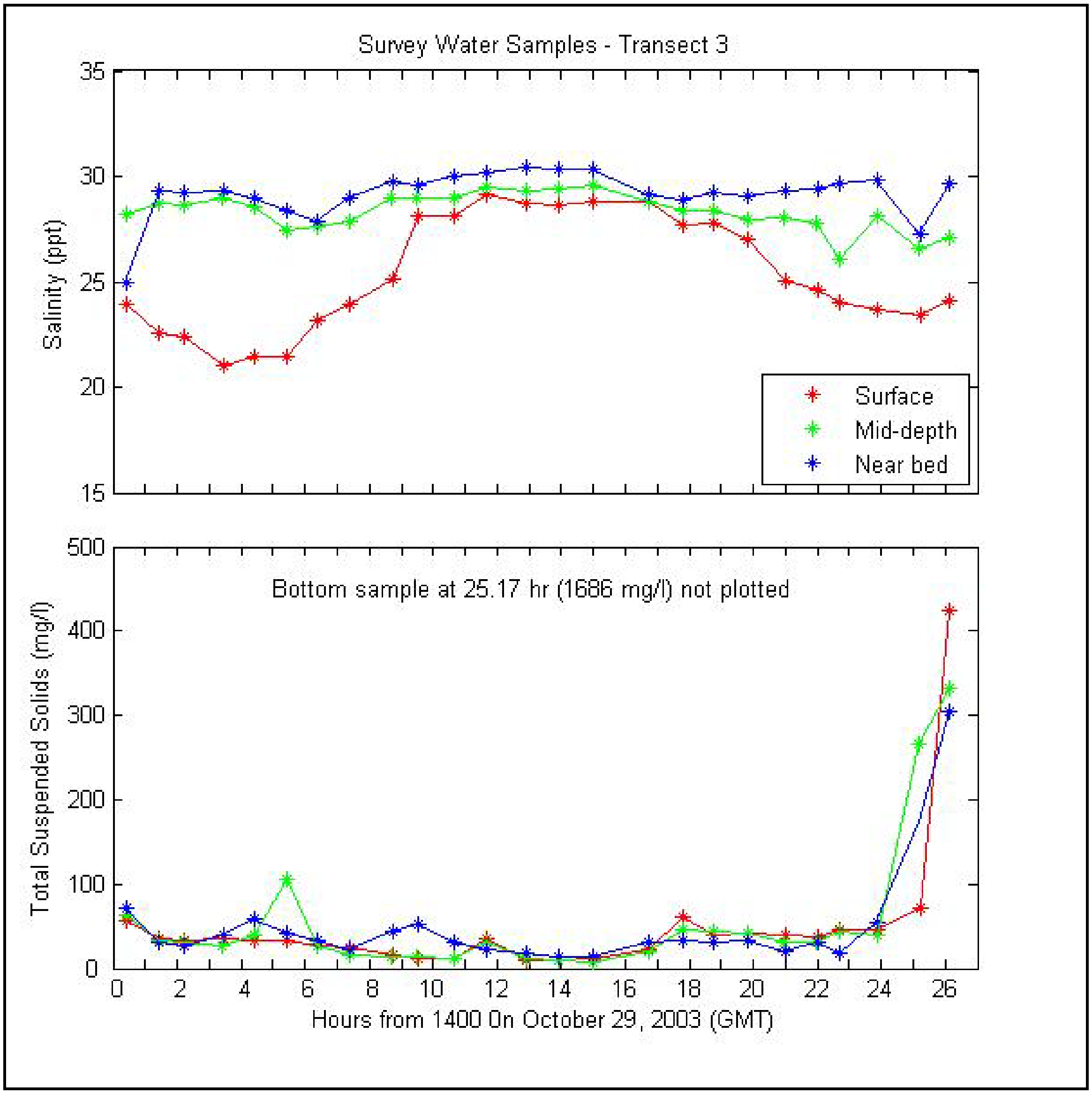
Appendix E Transect Water Samples, Salinities and Total Suspended Solids Plots

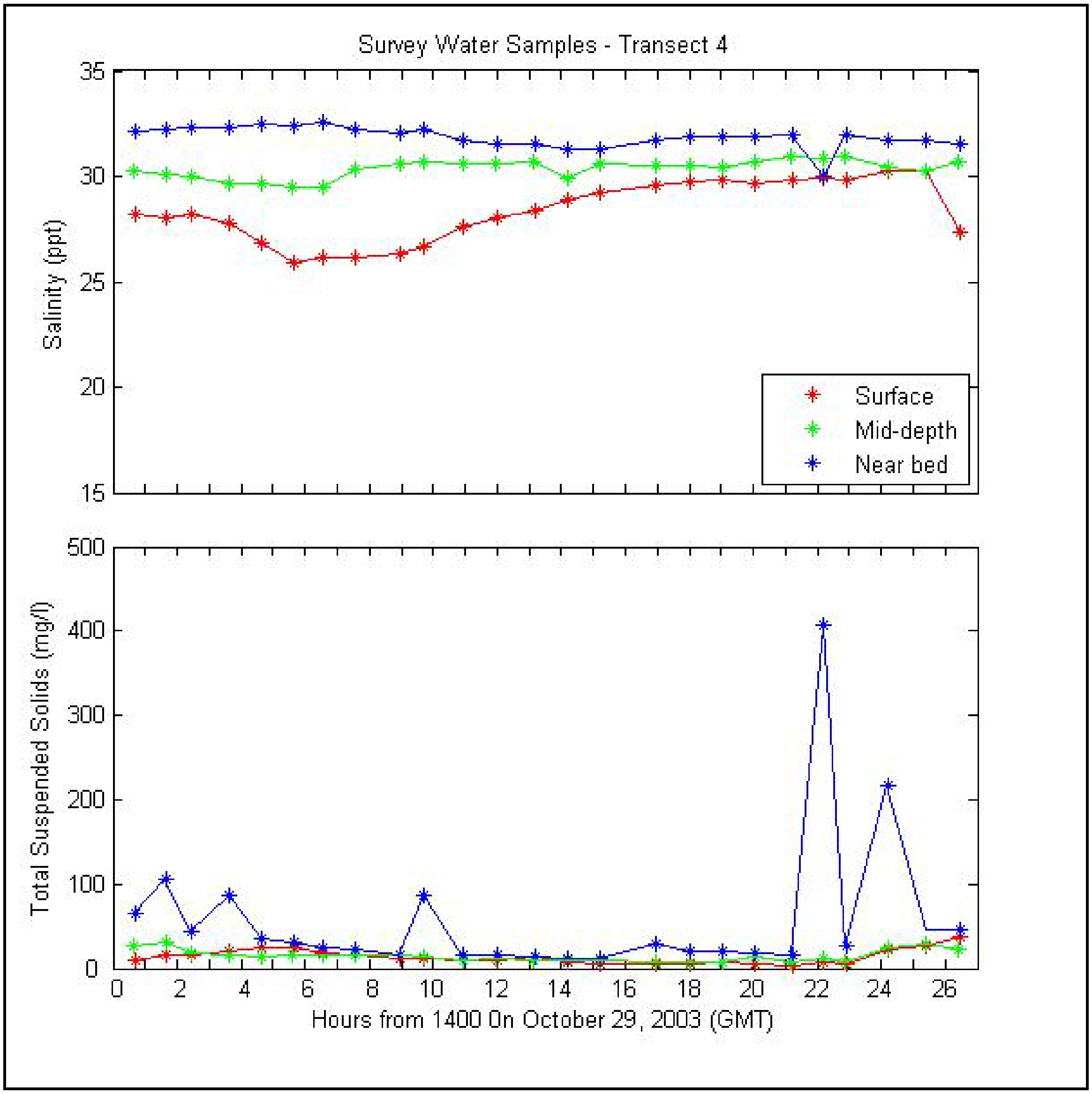
Contents



Survey Water Samples - Transect 1
Salinity (ppt)
35
30
25
20
15
Surface
Mid-depth
Near bed
Total Suspended Solids (mg/l)
500
400
300
200
100
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Hours from 1400 On October 29, 2003 (GMT)


Survey Water Samples - Transect 2
Salinity (ppt)
35
30
25
20
15
Surface
Mid-depth
Near bed
Total Suspended Solids (mg/l)
500
400
300
200
100
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Hours from 1400 On October 29, 2003 (GMT)


Survey Water Samples - Transect 3
Salinity (ppt)
35
30
25
20
15
Surface
Mid-depth
Near bed
Total Suspended Solids (mg/l)
500
400
300
200
100
0
Bottom sample at 25.17 hr (1686 mg/l) not plotted
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Hours from 1400 On October 29, 2003 (GMT)


Survey Water Samples - Transect 4
Salinity (ppt)
35
30
25
20
15
Surface
Mid-depth
Near bed
Total Suspended Solids (mg/l)
500
400
300
200
100
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Hours from 1400 On October 29, 2003 (GMT)

Appendix F Mid-depth Water Samples, Salinities and Total Suspended Solids Concentrations

Contents

Station	North Latitude	West Longitude
BS1	28.910546	95.270452
BS2	28.912460	95.272242
BS3	28.914168	95.274249
BS4	28.916072	95.276047
BS5	28.917989	95.277830
BS6	28.919348	95.280170
BS7	28.921287	95.281921
BS8	28.923217	95.283687
BS9	28.924980	95.285659
BS10	28.926903	95.287413
BS11	28.928606	95.289570
BS12	28.931789	95.293088
BS13	28.935553	95.296649
BS14	28.939845	95.300932
BS15	28.942594	95.305468
BS16	28.937682	95.315723
BS17	28.924096	95.337113
BS18	28.941781	95.313880
BS19	28.940201	95.319265
BS20	28.936569	95.322104
BS21	28.933823	95.325366
BS22	28.933569	95.327686
BS23	28.935639	95.330572
BS24	28.940465	95.330065
BS25	28.943259	95.327468
BS26	28.947735	95.327177
BS27	28.947664	95.327979
BS28	28.949930	95.329041
BS29	28.951094	95.332604
BS30	28.951204	95.337885
BS31	28.932718	95.320199
BS32	28.946370	95.304926
BS33	28.954918	95.294250

Sampling Date	Time GMT	Range Sta. #	Depth Ft.	Susp. Conc. mg/l	Salinity ppt
11/19/03	14:56	WS 01	28.0	29	31.51
11/19/03	14:52	WS 02	28.5	30	31.55
11/19/03	14:47	WS 03	25.0	31	31.39
11/19/03	14:43	WS 04	25.0	31	31.32
11/19/03	14:34	WS 05	25.0	41	31.04
11/19/03	14:30	WS 06	26.0	38	30.64
11/19/03	14:25	WS 07	25.0	40	30.81
11/19/03	14:21	WS 08	25.0	39	30.42
11/19/03	14:16	WS 09	25.0	43	29.98
11/19/03	14:12	WS 10	24.0	66	29.79
11/19/03	14:08	WS 11	25.0	81	28.49
10/16/03	17:54	WS 12	26.0	35	25.25
10/16/03	18:00	WS 13	8.5	40	21.03
10/16/03	18:05	WS 14	26.0	58	26.00
10/16/03	18:13	WS 15	26.0	39	25.90
10/16/03	18:22	WS 16	10.0	158	18.06
10/16/03	18:29	WS 17	5.5	329	4.87
10/16/03	18:40	WS 18	26.5	66	22.96
10/16/03	18:45	WS 19	25.5	36	23.53
10/16/03	18:51	WS 20	26.0	20	22.96
10/16/03	18:56	WS 21	26.0	10	22.84
10/16/03	19:00	WS 22	7.0	27	17.50
10/16/03	19:05	WS 23	26.5	14	24.18
10/16/03	19:10	WS 24	19.5	19	21.48
10/16/03	19:16	WS 25	12.0	19	20.40
10/16/03	19:21	WS 26	9.0	10	20.64
10/16/03	19:24	WS 27	7.5	8	20.63
10/16/03	19:30	WS 28	10.5	9	20.50
10/16/03	19:34	WS 29	10.5	8	20.14
10/16/03	19:40	WS 30	10.5	12	20.14
10/16/03	20:01	WS 31	9.5	79	16.59
10/16/03	20:12	WS 32	10.0	73	19.07
10/16/03	20:17	WS 33	10.0	50	18.55

Appendix G – Bed Sediment Samples, Analysis Results

Contents

Station	North Latitude	West Longitude
BS1	28.910546	95.270452
BS2	28.912460	95.272242
BS3	28.914168	95.274249
BS4	28.916072	95.276047
BS5	28.917989	95.277830
BS6	28.919348	95.280170
BS7	28.921287	95.281921
BS8	28.923217	95.283687
BS9	28.924980	95.285659
BS10	28.926903	95.287413
BS11	28.928606	95.289570
BS12	28.931789	95.293088
BS13	28.935553	95.296649
BS14	28.939845	95.300932
BS15	28.942594	95.305468
BS16	28.937682	95.315723
BS17	28.924096	95.337113
BS18	28.941781	95.313880
BS19	28.940201	95.319265
BS20	28.936569	95.322104
BS21	28.933823	95.325366
BS22	28.933569	95.327686
BS23	28.935639	95.330572
BS24	28.940465	95.330065
BS25	28.943259	95.327468
BS26	28.947735	95.327177
BS27	28.947664	95.327979
BS28	28.949930	95.329041
BS29	28.951094	95.332604
BS30	28.951204	95.337885
BS31	28.932718	95.320199
BS32	28.946370	95.304926
BS33	28.954918	95.294250

General Area	Range Sta. #	Date of Collection	Time of Collection (GMT)	Depth (ft.)
Outer Channel				
	BS 01	11/19/03	14:56	56.0
	BS 02	11/19/03	14:52	57.0
	BS 03	11/19/03	14:47	50.0
	BS 04	11/19/03	14:43	50.0
	BS 05	11/19/03	14:34	50.0
	BS 06	11/19/03	14:30	52.0
	BS 07	11/19/03	14:25	50.0
	BS 08	11/19/03	14:21	50.0
	BS 09	11/19/03	14:16	50.0
	BS 10	11/19/03	14:12	48.0
	BS 11	11/19/03	14:08	50.0
	BS 12	10/16/03	17:54	52.0
	BS 13	10/16/03	18:00	17.0
	BS 14	10/16/03	18:05	52.0
Junction	BS 15	10/16/03	18:13	52.0
West GIWW	BS 16	10/16/03	18:22	20.0
	BS 17	10/16/03	18:29	11.0
Inner Channel	BS 18	10/16/03	18:40	53.0
	BS 19	10/16/03	18:45	51.0
	BS 20	10/16/03	18:51	52.0
	BS 21	10/16/03	18:56	52.0
	BS 22	10/16/03	19:00	14.0
	BS 23	10/16/03	19:05	53.0
	BS 24	10/16/03	19:10	39.0
	BS 25	10/16/03	19:16	24.0
	BS 26	10/16/03	19:21	18.0
	BS 27	10/16/03	19:24	15.0
	BS 28	10/16/03	19:30	21.0
	BS 29	10/16/03	19:34	21.0
	BS 30	10/16/03	19:40	21.0
West GIWW	BS 31	10/16/03	20:01	19.0
East GIWW	BS 32	10/16/03	20:12	20.0
	BS 33	10/16/03	20:17	20.0

General Area	Sample#	Bulk Density (g/cm^3)	% Sand	% Silt & Clay	% Moisture	% Organics
Outer Channel	BS 01	1.317	18.14	81.86	144.21	5.55
	BS 02	1.252	20.91	79.09	170.92	6.19
	BS 03	1.353	5.69	94.31	172.98	6.77
	BS 04	1.275	10.91	89.09	147.16	7.24
	BS 05	1.227	8.03	91.97	166.43	6.76
	BS 06	1.218	5.32	94.68	195.84	6.66
	BS 07	1.339	27.94	72.06	187.26	7.80
	BS 08	1.300	30.26	69.74	114.70	5.23
	BS 09	1.319	24.83	75.17	126.68	5.46
	BS 10	1.377	41.66	58.34	114.40	5.66
	BS 11	1.361	56.37	43.63	95.50	4.10
	BS 12	1.313	35.36	64.64	122.08	5.40
	BS 13	1.509	58.71	41.29	56.18	2.57
	BS 14	1.316	21.83	78.17	151.18	6.63
Average =		1.320	26.14	73.86	140.39	5.86
Junction	BS 15	1.444	43.13	56.87	84.22	4.41
West GIWW	BS 16	1.380	21.03	78.97	110.27	6.83
	BS 17	1.501	10.59	89.41	94.81	7.85
Inner Channel	BS 18	1.210	0.87	99.13	225.28	11.17
	BS 19	1.200	0.21	99.79	223.78	10.61
	BS 20	1.201	0.68	99.32	223.02	9.23
	BS 21	1.189	0.83	99.17	229.88	8.91
	BS 22	1.478	39.57	60.43	57.95	3.46
	BS 23	1.208	6.55	93.45	221.65	10.81
	BS 24	1.247	10.00	90.00	149.84	7.80
	BS 25	1.572	52.37	47.63	56.24	3.37
	BS 26	1.577	62.44	37.56	55.19	4.26
	BS 27	shell grab	shell	grab	--------	--------
	BS 28	1.310	10.66	89.34	145.85	7.60
	BS 29	1.249	9.94	90.06	129.22	5.89
	BS 30	1.423	11.73	88.27	61.48	3.84
Average =		1.322	17.15	82.85	148.28	7.25
West GIWW	BS 31	1.305	18.89	81.11	100.46	5.70
East GIWW	BS 32	shell grab	shell	grab		
	BS 33	shell grab	shell	grab		

General Area	Sample#	Bulk Density (g/cm^3)	% Sand	% Silt & Clay	% Moisture	% Organics
Outer Channel	Average =	1.320	26.14	73.86	140.39	5.86
Inner Channel	Average =	1.322	17.15	82.85	148.28	7.25

Appendix H Folder Structure of Project DVD

Contents

Table H1. Folder structure of project DVD

Freeport Harbor Field Data Collection Program

Readme.txt(Table H1)

Documents

Report Contents.doc (report table of contents)
Report.doc (the report without the appendices)
Appendix A.doc (Scope of Work)
Appendix B.doc (Water-level Measurements Plots)
Appendix C.doc (Plots of the Salinities and Total Suspended Solids Concentrations of the Automatic Water Sampler Samples)
Appendix D.doc (Transect Current Surveys, Depth-averaged Current Plots)
Appendix E.doc (Transect Water Samples, Salinities and Total Suspended Solids Concentrations Plots)
Appendix F.doc (Mid-depth Water Samples, Salinities and Total Suspended Solids Concentrations)
Appendix G.doc (Bed Sediment Samples, Analysis Results)
Appendix H.doc (Folder Structure of Project DVD)
Appendix I.doc (Data File Formats)

Plots

Readme.txt (Figures 3, 4, and 5 showing instrument, current transects, and bed and water sample locations)

Water-level Measurements

TG1_1.jpeg (time series plot of water levels from TG1-October 16 to November 5, 2003)
TG1_2.jpeg (time series plot of water levels from TG1-November 5 to November 18, 2003)
TG2_1.jpeg (time series plot of water levels from TG2-October 15 to November 4, 2003)
TG2_2.jpeg (time series plot of water levels from TG2-November 4 to November 18, 2003)
TG3_1.jpeg (time series plot of water levels from TG3-October 30 to November 18, 2003)
TG4_1.jpeg (time series plot of water levels from TG4-October 15 to November 4, 2003)
TG4_2.jpeg (time series plot of water levels from TG4-November 4 to November 18, 2003)

Automatic Water Sampler Samples

WS0.jpeg (time series plot of salinities and total suspended solids from WS0 – October 16 to November 11, 2003)
WS1.jpeg (time series plot of salinities and total suspended solids from WS1 – October 28 to November 11, 2003)

Table H1. Folder structure of project DVD – continued 1

WS2A.jpeg (time series plot of salinities and total suspended solids from WS2 (3 ft) – October 16 to November 11, 2003)

WS2B.jpeg (time series plot of salinities and total suspended solids from WS2 (7.5 ft) – October 16 to November 11, 2003)

WS3.jpeg (time series plot of salinities and total suspended solids from WS3 – October 16 to November 11, 2003)

WS4.jpeg (time series plot of salinities and total suspended solids from WS4 – October 16 to November 11, 2003)

WS5A.jpeg (time series plot of salinities and total suspended solids from WS5 (3 ft) – October 16 to November 11, 2003)

WS5B.jpeg (time series plot of salinities and total suspended solids from WS5 (7 ft) – October 16 to November 11, 2003)

Current Transect Measurements

T1_10_29_1346.jpeg (depth-averaged current velocities across transect T1 at 1346 (GMT) on October 29, 2003)

T1_10_29_1501.jpeg (depth-averaged current velocities across transect T1 at 1501 (GMT) on October 29, 2003)

T1_10_29_1601.jpeg (depth-averaged current velocities across transect T1 at 1601 (GMT) on October 29, 2003)

T1_10_29_1702.jpeg (depth-averaged current velocities across transect T1 at 1702 (GMT) on October 29, 2003)

T1_10_29_1800.jpeg (depth-averaged current velocities across transect T1 at 1800 (GMT) on October 29, 2003)

T1_10_29_1900.jpeg (depth-averaged current velocities across transect T1 at 1900 (GMT) on October 29, 2003)

T1_10_29_1959.jpeg (depth-averaged current velocities across transect T1 at 1959 (GMT) on October 29, 2003)

T1_10_29_2211.jpeg (depth-averaged current velocities across transect T1 at 2211 (GMT) on October 29, 2003)

Table H1. Folder structure of project DVD – continued 2
T1_10_29_2307.jpeg (depth-averaged current velocities across transect T1 at 2307 (GMT) on October 29, 2003) T1_10_30_0004.jpeg (depth-averaged current velocities across transect T1 at 0004 (GMT) on October 30, 2003) T1_10_30_0108.jpeg (depth-averaged current velocities across transect T1 at 0108 (GMT) on October 30, 2003) T1_10_30_0218.jpeg (depth-averaged current velocities across transect T1 at 0218 (GMT) on October 30, 2003) T1_10_30_0320.jpeg (depth-averaged current velocities across transect T1 at 0320 (GMT) on October 30, 2003) T1_10_30_0422.jpeg (depth-averaged current velocities across transect T1 at 0422 (GMT) on October 30, 2003) T1_10_30_0531.jpeg (depth-averaged current velocities across transect T1 at 0531 (GMT) on October 30, 2003) T1_10_30_0715.jpeg (depth-averaged current velocities across transect T1 at 0715 (GMT) on October 30, 2003) T1_10_30_0816.jpeg (depth-averaged current velocities across transect T1 at 0816 (GMT) on October 30, 2003) T1_10_30_0920.jpeg (depth-averaged current velocities across transect T1 at 0920 (GMT) on October 30, 2003) T1_10_30_1017.jpeg (depth-averaged current velocities across transect T1 at 1017 (GMT) on October 30, 2003) T1_10_30_1128.jpeg (depth-averaged current velocities across transect T1 at 1128 (GMT) on October 30, 2003) T1_10_30_1221.jpeg (depth-averaged current velocities across transect T1 at 1221 (GMT) on October 30, 2003) T1_10_30_1321.jpeg (depth-averaged current velocities across transect T1 at 1321 (GMT) on October 30, 2003) T1_10_30_1422.jpeg (depth-averaged current velocities across transect T1 at 1422 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 3
T1_10_30_1534.jpeg (depth-averaged current velocities across transect T1 at 1534 (GMT) on October 30, 2003) T2_10_29_1410.jpeg (depth-averaged current velocities across transect T2 at 1410 (GMT) on October 29, 2003) T2_10_29_1514.jpeg (depth-averaged current velocities across transect T2 at 1514 (GMT) on October 29, 2003) T2_10_29_1633.jpeg (depth-averaged current velocities across transect T2 at 1633 (GMT) on October 29, 2003) T2_10_29_1734.jpeg (depth-averaged current velocities across transect T2 at 1734 (GMT) on October 29, 2003) T2_10_29_1812.jpeg (depth-averaged current velocities across transect T2 at 1812 (GMT) on October 29, 2003) T2_10_29_1914.jpeg (depth-averaged current velocities across transect T2 at 1914 (GMT) on October 29, 2003) T2_10_29_2011.jpeg (depth-averaged current velocities across transect T2 at 2011 (GMT) on October 29, 2003) T2_10_29_2111.jpeg (depth-averaged current velocities across transect T2 at 2111 (GMT) on October 29, 2003) T2_10_29_2227.jpeg (depth-averaged current velocities across transect T2 at 2227 (GMT) on October 29, 2003) T2_10_29_2318.jpeg (depth-averaged current velocities across transect T2 at 2318 (GMT) on October 29, 2003) T2_10_30_0020.jpeg (depth-averaged current velocities across transect T2 at 0020 (GMT) on October 30, 2003) T2_10_30_0121.jpeg (depth-averaged current velocities across transect T2 at 0121 (GMT) on October 30, 2003) T2_10_30_0238.jpeg (depth-averaged current velocities across transect T2 at 0238 (GMT) on October 30, 2003) T2_10_30_0336.jpeg (depth-averaged current velocities across transect T2 at 0336 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 4
T2_10_30_0441.jpeg (depth-averaged current velocities across transect T2 at 0441 (GMT) on October 30, 2003) T2_10_30_0544.jpeg (depth-averaged current velocities across transect T2 at 0544 (GMT) on October 30, 2003) T2_10_30_0730.jpeg (depth-averaged current velocities across transect T2 at 0730 (GMT) on October 30, 2003) T2_10_30_0828.jpeg (depth-averaged current velocities across transect T2 at 0828 (GMT) on October 30, 2003) T2_10_30_0932.jpeg (depth-averaged current velocities across transect T2 at 0932 (GMT) on October 30, 2003) T2_10_30_1029.jpeg (depth-averaged current velocities across transect T2 at 1029 (GMT) on October 30, 2003) T2_10_30_1146.jpeg (depth-averaged current velocities across transect T2 at 1146 (GMT) on October 30, 2003) T2_10_30_1231.jpeg (depth-averaged current velocities across transect T2 at 1231 (GMT) on October 30, 2003) T2_10_30_1339.jpeg (depth-averaged current velocities across transect T2 at 1339 (GMT) on October 30, 2003) T2_10_30_1441.jpeg (depth-averaged current velocities across transect T2 at 1441 (GMT) on October 30, 2003) T2_10_30_1553.jpeg (depth-averaged current velocities across transect T2 at 1553 (GMT) on October 30, 2003) T3_10_29_1424.jpeg (depth-averaged current velocities across transect T3 at 1424 (GMT) on October 29, 2003) T3_10_29_1525.jpeg (depth-averaged current velocities across transect T3 at 1525 (GMT) on October 29, 2003) T3_10_29_1612.jpeg (depth-averaged current velocities across transect T3 at 1612 (GMT) on October 29, 2003) T3_10_29_1725.jpeg (depth-averaged current velocities across transect T3 at 1725 (GMT) on October 29, 2003)

Table H1. Folder structure of project DVD – continued 5
T3_10_29_1823.jpeg (depth-averaged current velocities across transect T3 at 1823 (GMT) on October 29, 2003) T3_10_29_1924.jpeg (depth-averaged current velocities across transect T3 at 1924 (GMT) on October 29, 2003) T3_10_29_2021.jpeg (depth-averaged current velocities across transect T3 at 2021 (GMT) on October 29, 2003) T3_10_29_2121.jpeg (depth-averaged current velocities across transect T3 at 2121 (GMT) on October 29, 2003) T3_10_29_2240.jpeg (depth-averaged current velocities across transect T3 at 2240 (GMT) on October 29, 2003) T3_10_29_2329.jpeg (depth-averaged current velocities across transect T3 at 2329 (GMT) on October 29, 2003) T3_10_30_0035.jpeg (depth-averaged current velocities across transect T3 at 0035 (GMT) on October 30, 2003) T3_10_30_0138.jpeg (depth-averaged current velocities across transect T3 at 0138 (GMT) on October 30, 2003) T3_10_30_0251.jpeg (depth-averaged current velocities across transect T3 at 0251 (GMT) on October 30, 2003) T3_10_30_0350.jpeg (depth-averaged current velocities across transect T3 at 0350 (GMT) on October 30, 2003) T3_10_30_0456.jpeg (depth-averaged current velocities across transect T3 at 0456 (GMT) on October 30, 2003) T3_10_30_0641.jpeg (depth-averaged current velocities across transect T3 at 0641 (GMT) on October 30, 2003) T3_10_30_0746.jpeg (depth-averaged current velocities across transect T3 at 0746 (GMT) on October 30, 2003) T3_10_30_0845.jpeg (depth-averaged current velocities across transect T3 at 0845 (GMT) on October 30, 2003) T3_10_30_0948.jpeg (depth-averaged current velocities across transect T3 at 0948 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 6
T3_10_30_1057.jpeg (depth-averaged current velocities across transect T3 at 1057 (GMT) on October 30, 2003) T3_10_30_1159.jpeg (depth-averaged current velocities across transect T3 at 1159 (GMT) on October 30, 2003) T3_10_30_1241.jpeg (depth-averaged current velocities across transect T3 at 1241 (GMT) on October 30, 2003) T3_10_30_1350.jpeg (depth-averaged current velocities across transect T3 at 1350 (GMT) on October 30, 2003) T3_10_30_1452.jpeg (depth-averaged current velocities across transect T3 at 1452 (GMT) on October 30, 2003) T3_10_30_1604.jpeg (depth-averaged current velocities across transect T3 at 1604 (GMT) on October 30, 2003) T4_10_29_1435.jpeg (depth-averaged current velocities across transect T4 at 1435 (GMT) on October 29, 2003) T4_10_29_1534.jpeg (depth-averaged current velocities across transect T4 at 1534 (GMT) on October 29, 2003) T4_10_29_1621.jpeg (depth-averaged current velocities across transect T4 at 1621 (GMT) on October 29, 2003) T4_10_29_1734.jpeg (depth-averaged current velocities across transect T4 at 1734 (GMT) on October 29, 2003) T4_10_29_1835.jpeg (depth-averaged current velocities across transect T4 at 1835 (GMT) on October 29, 2003) T4_10_29_1933.jpeg (depth-averaged current velocities across transect T4 at 1933 (GMT) on October 29, 2003) T4_10_29_2029.jpeg (depth-averaged current velocities across transect T4 at 2029 (GMT) on October 29, 2003) T4_10_29_2130.jpeg (depth-averaged current velocities across transect T4 at 2130 (GMT) on October 29, 2003) T4_10_29_2251.jpeg (depth-averaged current velocities across transect T4 at 2251 (GMT) on October 29, 2003)

Table H1. Folder structure of project DVD – continued 7
T4_10_29_2339.jpeg (depth-averaged current velocities across transect T4 at 2339 (GMT) on October 29, 2003) T4_10_30_0049.jpeg (depth-averaged current velocities across transect T4 at 0049 (GMT) on October 30, 2003) T4_10_30_0152.jpeg (depth-averaged current velocities across transect T4 at 0152 (GMT) on October 30, 2003) T4_10_30_0304.jpeg (depth-averaged current velocities across transect T4 at 0304 (GMT) on October 30, 2003) T4_10_30_0405.jpeg (depth-averaged current velocities across transect T4 at 0405 (GMT) on October 30, 2003) T4_10_30_0507.jpeg (depth-averaged current velocities across transect T4 at 0507 (GMT) on October 30, 2003) T4_10_30_0655.jpeg (depth-averaged current velocities across transect T4 at 0655 (GMT) on October 30, 2003) T4_10_30_0759.jpeg (depth-averaged current velocities across transect T4 at 0759 (GMT) on October 30, 2003) T4_10_30_0857.jpeg (depth-averaged current velocities across transect T4 at 0857 (GMT) on October 30, 2003) T4_10_30_0959.jpeg (depth-averaged current velocities across transect T4 at 0959 (GMT) on October 30, 2003) T4_10_30_1108.jpeg (depth-averaged current velocities across transect T4 at 1108 (GMT) on October 30, 2003) T4_10_30_1208.jpeg (depth-averaged current velocities across transect T4 at 1208 (GMT) on October 30, 2003) T4_10_30_1251.jpeg (depth-averaged current velocities across transect T4 at 1251 (GMT) on October 30, 2003) T4_10_30_1400.jpeg (depth-averaged current velocities across transect T4 at 1400 (GMT) on October 30, 2003) T4_10_30_1520.jpeg (depth-averaged current velocities across transect T4 at 1520 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 8

T4_10_30_1621.jpeg (depth-averaged current velocities across transect T4 at 1621 (GMT) on October 30, 2003)

Transect Water Samples

Transect1.jpeg (time series plot of salinities and total suspended solids concentrations of water samples from Transect 1 - October 29 and 30, 2003)
Transect2.jpeg (time series plot of salinities and total suspended solids concentrations of water samples from Transect 2 - October 29 and 30, 2003)
Transect3.jpeg (time series plot of salinities and total suspended solids concentrations of water samples from Transect 3 - October 29 and 30, 2003)
Transect4.jpeg (time series plot of salinities and total suspended solids concentrations of water samples from Transect 4 - October 29 and 30, 2003)

Data Files

Water-level Measurements

Readme.txt (Table I1)
TG1.txt (water levels measured at TG1)
TG2.txt (water levels measured at TG2)
TG3.txt (water levels measured at TG3)
TG4.txt (water levels measured at TG4)

Automatic Water Sampler Samples

Water_Samplers.txt (salinities and total suspended solids concentrations at WS0, Ws1, Ws2, WS3, WS4, and WS5)

Current Transect Measurements

Readme.txt (Table I2)
T1_10_29_1346.txt (depth-averaged current velocities across transect T1 at 1346 (GMT) on October 29, 2003)
T1_10_29_1501.txt (depth-averaged current velocities across transect T1 at 1501 (GMT) on October 29, 2003)
T1_10_29_1601.txt (depth-averaged current velocities across transect T1 at 1601 (GMT) on October 29, 2003)
T1_10_29_1702.txt (depth-averaged current velocities across transect T1 at 1702 (GMT) on October 29, 2003)
T1_10_29_1800.txt (depth-averaged current velocities across transect T1 at 1800 (GMT) on October 29, 2003)

Table H1. Folder structure of project DVD – continued 9
T1_10_29_1900.txt (depth-averaged current velocities across transect T1 at 1900 (GMT) on October 29, 2003) T1_10_29_1959.txt (depth-averaged current velocities across transect T1 at 1959 (GMT) on October 29, 2003) T1_10_29_2211.txt (depth-averaged current velocities across transect T1 at 2211 (GMT) on October 29, 2003) T1_10_29_2307.txt (depth-averaged current velocities across transect T1 at 2307 (GMT) on October 29, 2003) T1_10_30_0004.txt (depth-averaged current velocities across transect T1 at 0004 (GMT) on October 30, 2003) T1_10_30_0108.txt (depth-averaged current velocities across transect T1 at 0108 (GMT) on October 30, 2003) T1_10_30_0218.txt (depth-averaged current velocities across transect T1 at 0218 (GMT) on October 30, 2003) T1_10_30_0320.txt (depth-averaged current velocities across transect T1 at 0320 (GMT) on October 30, 2003) T1_10_30_0422.txt (depth-averaged current velocities across transect T1 at 0422 (GMT) on October 30, 2003) T1_10_30_0531.txt (depth-averaged current velocities across transect T1 at 0531 (GMT) on October 30, 2003) T1_10_30_0715.txt (depth-averaged current velocities across transect T1 at 0715 (GMT) on October 30, 2003) T1_10_30_0816.txt (depth-averaged current velocities across transect T1 at 0816 (GMT) on October 30, 2003) T1_10_30_0920.txt (depth-averaged current velocities across transect T1 at 0920 (GMT) on October 30, 2003) T1_10_30_1017.txt (depth-averaged current velocities across transect T1 at 1017 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 10
T1_10_30_1128.txt (depth-averaged current velocities across transect T1 at 1128 (GMT) on October 30, 2003) T1_10_30_1221.txt (depth-averaged current velocities across transect T1 at 1221 (GMT) on October 30, 2003) T1_10_30_1321.txt (depth-averaged current velocities across transect T1 at 1321 (GMT) on October 30, 2003) T1_10_30_1422.txt (depth-averaged current velocities across transect T1 at 1422 (GMT) on October 30, 2003) T1_10_30_1534.txt (depth-averaged current velocities across transect T1 at 1534 (GMT) on October 30, 2003) T2_10_29_1410.txt (depth-averaged current velocities across transect T2 at 1410 (GMT) on October 29, 2003) T2_10_29_1514.txt (depth-averaged current velocities across transect T2 at 1514 (GMT) on October 29, 2003) T2_10_29_1633.txt (depth-averaged current velocities across transect T2 at 1633 (GMT) on October 29, 2003) T2_10_29_1734.txt (depth-averaged current velocities across transect T2 at 1734 (GMT) on October 29, 2003) T2_10_29_1812.txt (depth-averaged current velocities across transect T2 at 1812 (GMT) on October 29, 2003) T2_10_29_1914.txt (depth-averaged current velocities across transect T2 at 1914 (GMT) on October 29, 2003) T2_10_29_2011.txt (depth-averaged current velocities across transect T2 at 2011 (GMT) on October 29, 2003) T2_10_29_2111.txt (depth-averaged current velocities across transect T2 at 2111 (GMT) on October 29, 2003) T2_10_29_2227.txt (depth-averaged current velocities across transect T2 at 2227 (GMT) on October 29, 2003) T2_10_29_2318.txt (depth-averaged current velocities across transect T2 at 2318 (GMT) on October 29, 2003)

Table H1. Folder structure of project DVD – continued 11
T2_10_30_0020.txt (depth-averaged current velocities across transect T2 at 0020 (GMT) on October 30, 2003)
T2_10_30_0121.txt (depth-averaged current velocities across transect T2 at 0121 (GMT) on October 30, 2003)
T2_10_30_0238.txt (depth-averaged current velocities across transect T2 at 0238 (GMT) on October 30, 2003)
T2_10_30_0336.txt (depth-averaged current velocities across transect T2 at 0336 (GMT) on October 30, 2003)
T2_10_30_0441.txt (depth-averaged current velocities across transect T2 at 0441 (GMT) on October 30, 2003)
T2_10_30_0544.txt (depth-averaged current velocities across transect T2 at 0544 (GMT) on October 30, 2003)
T2_10_30_0730.txt (depth-averaged current velocities across transect T2 at 0730 (GMT) on October 30, 2003)
T2_10_30_0828.txt (depth-averaged current velocities across transect T2 at 0828 (GMT) on October 30, 2003)
T2_10_30_0932.txt (depth-averaged current velocities across transect T2 at 0932 (GMT) on October 30, 2003)
T2_10_30_1029.txt (depth-averaged current velocities across transect T2 at 1029 (GMT) on October 30, 2003)
T2_10_30_1146.txt (depth-averaged current velocities across transect T2 at 1146 (GMT) on October 30, 2003)
T2_10_30_1231.txt (depth-averaged current velocities across transect T2 at 1231 (GMT) on October 30, 2003)
T2_10_30_1339.txt (depth-averaged current velocities across transect T2 at 1339 (GMT) on October 30, 2003)
T2_10_30_1441.txt (depth-averaged current velocities across transect T2 at 1441 (GMT) on October 30, 2003)
T2_10_30_1553.txt (depth-averaged current velocities across transect T2 at 1553 (GMT) on October 30, 2003)

Table H1.   Folder structure of project DVD – continued 12
T3_10_29_1424.txt (depth-averaged current velocities across transect T3 at 1424 (GMT) on October 29, 2003) T3_10_29_1525.txt (depth-averaged current velocities across transect T3 at 1525 (GMT) on October 29, 2003) T3_10_29_1612.txt (depth-averaged current velocities across transect T3 at 1612 (GMT) on October 29, 2003) T3_10_29_1725.txt (depth-averaged current velocities across transect T3 at 1725 (GMT) on October 29, 2003) T3_10_29_1823.txt (depth-averaged current velocities across transect T3 at 1823 (GMT) on October 29, 2003) T3_10_29_1924.txt (depth-averaged current velocities across transect T3 at 1924 (GMT) on October 29, 2003) T3_10_29_2021.txt (depth-averaged current velocities across transect T3 at 2021 (GMT) on October 29, 2003) T3_10_29_2121.txt (depth-averaged current velocities across transect T3 at 2121 (GMT) on October 29, 2003) T3_10_29_2240.txt (depth-averaged current velocities across transect T3 at 2240 (GMT) on October 29, 2003) T3_10_29_2329.txt (depth-averaged current velocities across transect T3 at 2329 (GMT) on October 29, 2003) T3_10_30_0035.txt (depth-averaged current velocities across transect T3 at 0035 (GMT) on October 30, 2003) T3_10_30_0138.txt (depth-averaged current velocities across transect T3 at 0138 (GMT) on October 30, 2003) T3_10_30_0251.txt (depth-averaged current velocities across transect T3 at 0251 (GMT) on October 30, 2003) T3_10_30_0350.txt (depth-averaged current velocities across transect T3 at 0350 (GMT) on October 30, 2003) T3_10_30_0456.txt (depth-averaged current velocities across transect T3 at 0456 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 13
T3_10_30_0641.txt (depth-averaged current velocities across transect T3 at 0641 (GMT) on October 30, 2003)
T3_10_30_0746.txt (depth-averaged current velocities across transect T3 at 0746 (GMT) on October 30, 2003)
T3_10_30_0845.txt (depth-averaged current velocities across transect T3 at 0845 (GMT) on October 30, 2003)
T3_10_30_0948.txt (depth-averaged current velocities across transect T3 at 0948 (GMT) on October 30, 2003)
T3_10_30_1057.txt (depth-averaged current velocities across transect T3 at 1057 (GMT) on October 30, 2003)
T3_10_30_1159.txt (depth-averaged current velocities across transect T3 at 1159 (GMT) on October 30, 2003)
T3_10_30_1241.txt (depth-averaged current velocities across transect T3 at 1241 (GMT) on October 30, 2003)
T3_10_30_1350.txt (depth-averaged current velocities across transect T3 at 1350 (GMT) on October 30, 2003)
T3_10_30_1452.txt (depth-averaged current velocities across transect T3 at 1452 (GMT) on October 30, 2003)
T3_10_30_1604.txt (depth-averaged current velocities across transect T3 at 1604 (GMT) on October 30, 2003)
T4_10_29_1435.txt (depth-averaged current velocities across transect T4 at 1435 (GMT) on October 29, 2003)
T4_10_29_1534.txt (depth-averaged current velocities across transect T4 at 1534 (GMT) on October 29, 2003)
T4_10_29_1621.txt (depth-averaged current velocities across transect T4 at 1621 (GMT) on October 29, 2003)
T4_10_29_1734.txt (depth-averaged current velocities across transect T4 at 1734 (GMT) on October 29, 2003)
T4_10_29_1835.txt (depth-averaged current velocities across transect T4 at 1835 (GMT) on October 29, 2003)

Table H1. Folder structure of project DVD – continued 14
T4_10_29_1933.txt (depth-averaged current velocities across transect T4 at 1933 (GMT) on October 29, 2003) T4_10_29_2029.txt (depth-averaged current velocities across transect T4 at 2029 (GMT) on October 29, 2003) T4_10_29_2130.txt (depth-averaged current velocities across transect T4 at 2130 (GMT) on October 29, 2003) T4_10_29_2251.txt (depth-averaged current velocities across transect T4 at 2251 (GMT) on October 29, 2003) T4_10_29_2339.txt (depth-averaged current velocities across transect T4 at 2339 (GMT) on October 29, 2003) T4_10_30_0049.txt (depth-averaged current velocities across transect T4 at 0049 (GMT) on October 30, 2003) T4_10_30_0152.txt (depth-averaged current velocities across transect T4 at 0152 (GMT) on October 30, 2003) T4_10_30_0304.txt (depth-averaged current velocities across transect T4 at 0304 (GMT) on October 30, 2003) T4_10_30_0405.txt (depth-averaged current velocities across transect T4 at 0405 (GMT) on October 30, 2003) T4_10_30_0507.txt (depth-averaged current velocities across transect T4 at 0507 (GMT) on October 30, 2003) T4_10_30_0655.txt (depth-averaged current velocities across transect T4 at 0655 (GMT) on October 30, 2003) T4_10_30_0759.txt (depth-averaged current velocities across transect T4 at 0759 (GMT) on October 30, 2003) T4_10_30_0857.txt (depth-averaged current velocities across transect T4 at 0857 (GMT) on October 30, 2003) T4_10_30_0959.txt (depth-averaged current velocities across transect T4 at 0959 (GMT) on October 30, 2003) T4_10_30_1108.txt (depth-averaged current velocities across transect T4 at 1108 (GMT) on October 30, 2003)

Table H1. Folder structure of project DVD – continued 15

T4_10_30_1208.txt (depth-averaged current velocities across transect T4 at 1208 (GMT) on October 30, 2003)

T4_10_30_1251.txt (depth-averaged current velocities across transect T4 at 1251 (GMT) on October 30, 2003)

T4_10_30_1400.txt (depth-averaged current velocities across transect T4 at 1400 (GMT) on October 30, 2003)

T4_10_30_1520.txt (depth-averaged current velocities across transect T4 at 1520 (GMT) on October 30, 2003)

T4_10_30_1621.txt (depth-averaged current velocities across transect T4 at 1621 (GMT) on October 30, 2003)

Transect Water Samples

Transect1.txt (salinities and total suspended solids concentrations of water samples from Transect 1 - October 29 and 30, 2003)

Transect2.txt (salinities and total suspended solids concentrations of water samples from Transect 2 - October 29 and 30, 2003)

Transect3.txt (salinities and total suspended solids concentrations of water samples from Transect 3 - October 29 and 30, 2003)

Transect4.txt (salinities and total suspended solids concentrations of water samples from Transect 4 - October 29 and 30, 2003)

Appendix I Data File Formats

Contents

Table I1. Format of water-level measurements files on project DVD		
Water-level measurements files TG1.txt, TG2.txt, TG3.txt, TG4.txt		
Row	Field	Description
1	1	instrument designation
	2	geographic location description
2	1	latitude, degrees north
	2	longitude, degrees west
3	1	hour of first data value in record (GMT)
	2	minute of first data value in record (GMT)
	3	month of first data value in record (GMT)
	4	day of first data value in record (GMT)
	5	year of first data value in record (GMT)
4 – end of record	1	time in hours from first data value in record
	2	water level in feet relative to the record mean for TG1, TG2, TG3, and TG4

Example – first 6 rows of TG1.txt

```
TG 1 Outer Channel
28.940034 95.299569
15 30 10 16 2003
  0.000  3.14
  0.083  3.12
  0.167  3.10
```

Table I2. Format of current transect measurements file on project DVD		
Current transect measurements files - name format: transect_month_day_time.txt Example: T1_10_29_1346.txt		
Row	Field	Description
1	1	year of measurement in 2000 (i.e., either a 4 or a 5) (CST)
	2	month of measurement (local)
	3	day of measurement (local)
	4	hour of measurement (local)
	5	minute of measurement (local)
	6	second of measurement (local)
	7	hundredth of a second of measurement (local)
	8	depth in feet
2	1	latitude, degrees north
	2	longitude, degrees west
3	1	depth-averaged current speed in feet per second
	2	depth-averaged direction current going to in degrees true

Example – first 6 rows of T1_10_29_1346.txt

```
 3 10 29  8 53 48  5  9.19
        29.9447811      -95.3058230
              0.93 210
 3 10 29  8 53 51  7  9.73
        28.9447831      -95.3058429
              0.22 283
```