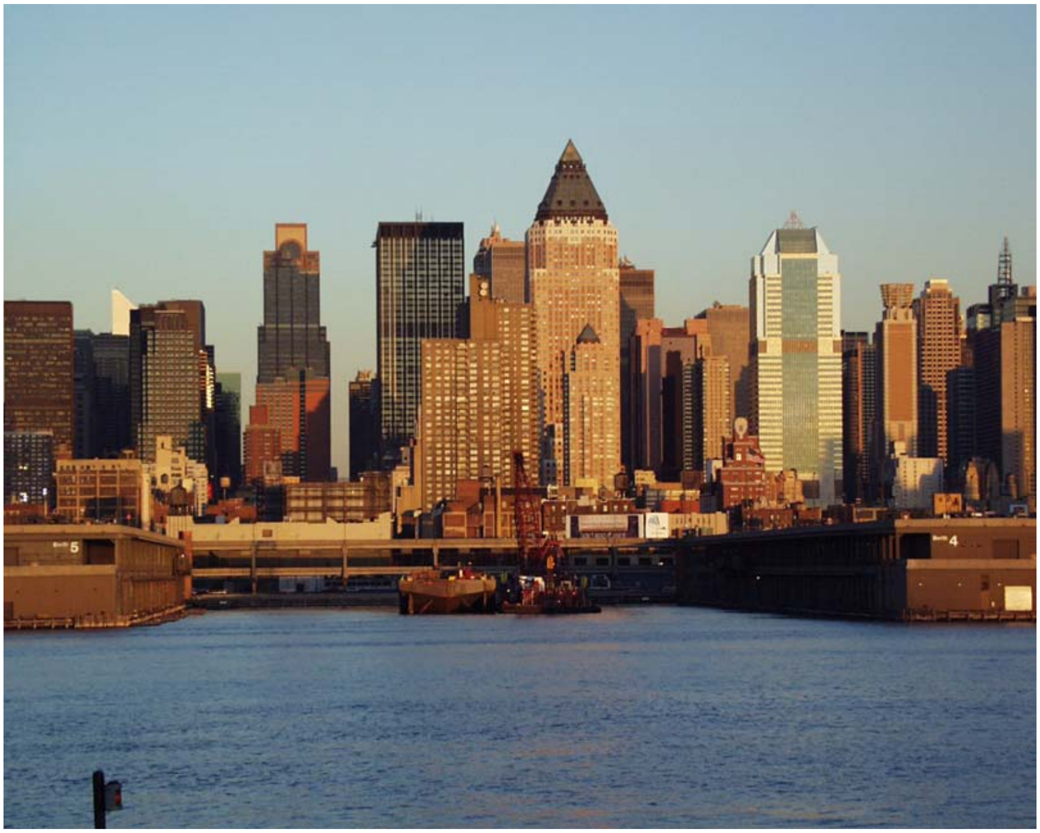
# MONITORING DREDGED MATERIAL PLACEMENT OPERATIONS AT THE HISTORIC AREA REMEDIATION SITE DURING THE PASSENGER SHIP TERMINAL PROJECT, March–May 2004

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## 1.0 OBJECTIVES

During the Passenger Ship Terminal project, Science Applications International Corporation (SAIC) provided Automated Disposal Surveillance System (ADISS) technical support services under separate contracts to the dredging contractor, Great Lakes Dredge and Dock Company (GLDD), and to the monitoring agency, U.S. Army Corps of Engineers, New York District (NYD). ADISS was employed to monitor the placement of dredged material at the Historic Area Remediation Site (HARS; [Figure 1]). Under contract to GLDD, SAIC provided the equipment, software and technical expertise to maintain the systems and process the data. For NYD the primary objectives were to:

- Provide real-time placement and draft information, including load misplacement and scow leakage alarms;
- Acquire, process and submit information concerning potential misplaced material events;
- Post the Inspector logs and Transportation Planning List (TPL) on the web site;
- Provide the placement grid used on the ADISSPlay vessel guidance system.

SAIC provided monitoring services to Weeks Marine, Inc. and NYD for the previous Passenger Ship Terminal project during May 2003. Initial development of ADISS during the 1997 Capping Project preceded introduction of ADISSPlay, the helmsman display and vessel guidance system. The present ADISS/ADISSPlay monitoring system was managed by SAIC for NYD placing dredged material within the HARS, and the installation and maintenance of the system on the dredge scows and tugboats occurred under separate contracts with GLDD.

In addition to hardware installation and maintenance, services included the daily monitoring of data transmitted via cellular telephone from the tugboats. The transmitted ADISS information was processed and made available to NYD via the ADISS web site, hosted at the SAIC Newport, Rhode Island facility. As ADISS data were received, they were processed for placement locations at the HARS grid and entered into the ADISSWeb (Internet Map Server) database. NYD personnel accessed the ADISSWeb plots posted on the web site, http://www.adiss-afiss.com/. Hardcopy plots of individual transits and vessel draft were submitted to GLDD along with summaries of placement activities. Plots and copies of the Inspector logs and TPL checklists were also provided to NYD for analysis.

The objectives of this project were based upon previous project experiences and GLDD and NYD needs. The requirement for daily monitoring was met by posting telemetered ADISS data on the Internet using ADISSWeb.

The position and draft data acquired from the ADISS installations were also provided on the Internet at http://www.adiss-afiss.com/ for public outreach.

SAIC programmed the placement grid for the Passenger Ship Terminal project shown in Figure 1 on the ADISSPlay system for placement guidance. The NYD provided the grid coordinates and dimensions to SAIC for this purpose.

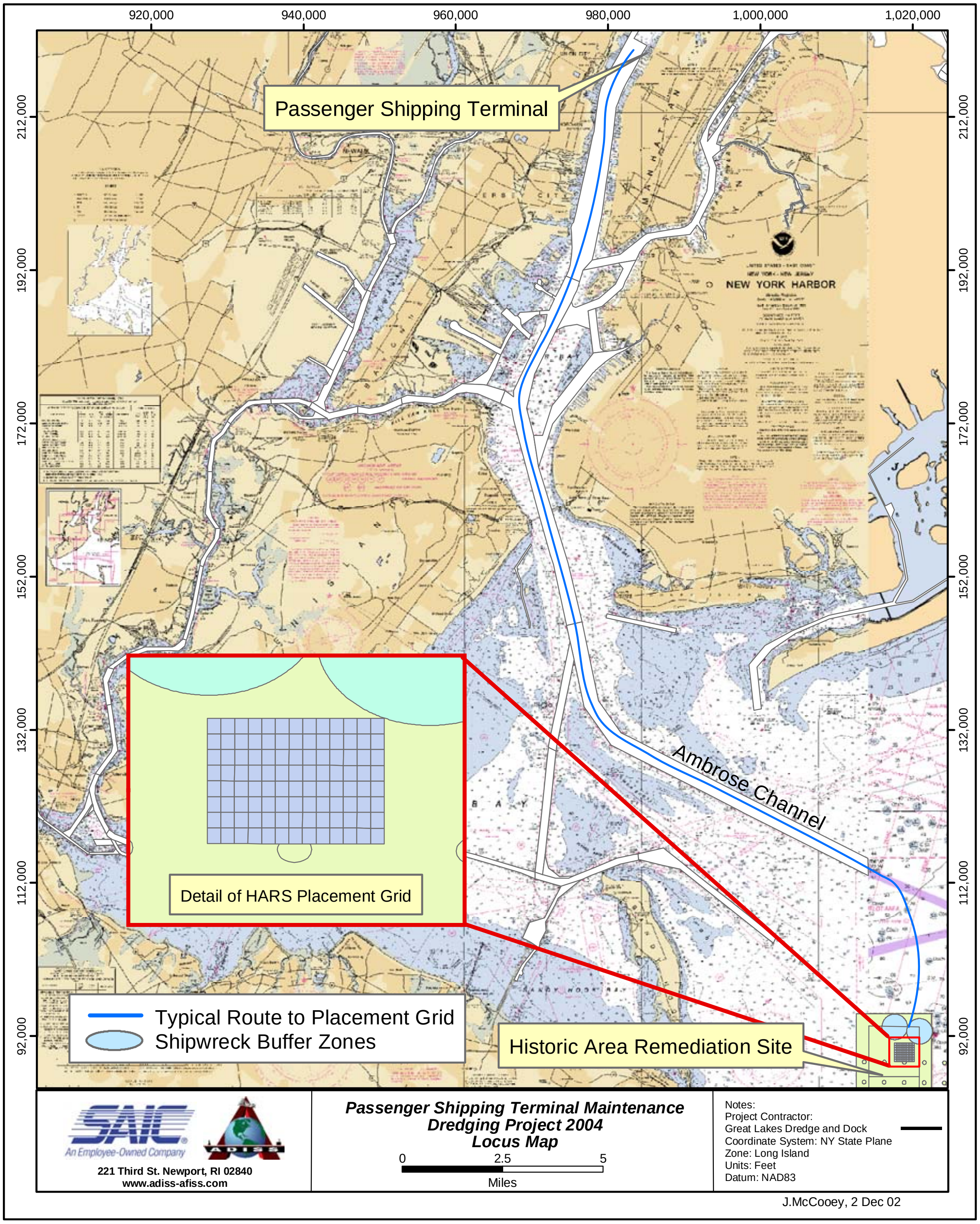



**Figure 1.** Passenger Ship Terminal placement at the Historic Area Remediation Site.

## 2.0 SYSTEM DESCRIPTION

ADISS was composed of a Global Positioning System (GPS), a draft recording unit and a spread-spectrum transceiver for data telemetry from the scow to the towboat. Aboard the boat, ADISSPlay consisted of a helmsman display, telemetry, and an Inspector database program. The combined ADISS/ADISSPlay system was adapted for monitoring placement operations at the HARS from previous experience. Data containing completed trips were telemetered via cell phone from the tugs to the SAIC Newport facility for processing and analysis. Processed data were posted on ADISSWeb for password-protected viewing by both NYD and GLDD.

Prior to the Passenger Ship Terminal (PST) project, an alternative method of recording scow transits and dredged material placements at the HARS was instituted (SAIC 2002a). In the event that communications failed with the ADISS unit installed on the scow, the Inspector would be able to switch to an alternate that estimated the scow position from the tugboat GPS unit and the layback distance to the towed scow. The alternative program, ADISSLt, could be used to track the scow until the problem was solved before the next transit took place. In addition to utilizing the ADISSLt program, the Inspector was instructed to notify SAIC of the problem, so corrective action could be taken in a timely manner. And the recorded data within the ADISS equipment could be recovered through wireless means upon restoration of the system.

A description of the ADISS system was available in the report of the prototype system (SAIC 1998a), and the ADISSPlay system, including the Inspector log function was described in a letter report (SAIC 1998b). Both systems have undergone extensive changes to increase the reliability of recording and transmitting data with advances in technology. Since the previous PST project, a fifth version of ADISS (V-5) was developed that stored and transmitted data with less power. Position and pressure data were recorded with an 8-Meg chipset embedded in the ADISS I/O board. The transceiver was a frequency-hopping, spread-spectrum modem that operated effectively in the pear-to-pear mode to eliminated interference. Position data were acquired utilizing the Garmin Model 16 GPS receiver: WAAS-enhanced for 2-meter accuracy. WAAS or Wide Area Augmentation System was satellite-based, and transmitted a corrective signal to increase the accuracy of the GPS position information. It replaced the U.S. Coast Guard-transmitted Differential correction system. Power for ADISS was provided with an internal 12 amp-hour battery recharged by a 10-watt solar panel, allowing ADISS to operate automatically, and record the transit and placement locations at the HARS.

The ADISSPlay system was modified to include the TPL checklist of items necessary for the successful shipping of each scow load to the HARS. Exceptions to the list were noted by the Inspector at different phases of each transit, and a record was transmitted to ADISSWeb at the end of each placement. ADISSWeb also displayed the locations of the TPL submission.

Volume calculations were completed for each load of material transited to the HARS, utilizing the 'Volumator' tool and the scow's loading displacement curve. The tool automatically estimated the amount of dredged material loaded into the scows based on reported material density, displacement curve values and the 'fore' and 'aft' draft observations entered into ADISSPlay at the beginning of each trip.

During the Passenger Ship Terminal project, the Internet display of placement events was maintained to monitor daily disposal activities without visiting the installations to retrieve the stored data for each event. The cellular telephone data transmissions received from ADISSPlay were automatically plotted and posted on the ADISS web site using ADISSWeb. Figure 2 showed an example of the data available at http://www.adiss-afiss.com/.

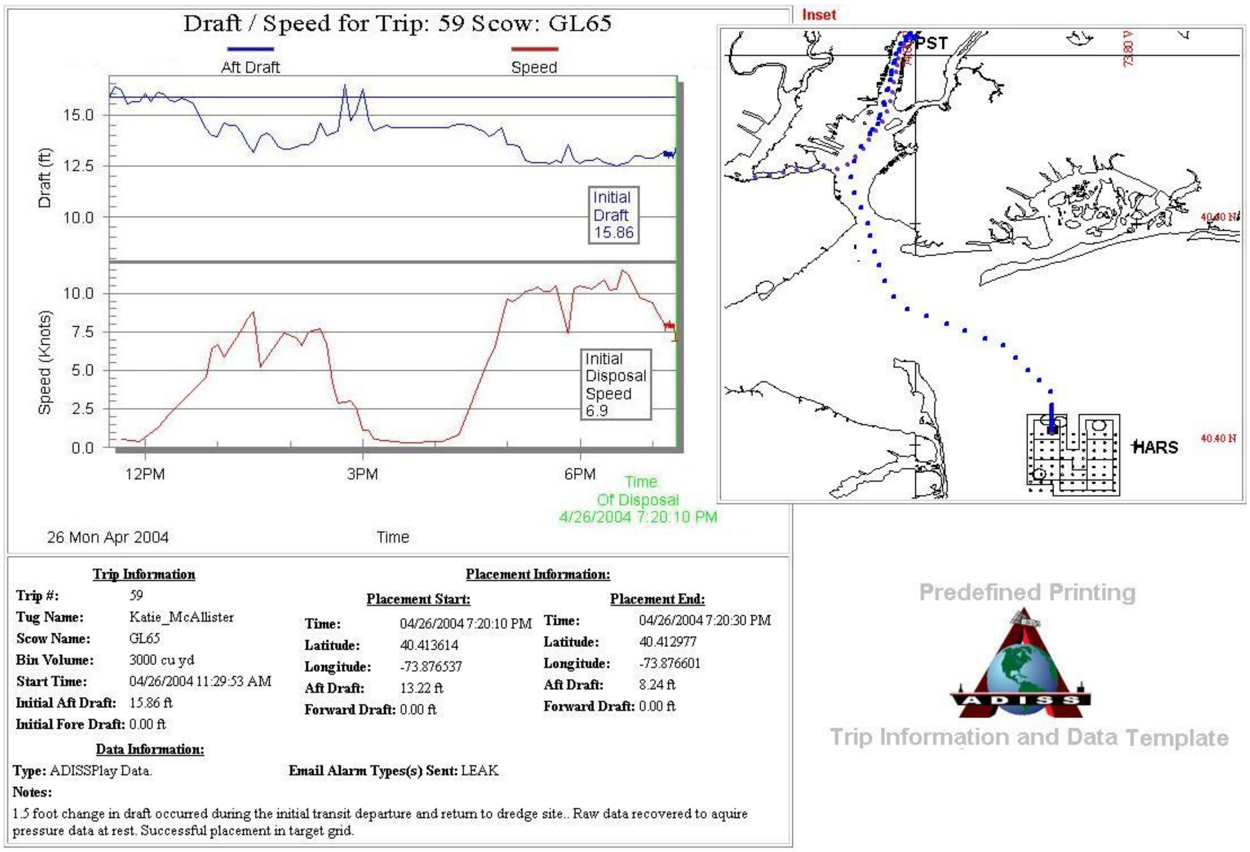
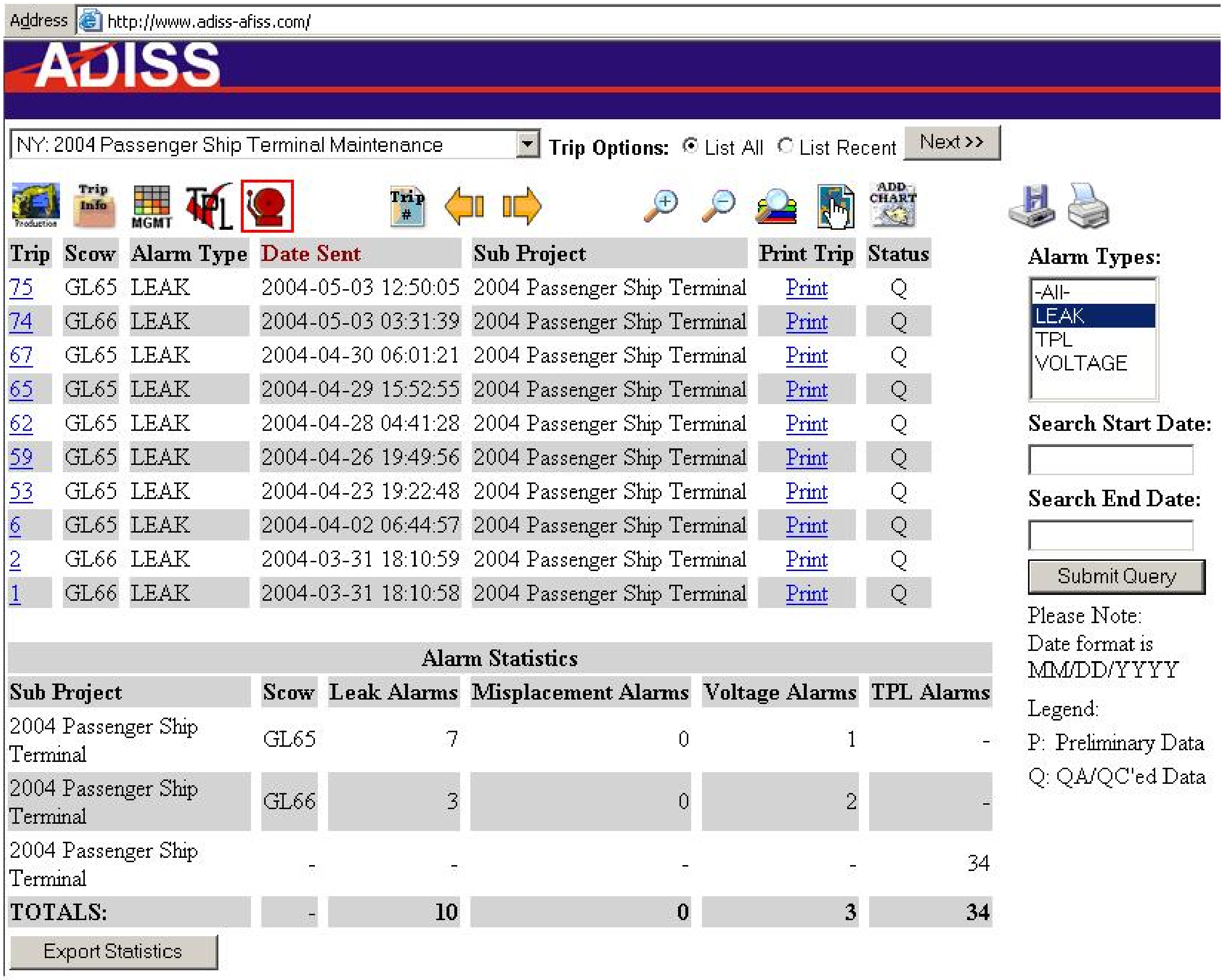



**Figure 2.** ADISS position and draft information displayed for Trip 59 on ADISSWeb.

The purpose of remote reporting was to provide NYD with a means of detecting leaking scows and potential misplacements outside the permitted area quickly without deploying technical personnel to recover the data. Automated subroutines checked the incoming data, and broadcast e-mail alarms if thresholds for placement or leakage (1.5-foot change in draft) were reached. E-mail warnings consisted of a notification of trip number, date and time. NYD personnel could then query the ADISS web site for misplacement times and positions, as well as plots of position and vessel draft during transit. A record of alarms was displayed on ADISSWeb for the project (Figure 3). The automatically processed data were unconfirmed until checked for accuracy by SAIC. Unconfirmed data, automatically posted on the web site prior to the QA checks were labeled as preliminary data. The label was removed from the display once the data were checked for accuracy. By monitoring the Internet, leaking scows and misplacements could be confirmed by NYD in a timely manner, and a solution reached with the dredging contractor.





| Trip | Scow | Alarm Type | Date Sent | Sub Project | Print Trip | Status |
|---|---|---|---|---|---|---|
| 75 | GL65 | LEAK | 2004-05-03 12:50:05 | 2004 Passenger Ship Terminal | Print | Q |
| 74 | GL66 | LEAK | 2004-05-03 03:31:39 | 2004 Passenger Ship Terminal | Print | Q |
| 67 | GL65 | LEAK | 2004-04-30 06:01:21 | 2004 Passenger Ship Terminal | Print | Q |
| 65 | GL65 | LEAK | 2004-04-29 15:52:55 | 2004 Passenger Ship Terminal | Print | Q |
| 62 | GL65 | LEAK | 2004-04-28 04:41:28 | 2004 Passenger Ship Terminal | Print | Q |
| 59 | GL65 | LEAK | 2004-04-26 19:49:56 | 2004 Passenger Ship Terminal | Print | Q |
| 53 | GL65 | LEAK | 2004-04-23 19:22:48 | 2004 Passenger Ship Terminal | Print | Q |
| 6 | GL65 | LEAK | 2004-04-02 06:44:57 | 2004 Passenger Ship Terminal | Print | Q |
| 2 | GL66 | LEAK | 2004-03-31 18:10:59 | 2004 Passenger Ship Terminal | Print | Q |
| 1 | GL66 | LEAK | 2004-03-31 18:10:58 | 2004 Passenger Ship Terminal | Print | Q |

**Alarm Statistics**

| Sub Project | Scow | Leak Alarms | Misplacement Alarms | Voltage Alarms | TPL Alarms |
|---|---|---|---|---|---|
| 2004 Passenger Ship Terminal | GL65 | 7 | 0 | 1 | - |
| 2004 Passenger Ship Terminal | GL66 | 3 | 0 | 2 | - |
| 2004 Passenger Ship Terminal | - | - | - | - | 34 |
| **TOTALS:** | **-** | **10** | **0** | **3** | **34** |

**Figure 3.** Listing of automated leak alarms and total alarm statistics shows ten leak, three voltage and 34 TPL exception alarms during the PST 2004 project.

In response to NYD questions concerning the leak alarms within the first two weeks of dredging, the ADISS firmware was modified to record all scow activities, including loading, transit and placement on a 24-hour basis. The new firmware was installed on May 10$^{th}$ on the scows, and test data were acquired throughout the remainder of the project.

Access to this report was made available to the public on the NYD web site (http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm.) in '.pdf' format.

## 3.0 FIELD SERVICES AND DATA PROCESSING

The Passenger Ship Terminal project began on March 31, 2004, when GLDD shipped the first load of maintenance dredge material to the HARS. ADISS units were installed aboard scows *GL-65* and *GL-66*, and on May 12 on the *GL-64*, when the *GL-66* was removed from service. The ADISSPlay unit was installed aboard the tug *Katy G. McAllister* over the course of the six-week project that ended on May 16, 2004.

ADISS/ADISSPlay successfully monitored 100% of all 102 placements. One trip was recorded with the ADISSLt version of the tracking software, when the Inspector was unable to establish communications with the scow. In this case, the alternate program estimated the scow position from the tug GPS and the layback distance to the scow. Without draft information, ADISSLt depended on input from the Inspector to mark a placement event. Once the ADISS firmware parameters were revised by SAIC engineers, ADISSPlay was reset to its default values, and the scows were tracked directly from ADISS signals aboard the scows.

Trip 30 was not recorded with ADISS, because of an erroneous threshold entry setup in the new 24-hour firmware. The error was corrected before a subsequent trip was made with the sister scow also equipped with the new version of firmware. The Inspector activated ADISSLt, so the placement was established with information from the tug GPS and scow layback.

During the previous Passenger Ship Terminal project, March-June 2003, 180 trips were successfully recorded out of a project total of 181 trips to the HARS (SAIC, 2003).

Plots of each placement and draft record were placed on the ADISS web site http://www.adiss-afiss.com/, and could be accessed by choosing a trip number. All showed the accurate placement within the designated target grid. Figure 4 illustrated a summary plot of all 101 recorded trips. The maintenance material dredged from the PST project contained significant volumes of water, decreasing the disposal time over the target cells to seconds instead of minutes. The quick release time resulted in accurate placement of material within the chosen target cells.

The following three features were introduced during the Passenger Ship Terminal project:

1. TPL times were recorded and displayed on ADISSWeb.
2. Automatic load volume calculations were compared with Inspector estimates.
3. A revised means of determining leaks was utilized, and a field sensor test was performed.

As a deliverable under the present GSA contract with NYD, SAIC modified ADISSPlay to record the times when each of the three sections of the TPL was submitted by the inspector. Section A was to be completed upon departure from the dredge site, Section B in Ambrose Channel, and Section C prior to placement at the HARS. SAIC also modified ADISSWeb to display the locations of TPL section submittal along the transit track line. These were displayed by activating the ‘TPL Checklist’ button on the trip page, and by minimizing the TPL exception log. The previously unmarked track line shown prior to the TPL activation was redrawn to include the submittal times and places (Figure 5).

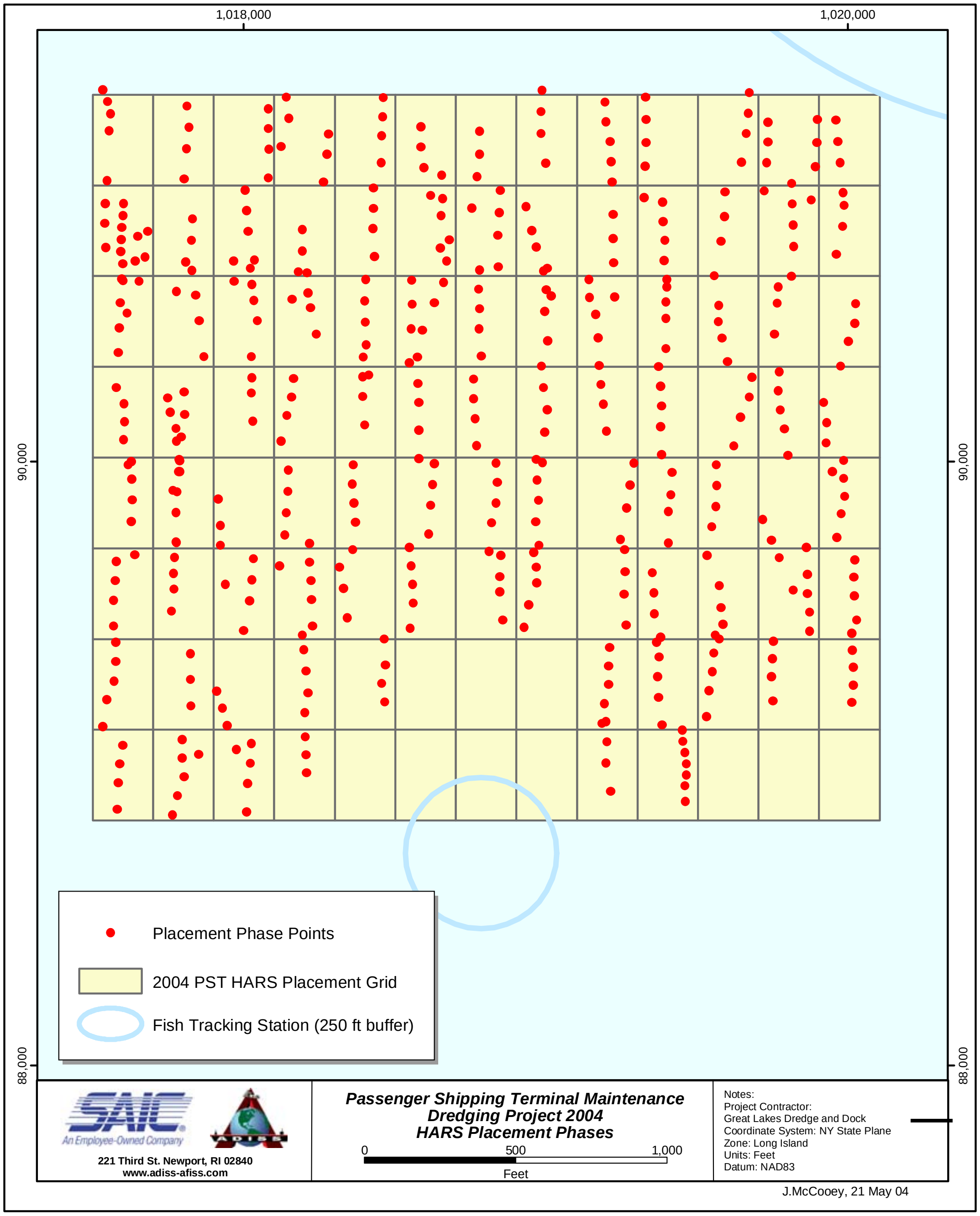



**Figure 4.** Summary of 102 placements at the Historic Area Remediation Site, Priority Area #1 during the Passenger Ship Terminal project, March-May 2004.

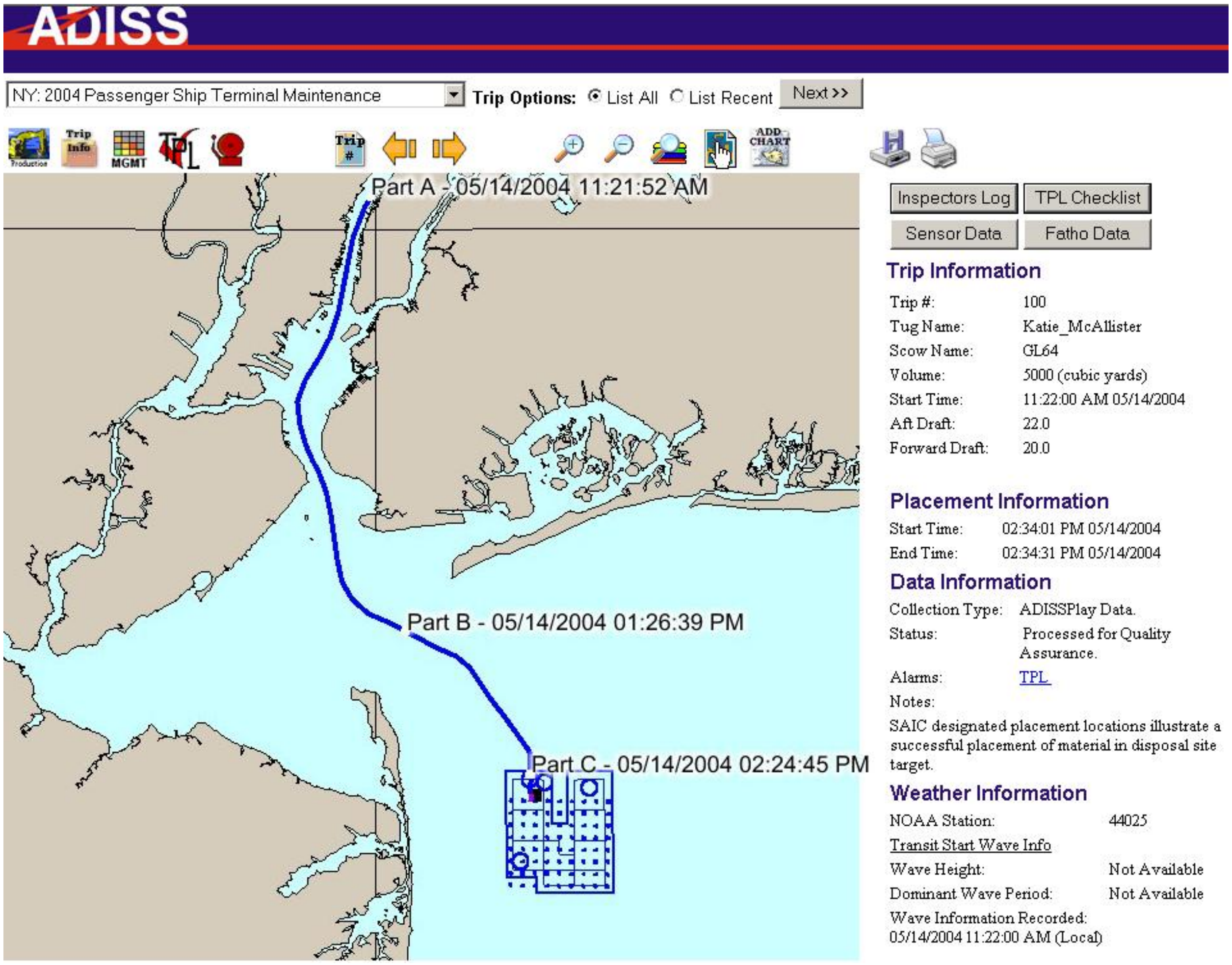



**Figure 5.** Example of TPL submittal times and locations during PST 2004 project.

TPL exceptions during the project were tallied according to Inspector. The first inspector recorded a total of 19 exceptions from March 30$^{th}$ to April 21$^{st}$, while the second inspector recorded a total of 45 exceptions through to May 15$^{th}$. Summaries of exceptions are available by activating the "TPL" icon, located in the menu tool bar, and by selecting the queries for "Inspector" or "Scow".

Calculated load volumes totaled 386,674 cubic yards for the project, while inspector estimates from ADISSPlay entries tallied 489,400 cubic yards (21% greater than estimated by the 'Volumator' calculation method). Data from the conditional bathymetric survey indicated 326,751 cubic yards of material had been removed from the project site. Both of the load estimates had two sources of potential error: The selection of the correct load curve depended upon the density of the material entered, and accurate draft observations were needed for each trip. Problems with either would have resulted in volume inaccuracies. To eliminate these sources of error, the level of the material present in the hopper could have been measured directly with an acoustic bin sensor, which would have provided a standard basis for monitoring the potential changes in scow content during the loading and transit process.

Prior to the Passenger Ship Terminal project, a revised means of determining scow leakage was developed that had eliminated false positive alarms during two West Coast projects. The new means of detection compared average draft readings at the beginning of each trip with those prior to placement. Differences in the average values greater than a threshold generated the alarms.

During the Passenger Ship Terminal project, speed was also plotted to document scow velocity for each placement. Requirements for placement operations listed a scow speed of 2 knots at the HARS, sea or towing conditions permitting. The requirement was not met by any of the placements recorded by ADISS. Most placements occurred at speeds greater than 6 knots, resulting in several automatically generated leak alarms.

Alarms generated during the project on trips 6, 53, 62, 65, 67, and 75 were probably due to the effect of speed on draft measurements. As depicted in Figure 6, the changes in draft recorded during trip 63 were inversely related to speed. At approximately 9:40 pm, scow speed increased from 1.5 knots to over 10 knots by 10 pm with a corresponding 1.5 foot decrease in draft. At rest by 10:20 pm, draft returned to nearly the original value. Once underway, draft again decreased until just prior to placement at 1 am, when speed decreased to 6.4 knots and draft increased to 14 feet. The data indicated that pressure measurements were affected by the speed of the scow. And the false alarms resulted from scows that did not slow down during placement.

A field test was conducted on April 29th to: 1) check the accuracy of the ADISS pressure sensor on the *GL-65* suspected to have lost approximately 1.5 feet of draft during trip 59 on April 26$^{th}$, 2) examine the relationship between pressure readings and scow speed, and 3) observe any change in the level of the material present in the hopper bin during a brief portion of trip 63. At the request of GLDD, the accuracy of the ADISS pressure sensor was verified. During a static test conducted in the ram well of the *GL-65*, ADISS pressure sensor readings were converted and compared with water level measurements from a carpenter's tape. The converted sensor values matched the levels measured with the tape, as well as those from a calibration conducted prior to installation. The sensor remained linear in its response to changes in pressure, and had accurately recorded the at-rest differences in draft noted during trip 59 (Figure 2). The relation between pressure readings and scow speed was observed during a brief ride down the Hudson River on the *GL-65*, loaded and bound for the HARS. Again, careful measurements were taken of the water level present in the aft ram well with the carpenter's tape while speeds of up to 10 knots were recorded by ADISS along with pressure sensor measurements. From 9:40 pm to 10 pm a 1.33 foot decrease in water level was noted in the ram well as speed increased from 1.5 to 10 knots. By 10:20 pm the level had returned to less than 1 inch of its original value with a corresponding decrease in speed to zero knots. This observation confirmed the relationship between pressure measurements and scow speed, and indicated that fast placement speeds at the HARS could have resulted in low pressure readings and equivocal leak alarms. During the trip down the Hudson River, hopper level measurements were also taken with the tape. At 9:40 pm the aft and fore bin readings were 91 and 117 inches, respectively. By 10:20 pm the aft bin measurement had dropped by 1.5 inches and the fore bin decreased by 1.0 inch, which would have indicated a loss of roughly 32 cubic yards of volume. This is based on current estimating methods, using the reported density of material and the appropriate load curve. However, the use of acoustic bin sensors would have provided a more direct method for monitoring fast-moving scows during this maintenance project.


**Trip Information**

| | |
|---|---|
| **Trip #:** | 63 |
| **Tug Name:** | Katie_McAllister |
| **Scow Name:** | GL65 |
| **Bin Volume:** | 3500 cu yd |
| **Start Time:** | 04/28/2004 9:19:49 PM |
| **Initial Aft Draft:** | 15.17 ft |
| **Initial Fore Draft:** | 0.00 ft |

**Placement Information:**

| | Placement Start: | Placement End: |
|---|---|---|
| **Time:** | 04/29/2004 12:42:32 AM | 04/29/2004 12:42:53 AM |
| **Latitude:** | 40.413531 | 40.412891 |
| **Longitude:** | -73.873712 | -73.873758 |
| **Aft Draft:** | 14.24 ft | 7.24 ft |
| **Forward Draft:** | 0.00 ft | 0.00 ft |

**Data Information:**

**Type:** ADISSPlay Data.

**Email Alarm Types(s) Sent:** None

**Notes:**

SAIC designated placement locations illustrate a successful placement of material in disposal site target.

**Figure 6.** ADISS draft information displayed for Trip 63 on ADISSWeb.

## 4.0 SUMMARY AND RECOMMENDATIONS

The following summarizes the results of monitoring the placement operations at the HARS during the 2004 Passenger Ship Terminal project:

- ADISS units aboard three scows recorded 99% of all 102 placements, and ADISSPlay recorded 100% of all transits to the HARS.
- Calculated total volume dredged was 386,674 $yd^{-3}$ compared with 489,400 $yd^{-3}$ from Inspector estimates and 326,751 $yd^{-3}$ from the conditional bathymetric survey.
- The ADISS/ADISSPlay-telemetered data provided near real-time updates on the Internet of daily placement activities using the ADISSWeb program, and detected several leaks.
- Pressure and ram well observations taken during a field test validated previous sensor measurements, which had indicated scow leakage.
- Pressure measurements affected by fast placement speeds may not detect the leakage of maintenance material from hopper bins.
- Continuous recording of ADISS data was tested. Twenty-four hour loading and transit information was acquired at 5-minute intervals in addition to 6-second placement data.
- Trip numbers were assigned by the ADISS computer, and transmitted to the towboat.
- The use of cellular technology also allowed remote trouble shooting. ADISS engineers rectified several errors during the project by remotely manipulating ADISSPlay on the tug from the SAIC Newport facility, which saved data and transit costs to the work site.
- Inspector log information along with the TPL checklist information and times of entry were transmitted and displayed on ADISSWeb.
- TPL exceptions and leak alarm statistics were listed and graphed for analysis by NYD on ADISSWeb.

The following recommendations are suggested to improve HARS management operations:

- Bin sensors should be utilized by the ADISS equipment installed on dredge scows for the purpose measuring the level of maintenance material loaded in the hoppers and during transit.

## 5.0 REFERENCES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SAIC. (1998b). Letter report to Mr. Brian May, USACE-NYD, presenting the deliverables for the project, ADISS Management Tolls for HARS Disposal Operations. November, 1998, from Mr. Steve Pace, Project Manager.

SAIC. (1999). Automated Surveillance of Disposal Operations during the 1999 Passenger Ship Terminal Project at the Historic Area Remediation Site. Report 93 of the New York Mud Dump Site Studies. USACE-CENAN, Contract No. DACW51-97-D-0014. SAIC Report No. 471.

SAIC. (2003). Monitoring Dredged Material Placement Operations at the Historic Area Remediation Site during the Passenger Ship Terminal project. USACE-CENAN, Contract No. GS-35F-4461G. SAIC Report No. 651.