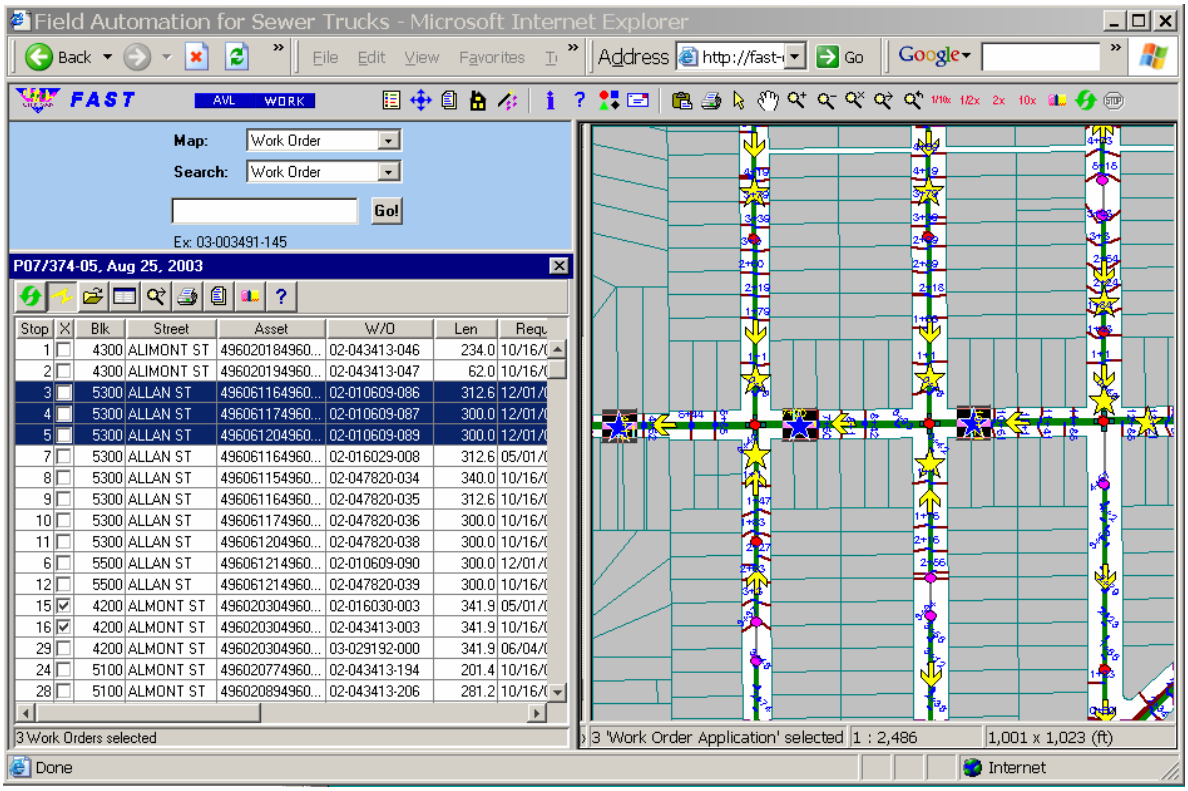
NaviGate Customer Success Story
City of LA FAST Improves Performance of Field Crews



NaviGate: Delivering Spatial Data to the People Who Need It

Gatekeeper Systems

Applications and Systems for the Internet

1010 East Union Street
Suite 205
Pasadena, CA 91106-1756

Phone: +1 626 449 8135
Fax: +1 626 440 1742

E-Mail: info@gatekeeper.com
URL: http://www.gatekeeper.com/

FAST System Delivers Work Orders and Maps Direct to Users in the Field

Introduction

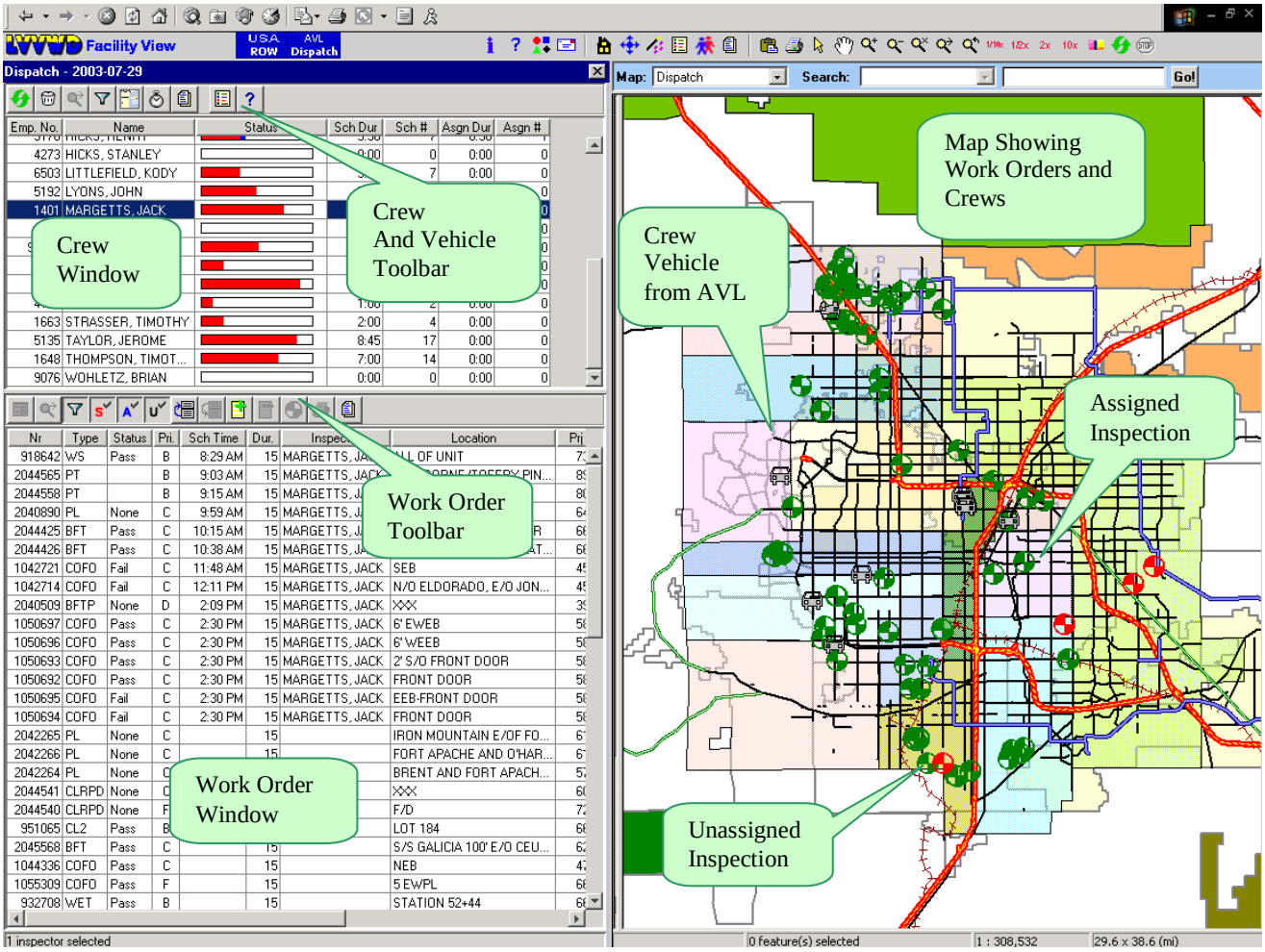
At the City of Los Angeles, over 100 maintenance crews are responsible for the huge task of maintaining and inspecting the vast LA sewer system. Like painting the Golden Gate Bridge, the work is relentless - every secondary sewer is cleaned and inspected on a regular basis at intervals ranging from quarterly to once every five years. Failure to perform regular maintenance is not an option: the City has committed at the highest levels to reduce the number of sewerage spills resulting from inadequate maintenance.

The *FAST* System (Field Automation for Sanitation Trucks) is an exciting new application for managing sewer maintenance work orders and the associated facilities data and deploying that data to the field. *FAST* replaces cumbersome and time-consuming manual processes with a modern wireless computer application, dramatically improving sewer maintenance productivity. The system eliminates paperwork and provides a graphical map-based interface that helps maintenance supervisors keep their crews operating at peak efficiency. FAST was built using off-the-shelf modules from the *NaviGate* family of products by Gatekeeper Systems.

The system is now in full production, installed in over 130 vehicles used to perform critical sewer inspection and cleaning operations that keep the City of LA sewers flowing smoothly and safely.

FAST by the Numbers	
Number of work orders per year processed by FAST	Over 100,000
Number of crews using FAST in the field	Over 120
Number of supervisors assigning and planning work	About 10
Typical crew size	2
Typical supervisor productivity improvement over prior manual process	Over two hours saved per day
Expected crew productivity improvement from reduced paperwork, improved scheduling, and online access to facility maps	Over one hour per day
Number of vehicles fitted with AVL and mobile hardware	Over 100
Number of supervisor vehicles	18
Number of manholes managed in FAST	146,395
Number of sewer pipelines managed in FAST	141,776
Miles of sewer managed in FAST	6487
Cost of typical sewer cleaning vehicle	$250,000
Cost of installed FAST laptop, modem, and GPS	$4200
Total system cost, including in-vehicle hardware, servers, software, and installation and startup	$1.3 million
Expected Return on Investment	Under 24 months
NaviGate Modules Implemented	NaviGate Core, NaviGate Automatic Vehicle Location, NaviGate Work Order Module

The following figure shows the basic layout of the *FAST* user interface.



FAST Speeds Access to Work Orders

The Bureau's Work Management System (WMS) automatically determines which facilities need cleaning or inspection and creates a work order for each operation, including a date by which that work order must be completed. The task of assigning, scheduling, and managing the day-to-day work for the 120 crews falls to about 12 supervisors.

Prior to FAST, these supervisors used printed reports and a traditional PC application to laboriously retrieve work orders from the WMS and plan the work for each crew. The job of planning a crew's daily tasks could take more than an hour. The result of that work, largely clerical in nature, was a stack of printed work orders that were handed to the crew at the beginning of each day.

To minimize travel time for the crews, work orders must be assigned so that one task is near the next. However, prior to FAST, creating nearby assignments was difficult and tedious, and involved cross referencing paper work orders with a paper map. The assignment efficiency was therefore often less than perfect.

In the field, the crews filled in paper forms to record their activities on each work order. Because the conditions found in the field are important in deciding how aggressively to schedule the next work order

for that sewer, crews are required to capture detailed information about their cleaning activities and conditions found. Crews often need to record additional information about specific problems encountered. And they need to record their time on each work order to facilitate planning, budgeting, and future work planning.

Back in the office, crews also had to provide daily summaries of their activities, including total number of work orders completed, special conditions found, and total length of lines cleaned or inspected. The extensive end-of-day paperwork substantially reduced the crew's time available to actually perform their assigned tasks. And after the crews were done with the paperwork, ten full-time clerks were required to perform the data entry of from the paper work order.. Data entry errors and backlogs were nagging problems that prevented effective use of the work order closure data.

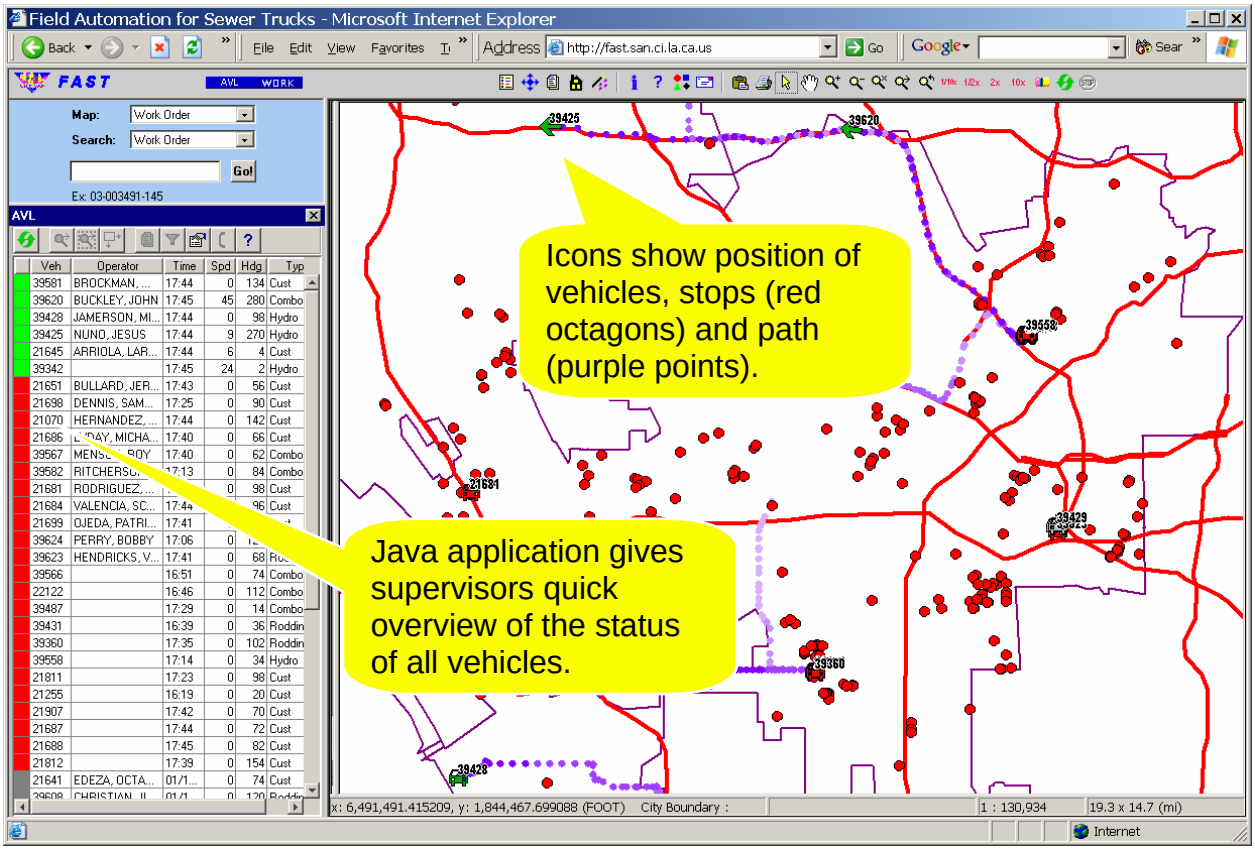
Supervisors Dramatically Improve Productivity using FAST

FAST has dramatically streamlined the workflow throughout the sewer maintenance process. Built from off-the-shelf components of the Gatekeeper Systems *NaviGate* family of products, FAST was implemented in just three months.

Supervisors now use a Web browser and the FAST system to view a map showing the locations of work orders that must be assigned to crews. By clicking on the work order on the map, the supervisor aggregates work into an assignment lists – a batch of work orders. The supervisor can also sequence the work using a simple click-to-sequence interface, saving the crew valuable time later planning their route. The resulting work assignment lists are then assigned to crews as they complete their previous lists.

The supervisors are also able to add work orders and adjust work while the crew is in the field. Because the crew is in wireless communication with the FAST system, supervisors can view the crew's status in real time. If a crew completes a work list, they can either pick up another batch of work orders, or the supervisor can construct a new batch of work orders appropriate to the crew's current location and the time remaining in the shift.

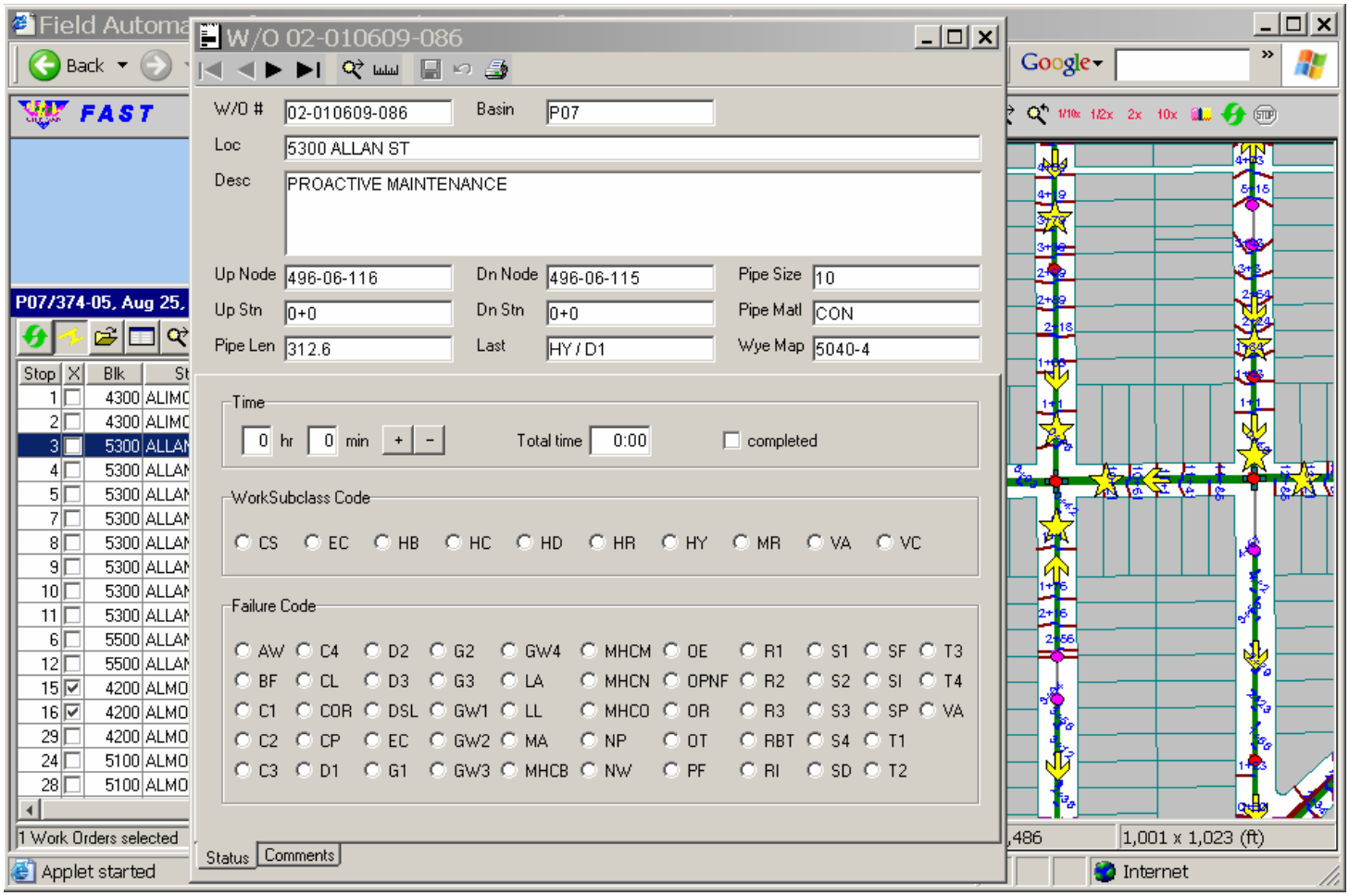
Because each sewer maintenance vehicle is equipped with a GPS system, the FAST Automatic Vehicle Location module (AVL) allows supervisors to monitor the location of crews and equipment. The City has recently committed to dramatically reducing the response time when a sewer overflow occurs, and knowing the location and status of vehicles is a critical element in meeting this goal. Because supervisors know at all times the status and location of sewer maintenance crews, they can much more easily dispatch the best crew to address emergency work requests.



The sum of these various performance improvements is impressive. Some supervisors have reported more than two hours per day of productivity improvement, allowing them to work less on clerical tasks and spend their time more appropriately, dealing with the other challenges of running a complex field organization.

Field Functions in FAST

Crew productivity also benefits substantially from FAST. Instead of handling 15 to 100 pieces of paper each day, the crew leader completes each work order electronically on a laptop in the truck. Each work order is transmitted back to the FAST server as soon as the work is completed. The crew can conveniently record their time spent on each work order, and the crew members are automatically credited for the number of work orders completed and the length of sewers cleaned or inspected. Comments are also entered electronically, and the system provides a mechanism to inform supervisors when a work order cannot be completed because of interferences such as cars parked on top of a maintenance hole or obstructions in the sewer line.



Most importantly, the crews have electronic access to accurate facility data and maps. The maps help them locate the work site quickly and efficiently. Online access to accurate sewer lengths and slopes helps them plan and verify their work. And online records of previous maintenance visits to the same location inform crews in advance of possible problems. Crews also have access to a variety of search and navigation tools to help them find specific facilities, work orders, or locations such as intersections. In the next phase of the project, crews will also have online access to detailed sewer construction drawings to help them become even more effective on-site problem solvers.

Oracle Data Warehouse

Part of the FAST application is a complete spatial data warehouse, built using the Oracle database system. The information about work orders, sewer facilities, vehicle location history, GIS data, addresses, parcels, and the other data that is shown in FAST is all accessible in this warehouse. No special GIS tools are required to access the data – just standard Oracle SQL queries.

Because of issues of database compatibility with the legacy Work Order System, the FAST database is currently running under Oracle 8i. It is planned to upgrade the system to Oracle 9i or Oracle 10g in the next few months, at which time the database will also take advantage of Oracle Locator functionality for storing and managing complex spatial information.

Field Hardware and Communications

Sewer maintenance workers are used to working with large power tools, not operating a computer keyboard. Sewer cleaning happens 24 hours a day, 365 days a year, and in all kinds of weather, and the truck cab can get wet and dirty. The huge sewer maintenance trucks and powerful hydraulic equipment they contain subject the computers to a great deal of vibration. For all of these reasons, the Bureau selected hardened laptops from Panasonic as the FAST field computers. The laptops are mounted on

freely adjustable brackets that allow the computer to be used by either the driver or the passenger. Mounting hardware has been a special challenge because of the unusual configuration of the many special-purpose vehicles used, and the presence of controls for the complex hydraulic equipment.

The Bureau uses wireless modems from Airlink. The model selected, the PinPoint CDMA for Sprint, provides good wireless coverage, throughput of over 6 Kbytes/sec, and accurate GPS positions. The modem is mounted securely inside the truck cab, with a single antenna on the roof for both wireless communication and GPS. The GPS position is updated every 30 seconds, and if the modem is temporarily unable to transmit the position the PinPoint stores the information and transmits it later. The FAST system itself also tolerates occasional gaps in wireless coverage, as work order information is cached in the software on the laptop.

The total hardware and wireless package has proved to be a reliable and effective platform for FAST.

Future Project Phases to Add Further Capabilities

The FAST project will be implementing additional *NaviGate* features in the future.

The next *NaviGate* module to be implemented will be the *NaviGate Document Manager Module.* The Document Manager Module will allow field crews to keep detailed engineering drawings local on the laptop. The local drawings will be automatically synchronized with the central drawing library, and will also be accessible by clicking on the main FAST map.

The *NaviGate Map Markup Module* will provide a mechanism for field crews to make notes and suggested corrections directly on the FAST maps. Those notes and sketches will be transmitted back to the map maintenance group for research and incorporation into the GIS database.

Finally, an upgrade to Oracle 9i or Oracle 10g is planned for later this year, and will utilize the features of Oracle Locator. That upgrade will allow all of the spatial data stored in FAST to be available to any Oracle application using standard SQL queries.