

BIOGRAPICAL INFORMATION

Greg Ramon
Water Distribution/Wastewater Collection Superintendent
City of Phoenix, Water Services Department
Water Distribution/Wastewater Collection Divisions

Specific Responsibilities

Greg joined the Phoenix Water Services Department in 2000. Responsible for managing the Water Distribution/Wastewater Collection Divisions of the Phoenix Water Services Department. The Water Distribution Division is a 24-hour, 7-day per week operation and is responsible for inspecting, maintaining and repairing nearly 6,100 miles of water distribution main lines and 375,000 service connections. The Division repairs approximately 2,000 main breaks and 8,000 service leaks per year. In addition, the Division maintains more than 91,000 valves and 40,000 fire hydrants and installs nearly 700 large taps each year. The Division has 7 service yards and over 300 remote water and wastewater facilities (wells, booster stations, storage tanks, reservoirs, Pressure Relief Valve stations, lift stations). The Division has a 24-hour, 7-day per week dispatch function and a Supervisory Control and Data Acquisition (SCADA) computer system.

The Wastewater Collection Division is responsible for inspecting, cleaning and repairing over 4,400 miles of sanitary sewer lines, including 68,000 manholes and cleanouts, located throughout the City. The Division has five wastewater collection yards, a dispatch function and a SCADA computer system. The Division also manages odor control and vector control programs and performs Blue Stake locating service.

Past Experience

(Period covers 1989 – 2000)

Chief of Water Distribution and Wastewater Collection Division, City of Evanston IL. Water Services Department. Responsible for similar duties on a much smaller scale.

Educational Information

B.S. Business Management, National Lewis University

M.B.A. University of Phoenix

Professional Memberships

American Water Works Association, Chairman of the Distribution O&M Committee

American Public Works Association

Water Environmental Federation

BIOGRAPHICAL INFORMATION

Chris Stern
President and CEO
Spacient Technologies, Inc.

Specific Responsibilities

Chris is Founder, President and CEO of SPACIENT ('spay-see-ent') TECHNOLOGIES, a firm specializing in enterprise technology and mobile computing solutions for government and utilities. In this role, Chris has overall responsibility for company strategy, business development, software application and product development, project delivery and client services. Chris is currently overseeing Spacient mobile GIS and field service application deployments for some of the largest municipalities and utilities in the United States. Chris is also focused on development of Fieldport Release 4.0, Spacient's next generation enterprise mobile GIS and field computing application platform.

Past Experience

Former technology executive for the Los Angeles Department of Water and Power, the largest municipally-owned utility in the United States, responsible for IT strategy, system development and operation and maintenance for over 2,000 employees in the water services organization.

Educational Information

M.S. - Engineering, University of California, Los Angeles
B.S. - Engineering, Loyola Marymount University
Registered Land Surveyor In Training - California
Registered Professional Engineer - California

Professional Memberships

Geospatial Information Technology Association (GITA)
American Water Works Association (AWWA)
AWWA Customer Service Committee
ESRI California Partner Council
Council of Energy Advisors

DEPLOYING MOBILE GIS AND WORKFORCE MANAGEMENT TECHNOLOGY TO TRACK, MEASURE AND IMPROVE UTILITY FIELD SERVICES

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ABSTRACT

This paper describes the implementation and use of enterprise mobile GIS and workforce management technology for tracking, measuring and improving utility field services at City of Phoenix Water Services Department.

City of Phoenix is the fifth largest City in the nation, and the second fastest growing in terms of population. To address this dramatic growth, the City's Water Services Department began implementation of an enterprise mobile GIS and workforce management solution, the Mobile Applications Program Solution (MAPS) in mid 2002. After having the technology deployed since late 2002, the City has now begun to realize many of the benefits of mobile GIS and workforce management technology. Using the data collected from field operations, the system is now providing timely and accurate operations data to City management, allowing for the design and implementation of performance measurement reporting and improvement programs.

This paper will provide an overview of the ROI-based design and implementation for the mobile GIS and workforce management solution, a description of the business and technical aspects of the system implementation, discussion of the human factors affecting the success of the project, and describe the evolutionary process the organization underwent to use the system data to better measure and improve utility field services.

OVERVIEW

The City of Phoenix Water Services Department (WSD) provides water distribution and wastewater collection utility services to over 1.4 million residents in the fifth largest and second fastest growing city in the nation. Challenged by this growth and the need to manage a rapidly expanding infrastructure and widely distributed mobile workforce, the City embarked on a program to deploy mobile technology to City field crews.

In April 2002, a project was launched to deliver an Enterprise Mobile GIS and workforce management system for the 450 field personnel in the newly combined Water Distribution and Wastewater Collection Divisions (WD/WC). The goal of the project, titled the Mobile Applications Program Solution, or MAPS, was to deliver essential data and information to and from WD/WC field service crews to enhance customer service and improve operational efficiency. Under this broad goal, City management had the specific objective of deploying mobile technology to empower City field crews with technology and provide a single system for

WD/WC management to capture, track, measure and ultimately improve field service operations. To achieve this end, the City engaged the support of CH2M Hill and Spacient Technologies, Inc. (Spacient), a software and systems consultant with broad expertise in mobile GIS and field automation for utilities. The consultants worked with City management to define a phased implementation program for the MAPS project that involved close collaboration with field crews on the delivery of an enterprise mobile GIS and workforce management solution.

The MAPS system was implemented in late 2002 and has subsequently been deployed to the majority of WD/WC field crews. Functionality for GIS mapping, work order and crew reporting, automated forms, workflow, administration and reporting have been deployed in the system that involved over 150 mobile devices and data communications. The system provides City management with a “one-stop” shop for all field data, including information which was previously kept on paper, entered into a CMMS, or recorded in the City’s legacy mainframe work tracking application. The system has been capturing data for some time, and it is now beginning to be tracked and monitored. The purpose of this paper is to discuss the City’s approach to the project and the next major stages of “measuring” and implementing “performance improvement” programs for WD/WC field operations.

BUSINESS DRIVERS AND ROI

The City launched the MAPS project to deploy technology to field personnel to continue the City’s effort to provide “Best in Class” services to Phoenix residents. Drivers for the project included:

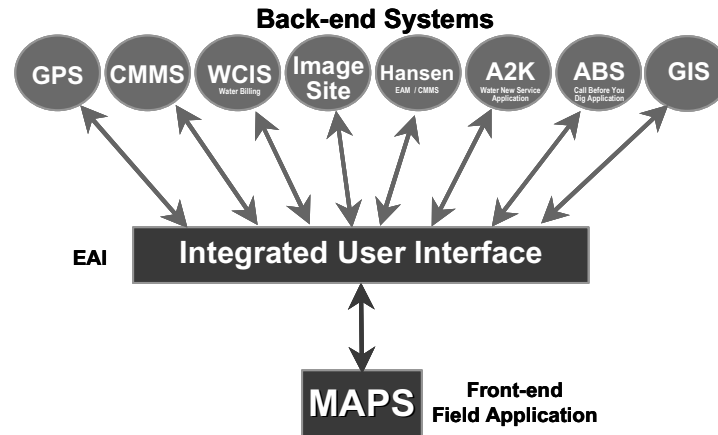
- Service area and demand are growing
- Customer demand for service levels increasing
- Consolidation of Water Distribution & Wastewater Collection Divisions
- Regulatory compliance driving technology and improved work practices (H&S, cMOM, SSO and SDWA regulations)
- Apply best-in-class practices to sustain the City’s reputation for excellence
- Integration of customer service call center and field dispatching
- Improve asset information
- GIS maps to the field
- Capture clear and accurate crew reports (field work orders)
- Maximize technology to improve work practices
- Integrate multiple ongoing projects involving field crews & field data

Like any major technology program, the MAPS project involved close scrutiny from City management and financial analysts. Before ever starting implementation, a rigorous business case was developed. The purpose of the business case was three-fold: (1) to outline the project vision, goal and objectives, (2) to justify project costs, and (3) to prioritize the implementation.

The initial step in the business case was for City management to outline the vision, goals and objectives for the project:

Vision

A Single Enterprise Mobile GIS and Workforce Management Solution for Water Distribution and Wastewater Collection Division Field Crews



Goal

“To deliver essential data and information to and from Water Distribution and Wastewater Collection Division field service crews to enhance customer service and improve operational efficiency”

Objectives

City management outlined the following project objectives:

- Improved customer service
- Improved operational efficiency
- Better communication with field crews
- GIS maps and work orders to the field
- Integrated Customer Service and WD/WC Divisions field services
- Reduced paperwork, backlog (maps and WOs), data entry
- Reduced radio/voice traffic (system currently over utilized)
- Better management reporting

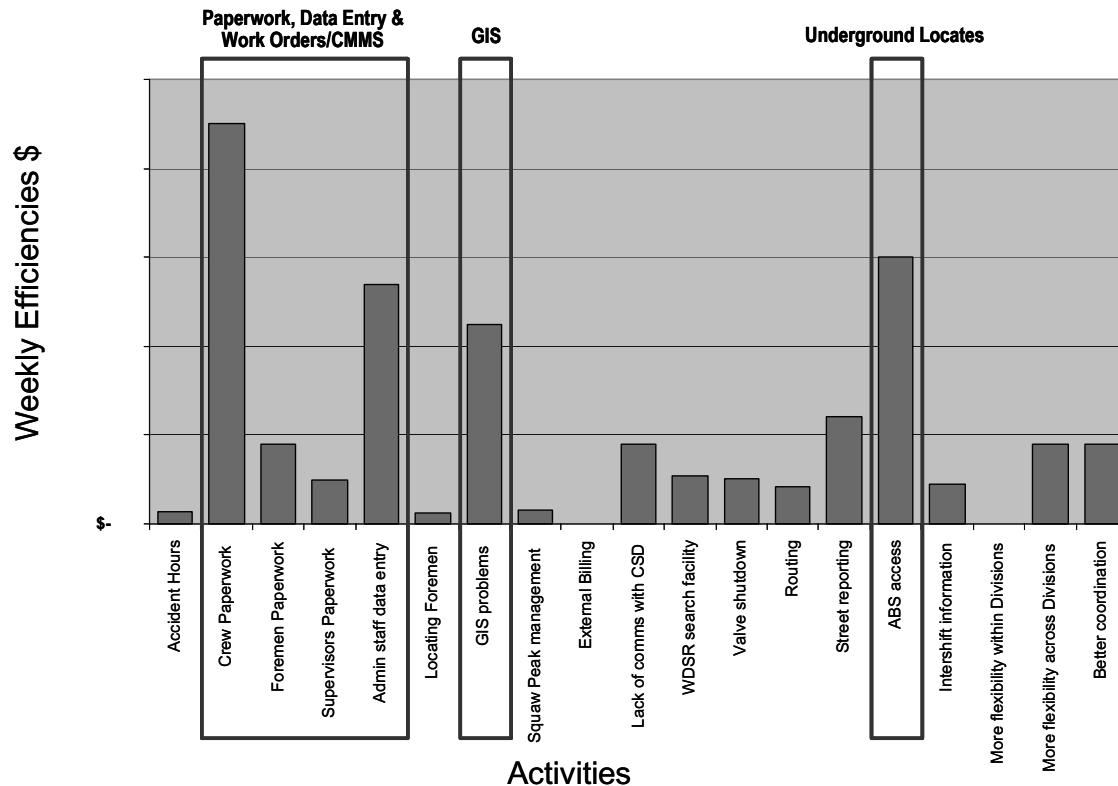
Return-on-Investment (ROI)

Key to the business case was the return-on-investment (ROI) analysis, which provided answers to the questions: (a) Why are we doing this project (i.e. What are the benefits); and (b) what are we going to implement and in what order?

The ROI for the MAPS project was the result of an extensive, over four month, analysis of City field operations, work processes and technologies. The ROI illustrated project benefits, both tangible and intangible, that amounted to more than 20% of the annual operating budget. The

study also showed that field automation would provide a wide variety of benefits across the organizations, with some of the largest coming from automating field paperwork and delivering GIS maps to field crews.

Benefits of Mobile GIS and Workforce Management



In addition to the large tangible benefits observed in the ROI analysis, other equally valuable intangible benefits were uncovered in the form of:

- Improved customer service
- Improved customer perception
- Better communication between divisions
- Better management information
- More accurate data
- More consistent business processes
- Integration with CIS/CRM at call center
- Improved communications internally
- Better identification of deficiencies
- Increasing employee moral
- Department's image in the industry

The tangible and intangible benefits more than justified the MAPS project costs, and indicated a project payback period of less than 24 months for the full implementation.

SYSTEM IMPLEMENTATION

The MAPS project implementation was guided by the project's business case document that included the vision, goal, objectives and ROI analysis. The MAPS project also utilized a philosophy developed by the consultants based on their prior experience with large field automation efforts to address key implementation issues:

Project Philosophy

- Prime risk is rejection by field crews and system users
- IT projects are prone to failure
- Incremental (rising iceberg) approach
- Defining functionality is difficult
- Flexibility (scope, functionality) vital for making progress

This philosophy and the consultants' close work with field crews led to a successful project implementation. The initial MAPS pilot system, with automated work orders, paperwork and workflow (no GIS mapping) went live in less than 2 months after City approval of the business case and implementation plan. The system was tested with management and personnel from 2 WD/WC combined field yards to validate functionality. Mobile devices were also tested, both Microslate tablets and the Panasonic Toughbooks, by City field crews in an operating environment (Phoenix temperatures greatly exceed 100 degrees Fahrenheit in Summer months) to ensure their performance and reliability. The Fieldport® Enterprise Field Service Management and Mobile Mapping software from Spacient was selected for the project as the system based on the City's project software design requirements.

MAPS Project Software Design Requirements

- A reliable, easy-to-use mobile computing system for field crews
- "Web-based" application – desktop & mobile
- Work on a variety of mobile devices
- Work online and offline
- Must have single, simple user interface
- User-friendly, intuitive interface
- Integrate GIS maps, CMMS/EAM, CIS/CRM, work orders, GPS & reference information
- Easy to support & maintain
- Management performance reporting

Upon completion of the MAPS Pilot, the full system implementation followed a structured and phased approach, deploying vehicle-mounted devices and the MAPS system to each of WD/WC's 14 yard locations over a 12 month period. In addition to deploying the base MAPS functionality for paperwork, work orders (crew reports) and workflow, additional functionality, including GIS mapping was deployed to all field crews.

The MAPS mobile GIS mapping functionality was deployed as an initial pilot with the goal of streamlining map delivery to field crews. The previous method of accessing maps in the field involved having the GIS group make edits, generate hard copy and microfiche maps, and distribute to field crews. These difficult to read maps were many times out of date and inaccurate.

The MAPS system automated the process of distributing GIS maps. Using the MAPS/Fieldport server, GIS maps can now be posted to the server by the GIS group and distributed out to the entire 450 field personnel in less than 2 days, including a Q/A process prior to map distribution. Additionally, the maps on the mobile devices are integrated into the work orders and workflow of the system and much easier for crews to read and utilize in the field. The MAPS system also provided a 2-way communication for field notes to be sent back to the GIS group for each of the GIS maps used in the field.

MAPS / Fieldport® System Features



**Crew Reports
(Field Work Orders)
Workflow**



**Mobile GIS /
Quarter Section
Maps**



**Field Inspection
Forms & Paperwork**



Administration



**Management Reporting &
Performance Measurement**

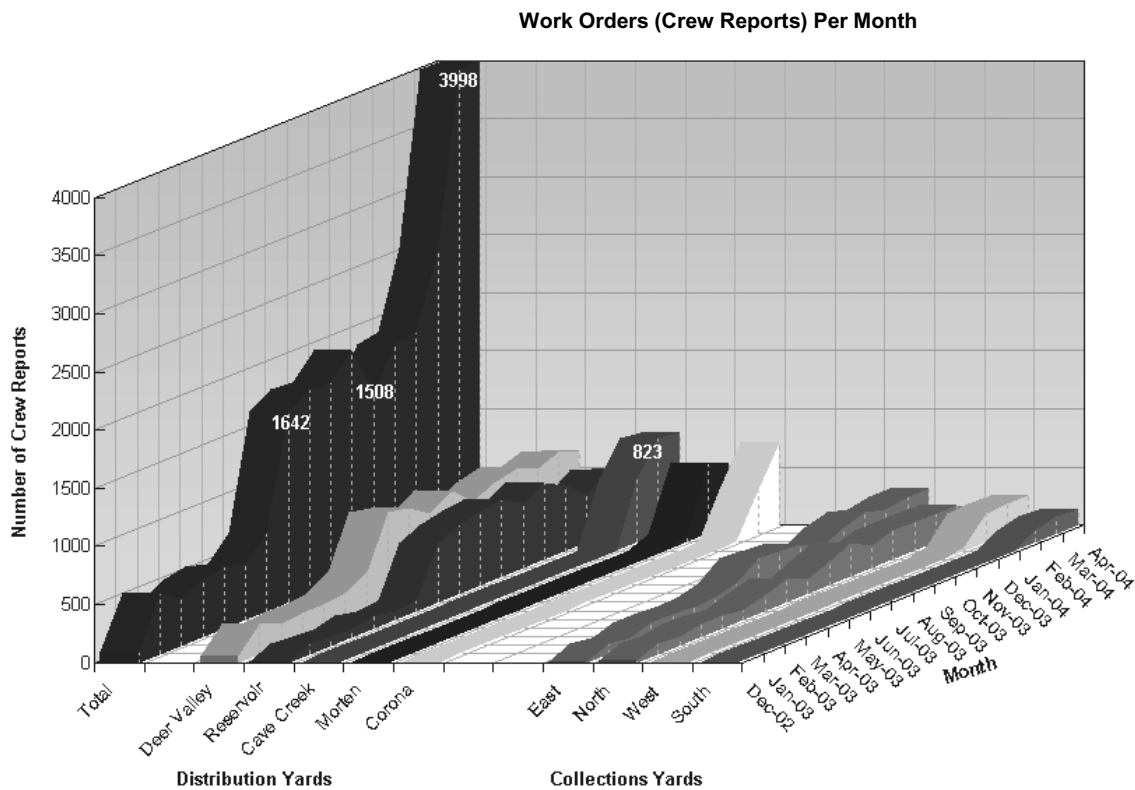
DELIVERING, CAPTURING AND TRACKING FIELD DATA

MAPS has been deployed to each of the WD/WC yards and is collecting, on a daily basis, full information about field crew work time, activities and costs. This data is providing the foundation for management in ongoing efforts to improve field operations and deliver “best-in-class” utility services.

Data captured in the MAPS systems has exploded, providing management with information on detailed work activities. This information was previously not available and only on hard copy forms, usually in files that were not readily accessible by City employees. Prior to MAPS, information from field personnel took weeks or months to arrive back in a central database, CMMS or other tracking system. MAPS ended this dilemma. Through a web browser interface, management now has direct access to daily field activities to enable improved communication with employees, City executives, customers and public officials during routine and emergency operations.

Data captured in the system is now providing the foundation for the City, through both the MAPS project and an ongoing Reengineering Program, to evaluate field operations activities and costs, to begin measuring and implementing programs to drive continuous performance improvement in City field services.

Volume of Field Data Captured in MAPS



MEASURING AND IMPROVING FIELD OPERATIONS

Deployment of the MAPS system to all City field crews is now providing the information foundation for measuring and improving field operations. This was an intended objective of the project and required that the same mobile system be: (a) installed for all field crews, (b) delivering and capturing all key information, and (c) in-place for an adequate period of time.

For MAPS, the system has been installed for over 18 months, with all crews using the system since September 2004. The system is delivering other substantial benefits to the City in the form of improved employee morale, enabling employee career growth through improved computing skills, and streamlining and standardizing many of the City's legacy work practices.

The MAPS project is now coupling with the City's ongoing Reengineering Project to help measure and improve WD/WC field operations. Using data in MAPS, the City is moving forward with programs to standardize routine field activities, implement baseline work templates to measure against, and use daily activity and cost tracking to drive performance improvement. These programs are expected to provide the foundation for achieving the overall benefits outlined in the MAPS business case.

CONCLUSIONS

The City of Phoenix Water Services Department MAPS mobile GIS and workforce management project has been enormously successful. The system has over 200 users and has received considerable attention from City officials, highlighting the productivity improvements that have been delivered through mobile technology. From this experience, we offer the following observations:

- Field computing is feasible, essential and can be started without waiting for other projects such as CMMS, GIS and CIS to get data to the field
- Look at your entire field operations to see what the requirements are and where the ROI could be achieved – it might not be obvious
- The return-on-investment (ROI) is perhaps unparalleled in operations and maintenance activities
- Field staff are perfectly able to adapt to new technology – if they are properly engaged in the process
- Keep the application simple to use – don't take attractive short cuts and end up with a myriad of different systems on the devices
- Support and maintenance for mobile IT is a major issue that must be addressed

The bottom line...the City's single enterprise mobile GIS and workforce management system is delivering substantial tangible benefits (in the case of Phoenix over 20% efficiencies as measured against the annual O&M budget), a variety of extremely important intangible benefits (increased field employee morale, improved field employee skills and better customer perception), and providing the foundation for improved utility field services.