

BIOGRAPHICAL INFORMATION

Bill Elliott
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Specific Responsibilities

Mr. Elliott joined har*GIS LLC as manager of channel partners in January 2004. He is responsible for business development and marketing of the TruckMap* Field Information System through vendor partner companies to provide comprehensive and integrated mobile GIS and mobile work force management solutions to utility and public works organizations. These systems improve field worker productivity and streamline field operations.

Past Experience

Mr. Elliott has 25 years experience in field force automation, GIS/GPS and infrastructure management system planning for utility, public works and transportation agencies. He provided subject matter expertise in business process analysis, GIS software, geocoding, data conversion, work force automation, GPS data collection, and AVL applications during client engagements at Exor, Tele Atlas, PlanGraphics, GeoResearch, Rolta, Prime/Computervision, Tektronix and IBM.

From 1992 to 1996, Mr. Elliott founded and published *MAPS ALIVE*, a field automation industry newsletter covering early developments in mobile GIS and AVL technologies and applications.

Educational Information

B.S. – Engineering, United States Military Academy
M.A. – International Relations, University of Southern California
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Field Force Work Management Business Processes and Implementation Strategies

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ABSTRACT

Work Management Systems have automated work planning, scheduling, resource loading and cost tracking to provide activity-based solutions vital to effective management. For the most part, however, fieldwork crews still deal with paper, and are only marginally automated. Even as Work Management Systems are being deployed, replacing paper-based documents and business processes in the field has been a challenge.

This paper will review the benefits of fieldwork crew automation over paper-based approaches, and discuss strategic alternatives to implementing work management field systems. It will also identify the importance of effective field work management systems in achieving asset management goals. A core competency approach to determining a field force automation rollout strategy within the organization will be presented. Various field system roll-out alternatives will be identified with benefits and challenges of each approach identified. The establishment of a 'corporate field force automation committee' will be presented. Leveraging investments in GIS as the backbone for field crew work management activities will be emphasized.

THE COMPELLING CASE FOR FIELD AUTOMATION

Field Force Overhead

In 1995, Cox Cable Hampton Roads of Virginia analyzed the daily activities of its field technicians and found that over 40% of the average technician's day was spent on activities other than installing and servicing customer accounts. The results broke out as follows:

- 57% On-the-Job Time – installing and servicing customer accounts
- 31% Job-Related Overhead – driving to job sites, communicating with dispatch, filling out paperwork, awaiting work assignments, finding data needed for job tasks
- 7% Management-Related Overhead – team meetings, training, and reporting
- 5% Vehicle-Related Overhead – vehicle refueling and maintenance time

The focus of Field Force Automation is to reduce the most significant category of field crew overhead activity: job-related overhead. With 40% to 60% of distribution utility company labor resources expended on field work activities, any reduction for time spent on job-related overhead can have a significant impact on the bottom line.

Procedures Break Down in the Field

Business process analysts, consultants and operations managers have relied on anecdotal evidence to better understand how established processes and operating procedures are carried out inside an organization. Well meaning instructions can be executed in such a fashion as to distort their original purpose, and even run counter to organizational goals. Nowhere in the organization are inadvertent distortions and outright schemes more prevalent than with field crews.

If a business process breaks down, odds are high the breakdown is in the field. Such schemes as a highway department worker placing old “road kill” out on a street on his way home from work in expectation of being called out to remove “newly reported road kill” later that evening at time-and-a half pay, is not uncommon. A Dispatcher who routes a ‘particular’ field technician to the opposite end of town on a call out as a form of harassment is another real life example of how procedures break down in the field. Recently, a water department GIS supervisor described this real life scenario at his organization:

A water main springs a leak at the intersection of Pine and Elm. A citizen on Elm dutifully reports the leak and it is recorded as being on Elm. Soon, another citizen on Pine sees the leak. Another call center operator takes the call and dutifully records the leak as being on Pine.

How many leaks are there? How many leak reports? How do you know if these leaks are the same or different? You cannot, unless you geocode the addresses and do a spatial search.

The repair crews didn't mind fixing the same leak twice. Later, the water leaks reporting database was geocoded and almost half of all leak entries turned out to be duplicates!

However, the mayor was able to report that a large number of leaks had been ‘fixed’.

Denver Pothole Crews – News at 11

Field crews are much more difficult to supervise than office staff. Evidence of this was brought to light in 1994 when an energetic Denver television news reporter followed a city pothole crew vehicle around the city for a day, documenting their activities on camera. The TV crew’s camera documented a mere twenty minutes of actual pothole filling work during the eight-hour shift. Numerous coffee break stops and an extended lunch hour accounted for the difference.

This story raised many eyebrows with citizens, and the mayor of Denver scheduled a frantic emergency meeting with his director of public works. Much of the blame for the incident was attributed to a lack of proper supervision. Management complained they were understaffed, burdened with paperwork, and had difficulty linking up with field crews that were always on the move. In spite of these valid complaints, the assistant director of public works was fired over this incident. Dispatcher and field force automation technology available today can now help overcome many of the obstacles to effective field force management identified during this episode. Successful asset and work management programs require effective field supervision.

Key Drivers for Field Automation

Below are some of the compelling reasons that distribution utility and public works organizations have identified to justifying expenditures for automating field crew business processes in ways that heretofore were confined to office system automation:

- Improve customer service
- Increased emphasis on Asset Management
- Streamline field operations (do more with less)
- Comply with new government regulations
- Mobilize desk-bound processes (end-to-end round trip of data)

More specifically, benefits of field automation effect both field users and office staff. Benefits in the field include:

- Eliminate redundant recording of field data
- Reduce paperwork and paper records
- Reduce office-to-field delays through wireless communications
- Optimize travel times

Benefits in the office can be even more significant. These include:

- Improve dispatcher productivity
- Improve workforce management
- Maintain crew control through location-based services
- Provide timely and current data or facility information
- Downsize the *field paper to database system* data entry staff

IMPROVING ASSET MANAGEMENT

A New Management Philosophy is Born

It all started when a group of government accountants expressed difficulties in determining the value of infrastructure assets in the financial statements they prepared. Looking at government financial statements, it is difficult, if not impossible, to tell if one jurisdiction is doing a better job of managing its infrastructure assets than another. Out of this dilemma came the Government Accounting Standards Board's Statement 34 (GASB-34) recommending accounting standards that show how well government is meeting its fiduciary and service obligations through the fiscal decisions it makes regarding infrastructure.

The GASB-34 Modified Approach provides a means of measuring how well jurisdictions are maintaining infrastructure through their work activities and public works department operations. It requires stewards of public infrastructure to do the following:

- Maintain an up-to-date inventory of assets (a field activity)
- Establish a basis for asset condition measurement
- Perform condition assessments every three years (a field activity)
- Establish asset preservation service levels
- Document asset preservation work activities to substantiate meeting target service levels (a field activity)

Different information systems are required to support the GASB-34 Modified Approach. The important point, however, is that these systems need to be integrated as shown in *Figure 1* below:



Figure 1: GASB-34 Compliance

The Modified Approach is gaining wide acceptance both inside and outside of government as the preferred method of asset valuation and management. A new philosophy about the interrelationships of asset management, work management and field automation has emerged as follows:

1. Work activities need to be tied to the assets effected by the work (asset-based work management)
2. Field activities are an integral part of the process and need to be automated (field force automation).

The information systems used to support the Modified Approach need to pass data and information along each step of the process. In this framework, data goes full circle and can best be managing if the process is automated. Sometimes referred to as the 'Asset-Work-Field Data Round Trip', this process is depicted in *Figure 2* below:



Figure 2: Asset-based Work Management Process

Most Independently Owned Utilities and Utility Cooperatives are not required to conform to GASB financial regulations. Despite this fact, new management philosophies that have taken hold as the result of GASB-34 will have a strong influence on the asset management, work management and field automation systems that are now being deployed at organizations responsible for infrastructure, both public and private.

UPGRADING THE DISPATCH CENTER

GIS, GPS, wireless communications and database technologies have revolutionized what is possible in the dispatch center. Unfortunately, much of this new technology has yet to be implemented in most organizations. The time-honored tools of utility field crew dispatch and management consist of an intricate combination of whiteboards, spreadsheets, magnetic charts, and analog radios. In this environment, each dispatcher can effectively manage 10 to 15 crews at best. In those few centers where automation has been applied, such as two-way digital messaging, automated vehicle tracking (AVL), and map-based computer-aided dispatch (CAD), 30 to 45 field crews are managed by a single dispatcher. The big payoff is not so much the

productivity improvements of dispatchers during normal operations. Instead, it's *the dramatic reduction in the need for additional dispatchers during emergencies*.

Vehicle tracking is one technology that has caught on recently. Once the 'big brother' concerns of workers' unions are mollified, the typical rollout involves tracking of crew vehicles on a street background map display of some sort. In this scenario, the GPS and communications equipment required to do basic AVL is mounted in vehicles in a non-obtrusive fashion, invisible to field crews in most cases. Pre-planned routing and scheduling of service calls can now be performed at the dispatch center. Daily schedules based on the optimization of travel times can be provided to field crews each morning.

Implementing crew vehicle AVL to improve dispatch operations is a laudable achievement. It is a good first step. Benefits increase by an order of magnitude, however, when other enterprise IT systems – GIS asset databases, customer information, work management, outage management, and/or SCADA systems – are integrated with the dispatch center's maps to provide a full, geospatial picture of the utility's entire service territory in real-time.

Integration of GIS and AVL provides the link between a utility's geographically dispersed infrastructure and the location of its field crews. Integration of CIS and AVL provides the link between the utility's customer locations and its field crews. Integration of WMS and AVL provides the link to the utility's work site locations and its field crews. Having the field components of major enterprise IT applications geographically referenced and available for management of field crews in real-time provides significant benefits over basic AVL.

This same order of magnitude increase in benefits can occur when the same map displays viewed by dispatchers are made available *in field crew vehicles*. Now, field crews can route and navigate in the field, geolocate incidents and emergencies, create redlines of work performed, and, in general, proactively dispatch themselves during ad-hoc work schedule changes and emergency call outs. As crews communicate critical, georeferenced information back to their dispatcher in real time, dispatchers can make it available immediately to operations and other field crews.

Help for Roving Supervisors

One of the latest innovations in vehicle tracking technology is *peer-to-peer AVL*. This technology provides a roving supervisor with the real-time locations of the field crews under his or her control. The supervisor's own location is also shown on the in-vehicle map display. Crew location information is updated in real-time in the supervisor's vehicle during travel, so meeting up with crews that are traveling between job sites, or stopping to visit nearby crews during travel, no longer requires pre-planning or extensive coordination over the radio. With a supervisor apt to show up at any time unannounced, field crews are more inclined to perform at full capacity, and not be tempted to slip out during the workday.

MOBILE APPLICATIONS – WHERE DO I START?

Core Competency

Once an organization decides to move information technology out to field crews, the question now becomes how best to ‘rollout’ field force automation technology. Two factors will weigh heavily on the deployment decision:

1. A critical or urgent requirement to automate a field business process as dictated by customer service needs and/or management directed goals.
2. Past enterprise automation successes in specific applications within the organization.

Outside factors may dictate that field automation deployment is based solely on a critical or urgent need. The good news is that the field automation will address the critical need. The bad news is that the organization may not be in the best position to automate the chosen business process due to deficient back office procedures or a poorly implemented enterprise application that is to serve as the backbone for the field automation rollout.

If a critical need is not the driving factor, then a ‘core competency’ approach to determining a field force automation rollout strategy is best. What this strategy does is look inside the organization for the most efficient and stable business processes and most robust enterprise IT applications. Is work management highly automated and efficient? Alternatively, does the organization shine in outage and trouble call handling? How about the GIS? Is it fully implemented and in use across the organization?

An examination of the organization’s enterprise IT environment will reveal that some applications are strong, while others need more work. The core competency approach to field automation deduces that the best chance for deployment success is automating the field components of your most stable enterprise applications first. Once field automation is well established here, one can then tackle those business processes that are the least automated.

One of the following four field force automation alternatives may be best suited to your organization based on its core competency:

- *GIS-Centric Approach:* Automate field map viewing and update first (Mobile GIS)
- *Work Management-Centric:* Automate mobile workforce management first (MWFM)
- *Outage/Emergency-Centric:* Automate outage response and trouble tickets first
- *Call Center-Centric:* Automate dispatch operations first

Managing Project Risk

History has shown that a significant number of information technology implementation projects have either failed outright, been only partially successful, or succeeded after going over budget and beyond schedule. The situation is no different with field force automation projects. Mitigating risk needs to be part of the project plan.

Some field application implementations are inherently more risky than others are. One way to analyze project risk is to categorize mobile applications by the response characteristics of the field crews. *Rapid response field applications*, such as outage management, emergency dispatch, and disaster recovery operations, are inherently more risky to automate because they receive more attention from customers and the media. However, these applications offer high potential for improving the bottom line and customer satisfaction. The risk-reward equation is high.

On the other hand, *scheduled response field applications*, such as inspections, maintenance, field design, stakeout and construction are generally low risk because they involve detailed planning, scheduling and management, and are less visible to the public. The potential benefits of automating field processes of scheduled response applications may not be as significant as with rapid response applications, however. For these applications, the risk-return equation is low.

The decision as to which category of field application to tackle first is based on many factors, including each utility's unique situation. Understanding the degree of project risk involved for the chosen application and managing that risk is a key success factor.

WIRELESS INTERNET VERSUS 'LOAD & GO'

Providing Internet applications to field crews over wireless communications as a strategy for field automation has shown poor results. Reliance on multiple network administrators can make the Internet slow and unstable for dedicated field user applications. Organizations have also found that the wireless services in their territories can be slow with frequent dead zones where no service is available. For example, a recent *Wall Street Journal* article described one journalist's frustration at trying to use a wireless Internet application for real-time navigation – *turning instructions were displayed after the vehicle had driven past the cross street for turning!*

At least for the immediate future, wireless Internet technology is not quite up to handling the complex user interactions frequently needed for dedicated field worker applications, such as work management and map updates. However, wireless Internet is ideal for the 'casual' field worker, such as a salesperson, who occasionally needs to check on a price or if an item is in stock while he is at a customer's location.

Load & Go Approach

Loading as much data as possible onto the mobile device, and communicating back to the office in short bursts, seems to be the most successful method for dedicated field applications. Data and applications can be transferred between mobile devices and an enterprise server in the office or fleet garage using a docking station to connect the mobile device to a local area network (LAN).

Another method gaining in popularity is the installation of Wi-Fi “hot spots” in garage areas. Wi-Fi facilitates the passive transfer of data and work assignments to field crews as they perform their normal vehicle maintenance activities in the garage. In either case, data is available for use in the mobile device even when no wireless connection is present.

Figure 3 below depicts the mobile aspects of a typical utility’s IT environment. Dedicated field users will have docking station or Wi-Fi access to the enterprise LAN through a *field server*, while casual field users will gain access through a wireless Internet *web server*.

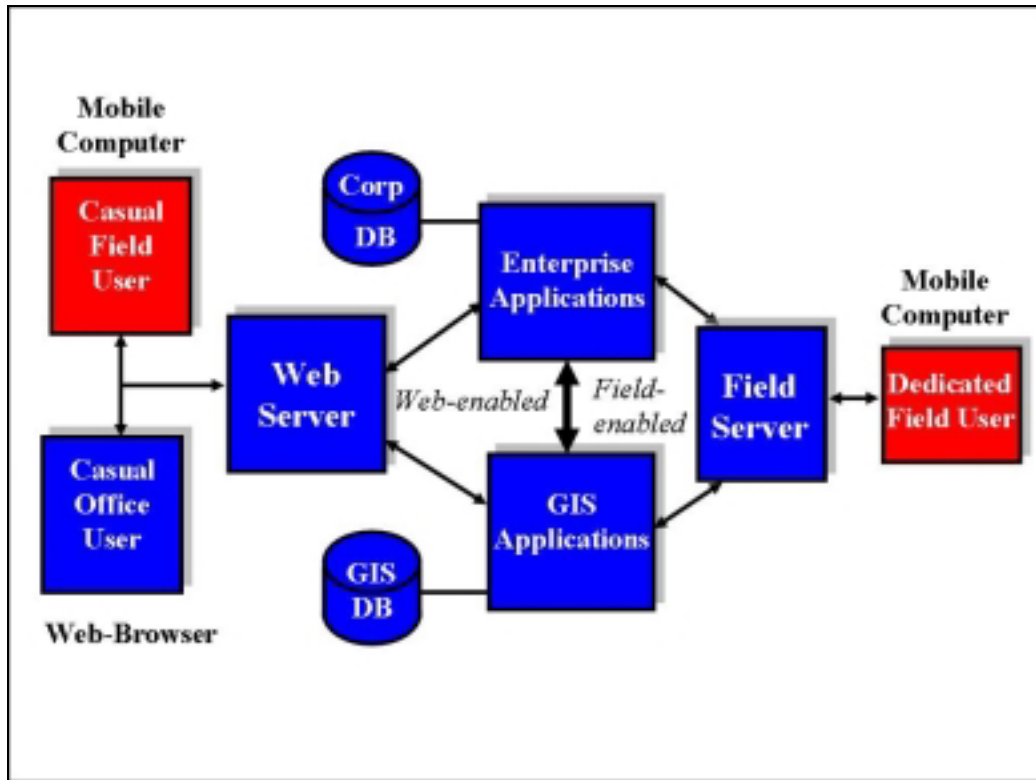


Figure 3 – Enterprise Mobile Access

FIELD AUTOMATION REQUIRES ENTERPRISE FOCUS

Extending information technology into the field is a significant undertaking fraught with challenges, the least of which is getting field crews to use the new systems. On the field worker side, union resistance to the big brother aspects of vehicle tracking and real-time job reporting may stop implementation dead in its tracks. Most organizations overcome these obstacles through informed negotiations with union representatives that point out the beneficial aspects of the technology for the field worker. Once workers are shown how their jobs can be made easier through automation, most will accept the new systems wholeheartedly.

Other challenges to implementation of field systems include:

- Formulating the payback equation – Some benefits are difficult to quantify. Management buy-in is difficult to achieve without a solid and convincing ROI.
- Interfacing to legacy systems – This is where much of the data comes from that is being pushed out into the field. Supporting multiple enterprise applications with mobile technology requires multiple interfaces. A dedicated field server is the best approach.
- Cultural and organizational changes – Field systems affect business processes that result in job reassignments, procedure changes and department reorganizations.

The project manager needs to anticipate these challenges, and formulate plans to resolve them.

Create a Mobilization Task Force

Many departments in the organization can benefit from the mobilization of applications. Field automation offers strategic advantage across the enterprise. Therefore, it requires an enterprise focus. Too often, individual departments plow forward extending specific applications into the field with little regard for establishing an integrated, coordinated architecture, and for sharing enterprise resources and standards. The result is field crews that need to learn the nuances of each departmental application in order to complete their daily work tasks.

Plan and coordinate field automation across the organization in a fashion similar to the enterprise IT experience. Hardware, software, communications and system administration standards need to be established. Only at the corporate level, can common departmental requirements be identified and satisfied through economies of scale. Therefore, *it is essential that the organization create a field automation corporate committee or task force*. This committee can establish uniform, compatible and interchangeable field system components, and identify which field applications need to be implemented first for strategic advantage.

Conclusion

Most field crews are minimally automated today, but this situation is changing. As technology has improved, more utility companies have begun to focus on that one area that information technology left behind – field crews. This paper has discussed benefits and approaches to bringing automation to field crews. As mobilization projects ramp up, new success stories will emerge. If a field force automation project is in your sights, these final six points may be helpful:

1. Create a corporate field automation committee or task force
2. Automate mobile functions across the enterprise using a phased rollout approach
3. Use established automation centers (GIS, WMS, OMS or CAD) as backbone for rollouts
4. Expect and anticipate challenges, and plan for their resolution
5. Project management best practices apply just like for regular IT projects
6. Engage and empower your mobile workforce (involve them in the decision process)