

Emergency Responder Personnel Accountability

Your firefighters' lives,
and the Incident Commanders success,
depend on it.

WHITE PAPER



ERT Systems, LLC
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ABSTRACT

Fire Department Administrators face unique challenges in pursuit of their goal of providing the highest levels of service, as demanded by city managers and members of the public. The range of services provided by Fire Departments continues to grow, expanding to include emergency medical services and special hazards, all while having to meet increased federal training requirements (N.I.M.S. in particular) with ever-diminishing resources.

As administrators, Chief Officers recognize that fiscal responsibility is a key component of successful department management. Fiscal responsibility means spending budget

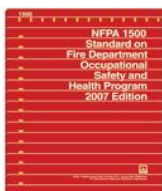


dollars wisely, evaluating needs and prioritizing them based on how each assists the department in accomplishing its mission. The department exists to provide the highest level of professional emergency

services possible to the public, but the Chief must understand that meeting this goal also requires a strong commitment to the safety of his or her firefighters. The chief has both a moral and legal obligation to provide every member of the team with the training and equipment they need to do their jobs safely and effectively.



A crucial, but often overlooked building block in the foundation of fire ground safety is personnel accountability, defined as “a system that readily identifies both the location and function of all members operating at an incident scene” ([NFPA 1500](#), [NFPA 1561](#); Definitions). Note that the definition does not state that the chief should *attempt* or *try* to identify personnel and assignments, yet that’s



how it is often approached: many departments rely on variations of ID tag and radio procedures (one, two or three tag systems), whiteboards, or even memory, in an *attempt* to manage personnel accountability, usually with very limited results.

Unfortunately, research and anecdotal evidence has shown that although Chief Officers acknowledge that current accountability systems are burdensome or ineffective, and while they understand the benefits that an effective personnel accountability solution delivers (most importantly, increased firefighter safety and operational efficiency), these same professionals have been slow to adopt, or even demand, potential solutions. Fortunately, the influx of technological solutions in the areas of SCBAs, Thermal Imaging Cameras, GIS Mapping, Fire Pre-Planning, Automated Dispatch, and so on, has increased the understanding and acceptance of technological solutions in fire response. We believe it is time to employ similar existing and proven technologies as a viable solution to the crucial, yet often marginalized, issue of on-scene accountability.

THE CURRENT STATE OF ACCOUNTABILITY

ERT Systems' founding mission is very simple: deliver an effective, easy-to-use solution to the professional Fire Chief who recognizes that personnel accountability has a direct and immediate effect on the safety and efficiency of their responders.

To accomplish this goal, we began by examining the current state of personnel accountability systems in use by fire departments across the United States and Canada. Our objective was to determine whether a problem really exists, and if so, to gather reliable, real-world data "from the trenches" that we could use to design a truly useable solution.

Right away, we came across a startling statistic: when asked "Do you use a formal personnel accountability system on scene?" the respondents answered:

- Never 18%
- Sometimes 23%
- Usually 49%
- Always 10%

As unexpected as it was to find that nearly 1 in 5 Chiefs say they use no "formal" accountability system at all, further questioning showed that of the 80% who do employ a formal system, virtually all use ID tags which they further stated are "frequently or almost always" ineffective.

When questioned as to why they consider their accountability system to be ineffective, the following issues were cited:

- Tags are not handled properly:
 - Firefighters lose their tags off scene, or simply forget to bring them
 - They do not always follow procedure to turn in and retrieve tags
 - Tags can be lost or misplaced (dropped) while on scene
- Tag boards are not managed effectively:
 - Early in an incident, everyone is committed to operations
 - The board is not set up properly, and tags are just dumped in a pile
 - The "pile" only shows who is on scene, not Locations or Functions

- Once a Safety Officer is available:
 - It is nearly impossible to “catch-up”, so the board remains in a state of chaos for a long period
 - Firefighters still do not reliably report changes in Location or Assignment, keeping the information unreliable
 (Note that these issues scale dramatically with larger scenes.)
- Tag systems still rely on radio communication
 - Radio “dead spots” and periods of heavy traffic may keep firefighters from reporting changes in Location or Assignment
- Tag boards offer no historical tracking or timekeeping
 - SOs must still rely on manual counts to monitor time in Hot Zone, what firefighters have been through Rehab ([NFPA 1584](#)), etc.
 - Post-incident analysis and after-action reports are limited to memory or notes written down on-scene “when there is time”

While it is commendable that many of these same Fire Departments have written S.O.G.s (Standard Operating Guidelines or Procedures) for personnel accountability, the Chiefs note that actually putting an S.O.G. into practice on the fire ground is a continual and ongoing challenge. The ultimate goal of any accountability S.O.G. is to provide for the systematic tracking of every firefighter on scene, in real-time, for the duration of the event. Unfortunately, the combination of limited tools and the chaotic nature of any emergency scene conspire to make those S.O.G.s difficult to follow (or enforce), often rendering them ineffective.

The consensus was that for a personnel accountability system to be more effective, it would have to address and eliminate most of the issues that plague tag-based systems, but that remained extremely easy to use and did not interfere with their departments’ emergency operations and standard procedures.

A LITTLE HISTORY



Some of us are old enough to remember the days of the “smoke eaters”, firefighters who would go into smoke-filled environments without an S.C.B.A. There was a time when they were admired for being “tough”, but today, we realize that it’s just foolish to not take advantage of modern safety equipment – not to mention the legal and health ramifications. Today’s S.C.B.A.s are lightweight, offer an excellent field of vision, have integrated PASS devices, and some even provide air management information in heads-up displays. The



improvements in this area have been extraordinary, and have greatly improved firefighter safety and survivability.



Similarly, there was a time when a firefighter would brag about how much heat he or she was able to withstand, which would even escalate into fire ground competitions over how deep into the fire they were able to get. Today's turn-out gear makes use of high-tech materials such as carbon hoods and gloves, offering firefighters protection even in extreme environments, allowing deeper access without the macho risk-taking. Don't get me wrong: there's a time and place for competition. It's just not on the fire ground, where taking an unnecessary chance can literally cost a firefighter their life.



Of course, changes in equipment often require changes in operations. For example, new turnout gear does such an excellent job of isolating firefighters from heat, we actually lose some of the 'cues' we used to rely on (like that tingle in your ears) to warn us of dangerous situations. To balance this loss, the fire service continues to introduce new and innovative techniques (positive pressure ventilation, better coordination between vent and attack) and equipment (positive pressure fans, vent saws such as the K-12, and chain saws with carbide chains) that allow us to remove smoke and heat much more effectively. This not only addresses the immediate dangers, but also reduces the chance of flashover, back draft, steam burns, and similar critical risks.

Of course, nothing creates an adrenaline rush like the rescue call: occupants of a structure are trapped and need extraction. This is the core of firefighting: saving lives. Heroic as it may have been, gone are the days when a firefighter rushes in single handedly through the flames: today's responders follow the two-in/two-out rule, stay on the hose line, stay on the wall, and always maintaining team contact. These are the fundamental rules that offer first responders the greatest opportunity to execute a successful rescue, and they train extensively under low-to-zero visibility, high heat/steam/smoke, and crowded, multi-level environments to mimic real-life scenarios. And again, modern equipment has helped make rescues even more safe and effective: thermal imaging cameras (TICs), beacons and self-rescue tools, just to name a few.

On-scene personnel accountability is another area that has seen some progress, although it's been more limited than other areas. For decades now, most fire departments have been using variations of the ID tag system, typically multi-part devices that are manually passed from responder to officer, and moved around on a tag board to track locations and assignments. Clearly, this is a step forward from note pads and memory, but it has been at best a limited success. Chiefs and Safety Officers routinely complain about the amount of attention a tag system requires to keep



it accurate. Many openly admit that their on-scene personnel accountability is inadequate under even routine conditions, and that they're "lucky" that nothing catastrophic has happened. Others haven't been so lucky, and have experienced firsthand the difficulty of trying to recreate personnel movement and assignments during the investigation of an injury or death, and having to determine whether better accountability could have averted or lessened the severity of the event.

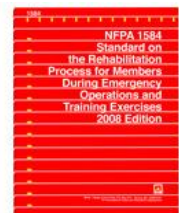
Just as the fire service has grown from idolizing the smoke eaters and heat seekers to adopting tools and technologies to improve operations and safety for all responders, the time has come for Fire Officers to understand that personnel accountability – knowing who and what is on scene, and where they are right now – has a direct impact on the safety of every firefighter, and to recognize that memory, tag boards and hand-written notes are no substitute for properly applied technology.

ACCOUNTABILITY TODAY

As noted above, most departments today use some variation on ID tag-based accountability. Unfortunately, these systems tend to be resource-heavy, requiring close attention and dedicated personnel to collect, return, and arrange tags as firefighters move around and change assignments. While some departments have the resources available to dedicate to managing tags, most do not. Early in the incident is especially difficult, since all personnel are needed for operational tasks and no one is left to collect and manage tags. Tags that are turned in generally wind up in a pile somewhere, and without someone to remind them, some firefighters simply forget – a firefighter walking around with their tag still hanging off of their helmet is a common sight. Although "better than nothing," an unattended pile of tags can only confirm who is on scene, with no detail about location or assignment. After sufficient personnel have arrived on scene and a firefighter is finally assigned accountability, they often find it's all but impossible to get the system organized and accurate.



In addition, tag systems typically require that responders report changes in assignment and location via radio, so that the accountability officer can update the tag board as appropriate. In addition to the traditional "forgot to call in" issues, this encounters another well-known problem: radio breakdowns due to heavy traffic and dead spots. When communication fails, the accountability board isn't updated and quickly becomes inaccurate; in the best case, outdated information is just useless, but at the worst, it's outright dangerous. Aside from simply knowing where your firefighters are, it's critical to know their timeline: extended periods in the hot zone and/or time without rehabilitation can be direct, even fatal, hazard (approximately 50% of all firefighter fatalities are from heart attack attributable to overexertion, [NFPA 1584](#)).



WHY ISN'T THERE A BETTER WAY?

It's hard to overstate the importance of accurate, effective, and real-time personnel accountability, yet responders widely admit the limitations and failures of current systems. So why haven't firefighters and Chief Officers demanded a better solution? Well, there are a variety of reasons:

Time Heals. Research clearly shows that in a majority of after-injury reports, lack of effective accountability is at least a contributing factor, and Chiefs tell us that when such an event occurs, personnel accountability almost always jumps into the spotlight. Questions come up about operating procedures (and why they weren't followed), and demands made that "something be done". However, memories are short and thankfully, serious incidents are rare; as time passes and no other incidents occur, the importance of good personnel accountability seems to fade... until the next incident.

Force of Habit. Inertia plays a big role: Chiefs will continue to use a system, even knowing it is ineffective, simply out of a desire to stay in their comfort zone. Uprooting and replacing an established way of doing things is disruptive and difficult, and the longer the current system has been in place, the more difficult that change becomes. Therefore, departments tend to justify current methods and blame S.O.P. failures rather than considering brand-new solutions, even in view of obvious advantages.

Fewer Fire Runs. Today's Fire Inspectors are armed with aggressive fire codes, backed with new tools and educational opportunities that result in better fire preparedness and prevention. As a result, many departments are experiencing a decrease in the number of fires calls: obviously excellent for the community, but as a side effect, it reduces the amount of direct firefighting experience that responders gain over time. Increased and improved training helps mitigate that lost experience, but as the old adage goes, "you lose what you don't use." This applies just as much to fire ground activities such as accountability management as it does to specific firefighting and rescue skills and techniques.

Nothing has Happened (Yet). Sadly, the fact that no firefighters have (recently) been injured or killed at a given department can become an excuse to accept inertia, avoiding the work and expense of changing to new, better methods and equipment. They become OK with tracking some of the firefighters some of the time and "playing the odds" since it's easy and hasn't been a problem. A quick search of "personnel accountability" at www.firefighternearmiss.com clearly demonstrates why this attitude is so dangerous:



NIOSH just like a smoke detector in your home, you may never need it, but it suddenly becomes invaluable when you do. It's also worth a visit to <http://www.cdc.gov/niosh/fire/> to review some investigative reports, which routinely cite the lack of an effective personnel accountability system as a

contributing factor in many in-action fatalities. As you might imagine, “this never happened before” is a pretty weak position to take when facing an investigator.

THE SOLUTION: AUTOMATIC ACCOUNTABILITY

We believe that the best approach is to make personnel accountability an automatic part of on-scene operations, eliminating opportunities for human error where possible and providing continuous tracking without interfering with operations or requiring dedicated personnel. ***OnSite ERT™ provides this with accurate, real-time tracking of personnel and equipment, automatically, at every scene, with minimal equipment and no change in behavior by responders.***

The table below shows the issues that prevent tag systems from working effectively, and how OnSite ERT™ addresses each:

TAG SYSTEM	ONSITE ERT SOLUTION
Firefighters forget to bring their tags	Wireless tags are “always on” and kept secure in turn-out gear
Firefighters forget to turn in or retrieve tags	Wireless tags are kept with the firefighter at all times, not turned in or retrieved
No one is available to manage tags	Firefighter movement is detected automatically; system runs unattended
Only shows who is on scene, not current locations	System automatically updates firefighter location by “zone” and displays on screen
Does not track both location and function (assignment) in detail	Software automatically tracks zones, and allows AO to add extra information such as assignment or specific location (i.e., floor)
Difficult to manage large scenes	Automatic integration between departments, plus reduced radio traffic, eases large scenes
Very difficult to play “catch-up”	No catch-up required; system operates unattended from the start of the incident
Information gets outdated	Automatic tracking maintains accuracy
Radio communication issues; dead spots, heavy traffic	Location tracking doesn’t rely on radio contact
No on-scene history provided	System provides a “current activity” tab that shows every firefighters history on scene.
No post-incident documentation	Every action is time stamped and available via chronological report after the incident is over

MEASURABLE BENEFITS

While the overall benefits of having a clear, accurate picture of the personnel and equipment while on scene seems obvious, it is important to understand specific, measurable benefits that can be achieved via a strong personnel accountability system.

For example, consider the Rapid Intervention Team (R.I.T., or R.I.C. for “crew”). Even in the ideal case, where sufficient training and proper application of risk management can minimize the need for a R.I.C., having a properly trained, equipped, and **informed** team can literally mean the difference between life and death. Studies completed by Phoenix, AZ and Seattle, WA both concluded that the cost of locating and rescuing a downed firefighter is up to twelve personnel and an average of 22 minutes. Compare that with the average amount of air a firefighter has available in an SCBA bottle, and it’s clear that this leaves little room for error. While current practice is for R.I.C.s to carry a spare bottle (to supply the downed firefighter with air immediately), that only helps if the team can locate the firefighter inside the available window. Proper personnel tracking can significantly reduce the amount of time spent locating the target, greatly increasing the chance of survivability.

In addition, simply knowing the total numbers of responders on scene is critical to successful scene management. Incident Action Plans (IAPs) are commonly designed around specific goals and objectives, and are based on the deployment of specific numbers of trained, qualified resources in each step. Proper scene management is critical, since attempting to implement an IAP with too few resources can allow the incident to get out of control quickly, creating a much more dangerous environment for responders and the public (as Fire Chiefs know, “it’s better to have them and not need them, than to need them and not have them.”) An ideal personnel accountability system provides the IC with complete, accurate, and real-time information on **all available resources**, allowing them to implement those IAPs as efficiently as possible, avoiding delays while maintaining operational standards and safety.

Equally important is to know the credentials and capabilities of every responder on scene. Incident Commanders have specific goals and objectives they need to accomplish as they manage their emergency scene, and to do so, they are required by law to utilize only those personnel that are properly trained to do the job. Modern emergency response covers far more than traditional firefighting, and today’s firefighters are trained accordingly and to varying degrees depending on their role within the organization. Of course, not all firefighters have the same certifications or credentials, which can make it very difficult for an IC to quickly identify and locate personnel with a specific specialization needed to address an unexpected situation emerging on scene. This problem compounds quickly at large events, as well as mutual-aid and regional response scenes. Again, the ideal personnel accountability system will make that

information available on demand, giving the IC the flexibility to respond to unexpected situations much more efficiently.

OnSite ERT is designed to support all of these situations effectively and with little or no operational overhead. It supplies Incident Commanders with the accurate, real-time personnel accountability data needed to meet NFPA 1500, NFPA 1561, OSHA and NIMS requirements, and its searchable database of responder credentials provides immediate, on-demand access to detailed information about every available responder to help deal with emergent situations more efficiently and effectively.

HOW ONSITE ERT™ WORKS

OnSite ERT is a unique combination of proven technologies, including wireless ID tags, portable Drop Readers, and the PAR command software.

Wireless Tags: Each firefighter is assigned a wireless tag containing a globally-unique ID number (for security reasons, no personal data is stored on the tag). The tag is typically kept in the firefighter's turn-out gear, often in a specially-



added shoulder pocket. The tags are “always on” (so no need to remember to switch them on and off), and operate for about 6 months on a pair of AAA batteries. The tags are impact and water resistant, and built to withstand typical fire ground environments.

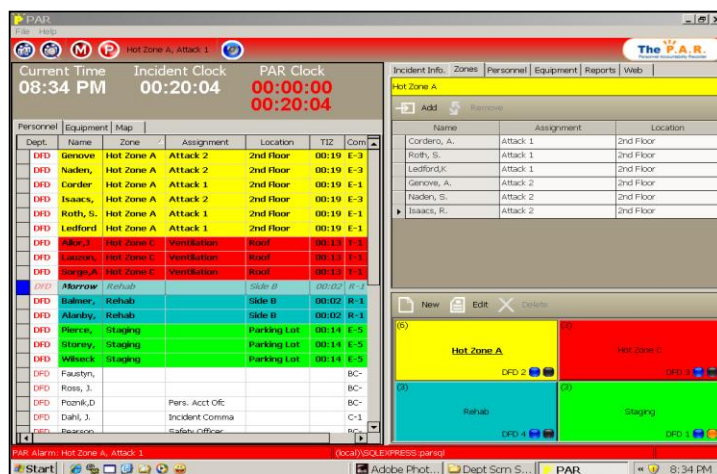
Drop Readers: Drop Readers (DRs) are small, portable, battery-powered units that detect the wireless ID tags and report them back to the command PC. The DRs can be placed around the scene to track various zones, typically including Staging, Hot Zone A-C, Rehab, and so on (these can be easily redefined to fit different operating procedures). As a firefighter moves around the scene, the DRs report their general location, displaying a given responder as currently being in Staging or the Hot Zone.



The Drop Readers communicate with each other and with the command PC by forming an on-scene wireless network. They have a range of about ½ mile line-of-sight, and will automatically expand and reorganize the network as the DRs or moved or as more arrive on scene. The DRs also include other sensors, specifically including GPS.

PAR Software: The Personnel Accountability Recorder (PAR) software, which runs on a command PC on scene, collects, analyzes and displays the information reported by the Drop Readers. The software indicates which firefighters are on scene and in which zone they are located, updating in real time. Zones are color-coded and all lists are searchable, making it very easy to identify and locate firefighters and equipment on demand.

An accountability officer can simply monitor the display, responding to automatic warnings and alarms (i.e., timed PARs), and using the searching, historical tracking, mapping and other features as needed to maintain an accurate, up-to-date understanding of the fire ground for the duration of the event.



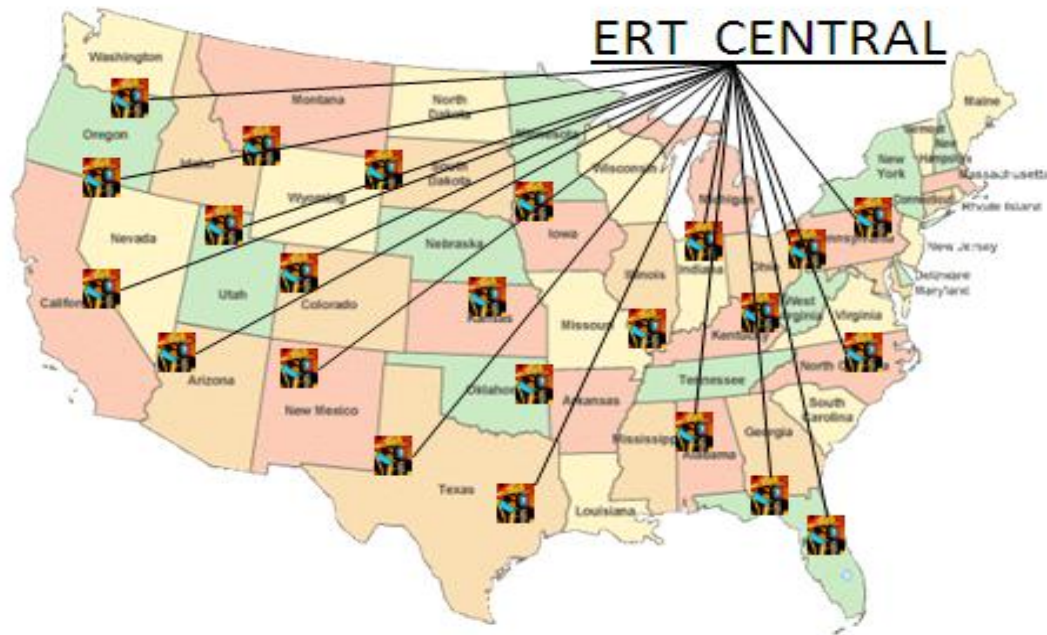
SCALABILITY VIA ERT CENTRAL™

Even within a single department, maintaining accountability is a daunting task; when dealing with a mutual-aid or regional response event, the problem escalates dramatically. Many of the responders may be unknown to the Incident Commander, and the equipment and skill sets unfamiliar.

To help in this situation, OnSite ERT was designed for seamless scalability. Every wireless tag is globally unique, and can be read by any Drop Reader regardless of department. Drop Readers brought to the scene by separate departments will automatically and seamlessly join an existing network, providing tracking across larger and larger scenes as necessary.

ERT Central™ provides additional benefits in the case where a department has Internet connectivity, either at the station or when deployed at the fire ground. ERT Central is a single, off-site database of all OnSite ERT users which:

- Automatically synchronizes mutual-aid and neighboring department's equipment & personnel rosters, ensuring up-to-date information between partners
- Recognize and look up “unknown” tags as they arrive on scene, downloading and displaying the responder's credentials or equipment load-out
- Collect and analyze response data (stripped of personal identifying data) for historical archive and reporting, and inter-departmental comparison and research



CONCLUSION

There is a general consensus among professional Fire Chiefs that ID tag systems, the most commonly-used personnel accountability today, are largely ineffective in providing accurate and reliable information. They realize and understand that the lack of that information while deployed on scene has a direct and serious impact on firefighter safety. But they also acknowledge that manual accountability solutions rely too heavily on personnel and operational procedures to be effective in the dynamic environment of an on-scene deployment.

Still, personnel accountability is often considered a “second-tier” problem, compounded by the fact that while significant technological advances have been made in other areas (S.C.B.A.s, T.I.C.s), the most commonly-available technological solutions for personnel

accountability (i.e., bar-code readers) still don't address the core weakness and limitations of manual accountability tracking. Some electronic systems have begun to appear, but these are just partial solutions that offer, at best, a small improvement (i.e., "on scene" visibility, but without location or assignment tracking) while still requiring dedicated personnel and/or cumbersome manual processes.

To best meet the needs of Fire Response, the ideal solution must reside "in the background", with minimal operational changes and unattended operation. It must keep information up-to-date, accurate, and readily accessible, remaining completely unobtrusive when not needed, but immediately available when the demand occurs.

Incident Commanders are often overloaded with information as they strive to make informed decisions about mission-critical operations. Key to this is having accurate, up-to-date detail about what personnel are on scene, individual credentials, and current locations, assignments, and availability. OnSite ERT™ is able to provide all of this information on demand with little or no changes to operational procedures, making it not just the best personnel accountability system available, but a powerful incident management tool as well.

ABOUT ERT SYSTEMS

Based in Ann Arbor, Michigan, ERT Systems, LLC developed OnSite ERT™ as the ideal accountability solution for Fire Response. First introduced in early 2006, OnSite ERT has earned a number of awards and accolades, including recognition at the Michigan Homeland Security Consortium's SELECT awards. For more information, visit:

WWW.OnSiteERT.com