USAF Emergency and Incident Management Systems: A Systematic Analysis of Functional Requirements

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Abstract:

Standardized software for Emergency & Incident Management (EIM) can play a vital part of preparedness, planning, response, mitigation and recovery within the United States Air Force (USAF). Currently, a wide variety of non-standard software solutions are in use. This approach both limits effectiveness and increases cumulative costs to US taxpayers. This classic case of unique-yet-redundant investments, underpin the need for deliberative Information Technology (IT) acquisition processes - to include requirements gathering, strategic mission alignment, cost benefit & alternatives analyses. For these reasons, the USAF sought to understand the IT needs of the emergency management community. Nine hundred and sixty Air Force Personnel involved in emergency management areas were asked to rank the importance of 42 features previously identified as significant components in EIM systems software. While some differences were found between different groups (e.g. Command Post, Fire, Law Enforcement), the results reveal a clear picture of functional requirements that can form the foundation of a Common OperatingPicture (COP) for the emergency management community.

Introduction:

On July 31, 2008, David Powner, Director of Information Technology Management at the United States Government Accountability Office (GAO) testified to the US Senate,

> *"OMB and federal agencies have identified approximately 413 IT projects – totaling at least $25.2 billion in expenditures for fiscal year 2008 – as being poorly planned, poorly performing, or both." (GAO, 2008)*

The 413 IT projects mentioned in the GAO testimony include the US Air Force's Global Combat Support System (GCSS-AF) and Theater Battle Management Core System (TBMCS), both of which have been looked to as key systems to support USAF incident management in the past. In order to mitigate the decisions that contributed to the current status of these systems, the USAF embarked on a deliberative process to identify, evaluate, select and sustain a computer-based emergency and incident management (EIM) system. This document describes the repeatable and defensible research and results employed to begin the process with identification and prioritization of user requirements for an EIM system.

Strategically-developed and implemented computer-based EIM systems are vitally important in emergency preparedness, planning and response. Well-trained users of such systems integrate large quantities of diverse information to help emergency managers, first responders and others to make effective decisions with respect to incidents both large and small. Dispatchers, police, fire and medical personnel, incident commanders, and Hazardous Materials (HAZMAT) teams are a few examples of the wide variety of individuals that use these systems. Higher level decision makers also make use of the information derived from these systems, such as government officials and military command staff. Such systems are used at operational, tactical and strategic levels to facilitate situational awareness, organization and decision-making in emergency mitigation, preparedness, response and recovery.

Implementing a complete incident management system on a computer platform is difficult to do effectively. It must be flexible enough to cope with a variety of emergencies, integrate a range of information sources, and integrate a broad scope of functional requirements. It must effectively facilitate organization and communication of an incident, while being easy to use (Turoff et. al., 2004; Iannella & Henricksen, 2007).

Despite the difficulty, a wide range of EIM software platforms are available (Clark & Sambrook 2007, Robillard et. al. 2007). These range from fairly simple spreadsheet-based applications to complex Geographic Information Systems (GIS). Complete systems range in cost from free software such as Sahana (Currion et. al, 2007) to many hundreds of thousands or even millions of dollars, depending on the number of seats or licenses sold. Often the base software cost of such systems is far outweighed by the implementation, customization and training costs to make them work within a given organization. Even so, a good EIM system can pay for itself during an emergency, where it can save lives, equipment, property and other assets.

The study of computer based incident management systems is relatively new and falls into three main categories. The first is theoretical, and emphasizes the application of psychological, engineering and other scientific principles to determine what should, and should not comprise such systems (e.g. Hernandez & Serrano, 2001; Pyush et. al. 2002; Turoff et. al, 2004). The second is the case-study approach, where a particular software system is evaluated in the context of a particular organization and/or emergency (e.g. Uddin & Enqi, 2002; Zerger & Smith, 2003). A third, and very important category is almost entirely absent from the research literature – namely examining the requirements of the emergency management community. This study aims to fill that gap.

Requirements analysis is a critical part of software design and engineering. It involves descriptions of how a proposed system should behave, its attributes and other relevant properties (Sommerville & Sawyer, 1997). It is important to determine what software users actually need. Unfortunately this phase is often ignored or not done very well. It is laborious, time-consuming and data is difficult to interpret clearly. There are several factors that make this true. The first is the issue of getting a representative sample of the user community who can clearly state their requirements; sometimes users don't have a precise idea of what they want or have trouble translating their needs. In other instances, companies have an already developed (or are developing) product that they want or need to sell. In these cases, vendors will often seek to explain to potential users why their product is "just what you need", without ever asking the questions "What do ***you*** think you need?" It can be difficult for industry to ask this (apparently) obvious question for the simple reason that it implies less than perfect knowledge.

Vendors do consult the industry, and often hire experts and other consultants who inform them about what users need. The use of consultants – especially based on small samples of opinion, runs the risk of producing biased or incomplete information about user needs. The area of incident management suffers more than others in this regard: Users' needs are so diverse, that it is easy to hold an opinion that is valid in a particular instance, but not widely held or accepted within the community.

When user needs are not clearly articulated, programs are often destined to fail (Standish Group, 1995). Development and implementation tend to over-run in terms of time and budget, and are less effective (GAO, 2008). Users are less likely to embrace the resulting system, they may use it only grudgingly, or otherwise fail to adopt it fully. They may simply not use the software, even if it has been installed because they lack motivation to learn to use a system they do not want. They may expend further effort in "going around" the software – perhaps finding ad-hoc or alternate software solutions, rather than using the software they feel has been pushed upon them (Mendonca et. al. 2007). The result is a clear waste of resources in time, money and people not to mention the lost opportunities that might have been obtained through an effective requirements gathering, management and implementation process. However, good requirements analysis can save time, effort and money (Leffngwell, 1997). In the case of developing incident management systems – the potential payoff is that better systems can help save infrastructure, equipment and most importantly – help save lives.

The United States Air Force has utilized a wide range of Incident Management Software Systems (e.g. TBMCS-UL, WebEOC, WebTAS) and is aware of a variety of Commercial Off-The-Shelf (COTS) and Government Off-The-Shelf (GOTS) products currently available. A preliminary study (Robillard et. al. 2007) established a methodology and evaluated appropriate IT solutions and products for incident management. The study found that none of the IT solutions evaluated meet AF requirements. More importantly, they found the functionality requirements were flawed in that they were biased toward a GIS solution. Therefore, before determining which (if any) package was most suitable, it was first necessary to determine what the actual users would need. With this in mind, we sought to investigate the user requirements for a computer-based EIM system for the United States Air Force.

Method :

In order to identify the relative importance of the various functional components of EIM software, a survey instrument was devised. This instrument listed 42 different functionalities and (to levy the fiscal constraint realities of system acquisition) required respondents to allocate a total of one thousand (1000) points among them. Respondents were instructed to treat their points as dollars, and spend according to their priorities. The more points allocated, the more important the functionality. Scores could range from zero to one thousand The list of functionalities were identified through a series of requirements workshops conducted with USAF installation-level emergency responders and USAF headquarters-level policy and decision-makers. Survey respondents were encouraged to add functional requirements they felt were missing and allocate points appropriately.

Forty-seven USAF installations provided various emergency operations representatives to answer the survey instrument. These included a minimum of two representatives from each of the 15 Emergency Support Functions (ESF) within the National Incident Management System (NIMS), a minimum of three representatives from the Emergency Communications Centers (ECC), a minimum of two representatives from the Command Post and a minimum of one Squadron Commander or Group Commander. This ensured a diversity of perspective among emergency responders, managers, and commanders within USAF installation organizations.

Responses were analyzed by functional community, major command (MAJCOM), and organizational structure (Mission Operations, Installation Management, and Security Forces). It is important to note that the rationale for grouping respondents goes further than prevention, mitigation and mission continuity. USAF funding is split between these three groups (A3, A7C, and A7S). The *Mission Operations Group* included personnel whose primary responsibility was mission-related activities (such as operating aircraft and weapon systems, communications and other related functions). This group is normally concerned with the effects of an emergency on the operational status of the wing missions The *Installation Management Group* included fire department personnel (including other first responders and dispatchers), incident commanders, civil engineers,

facilities/infrastructure personnel and other installation management community representatives. This group has mitigation as its primary concern – minimizing the effect of an emergency on missions, saving lives, preserving assets and restoring operations. The *Security Forces Group* comprised security personnel including law enforcement, first responders and dispatchers. This group has a significant role in law enforcement, threat prevention and emergency response..

Allocated points for each functional requirement were averaged and ranked within each of the three main groups for the overall AF-wide respondent population and by major command. The functional requirements were ranked based on point allocation averaged across the groups so as to provide equal weighting for each. Breakpoints were applied to the requirement rankings based on their mean scores, resulting in 3 priority sets. These were high priority (score 25 - 45), medium priority (score 20-25), and low priority (score 10 – 20).

Each requirement was also compared using a 1-way analysis of variance to determine whether significant differences could be found between the different stakeholder groups. In addition, a factor analysis was conducted in an attempt to collapse the 42 individual requirements into a smaller number of distinct functional groupings. Data was analyzed using the SPSS 15 statistical package.

Results:

Table 1 shows a list of the functional requirements, ranked in order from most to least important as ranked by all respondents and by organizational group. All three organizational groups identified 6 of the top 7 requirements as highest priority. In addition, at least two of the three groups agreed on 11 of 18 highest priority items. And at least one (or more) group agreed with the overall AF response on 20 of 22 highest ranked requirements.

Statistical analysis found that functional requirements of high importance to one group, were consistently of high importance for all groups (with some variability).

The disparities in highest priority items appear to be a reflection of the focus of each primary group when we compare the composition of the different priority groupings (Table 2). The *Security Forces Group* identification of *explosive ordinance blast display* was the only high priority item that was not identified as high priority by the USAF-wide population. The *Installation Management Group* identified 15 high priority items, 7 of which were not identified as high priority requirements by the USAF-wide population average. These were *chat (time-stamped), multiple synchronous event plotting, deployable/mobile capability, current weather conditions, installation map data display/query/analysis, synchronous/multiple users access* and *links to the USAF automated civil engineering system (ACES_FD)*. Three high priority items identified by the *Mission Operations Group* were not found to be high priority items for the AF-wide

population. These were *current weather conditions, synchronous / multiple user access* and *significant event / visitor information*.

PRIORITY	REQUIREMENT	AF Mean	ALL AF	SECURITY FORCES	INSTALLATION MANAGEMENT	MISSION OPERATIONS
HIGH	MULTIPLE EVENT LOG (TIMESTAMPED)	44.71	1	1	1	2
	CHECKLIST MANAGEMENT	37.75	2	5	2	1
	EVENT REPORTS	34.13	3	4	8	3
	CORDON CREATION/MANIPULATION/PLOTTING	33.47	4	2	3	14
	PERSONNEL ACCOUNTING	30.43	5	7	9	5
	TCP/ECP CREATION/MANIPULATION/PLOTTING	30.38	6	3	6	17
	DAMAGE ASSESSMENT	28.38	7	10	4	11
	MISSION STATUS REPORTING	28.19	8	13	20	4
	DEAD/INJURED/MISSING (DIM) COUNT DISPLAY	26.98	9	8	19	6
	AIR DISPERSION MODEL PLOTTING	26.35	10	11	5	20
	4 HOUR LEARNING CURVE	25.63	11	9	18	8
	CREATE INCIDENT HISTORY FILES	25.01	12	14	21	7
MEDIUM	CHAT (TIMESTAMPED)	24.38	13	17	10	15
	MULTIPLE SYNCHRONOUS EVENT PLOTTING	23.74	14	15	13	18
	DEPLOYABLE/MOBILE CAPABILITY	23.68	15	20	11	16
	CURRENT WEATHER CONDITIONS	23.61	16	21	12	13
	INSTALLATION MAP DATA DISPLAY/QUERY/ANALYSIS	23.08	17	18	7	26
	SYNCHRONUS/MULTIPLE USERS ACCESS	22.96	18	29	15	10
	EXPLOSIVE ORDINANCE BLAST DISTANCE DISPLAY	22.45	19	6	26	29
	INSTANT MESSAGING (TIMESTAMPED)	21.5	20	22	17	22
	SIGNIFICANT EVENT/ VISITOR INFORMATION	20.63	21	16	41	9
	INFORMATION SHARING (TO DOD PARTNERS)	20.59	22	28	31	12
	FACILITY OPERATIONAL STATUS DISPLAY	20.45	23	31	16	25
	REGIONAL INFO SHARING (TO NON-DOD)	20.21	24	23	27	23
	ALARM/SENSOR STATUS DISPLAY	20.18	25	12	39	21
	DRAWING/PHOTO MARK UP CAPABILITY	19.65	26	25	22	27
LOW	FORECASTED WEATHER CONDITIONS	19.45	27	38	24	19
	ACCEPT/DISPLAY STREAMING VIDEO	18.56	28	19	35	28
	ROLE-BASED ACCESSIBILITY CONTROL	18.48	29	27	34	24
	DISPLAY & UPDATE EOC RESOURCE LISTS	18.3	30	30	23	32
	FACILITY OPERATIONAL STATUS DISPLAY	18.12	31	26	30	31
	UTILIZES NIMS/AFIMS PROTOCOLS AND FORMS	18.03	32	34	28	30
	LINKS TO ACES-FD	17.92	33	36	14	35
	CURRENT/FORECASTED WEATHER PLOTTING	16.6	34	33	29	34
	DISPLAY CAD DRAWINGS	16.39	35	35	25	36
	(NRT) VEHICLE/ASSETT LOCATION PLOTTING ON NETWORK	16.09	36	24	33	39
	TRANSPORTATION ROUTE OPTIMIZATION/PLOTTING	15.39	37	32	32	38
	COLOR CODED TASK MANAGEMENT	13.86	38	41	36	33
	IMPORT SUPPLEMENTAL GEOSPATIAL DATA	13.15	39	40	38	41
	ATTRIBUTE-BASED MAP DISPLAY	13.08	40	39	37	42
	THREAT DOME MAPPING/DISPLAY	12.83	41	37	42	37
	WEB-BASED AUDIO-VIDEO CONFERENCING	11.36	42	42	40	40

***Table 1**: Ranking of 42 functional area requirements for Emergency Incident Management Software, based on equally weighted mean respondent scores by USAF respondents.*

Exploratory analyses of different sub-groups within these primary groups (i.e. dispatch, fire, police, incident managers, etc.) revealed agreement and variation among ratings of numerous different criteria. Some of these reflected the differing needs of the first responders (e.g. fire, law enforcement) from non-first responders (e.g. dispatch). After taking these into account, we were left with four main factors corresponding to differing groups of functionalities: Administration, Communication, Display and Usability. These are discussed in the next section.

Security Forces Group
1. Multiple event log (time stamped)
2. Cordon creation/manipulation/plotting
3. Traffic & entry control point creation/manipulation/plotting
4. Event reports
5. Checklist management
6. Explosive ordinance blast distance display
7. Personnel accounting
8. Dead/injured/missing (dim) count display
9. 4 hour learning curve
Installation Management Group
1. Multiple event log (time stamped)
2. Checklist management
3. Cordon creation/manipulation/plotting
4. Damage assessment
5. Air dispersion model plotting
6. Traffic & Entry control point creation/manipulation/plotting
7. Installation map data display/query/analysis
8. Event reports
9. Personnel accounting
10. Chat (time-stamped)
11. Deployable/mobile capability
12. Display current weather conditions
13. Multiple synchronous event plotting
14. Links to automated civil engineer system (fire dept)
15. Synchronous/multiple users access
Mission Operations Group
1. Checklist management
2. Multiple event log (time stamped)
3. Event reports
4. Mission status reporting
5. Personnel accounting
6. Dead/injured/missing count display
7. Create incident history files
8. 4 hour learning curve
9. Significant event/ visitor information
10. Synchronous/multiple users access
11. Damage assessment
12. Information sharing (to Department of Defense Partners)
13. Display current weather conditions
14. Cordon creation/manipulation/plotting

*Table 2: Rankings of high priority items for the three primary groups. **Bold** items are common to all three groups.*

When analyzed by MAJCOM, more variability is seen, but again – most significant is the general consistency of the highest and lowest priority functional requirement rankings (Table 3).

PRIORITY	REQUIREMENT	AF Mean	AF Rank	ACC	AETC	AFDW	AFMC	AFRC	AFSOC	AFSPC	AMC	PACAF	USAFE
HIGH	MULTIPLE EVENT LOG (TIMESTAMPED)	50.48	1	1	1	1	1	1	4	1	2	2	2
	CHECKLIST MANAGEMENT	39.57	2	7	4	2	3	4	1	2	5	6	1
	PERSONNEL ACCOUNTING	39.38	3	15	2	4	4	5	2	5	7	4	5
	EVENT REPORTS	34.68	4	6	7	3	8	6	5	6	6	5	31
	CORDON CREATION/MANIPULATION/PLOTTING	32.96	5	2	15	6	5	9	11	7	21	8	3
	DEAD/INJURED/MISSING (DIM) COUNT DISPLAY	32.59	6	21	13	10	2	22	3	8	11	1	4
	CHAT (TIMESTAMPED)	30.03	7	4	9	39	11	17	18	4	1	9	25
	INSTANT MESSAGING (TIMESTAMPED)	28.03	8	9	11	31	7	15	24	21	3	12	30
	AIR DISPERSION MODEL PLOTTING	28.00	9	18	23	5	6	8	8	9	25	22	7
	DAMAGE ASSESSMENT	27.91	10	14	8	27	16	2	15	3	28	3	14
	TCP/ECP CREATION/MANIPULATION/PLOTTING	27.54	11	3	10	11	10	29	20	15	17	10	8
	MISSION STATUS REPORTING	27.34	12	20	6	25	15	3	28	13	16	7	21
	CURRENT WEATHER CONDITIONS	26.09	13	23	19	24	14	7	17	23	26	25	6
	4 HOUR LEARNING CURVE	25.75	14	10	5	13	27	12	13	14	9	14	9
	SYNCHRONUS/MULTIPLE USERS ACCESS	25.10	15	12	29	22	22	23	6	18	8	15	13
MEDIUM	CREATE INCIDENT HISTORY FILES	24.08	16	13	12	28	9	24	7	20	23	11	18
	INSTALLATION MAP DATA DISPLAY/QUERY/ANALYSIS	24.06	17	27	21	12	26	14	9	17	20	26	10
	DEPLOYABLE/MOBILE CAPABILITY	22.58	18	5	17	15	25	27	27	11	4	30	22
	UTILIZES NIMS/AFIMS PROTOCOLS AND FORMS	22.30	19	32	30	21	20	33	22	29	39	32	11
	DISPLAY & UPDATE EOC RESOURCE LISTS	21.95	20	33	18	34	13	19	14	16	13	13	23
	MULTIPLE SYNCHRONOUS EVENT PLOTTING	21.78	21	16	31	18	19	21	19	24	14	19	16
	REGIONAL INFO SHARING (TO NON-DOD)	20.96	22	11	14	20	12	18	31	30	10	21	20
LOW	CURRENT/FORECASTED WEATHER PLOTTING	19.80	23	24	40	7	18	36	21	36	36	38	24
	INFORMATION SHARING (TO DOD PARTNERS)	19.32	24	8	24	19	31	26	32	31	30	18	19
	(NRT) VEHICLE/ASSET LOCATION PLOTTING ON NETWORK	19.23	25	19	3	9	32	40	39	40	38	27	33
	FORECASTED WEATHER CONDITIONS	18.86	26	31	22	37	17	13	23	28	32	28	26
	DRAWING/PHOTO MARK UP CAPABILITY	18.81	27	29	16	23	30	30	29	27	12	29	15
	EXPLOSIVE ORDINANCE BLAST DISTANCE DISPLAY	18.55	28	26	28	17	23	28	41	26	24	16	36
	ROLE-BASED ACCESSIBILITY CONTROL	18.36	29	22	25	26	24	38	12	38	29	33	17
	FACILITY OPERATIONAL STATUS DISPLAY	18.12	30	30	33	41	21	11	26	19	31	17	27
	ACCEPT/DISPLAY STREAMING VIDEO	17.95	31	25	26	14	28	25	25	32	18	35	41
	TRANSPORTATION ROUTE OPTIMIZATION/PLOTTING	17.37	32	38	37	8	37	39	34	25	37	31	32
	SIGNIFICANT EVENT/VISITOR INFORMATION	17.30	33	28	20	29	34	16	35	10	33	23	37
	LINKS TO ACES-FD	17.07	34	37	35	30	38	34	10	12	19	36	28
	DISPLAY CAD DRAWINGS	16.55	35	39	34	32	40	10	36	34	34	39	12
	FACILITY OPERATIONAL STATUS DISPLAY	15.81	36	34	32	33	35	20	40	22	41	20	29
	ALARM/SENSOR STATUS DISPLAY	15.51	37	17	38	35	39	31	30	37	35	34	34
	WEB-BASED AUDIO-VIDEO CONFERENCING	15.29	38	41	42	42	29	42	33	39	15	42	42
	COLOR CODED TASK MANAGEMENT	14.94	39	40	27	38	33	37	16	33	22	24	35
	THREAT DOME MAPPING/DISPLAY	12.82	40	35	41	16	36	41	42	42	42	40	40
	IMPORT SUPPLEMENTAL GEOSPATIAL DATA	12.29	41	42	36	36	41	35	38	41	27	41	38
	ATTRIBUTE-BASED MAP DISPLAY	11.98	42	36	39	40	42	32	37	35	40	37	39

***Table 3**: Ranking of 42 functional area requirements for Emergency Incident Management Software, based on equally weighted mean respondent scores by all USAF and USAF MAJCOM respondents.*

Discussion:

This study included a large number of functional requirements, and a diverse population of responders involved in emergency management within the United States Air Force. The highest priority functional requirements that emerged might be best understood as providing temporal (time-related), administrative, and/or geographic information.
The data in Tables 1 and 2 suggest some commonalities in underlying user requirements between the *Security Forces*, *Installation Management*, and *Mission Operations* groups. These common high-importance functionalities are :

- Multiple event logging (temporal)
- Checklist management (temporal/administrative)
- Event report creation (temporal)
- Cordon creation, manipulation & management (geographic)
- Personnel accounting (temporal/administrative)
- Damage Assessment (temporal/administrative/geographic)

An additional five functionalities were rated as being of "high importance" to at least two out of the three groups:

- Four-hour learning curve
- Dead/injured/missing count display (temporal/administrative)
- Display of current weather conditions (temporal and geographic)
- Synchronous/multiple users access
- Traffic & Entry control point creation/manipulation/plotting (geographic)

Finally, 10 functionalities were identified as "high importance" or "medium importance" by two or more groups:

- Mission Status Reporting (temporal/administrative)
- Air Dispersion Model Plotting (geographic)
- Incident History File Creation (temporal)
- Chat (time-stamped) (temporal)
- Multiple Synchronous Event Plotting (geographic)
- Deployable / Mobile Capability
- Map Data Display/Query/Analysis (geographic)
- Explosive Ordinance Blast Distance Display (geographic)
- Instant Messaging (temporaladministrative)
- Significant Event / Visitor Information (administrative)

These commonalities could form the core functionality of a standardized Air Force EIM system, or may be regarded as comprising a minimal set of functional requirements that should be satisfied by any prospective software solution. Given the different requirement rankings shown in Table 2, we can see that even the high importance factors receive different priorities. If the Air Force was to choose a single package for its incident management needs, it would need to allow for, but control, customization so as to address the differing priorities of users. Customization allows different functionalities to be prioritized based on user needs while potentially keeping the same core architecture for the base system.

As shown clearly by this study, the Air Force EIM community has diverse needs, which may not readily be served by any single currently available software interface. The differences between first-responder groups (i.e. fire, police, medical) as well as incident command groups points to an extremely diverse user community. This also makes a great deal of sense. A dispatcher has a different role during an emergency than an incident

manager, or a medic. Individual users and user groups have highly diverse objectives, resources and missions in emergencies. This further reinforces the need for customization of any standard EIM system. Clearly a "one-size-fits-all" interface would not be effective. This raises the issue of whether every user needs access to the same software functionality. It may be that a modular design is the most effective. This would have the benefit of lowering the systems requirements for such software, reducing communications bandwidth, and simplifying training to only the systems that a particular user needs. This would also reduce the cognitive load on individual users, freeing them up to make decisions, rather than wrestle with complex software.

Conclusions and Recommendations

Geographic Information Systems have been assumed by many as the best platform to provide an EIM solution due to the ability to integrate a wide range of data, implement models and display information the form of maps (e.g. Pyush et. al. 2002). However, our findings clearly do not support that assumption. While the US Air Force already utilizes a GIS system (GeoBase) that is capable of such mapping and display, previous research found that GIS capabilities were overemphasized and were not the highest priority capability sought by the user community. In this study, aspects of functionalities that display geographic information did show up in the overall high importance group, but as stated earlier, functionalities that display temporal and administrative information were also highly valued. This suggests that a holistic picture of **when** things happen is of equal or greater importance than solely a picture of **where** things happen.
While some high value functional requirements and would of course be well served by Geographic Information Systems, other high value functionalities which involve temporal or administrative information and might be better provided by non-GIS platforms.

We recommend that whichever solution is selected, that it be a one that allows the user to view both temporal and geographic information.

This study's goal was to identify prioritized functional requirements of the USAF emergency management community. While this was an important first step, USAF emergency responders are part of a larger community responsible for emergency response and management. In the United States, USAF, and indeed all federal agencies, are mandated by Homeland Security Presidential Directive 5 (HSPD-5) to share emergency event information with local, state and federal agencies. Overseas, military installations or complexes are often home to more than one of the U.S. Armed Services. To share information and respond collobaratively, a common IT platform that met the common requirements of the broader EIM community would be a worthy, albeit lofty, goal.

We recommend that this study be replicated to gather requirements from similar functional communities in the Army, Navy, Marines, and Dept of Energy installations, and compare them to these results.

Subsequently, we recommend that an analysis of COTS and GOTS EIM software solutions be conducted in a highly controlled environment to evaluate the degree to which they perform the prioritized functional requirements. The use of a structured, quantitative and well-documented requirements identification process as described above is proven to significantly influence the long-term success of any software effort. The ideal software solutions will be those that most effectively perform the highest priority functional requirements. A systematic approach would prevent a decision that overvalues attractive but low priority capabilities while reducing resources available for the high priority requirements.

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