

Research on Emergency Rescue Command Information System based on Integrated Theory

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Abstract

The paper has conducted research and analysis on the basic concepts and characteristics of joint military and civilian emergency rescue, and sorted out China's the historical evolution and institutional setup of joint military and civilian emergency rescue have pointed out that joint military and civilian emergency rescue should provide first aid from a practical perspective the difficulties and pain points in the rescue and command work have been identified, and the operational requirements for joint military and civilian emergency rescue have been proposed, a new type of military civilian joint emergency rescue command system was explored. Combining the requirements and command system, The main framework and design scheme of the integrated military-civilian joint emergency rescue command information system are aimed at the Task mode and system view, from six architectures: business, capability, system, technology, service, and data Itemized design, and establish a system visual expression interface and information data synchronization mechanism from an application perspective.

Keywords

Emergency Rescue; Command Information System; Integrated Theory.

1. Introduction

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Emergency rescue is a social behavior to deal with emergencies, mainly refers to the activities of prevention, preparation, response, and recovery for sudden and destructive emergencies. According to different types of emergencies, emergency rescue actions can be divided into various types, such as traffic emergency, health emergency, earthquake emergency, fire emergency, factory and mine emergency, and family emergency. Its basic tasks mainly include rescue, organizing evacuation, and protecting relevant personnel; Control the situation, and conduct data collection and comprehensive measurement; Eliminate the consequences of sudden hazards and strive to achieve on-site recovery; Accurately investigate the cause of the accident and timely assess the degree of harm. Joint emergency rescue is a new combined emergency rescue mode, which is an activity and plan to achieve the integration of military and local advantageous resources under the unified coordination and command of national or territorial headquarters, and take necessary prevention, preparation, response, and recovery measures for various sudden disasters and emergencies. Joint emergency rescue command refers to the organization and leadership activities of joint commanders and their command organs for all rescue forces participating in emergency rescue operations after the formation of military and local force structures.

The actual work of emergency rescue faces many public security fields. Overall, it is characterized by uncertainty, suddenness, complexity, and easy evolution of consequences.

Let's analyze one by one. The uncertainty, suddenness, uncertainty, and suddenness of emergency rescue activities are the common characteristics of emergency rescue target events. There are basically no obvious signs before the outbreak, and the development and spread of emergency rescue activities are rapid, making it difficult to effectively control them in a timely manner. Therefore, our emergency rescue operations are required to be rapid, accurate, and effective, with preset and timely measures for protection, rescue, evacuation, and control of the situation. The complexity of emergency rescue activities is that the influencing factors and evolution laws of natural disasters and emergencies themselves have uncertainty and unpredictable variability; Second, it is difficult to effectively organize and manage key links such as emergency rescue information communication, action coordination and command, authorization and responsibility, and communication. These complex factors pose serious challenges to various on-site emergency rescue work. Therefore, in order to build a more stable and efficient emergency rescue system, it is necessary to fully predict and analyze various complex situations that may occur in emergency rescue work, and formulate specific response plans. Although the consequences are prone to sudden changes, intensification, and amplification of various natural disasters, sudden social events, and public safety accidents are all small probability events, once they occur, the consequences are often extremely serious, and often accompanied by lasting and difficult to eliminate social and public impacts. Therefore, a slight carelessness in emergency rescue activities may lead to changes in the nature of disasters and emergencies, leading to an expansion of the scope of accidents, disasters, and events, an increase in the number of victims, and increased consequences of casualties and property losses. In particular, the uncontrolled state caused by sudden changes, intensification, and amplification not only forces the escalation of emergency response, but may even lead to a social crisis, causing the public to immediately plunge into tremendous turbulence and panic.

2. Basic Principles for Integrated Joint Emergency Rescue Command Information System

Realizing the true integration of various business functions of emergency rescue requires the use of information technology to play the role of overall planning, connect various departments, achieve overall management of institutions, personnel, and information, and achieve unified scheduling of emergency command. From the task level, it is manifested as: managing and controlling risk points to achieve clear situation and clear bottom line; Establish emergency reporting channels to ensure emergency response to accidents and disasters; Realize online monitoring of key places and an emergency communication system with integrated sky and ground; Achieve unified management of emergency supplies, equipment, and experts nationwide; Utilize technologies such as big data and artificial intelligence, combined with disaster analysis models and historical event handling cases, to provide auxiliary support for the Emergency Management Department in formulating emergency rescue disposal plans. From the command level, it is specifically manifested as follows: first, to establish a simple and three-dimensional information network system for the flat command requirements of joint operations; The second is to continuously improve the information support capability of joint combat command around optimizing the command information process; The third is to focus on precise command at the tactical level and accelerate the close interaction between the command information system and the combat unit.

Joint emergency rescue requires the establishment of an effective mode of integrated joint action, but due to the numerous categories of departments and complex tasks, coordination and decision-making are extremely difficult. Therefore, the primary responsibility of joint emergency command is to form a timely and effective decision-making and command organization from both parties when responding to emergencies, quickly make decisions and

direct relevant forces to handle emergencies. Simon, a master of management decision-making, once said, "Management is decision-making.". For joint handling of emergencies, it is the first important thing to quickly and accurately respond and make decisions, and conduct command based on the decisions.

Joint Emergency Command Research Joint response to emergencies spans both military and political circles, with numerous departments involved. In the government system alone, there are dozens of departments, including emergency management departments, public security departments, financial departments, and civil affairs departments. The emergency management force is diverse, not only from the government and the military, but also from charitable organizations, enterprises, institutions, volunteers, and other public sectors. When the military participates in emergency management, the procedures for jointly handling emergencies are more complex than under normal circumstances. All kinds of situations require that the joint emergency response mechanism should have good organizational and coordination functions, comprehensively coordinate, effectively mobilize, and fully integrate the forces and resources of both sides, forming a joint response force to do a good job in emergency response.

The command and coordination of emergency rescue is extremely difficult, and the main solution to effectively solve this problem is to improve the implementation and execution capabilities of decision-making among different departments. The control and execution function is to ensure the implementation of decision-making and the authority of command, and improve the execution ability of decision-making and command. How to ensure the implementation of decision-making and the authority of command in a joint emergency state where multiple departments and forces jointly handle emergencies is a crucial factor in the success or failure of joint handling of emergencies. Therefore, the formulation of a joint emergency response machine should have a strong control and execution function, assign responsibilities to specific departments and units, supervise the implementation results, and give full play to the effectiveness of joint emergency response.

3. Main Structure of Integrated Emergency Rescue Command Information System

Joint emergency rescue is mainly responsible for responding to emergencies such as production safety and natural disasters, as well as comprehensive disaster prevention, mitigation, and relief work. The mission is to improve disaster prevention, mitigation, and relief capabilities through the integration and optimization of emergency forces and resources, prevent and resolve major security risks, and ensure the safety of people's lives and property and social stability. Through the construction of an integrated command information system, establish collaborative relationships in all fields related to emergency tasks, rely on the integrated sensing and communication network of heaven and earth, connect the entire process of information links before, during, during, and after the incident, and form capabilities such as casual access, full dimensional sensing, information fusion, visual command, and intelligent collaboration, to support the realization of integrated, omni-directional, digital, self process, and public participation in the entire process of emergency business Normal business, abnormal business, and comprehensive security business.

Normal business includes monitoring and early warning, risk assessment, disaster prevention, supervision and management, etc. Combining risk monitoring information, quickly identify various risk sources, monitor risk development trends in real time, conduct major safety production risk assessment and demonstration, and investigate and evaluate comprehensive risk and disaster reduction capabilities of natural disasters, and achieve disaster prevention and control. Conduct safety production inspections, assessments, and law enforcement in the

industrial, mining, and commercial industries, and achieve comprehensive supervision and management of safety production in hazardous chemicals, fireworks, non coal mines, offshore oil, industrial, commercial, and trade industries, as well as coal mine supervision and fire control supervision. Unusual business includes disaster reporting, disaster information release, emergency response, coordination and linkage, emergency scheduling, command and rescue, resource allocation, post disaster assessment, post disaster rescue, accident investigation, investigation and rectification, etc. Under the emergency command system composed of the emergency command center and on-site command vehicles, effectively coordinate with other ministries and commissions, connect the People's Liberation Army and the Armed Police Force, uniformly command and dispatch various rescue forces and materials and equipment on the scene, carry out on-site search and rescue, emergency transfer, resettlement of affected people, medical assistance, and other work, as well as post disaster assessment, detection, and rectification. Comprehensive support business includes laws and regulations, plan preparation management and drills, equipment and materials management, team management, infrastructure construction, government affairs activities, emergency management statistical analysis, international exchange and cooperation, publicity and education, science and technology informatization construction, etc. Provide support for the entire process of emergency management, normal and abnormal business activities through the implementation of plan preparation management and drills, equipment and material management, team management, infrastructure construction, government activities, emergency management statistical analysis, international exchange and cooperation, publicity and education, and scientific and technological informatization construction. Relying on the scientific and technological informatization construction of hardware facilities such as perception network, communication network, data center, security protection, operation and maintenance management, we will build an integrated command information system, create a business chain of perception, analysis, decision-making, command, action, and evaluation, and run through the entire process of "pre event, incident, event, and post event" to monitor and early warning, risk assessment, disaster prevention, supervision and management, emergency response, and command and rescue during the emergency management process. Provide support for the development of various businesses such as coordination and linkage, emergency scheduling, resource allocation, disaster assessment, disaster relief, accident investigation, team management, plan preparation, government affairs activities, and publicity and education, and promote the intelligent, collaborative, and efficient operation of various emergency management tasks.

According to the idea of "laying a solid foundation, integrating support, and opening applications", plan and design five parts of emergency management informatization construction content, namely, perception network, emergency communication network, big data support system, business application system, and operation guarantee system, based on the nine major capability requirements. In terms of infrastructure, the focus is to coordinate the construction of awareness networks and emergency communication networks in an intensive manner, providing unified and transparent shared infrastructure; In terms of support, integrate and aggregate common data and service resources to provide a resource sharing environment for business applications; In terms of application, based on a unified big data application support platform, create a business application development ecosystem and form a mass entrepreneurship development model. The five major components are interconnected, providing capabilities such as global information awareness, wide area communication coverage, unified computing storage, joint data sharing, complete business services, and reliable operational support. Knowledge networks mainly include means and facilities such as Internet of Things awareness, satellite awareness, aviation awareness, video awareness, and national awareness to support the rapid response, handling, and rescue of disasters and

accidents. The emergency communication network mainly includes facilities and equipment such as command information network, satellite communication network, and wireless communication network, providing integrated communication support for rapid response and unified command of emergency rescue. The big data support system mainly includes systems such as data centers, cloud computing platforms, and data governance. By integrating computing and storage resources, aggregating various types of data, it provides cloud resource service capabilities such as computing, storage, and networking, and provides general service capabilities such as big data computing, map services, and unified authentication, as well as data governance service capabilities such as data access, processing, exchange, sharing, management, and services. Provide computing environment and big data support for the construction and operation of business applications. The business application system mainly includes business applications such as supervision and management, monitoring and early warning, command and rescue, decision support, and government management, as well as big data application support platforms and unified portal services. Based on the emergency management big data application support platform, it aims to create an "open, jointly created, and shared" application ecosystem and development ecosystem, support the implementation of various business services in emergency management, and ensure the efficient operation of various business activities in emergency management. Your paper will be part of the journals therefore we ask that authors follow the guidelines explained in this example, in order to achieve the highest quality possible.

4. Application of Integrated Joint Emergency Rescue Command Information System

Synchronous and interactive information communication is a synchronous and interactive information communication between a commander and a command object using an integrated command information platform. Command organizations at all levels use the emergency communication system to achieve real-time awareness of the disaster situation and its changes based on overall operational intentions, and then actively take corresponding operational actions according to certain operational rules to gain the initiative in emergency rescue. Synchronous interactive command mode can fully exert the adaptive ability of each command subject and the interactivity between command subjects to improve operational command effectiveness and achieve operational intent. Synchronous interactive communication does not negate the fact that commanders make reasonable decisions at their own level based on the situation of the disaster, but rather strengthens the command and control capabilities and autonomous decision-making capabilities of commanders at all levels. In joint emergency rescue, the application of synchronous and interactive command meets the requirements of the flattening of the future information based combat command system, as well as the requirements of rapidly changing emergency rescue situations, increasing rescue information flow, and frequent interaction between commanders and combat units. The synchronous and interactive command mode further highlights the correlation between the current level, upper and lower levels, and friends and neighbors. The use of synchronous and interactive command methods in joint emergency rescue operations can better synchronize commander decision-making with real-time battlefield situations; It can realize the synchronization of decision-making between the upper and lower levels of the joint emergency rescue operation team; It can synchronize actions between friendly and neighboring teams. Only in this way can we react quickly to the real-time situation of the battlefield and handle it flexibly and efficiently, thus addressing the non-linear, complexity, and uncertainty of operations. At the same time, the commander utilizes the distributed and interactive characteristics of the emergency communication network, which is crisscrossed and multi-dimensional, to reduce the

dependence on a certain vertical information flow, communicate and feedback with the command object synchronously and directly, achieving a synchronous cycle from command to feedback, and ultimately improving command effectiveness.

The interactive information interaction mode of access refers to a new command mode in which information is obtained between the commander and the command object through mutual access based on the integrated command information platform, thereby implementing real-time command and control of combat operations. This command mode realizes seamless docking between commanders and combat units in the information domain, and is a bipolar coupling of highly centralized and highly decentralized command. The commander can directly achieve "face-to-face communication" with specific combat units or forces without any intermediate links, and issue combat instructions to their respective combat units in the form of broadcast. Each combat unit can also obtain real-time instructions from its superiors and disaster situation information required by its own level to carry out specific combat tasks. This allows highly dispersed combat units located in different combat tasks and directions to be integrated with command agencies based on the network, achieving real-time information exchange and situation sharing. This can not only exert the overall synergy between various combat units, but also flexibly handle various random situations, achieving autonomous coordination and cooperation between commanders and command objects, and improving command effectiveness. At the same time, the access interactive command method relies on the situation sharing and interconnection capabilities between various command levels to achieve "face-to-face" joint negotiation across the entire command network through mutual visits between various command levels and nodes around the overall operational intention. To synchronize various combat forces, continuously revise their own combat operations, and achieve coordination with other combat forces. The practical application of the interactive access information interaction mode requires three implementation foundations: first, a high dependence on the integrated command information system, whose stability and reliability are the foundation for its application during the rescue process; The second is that access interaction and mutual visits and consultation are the common vision among all command levels, which focus on the overall operational intention and jointly complete their own operational tasks to achieve operational objectives; The third is the corresponding access interaction mechanism, which ensures that access interaction is the basis for the use of command methods. Without a complete access interaction mechanism, mutual visits between various levels will become chaotic and disorderly, which is not conducive to the orderly flow of command information and the stability of the command network.

The application steps of the interactive information interaction mode mainly include: first, establishing a mutual visit network. Highly dispersed combat units need a network as a support to establish collaborative relationships based on the real-time disaster situation and our operational needs, and access interaction mechanisms to interact with operational information in real time. The second is to implement joint consultation. Based on the real-time disaster situation, the information system is used to virtually centralize all command levels and nodes requiring access and interaction, conduct joint discussions, unify ideas, coordinate actions, and prepare action instructions for existing and potential situations. The third is to issue instructions and monitor feedback. According to the action instructions jointly drawn up between the command nodes that visit and interact, commanders and command organs at all levels issue operational instructions to their respective combat forces and constantly monitor disaster situation feedback, and further determine the next action plan based on the disaster situation feedback.

The integrated emergency rescue command information system has the characteristics of rapid response, effective access to information, and rapid decision-making in the face of various disasters and social emergencies. Different disasters, such as fires, earthquakes, and floods,

have different characteristics, but they are generally characterized by the chaos and complexity of the on-site environment, the multithreading of emergency rescue tasks, and difficulties in data acquisition and communication. These all pose a serious test to the effectiveness of the integrated emergency rescue command information system. In order to verify the practical application effect of the integrated emergency rescue command information system, we have designed a corresponding disaster actual case to examine the ability of the designed system in terms of timeliness and accuracy of emergency rescue through the emergency effect of the actual case. In order to achieve the purpose of verification, we need to design corresponding system actual operation processes for the realization of system functions and application effectiveness during the actual application transformation process.

5. Conclusion

Emergency rescue work for major disasters is an important topic related to the safety of people's lives and property and national development. In recent years, informatization and intelligent technology have provided a good technical carrier for improving the efficiency of emergency rescue tasks in China. Building an integrated emergency rescue command information system that gathers multiple forces and advantageous resources is an important means to solve disaster emergency problems. However, there is currently a lack of systematic research work in China, and there is no clear research plan for establishing a joint emergency rescue mechanism. Therefore, starting with meeting the actual technical requirements of emergency rescue work, this article proposes the theoretical methods and technical implementation routes for constructing an integrated joint emergency rescue system, designs the organizational structure and functional model of the integrated joint emergency rescue command, and completes the relevant information processing and analysis work of the system based on actual cases.

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