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Demand Analysis of Air-Ground Integrated Cooperative Urban Anti-Terrorism Operations Capabilities based on GQFD

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Abstract

Urban counter-terrorism operations involve complex environments and high information uncertainty, making Integrated Air-Ground Teaming (IAG-T) a critical model for enhancing operational effectiveness. However, systematically and precisely translating ambiguous operational tasks into clear, quantifiable system capability requirements remains a core challenge in current equipment system development. This study aims to employ a combined approach of Grey System Theory and Quality Function Deployment (GQFD) to construct a scientific requirements analysis model. This model addresses uncertainties in mapping integrated air-ground urban counter-terrorism operational capability requirements, providing a theoretical foundation for equipment system development, tactical formation, and effective support.The paper first analyzes typical urban counter-terrorism scenarios to extract operational mission requirements. It then employs grey system theory to address the incompleteness and ambiguity of expert evaluations, determining grey weights for each requirement. Subsequently, a "mission-capability" relationship matrix is constructed using GQFD, precisely mapping top-level mission requirements to specific integrated air-ground system capabilities. Finally, computational analysis identifies critical capability requirements and their priority sequence.Applying GQFD (Grey Quality Function Deployment) to analyze urban counter-terrorism operational capability requirements for integrated air-ground coordination effectively addresses uncertainty and ambiguity in requirement information, ensuring capability development precisely aligns with operational missions.

Keywords

Air-Ground Integrated Coordination; Urban Counter-Terrorism; Capability Requirements Analysis; Grey Quality Function Deployment; GQFD.

1. Overview of Air-Ground Integrated Urban Counter-Terrorism Operations

Modern cities provide unprecedented support for counterterrorism through technology, infrastructure, and command systems, enabling intelligence gathering, rapid deployment, and precision strikes [1]. However, the same high density, complex spaces, critical facility interdependencies, and cybersecurity risks stemming from informatization also offer terrorists greater operational space and higher destructive potential [2].

1.1 Operational Advantages of Air-Ground Integrated Urban Counterterrorism Operations

1.1.1 Situational Awareness Advantage: Provides Continuous, Multidimensional, and Penetrative Battlefield Monitoring Capabilities to Dispel the "Fog of War."

Unmanned platforms leverage their unique mobility to establish a three-dimensional reconnaissance network spanning air, ground, and indoor environments. High-altitude UAVs offer a "bird's-eye view" to oversee neighborhood dynamics; micro-UAVs infiltrate buildings through doors, windows, and vents, achieving "eyes through walls" to relay real-time structural, personnel, and equipment intelligence; ground robots conduct reconnaissance along corridors and stairwells, completely dispelling battlefield fog and delivering unprecedented operational transparency to commanders.

1.1.2 Non-contact Combat Advantage: Achieving "Zero Casualties" Or "Low Casualties" in Operations Yields Significant Political and Military Benefits.

This represents the most direct and prominent value of unmanned operations. Unmanned platforms can replace personnel in entering the most hazardous areas (such as suspected explosive sites, crossfire zones, and bio-chemical contamination areas) to perform reconnaissance, bomb disposal, and direct strike missions. This drastically reduces the risk of casualties among friendly forces, enabling "zero casualties" or "low casualties" operations [7]. This not only holds military significance but also yields major political benefits in protecting elite special forces and reducing societal pressure.

1.1.3 Operational Effectiveness Advantages: Faster Response Times, More Precise Strikes, and Enhanced Sustainable Combat Capabilities.

Unmanned operations compress the traditional Observe-Observe-Decide-Act (OODA) loop to its absolute limit [3]. The process from target detection to weapon guidance can be reduced from minutes to seconds. AI-assisted target identification and fire allocation ensure exceptional strike precision, enabling effective differentiation between terrorists and hostages to achieve "pinpoint elimination" and minimize collateral damage. Furthermore, unmanned systems operate tirelessly, sustaining 24/7 operations with endurance far exceeding human physiological limits.

1.1.4 Psychological Deterrence Advantage: Exerts Formidable Psychological Pressure on Terrorists.

Unmanned combat forces possess not only physical destruction capabilities but also serve as potent psychological warfare tools. The constant hum of drones hovering overhead and their pervasive surveillance perspectives inflict immense psychological pressure and isolation on trapped terrorists. Combined with broadcasts urging surrender through onboard loudspeakers, these systems can effectively erode enemy combat will, forcing capitulation and potentially achieving the optimal outcome of "subduing the enemy without fighting."

1.2 Challenges in Air-Ground Integrated Urban Counterterrorism Operations

1.2.1 Communication and Navigation Resilience in Complex Urban Environments

In urban counterterrorism, GPS spoofing and communication disruption pose significant risks. Dense high-rise buildings cause multipath refraction of GPS signals, allowing spoofed signals to infiltrate genuine ones. Low-cost devices can execute spoofing attacks; incidents have occurred where drones, disrupted by interference, deviated from reconnaissance routes and entered civilian areas, exposing operational intentions and nearly causing collateral damage. Communication challenges arise as reinforced concrete structures form "electromagnetic shielding layers," severely attenuating VHF and microwave signals. Underground passages and high-rise canyons often create signal dead zones. Simultaneously, electromagnetic interference from urban power grids and base stations can distort operational communications. During one operation, ground assault forces suddenly lost communication with their helicopters, preventing them from receiving real-time intelligence and command instructions. This forced them to suspend their assault, giving terrorists time to move hostages and set traps.

1.2.2 Limitations of Autonomous Intelligence

Current AI systems face significant misjudgment risks in urban counterterrorism. At the recognition level, training data often suffers from incomplete scenario coverage and limited population diversity, leading to "cognitive biases" in models. Combined with sudden changes in urban lighting, smoke obstruction, and target camouflage, the probability of misjudgment increases dramatically. In one exercise, AI mistakenly identified civilians running with packages as terrorists carrying explosives. It also failed to detect disguised terrorists, resulting in ground forces being ambushed. At the decision-making level, AI struggles to comprehend complex battlefield situations, and its decision-making process is "non-traceable," unable to comprehensively consider factors like civilian safety. In one simulation, AI recommended an airstrike solely based on detecting weapon signals, completely ignoring hostages held inside a building. It also lacks the ability to respond to new tactical approaches.

1.2.3 Lack of Air-Ground Integrated Tactical Procedures

Existing tactical regulations lag significantly behind technological advancements, failing to support integrated air-ground coordination. Traditional manuals, designed for manpower-centric operations, lack provisions for deploying new assets like drones and intelligent robots. They do not specify standards for human-machine information exchange or emergency response protocols. Many nations' regulations only vaguely define drone flight altitudes and reconnaissance ranges, resulting in "information silos" during combat operations where intelligence gathered by drones cannot be swiftly translated into ground force actions. Simultaneously, the absence of equipment interoperability standards leads to inconsistent interfaces and incompatible data formats. Incidents have occurred where data transmission delays between drones and command systems resulted in critical information loss. Training programs also lack specialized human-machine coordination content, leaving soldiers unfamiliar with equipment boundaries. During one exercise, ground troops inadvertently entered a drone's airspace, forcing the drone to perform an emergency evasion maneuver that interrupted its mission and nearly caused an accident.[17]

2. Air-Ground Integrated Coordination in Urban Counter-Terrorism Operations: "Mission → Capability" Analysis

2.1 Mission Analysis

From the perspective of mission analysis for integrated air-ground counter-terrorism operations in urban environments, core tasks must be tightly interconnected and executed in concert. Communication and command control form the mission's nerve center, requiring the establishment of an anti-jamming communication network that integrates command transmission for both air and ground assets. This ensures stable command signal delivery amid high-rise obstructions and electromagnetic interference, preventing decision delays caused by communication breakdowns. Real-time three-dimensional surveillance relies on aerial drones, helicopters, and ground monitoring equipment to achieve comprehensive coverage of streets, alleys, high-rise buildings, and underground spaces. This enables timely detection of terrorist movements and hostage locations, providing intelligence support for subsequent operations. Target identification and lock-on require combining artificial intelligence technology with manual verification to overcome challenges such as target obstruction and camouflage in complex urban environments. This ensures precise differentiation between terrorists and civilians, reducing the risk of misjudgment. Task allocation must align with air and ground asset capabilities, assigning aerial forces to fire suppression and casualty evacuation while ground units handle assault operations and civilian evacuation, ensuring optimal role-personnel matching. Path planning requires avoiding structural obstacles and civilian-dense areas to optimize routes for ground troop advancement and aerial asset flight, minimizing exposure risks. Precision real-time strikes must rely on navigation and target-locking data to deliver accurate strikes on terrorist strongholds through coordinated air support and ground assaults, balancing combat effectiveness with minimal collateral damage. Low-latency collaborative control requires synchronized air-ground actions-such as seamless transitions between aerial suppression and ground breakthroughs-to prevent operational disruptions from timing discrepancies. Efficient support logistics necessitate integrated medical and supply chains to promptly deliver resources and treat casualties, sustaining combat endurance. Protection and counter-drone operations must guard against terrorist drone attacks, safeguard friendly equipment and personnel, establish comprehensive defense systems, and ensure the orderly progression of overall combat missions.

2.2 Capability Analysis

From the perspective of analyzing integrated air-ground counterterrorism capabilities in urban environments, core competencies form the critical foundation for mission execution and must be developed into a complementary, interconnected capability system. Integrated air-ground hybrid decision-making capabilities fuse rapid AI algorithm processing with human commanders' experiential judgment. This approach enables efficient combat plan generation based on data while adapting to urban battlefield contingencies (e.g., hostage situations, building collapses), avoiding the mechanical rigidity of pure AI decision-making and the lag of purely manual command. Cross-domain heterogeneous coordination control capabilities break down barriers between aerial drones, helicopters, and ground forces/equipment, resolving communication protocol and control standard differences across platforms to achieve seamless integration between "aerial reconnaissance - ground response" and "aerial suppression - ground assault." Omni-domain multidimensional perception capabilities integrate aerial optical/infrared reconnaissance, ground radar detection, and underground life-sign monitoring to cover complex urban environments including streets, high-rises, and underground spaces, eliminating reconnaissance blind spots and providing real-time battlefield situational awareness; Multi-source heterogeneous data fusion capability: Cleanses, correlates, and analyzes reconnaissance data, equipment status data, and environmental data, transforming fragmented information into a unified battlefield picture to provide precise data support for decision-making; Strong anti-jamming dynamic self-organizing networking capability: Automatically adjusts communication frequencies and network topology in urban electromagnetic interference and signal-blocking environments to ensure stable transmission of command instructions and intelligence data, preventing communication interruptions; Air-ground integrated strike capabilities: Coordinate precision airborne guidance with ground firepower through shared target data, achieving both accuracy and minimal collateral damage when targeting terrorist strongholds; Comprehensive point-area defense capabilities: Deploy specialized protection for critical areas (e.g., hostage locations, key facilities) while establishing an all-domain defense network with anti-drone systems and blast-resistant equipment to counter terrorist attacks; Real-time rapid precision support capabilities: Leveraging modular logistics equipment and airlift corridors to ensure precise material delivery and rapid casualty evacuation, sustaining frontline operations and bolstering overall combat effectiveness.

2.3 Mission-Capability Mapping Analysis

In any campaign, operational capabilities form the foundation for achieving and completing combat missions, with a "many-to-many" relationship between tasks and capabilities. Specifically in urban warfare, each task requires support from multiple capabilities.[6] Through task decomposition and capability relationship analysis, a preliminary mapping relationship between the two can be established, as shown in Figure 1. However, only by further determining the importance levels of combat tasks and capabilities, along with their mutual influence, can operational capability development and equipment system design proceed.[4]

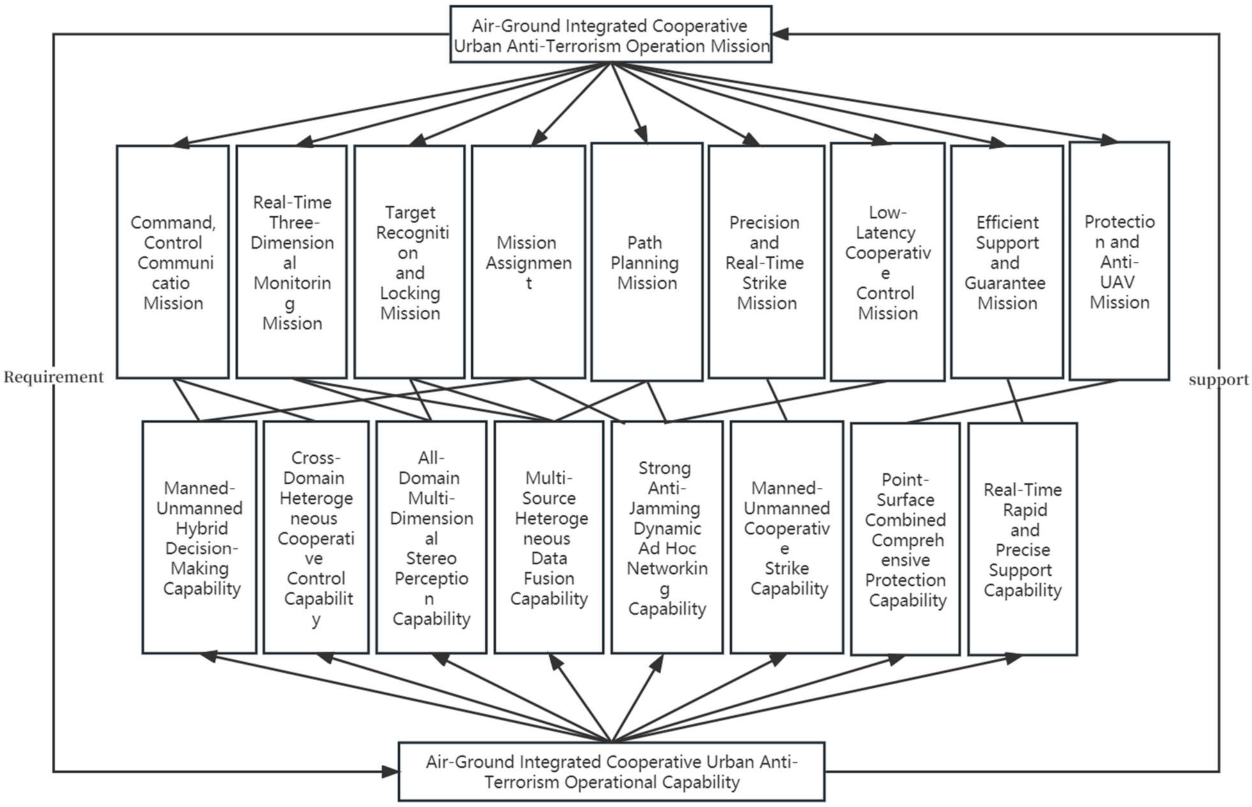

Figure 1. Air-Ground Integrated Combat Mission-Capability Mapping Diagram

3. Development of an Operational Capability Requirements Analysis Model based on GQFD

3.1 Introduction to the QFD Model

Quality Function Deployment (QFD) is a method for translating customer requirements into quality specifications within the product development process. [7]It identifies key quality characteristics by analyzing customer needs and converts these into specific engineering requirements and component specifications. Its core model, the House of Quality (HOQ), consists of the components shown in Figure 2.[8]

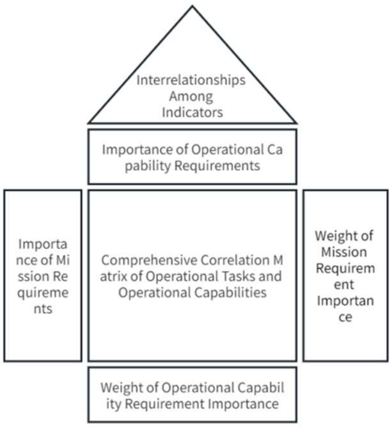

Figure 2. House of Quality Model

3.2 GQFD-Based Requirement Analysis Model

Building upon traditional QFD, this approach incorporates grey relational analysis by replacing the subjective correlation matrix in QFD with a grey relational matrix. [9]This reduces the subjectivity of expert scoring, enhancing the objectivity and reliability of requirement analysis. Through a closed-loop process of task decomposition → capability definition → expert scoring → grey correlation matrix → House of Quality → capability importance ranking, this approach systematically reveals the most critical equipment capabilities, providing scientific basis for R&D, procurement, and resource allocation.[10]

Step 1: Determine the reference sequence and comparison sequence

First, combat missions and raw capability requirements are obtained through expert consultation, theoretical analysis, and operational simulations. Second, these raw requirements are categorized and decomposed to form a two-tiered mission and capability requirement indicator system. Finally, domain experts score the importance of combat missions and capability requirement indicators. [11]Let the mission requirement indicator sequence (corresponding to the expert scoring sequence for mission requirement Ti) be defined as: Ti= (ti(1), ti(2), ···, ti(n), (i=1,2, ···, s), where n is the number of experts. The capability requirement indicator sequence (corresponding to the optimal expert scores for capability requirement Cj) is Cj= (cj(1), cj(2), ----, cj(n), (j=1,2,----,m).

Step 2: Calculate the grey correlation matrix

① Calculate gray absolute correlation ε_{ij}

$$\left|T_{si}\right| = \left|\sum_{k=2}^{n-1} t_i^0(k) + \frac{1}{2} t_i^0(n)\right| \tag{1}$$

$$\left|C_{sj}\right| = \left|\sum_{k=2}^{n-1} c_j^0(k) + \frac{1}{2} c_j^0(n)\right| \tag{2}$$

$$\left|C_{sj} - T_{sj}\right| = \left|\sum_{k=2}^{n-1} (c_j^0(k) - t_i^0(k)) + \frac{1}{2} (c_j^0 - t_i^0(n))\right| \tag{3}$$

$$\varepsilon_{ij} = \frac{1+\left|T_{si}\right|+\left|C_{sj}\right|}{1+\left|T_{si}\right|+\left|C_{sj}\right|+\left|C_{sj}-T_{si}\right|} \tag{4}$$

② Calculate the gray relative association degree r_{jk}

$$\left|T_{si}^{'}\right| = \left|\sum_{k=2}^{n-1} t_i^{0'}(k) + \frac{1}{2} t_i^{0'}(n)\right| \tag{5}$$

$$\left|C_{sj}^{'}\right| = \left|\sum_{k=2}^{n-1} c_j^{0'}(k) + \frac{1}{2} c_j^{0'}(n)\right| \tag{6}$$

$$\left|C_{sj}^{'}-T_{si}^{'}\right|=\left|\sum_{k=2}^{n-1}(c_j^{0'}(k)-t_i^{0'}(k))+\frac{1}{2}(c_j^{0'}(n)-t_i^{0'}(n))\right| \tag{7}$$

$$r_{ij}=\frac{1+\left|T_{si}^{'}\right|+\left|C_{sj}^{'}\right|}{1+\left|T_{si}^{'}\right|+\left|C_{sj}^{'}\right|+\left|C_{sj}^{'}-T_{si}^{'}\right|} \tag{8}$$

③ Calculate the gray comprehensive correlation matrix Ψ

T_i and C_j's grey comprehensive correlation degree

$$\rho ij = \theta \varepsilon ij + (1-\theta) rij \ (\theta = 0.5) \tag{9}$$

The grey comprehensive correlation matrix between T_i and C_j

$$\psi = (\rho_{ij})_{s\times m} = \begin{pmatrix} \rho_{11} & \rho_{12} & \cdots & \rho_{1m} \\ \rho_{21} & \rho_{22} & \cdots & \rho_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ \rho_{s1} & \rho_{s2} & \cdots & \rho_{sm} \end{pmatrix} \tag{10}$$

The comprehensive correlation coefficient not only reflects the similarity between the T_i and C_j, but also indicates the closeness of their relative rates of change from the starting point. It serves as a comprehensive quantitative metric for assessing the strength of connections between sequences.[12]

④ Calculate the importance weight λ for task requirement indicators

Step 3: Construct the Quality House Model

Populate the quality house with the grey comprehensive correlation matrix Ψ and the task requirement indicator importance weights λ to form a quality house model based on grey correlation analysis.[13,14]

Step 4: Determine the Importance Ranking of Combat Capability Requirement Indicators[15,16]

Calculate the importance of combat capability requirement indicators using traditional QFD methods to determine their importance ranking.

4. Analysis of Air-Ground Integrated Urban Counterterrorism Combat Capability Requirements

4.1 Operational Mission Requirement Metrics

Based on the preceding analysis of "mission-capability" relationships, air-ground integrated collaborative combat missions can be categorized into nine requirements: communication and command control, real-time three-dimensional surveillance, target identification and lock-on, mission assignment, path planning, precision real-time strike, low-latency collaborative control, efficient support and sustainment, and protection and countermeasures. These serve as calculation indicators and are numbered as shown in Table 1.

Table 1. Operational Mission Requirements

Operational Mission Requirement Metrics	No.
Communication and Command Control	T_1
Real-time Three-dimensional Surveillance	T_2
Target Identification and Locking	T_3
Mission Assignment	T_4
Path Planning	T_5
Precision Real-Time Strike	T_6
Low-Latency Collaborative Control	T_7
Efficient Support and Assurance	T_8
Protection and Anti-Unmanned Systems	T_9

4.2 Operational Capability Requirements

Based on the preceding analysis of "mission-capability" relationships, the operational capability requirements corresponding to air-ground integrated joint operations mission demands are: integrated air-ground hybrid decision-making capability, cross-domain heterogeneous collaborative control capability, all-domain multidimensional three-dimensional perception capability, multi-source heterogeneous data fusion capability, robust anti-jamming dynamic self-organizing networking capability, integrated air-ground joint strike capability, point-area combined comprehensive defense capability, and real-time rapid precision support capability. These eight capability requirements are identified by their respective indicator codes as shown in Table 2.[5]

Table 2. Operational Capability Requirements

Operational Capability Requirement Metric	No.
Air-Ground Integrated Hybrid Decision-Making Capability	C_1
Cross-domain Heterogeneous Collaborative Control Capability	C_2
Global Multi-dimensional Three-dimensional Perception Capability	C_3
Multi-source Heterogeneous Data Fusion Capability	C_4
Strongly Resilient Dynamic Self-Organizing Networking Capability	C_5
Air-Ground Integrated Collaborative Strike Capability	C_6
Integrated point-to-area defense capability	C_7
Real-time Rapid Precision Support Capability	C_8

4.3 Operational Capability Requirements Analysis

Based on the aforementioned "mission-capability" requirement indicators, we invited 15 experts with extensive experience in relevant fields to rate the importance of these indicators on a 9-point scale. The scoring results are presented in Table 3.

Table 3. Demand Indicator Importance Scoring Table

Requirement ID		Expert ID														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Communications and Command Control	T_1	8	8	8	9	9	9	8	8	8	8	9	9	9	9	9
Real-time Stereoscopic Monitoring	T_2	7	6	7	8	8	8	8	8	7	8	8	8	8	8	7
Target Identification and Lock-on	T_3	7	8	7	7	8	8	8	7	8	7	8	9	8	9	8
Task Assignment	T_4	6	6	7	5	6	7	8	7	7	7	7	8	7	7	6
Path Planning	T_5	7	8	7	8	7	8	8	8	8	7	8	9	9	8	8
Precision Instant Strike	T_6	7	6	8	8	8	8	9	8	7	8	8	8	7	8	7
Low-Latency Collaborative Control	T_7	8	9	9	8	9	8	9	8	9	9	8	9	8	9	9
High-Efficiency Support Assurance	T_8	5	5	6	5	5	7	7	6	6	6	6	6	5	6	5
Protection and Anti-Unrest	T_9	4	5	5	4	4	6	6	5	5	5	6	6	5	6	5
Integrated Air-Ground Hybrid Decision Capability	C_1	6	7	6	6	6	7	6	7	6	7	7	6	5	6	7
Cross-domain heterogeneous collaborative control capability	C_2	8	8	9	8	9	9	8	9	9	8	9	8	8	9	8
Global Multi-Dimensional Stereoscopic Perception Capability	C_3	5	6	7	6	7	6	6	7	6	6	7	7	6	7	5
Multi-source Heterogeneous Data Fusion Capability 1	C_4	8	9	9	8	9	9	9	8	9	8	9	9	9	8	9
Strong Anti-Interference Dynamic Self-Organizing Networking Capability	C_5	8	9	8	9	9	9	9	9	9	9	8	9	9	9	9
Integrated Air-Ground Collaborative Strike Capability 3	C_6	8	9	9	9	8	9	9	9	9	9	9	9	9	9	9
Integrated Point-to-Area Protection Capability	C_7	7	6	7	7	7	7	7	7	7	7	7	6	6	7	7
Real-time Rapid and Precise Assurance Capability	C_8	8	8	8	8	7	8	7	8	8	7	8	8	8	8	7

$$\psi = \begin{bmatrix} 0.61 & 0.89 & 0.52 & 0.92 & 0.93 & 0.94 & 0.55 & 0.78 \\ 0.63 & 0.75 & 0.58 & 0.80 & 0.81 & 0.82 & 0.60 & 0.72 \\ 0.62 & 0.76 & 0.59 & 0.81 & 0.82 & 0.83 & 0.61 & 0.73 \\ 0.51 & 0.60 & 0.48 & 0.65 & 0.66 & 0.67 & 0.50 & 0.59 \\ 0.62 & 0.76 & 0.59 & 0.81 & 0.82 & 0.83 & 0.61 & 0.73 \\ 0.63 & 0.75 & 0.58 & 0.80 & 0.81 & 0.82 & 0.60 & 0.72 \\ 0.80 & 0.95 & 0.68 & 0.97 & 0.98 & 0.99 & 0.71 & 0.89 \\ 0.49 & 0.57 & 0.46 & 0.62 & 0.63 & 0.64 & 0.48 & 0.56 \\ 0.48 & 0.56 & 0.45 & 0.61 & 0.62 & 0.63 & 047 & 0.55 \end{bmatrix}$$

Figure 3. the fuzzy comprehensive correlation matrix

Using Python programs based on formulas (1) to (10), the fuzzy comprehensive correlation matrix Ψ between the air-ground integrated combat mission requirement indicators T_i and combat capability requirement indicators C_j was calculated. Its value distribution is shown in Figure 3, intuitively reflecting the degree of connection between T_i and C_j. Calculations reveal that

$$\sum_{j=1}^{8}\rho_{7j} > \sum_{j=1}^{8}\rho_{1j} > \sum_{j=1}^{8}\rho_{3j} \geq \sum_{j=1}^{8}\rho_{5j} > \sum_{j=1}^{8}\rho_{2j} \geq \sum_{j=1}^{8}\rho_{6j} > \sum_{j=1}^{8}\rho_{4j} > \sum_{j=1}^{8}\rho_{8j} > \sum_{j=1}^{8}\rho_{9j}$$

Therefore, the importance ranking of the air-ground integrated joint operations mission requirement indicators is:

$$T_7 > T_1 > T_3 \geq T_5 > T_2 \geq T_6 > T_4 > T_8 > T_9$$

According to formula (12), with $\mu=0.5$, the importance weight λi for mission requirement indicators Ti is calculated as: $(\lambda 1, \lambda 2, \lambda 3, \lambda 4, \lambda 5, \lambda 6, \lambda 7, \lambda 8, \lambda 9) = (8, 4.5, 6.5, 4, 6.5, 4.5, 9, 3, 2)$

Substituting the grey composite correlation matrix Ψ between Ti and Cj, along with the importance weights λi, into the quality house model, the importance and ranking of combat capability requirement indicators Cj are calculated using the QFD method, as shown in Table 4.

Table 4. "Mission-Capability Requirements" Quality Matrix

Mission Requirements	Combat Capability Requirements								Task Requirement Importance
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	
T_1	0.61	0.89	0.52	0.92	0.93	0.94	0.55	0.78	8
T_2	0.63	0.75	0.58	0.80	0.81	0.82	0.60	0.72	4.5
T_3	0.62	0.76	0.59	0.81	0.82	0.83	0.61	0.73	6.5
T_4	0.51	0.60	0.48	0.65	0.66	0.67	0.50	0.59	4
T_5	0.62	0.76	0.59	0.81	0.82	0.83	0.61	0.73	6.5
T_6	0.63	0.75	0.58	0.80	0.81	0.82	0.60	0.72	4.5
T_7	0.80	0.95	0.68	0.97	0.98	0.99	0.71	0.89	9
T_8	0.49	0.57	0.46	0.62	0.63	0.64	0.48	0.56	3
T_9	0.48	0.56	0.45	0.61	0.62	0.63	0.47	0.55	2
Capability Indicator Importance	30.68	37.53	24.47	39.44	40.04	40.46	28.50	35.36	
Percentage	11.34	13.87	10.16	14.58	14.80	14.96	10.54	13.07	
Sort	6	4	8	3	2	1	7	5	

5. Conclusion

Research demonstrates that the GQFD model effectively translates critical mission requirements-such as "stealthy approach," "real-time three-dimensional surveillance," "precision instantaneous strike," and "low-latency collaborative control"-into core system capabilities including "multi-source heterogeneous data fusion capability," "strong anti-jamming dynamic self-organizing networking capability," "human-machine hybrid intelligent decision-making capability," and "heterogeneous cluster collaborative autonomy capability." It also establishes their priority development levels. This study validates the applicability and effectiveness of the GQFD method in military requirements analysis. The proposed requirements analysis framework and conclusions provide direct theoretical support and decision-making references for the modular and intelligent development of integrated air-ground collaborative urban counter-terrorism operations systems.

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