Technical Approaches to Defense Functions of Civil Carriers

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Keywords: Civil-military integration, Civil carrier, Defense function, Realization.

Abstract. To deeply implement the strategy of civil-military integrated development and give full play to civil carriers, four issues were analyzed such as contents of defense functions, prerequisites for mobilization and employment, technical approaches to defense functions, and principles for the design of conversion kits. This article can provide theoretical reference for peacetime technical preparation of civil carriers.

Introduction

Logistical support to military struggle cannot be separated from a solid material foundation. Mobility of troops, movement of weapons, deployment of units and implementation of logistical support could not be realized without plentiful transportation resources. With the limitation on China’s defense budget and scale of armed forces, the development of transportation equipment should follow the path to civil-military integration, and make full use of civil carriers to cover the shortage of organic equipment.

To systematically study national defense functions of civil carriers and make a technical preparation for mobilization under new situations would be good for rapid transformation from peacetime resource potential to wartime transportation strength, and be favorable for exertion of support effectiveness by civil carriers.

Contents of Defense Function

The contents of defense function of a civil carrier mean that it could be utilized to certain military support purposes, which are different from its original function. By transport mode, civil carriers can be divided into four classes (Figure 1), including but not limited to following contents.

Casualty Evacuation
Civil carriers should evacuate the wounded to rear hospitals in wartime, have functions such as safe and fast boarding, internal placement and en-route medical care of the patients, and render emergency treatment conditions for severely wounded persons when needed.

Transportation of Materials and Equipment

Transport of Accompanying Weapons. Weapons such as machine rifles, rifles, light machine guns, light grenade launchers could be placed and constrained within the carriers. The carriers operating in plateau areas should supply oxygen for soldiers.

Movement of Missiles at Sea. The civil carriers should transport cross-sea organic missile troops of PLA Rocket Force, tie down special-purpose equipment, supply power to missile-carrying equipment and provide life support.

Transportation of Equipment. Equipment could be loaded and constrained in the carriers, and transported by them.

Oil Supply. Surface combatants of PLA Navy should be replenished alongside and astern at sea.
Movement of Organic Troops

Railway passenger cars should provide facility for emergency power supply and fixing of weapons and ammunition; freight cars should be able to fasten equipment. Equipment could be carried by and fastened to waterway carriers, and persons’ lives be supported and saved.

Prerequisites for the Mobilization of Civil Carriers

Several conditions should be satisfied before the mobilization of civil carriers. First of all, original functions of carriers should be similar with their defense functions, meaning that they are possible to be utilized in military and can be shifted into wartime support strength with only a little technical preparation means. And the second, a large number of civil carriers should exist and have a source of supply, ensuring they could be mobilized in large quantities during war and meet transportation needs. Lastly, carriers should maintain good technical conditions and be employed just after mobilization.

Similarity between Original and Defense Functions

The comparability of passenger transport with defense functions have three meanings. The first is the media of two functions are civil carriers, and both functions should be combined with carriers so as to realize those functions. Secondly, the necessary aspects of two functions are basically the same such as heating, ventilation, air-conditioning, lighting and emergent power supply. Besides, the persons could be comfortably placed and convenient to pass by, and equipment be reasonably arranged and reliably fastened. The third is that both functions could realize the change of spatial displacement of transport objects in a certain time and on a certain transport route.

Large Holdings

Civil carriers with small quantity and scattered ownership are not suitable for mobilization, and those no longer produced in the future or planned to be phased out should not be considered[1].

Good Technical Conditions

Priority should be given to carriers with good performance, regular maintenance and less failures.

Technical Approaches to Defense Functions

Although the existing functions of civil carriers are similar to defense functions, they are essentially civilian products owned by the state or society, i.e., military requirements are not generally taken into consideration in design and construction. Therefore, in order to enhance the suitability of carriers for military logistical support, a significant part of carriers must be modified with technical means, mainly conversion and implementation of national defense requirements.

Conversion

Conversion measures are applicable to existing carriers. They temporarily meet military needs after conversion, and conversion kits will be removed in line with reversed process of conversion so as to restore to their original states.

Railway Carriers. Passenger cars and electrical multiple units (EMU) are apt to transport troops with carry-on equipment and casualty. When used to move troops, those carriers should add devices for fixation of weapons and other materials. Simple oxygen supply device should be retrofitted to ordinary passenger cars running on lines in plateau regions. Passenger cars, exclusive of 25G plateau model, should be modified with movable windows and turnable middle berths in order to open boarding passages for the wounded. Related nursing stations should be opened with some medical devices reasonably fixed. Temporary power supply lines and simple oxygen supply devices should be considered, as well as auxiliary equipment for boarding and transferring of the patients. As for EMU, after the dismantlement of indoor seats, devices for casualty placement should be fixed, and other
conversion contents are identical to those of passenger cars. There is no need to open boarding passages. Flatcars are suitable freight cars for transportation of military equipment. Among which, flatcar-container dual-purpose car and container special-use flatcar are need converting. Rope lugs should be welded along each side beam of a flatcar-container dual-purpose car in order to fasten the equipment.

**Highway Carriers.** Trucks can be used to load tracked equipment, containers and troops. During the transport of equipment, related kits should be retrofitted to a flat transporter such as a dilated board for equipment to roll-on from the tail, foldaway gangway foot plate for discharge and fixtures. Turning locks for fixing containers will be added to a transporter carrying containers. When applied to move troops, a truck would add auxiliary devices, each including seats, safety belts, gun racks and tiedown nets. Medium-sized and large coaches are suitable for transport of soldiers and patients. The luggage rack in coaches used to carry soldiers would be modified so as to enlarge the space for rucksack. Mounting interfaces for gun rack should be retrofitted on the floor to tie down carry-on weapons. Tiedown ring, rope and bandage should be used when needed. When the wounded are moved, the seats in a coach would be removed and devices for casualty placement be installed. Working area for medical treatment should be opened as well as fixtures for some medical devices and several temporary power supply lines.

**Waterway Carriers.** Certain ships, including RO-RO passenger vessel, container ship, multiple-purpose ship, general ship, bulk vessel, river-to-sea ship, RO-RO ship, are apt to transport organic forces, patients and missile troops. Their conversion needs are listed in Table 1. When a RO-RO passenger vessel is used to carry the patients, equipment for casualty placement would be installed after seats in the seat-hold and dining-room are removed. Original supermarket, counter in dining-room or infirmary would be modified into nursing stations. Power supply device and newly-designed maritime patients transfer system would be temporarily used. When carrying missile troops, RO-RO ships would add life support and power supply facility. Tiedown kits and fire equipment are also required.

**Aviation Carriers.** Passenger planes can transport soldiers and patients. When transporting combat personals, the planes will add fixtures for carry-on weapons, and separation nets for forward and aft cargo holds. When used for casualty evacuation, the planes will add equipment for patient placement after removal of most of the seats, and need temporary power supply lines and working area for medical treatment. Cargo airplanes, suitable for wheeled equipment, will need unit load devices, load-sharing plate and lashing equipment. When utilized to move severely wounded patients, the transport or utility helicopter will add an airborne comprehensive first-aid module for severely wounded persons, evacuation module, oxygen supply module, cabinet containing drugs and medical devices, and a patient nacelle at fuselage tail.

**Implementation of Defense Features**

This sort of measures is applicable for newly-built carriers. In the process of design and manufacturing, some conversion contents will be preset in advance in order to improve the fastness of conversion during war.

<table>
<thead>
<tr>
<th>Ship Type</th>
<th>Conversion Content</th>
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<tbody>
<tr>
<td>RO-RO Passenger Vessel</td>
<td>Existing storage rooms and tool rooms will be transformed into magazines.</td>
</tr>
<tr>
<td>Multiple-Purpose Ship</td>
<td>● Life containers will be added on the hatches;</td>
</tr>
<tr>
<td></td>
<td>● Existing storage rooms and tool rooms will be transformed into magazines;</td>
</tr>
<tr>
<td></td>
<td>● Pallets and tiedown kits will be used.</td>
</tr>
<tr>
<td>Container Ship</td>
<td>● Non-watertight bulkheads will be removed;</td>
</tr>
<tr>
<td></td>
<td>● Container bearing platforms will be added to cargo holds;</td>
</tr>
<tr>
<td></td>
<td>● Auxiliary loading frame will be preset in cargo holds;</td>
</tr>
<tr>
<td></td>
<td>● Life containers will be added on the hatches;</td>
</tr>
<tr>
<td></td>
<td>● Existing storage rooms and tool rooms will be transformed into magazines.</td>
</tr>
<tr>
<td>General Ship</td>
<td>● Bilge and middle decks will be strengthened;</td>
</tr>
</tbody>
</table>
Principles for Design of Conversion Kits

The significant feature in conversion of civil carriers is that according to military requirements during war or emergencies, those carriers will be rapidly converted in large numbers, and restored to original state for business operation after tasks are accomplished. This feature contains several meanings. The first is skillful conversion, i.e., to take into account moderation and generalization in order to realize defense functions with less conversion contents and universal conversion kits. Second, fast conversion requires that original facility and structures be utilized to the most extent with light newly-designed kits and rational construction process in order to ensure a quick and standardized conversion. The third is economic conversion. It makes conversion kits both available and inexpensive through strict control of costs in kit design, practical modification and storage stages.
Therefore, generalization, moderation, fastness and economy principles should be followed in the design of conversion kits, contributing to improving conversion quality and benefit of civil carriers.

**Generalization.** In the conversion of railway, highway, waterway and aviation carriers, each including some suitable models, a type of carrier would need a set of conversion kits without necessary generic analysis and reasonable technical approaches. It is not only duplication of design and manufacturing, but brings difficulties in use, storage and management. To realize generalization of conversion kits, feasible approaches should be unification of conversion content, scheme, and kits, among which unification of contents is the precondition, unification of scheme the basis, and unification of kits the symbol and foothold. Especially, unification of conversion kits is to analyze whether current kits meet the needs of conversion scheme, and make full use of current kits through direct utilization and model unification after modification, respectively. If the kits require developing, their structural forms should be merged with functions combined to realize generality among inhomogeneous carriers to the most extent. Generality among homogeneous carriers is the minimum requirement. Conversion kits special for a certain type of carrier is not encouraged.

**Moderation.** As a temporary and emergent technical measure, conversion should make converted carriers satisfy the demands of logistical support, and be convenient for rapid removal and restoration, which basically determine the scope and extent of conversion. To elevate conversion moderation, original major structure and technical performance should be changed as little as possible. Do a good job in the conversion contents. It’s necessary to make minor changes, direct utilization or even keep the carrier under original state, a convenient way for restoration to original appearance after the removal of conversion kits.

**Fastness.** During conversion, original facility, structures, installation mode and dismantled parts should be used fully. Conversion kits should have same external dimensions, installation structure and assembly process as original parts of the carrier. The removed parts should be directly utilized and lightweight kits designed. Construction process for conversion should be optimized with working procedures and operating persons arranged rationally. A reasonable conversion standard should be established on the basis of conversion validation.

**Economy.** To realize the requirements of generalization, moderation and rapidity of conversion and to minimize the workload of conversion, it is necessary to adopt modular design method, mature and reliable technologies and process convenient for mass production, embodying the economical advantage in conversion of civil carriers compared with development of organic equipment.

**Conclusion**

Civil carriers are the state’s important strategic resources, of which original functions is close to defense functions, thus providing the possibility for mass mobilization and conversion in wartime. As a creative job, conversion of civil carriers should take rapid conversion and convenient restoration as the goal, follow the principles of generalization, moderation, fastness and economy. With the most concise conversion contents, ingenious design idea and mature technologies, defense functions should be realized in the limited space under rigid constraints on overall performance and main structure of the carrier. At the same time, after the carrier is restored to its original state, there should be no obvious signs of conversion on appearance[2].

**References**
