Standard of Joint Military and Military Safeguard Stock of Aviation Equipment based on Cost-Support Coupling Development of Methodology

Yan Liu, Xiaowen Wu
Aviation Logistics Research Center, Air Force Logistics Collage, Xuzhou, Jiangsu

Abstract—For the aviation equipment of joint support, the influence factors of military and civilian joint support of aviation equipment are analyzed in detail. To establish a model for determining the inventory standard of military and civilian joint support based on cost and support degree for wartime equipment maintenance equipment, and to provide effective technical support for scientifically formulating the inventory standard of military and civilian joint support for aviation equipment.

Index Terms—aviation equipment; Guarantee costs; Protection; Inventory

I. ANALYSIS OF INFLUENTIAL FACTORS OF AVIATION EQUIPMENT INVENTORY

The standard of the quantity of equipment storage guaranteed by the aviation equipment manufacturers is the basis for the financing, storage and supply of aviation equipment in the protection of the military equipment manufacturers. The establishment of standards for the quantity of guaranteed storage for aviation equipment manufacturers mainly takes into account the following factors:

(1)The number, cycle and location of aviation equipment with different equipment regulations are different, and different safeguards standards must be formulated according to the actual situation.

(2)Different aviation equipment control channels in different units of equipment financing channels need to formulate different protection standards according to actual conditions.

(3)The safeguard effectiveness ratio is different from that of different types of aviation equipment, and different protection standards must be formulated according to the actual situation.

(4)Different systems, equipment, units and enterprises with different rules of protection, with different cost and time of protection, shall formulate different standards of protection according to the actual situation.

II. COMPUTATION OF TROOP MANUFACTURER'S WARRANTY

Force manufacturers aviation equipment security, namely

$$Q_1 = \frac{T_1}{T_1 + T_{12}}$$

Assumptions:

(1) The average time required to transport equipment from a unit manufacturer is one kilometer;

(2) The time for emergency production of equipment in case of shortage.

So, the total time required to transport equipment from the unit manufacturer is

$$t_{11} = t_1 \sum_{k=1}^{n} \gamma_k g_{1k} E(Y_k)$$

So, the total delay for emergency production equipment in stock is

$$t_{12} = t_2 \int_{S_1}^{+\infty} u_1 f(u_1) \mathrm{d}u_1$$

The total number of equipment guaranteed is recorded as

$$\sum_{k=1}^{n} \gamma_k m_k > 0$$

Then the average delay time for aviation equipment when missing is

$$T_{12} = \frac{t_{11} + t_{12}}{\sum_{k=1}^{n} \gamma_k m_k}$$

Then, the military manufacturer's aviation equipment protection level is

$$Q_1 = \frac{T_1}{T_1 + \frac{t_{11} + t_{12}}{\sum_{k=1}^{n} \gamma_k m_k}}$$

III. COMPUTATION OF LOCAL MANUFACTURER'S WARRANTY

Local manufacturers of aviation equipment security, namely

$$Q_2 = \frac{T_1}{T_1 + T_{22}}$$

Indicates the average time between failures of the equipment; Indicates the average delay time of aviation equipment when missing.

Assumptions:

(1) The average time required to transport equipment from local manufacturers is 1,000 meters

(2) The time for emergency production of equipment in case of shortage.

So, the total time required to transport equipment from local manufacturers is

$$t_{21} = t_1' \sum_{k=1}^{n} \gamma_k g_{2k} E(Y_k)$$

So, the total delay for emergency production equipment in stock is

$$t_{22} = t_2' \int_{S_2}^{+\infty} u_2 f(u_2) \mathrm{d}u_2$$

The total number of equipment guaranteed is recorded as

$$\sum_{k=1}^{n} (1-\gamma_k) m_k > 0$$

Then the average delay time for aviation equipment when missing is

$$T_{22} = \frac{t_{21} + t_{22}}{\sum_{k=1}^{n} (1-\gamma_k) m_k}$$

Then, the local manufacturer's aviation equipment protection is

$$Q_2 = \frac{T_1}{T_1 + \dfrac{t_{21} + t_{22}}{\sum_{k=1}^{n} (1-\gamma_k) m_k}}$$

IV. CALCULATION OF AVIATION EQUIPMENT SECURITY WHEN MILITARY AND CIVILIAN JOINT SUPPORT

Aviation equipment security when military and civilian joint support, namely

$$Q = \frac{T_1}{T_1 + T}$$

The average delay in the absence of aviation equipment is

$$T = \gamma_k T_{12} + (1-\gamma_k) T_{22}$$

The average delay in aviation equipment due to the protection of the military manufacturers was

$$T_{12} = \frac{t_{11} + t_{12}}{\sum_{k=1}^{n} \gamma_k m_k}$$

The average delay in the protection of aviation equipment by local manufacturers is

$$T_{22} = \frac{t_{21} + t_{22}}{\sum_{k=1}^{n} (1-\gamma_k) m_k}$$

Therefore, when the military and civilians jointly protect, the security of aviation equipment is

$$Q = \frac{T_1}{T_1 + \gamma_k T_{12} + (1-\gamma_k) T_{22}}$$

Assumptions:

$$T_{总} = T_1 + T$$

Then, when the military and civilians jointly protect, the degree of aviation equipment protection can also be expressed as

$$Q = \frac{T_{总} - T}{T_{总}} = 1 - \frac{T}{T_{总}}$$

Due to the average delay of aviation equipment when missing

$$T = \gamma_k T_{12} + (1-\gamma_k) T_{22}$$

Therefore, when the military and civilians jointly protect the security of aviation equipment, another form of expression is

$$Q = 1 - \frac{\gamma_k T_{12} + (1-\gamma_k) T_{22}}{T_{总}}$$

V. COMBINED MILITARY AND MILITARY SUPPORT COST-SECURITY COUPLING MODEL

Through the investigation and study of several units, it is found that the current Air Force equipment and equipment support should not only consider the degree of Air Force equipment maintenance equipment, but also focus on the economic factors of Air Force equipment maintenance equipment support.

$$\eta = \frac{Q}{P}$$

For the protection of equipment maintenance equipment during wartime, what kind of protection plan is specifically selected, and how to use the operational research method to select the guarantee plan can be determined based on the cost-guarantee coupling model:

$$\eta' = \frac{Q P_{\max}}{P}$$

Among them: the maximum cost for the joint guarantee of aviation equipment.

The optimal security strategy is determined by the cost-support coupling model, and the optimal equipment storage capacity of the military manufacturers and the optimal equipment storage capacity of the local manufacturers are calculated. The obtained security strategy is the optimal strategy.

This type of standard formulation method is suitable for wartime aviation equipment protection.

VI. CONCLUDING REMARKS

Based on the analysis of the joint support system for aviation equipment composed of military and local manufacturers and the simplification of the problems, and the methods of operational research and multi-objective decision-making, a model for determining joint support standards for military and civilian aviation equipment based on cost-guarantee coupling was first established. The optimal storage quantity of aviation equipment of military and local manufacturers is calculated, and the efficiency of aviation equipment support can be further improved.

REFERENCES

[1] Gao Qi. Management of Qrdnance Maintenance Material. Beijing: National Defence Industry Press, 2011.

[2] Wang Tiening, Wang Hongwei, Cao Yu.. Research on Joint Managed Inventory Strategies of Material Supply Chain. China Logistics & Purchasing, 2009, 13: 56~57.

[3] Sheng Zhou, Xie Shiqian and Pan Chengyi. Probability Theory and Mathematical Statistics. Beijing: Higher Education Press, 2008.