

Research on Evaluation Index System of Air to Ground Missile Testing Quality

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Abstract: According to the environmental factors which were optimized, with the reference of opinions from expert, the initial establishment of the influence factors of air to ground missile quality evaluation. Using principal component analysis and fuzzy prioritization method to develop a preliminary index system of quantitative indicators and indicators were screened, air to ground missile quality evaluation index system is established, getting comprehensive, system reflect missile quality characteristics from many aspects.

Keywords: detection quality; air to ground missile; evaluation index system

Introduction

In the context of new military changes in the world, air to ground missile can play its powerful combat effectiveness is crucial to the future high technology war in the informationization of the rational use. Therefore, in order to enable the missile to fully play its role in the process of use, has very important significance to establish the quality evaluation index system is evaluated. The platform of the missile test parameters, proposed must comply with certain principles, establish^{[1][2]}. For missile detection parameters using appropriate methods, the quality and effect of missile combat training as the research object, to calculate the weights of the various indicators based on fuzzy AHP method, analysis of the weight percentage of each index in the influencing factor the determination of the indexes at all levels, build missile quality evaluation index system, provides a theoretical basis for the analysis of the quality of the missile.

1 The Method of The Evaluation Index System for The Quality Evaluation of Air to Ground Missile

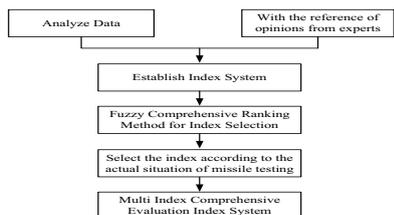
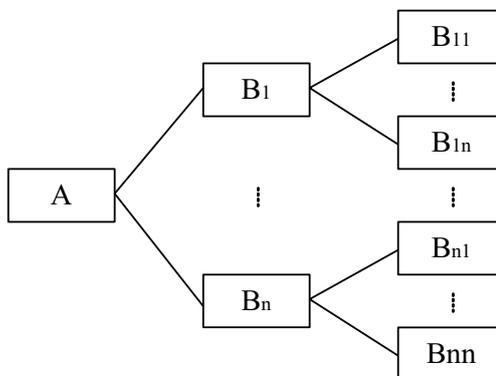


Fig1. the method of establishing the multi index system

According to the performance parameters of air to ground missile, tentatively the quality evaluation index

system of a certain type of air to ground missile. Considering the missile indicators may be the existence of a large number, information duplication, the phenomenon of mutual interference by fuzzy analytic hierarchy process (AHP) screening indicators, the establishment of air to ground missile detection quality evaluation index system as Fig.1 follows.

Using the missile impact the effectiveness of many factors, the establishment of comprehensive evaluation index system of missile quality, to take a one-time all details are difficult to, so the use of system theory of decomposition and coordination principle, namely scientific system level principle, the problem can be decomposed into multiple levels, each level and a plurality of components, from coarse to fine from the outside to the inside, from the global to local to a gradual in-depth analysis, the effect of Missile Quality Evaluation of many factors structured, hierarchical, so as to establish hierarchical analysis model, as shown in Figure 2. The model by the evaluation object a, level



refers to the standard B_i and secondary index b_{ij} composition.

Fig. 2 hierarchical analysis model

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According to this principle, we tentatively index system mainly includes the level indicators and secondary indicators, the television homing seeker system, control and navigation systems, image / instruction transmission system and power system four system as the first grade indexes.

Because the four indicators can only reflect the missile general technical performance, by their reflect missile quality is too general, so, should according to the technical requirements of each detection parameters of a certain type of air to ground missile, missile quality evaluation indicators at the second level is established. Second level indicators to establish such as:

Guidance performance of main line of sight angle speed precision, stable platform isolation, heading and pitch open-loop optical axis drift, photoelastic shaft angle accuracy, roll stability range, roll angle zero bit accuracy, heading and pitch search, tracking range, maximum search speed and tracking precision of the secondary indicators.

Control and navigation performance mainly in the heading angle and angular accuracy, position accuracy, angular velocity range, sensitivity, angular velocity, angular velocity is zero, air data system is tight, air data system height accuracy, radio altimeter altimetry precision, radio altimeter sensitivity, maximum output torque, steering gear band, zero position of the steering gear, steering sensitivity, the maximum rudder angle, no-load angular velocities of the secondary indicators.

Image / instruction transmission performance is mainly transmitted by the image transmitting device, the command receiver sensitivity, the command receiving antenna gain, the image transmit antenna gain, image transmission system transmission delay and so on two level indicators.

Dynamic performance of the engine thrust, fuel consumption rate, servo valve current and fuel flow, exhaust temperature, the output voltage of the generator, lube oil consumption and secondary indicators. Initial formulation of the index is more, may overlap information exists, to be screened. Fuzzy analytic hierarchy process (AHP) is based on a certain number of data samples, using mathematical method to calculate and analyze, pick less index to reflect the connotation of selected indicators of the upper indexes, suitable for screening of quantitative indicators. According to the characteristics of this method, combined with the selected indexes do not have quantitative properties of, the performance of the steering, control and navigation performance, image / instruction transmission performance, dynamic performance and other qualitative indicators indicators at the second level using fuzzy analytic hierarchy process (AHP) screening.

2 The Principle of The Evaluation Index System for The Quality Evaluation of Air to Ground Missile

Air to ground missile detection quality evaluation index should be able to reflect the influence of air to

ground missile application, selection of various factors. Selection index is appropriate, directly affect the final evaluation result is reasonable and reliable. To establish an air to ground missile comprehensive evaluation index system of decision-making, intends to set evaluation index should follow the following principles:

(1) the aim is to point out the purpose is the starting point, the index system should cover the basic content of evaluation purposes, can reflect all the information of the object.

(2) indicators should be independent, each index should be clear, relatively independent, the same level of indicators should try not to overlap each other; the index system to be distinct.

(3) indicators should be representative and feasible. It can reflect the characteristics of the evaluation objects, and is in line with the objective reality, easy to operate, easy to evaluate and compare.

3 Multi Index Comprehensive Evaluation Index System

The air to ground missile performance parameters and technical indicators as the basis, reference of air to ground missile expert opinion survey, the initial establishment of the influence factors of air to ground missile quality evaluation. On the guidance performance, control and navigation performance, image / instruction transmission performance, dynamic performance of the four first level indicators screened secondary indexes, the establishment of air to ground missile quality evaluation index system as shown in Figure 3.

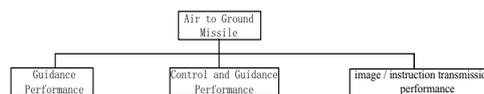


Fig. 3 index system of Missile Quality Evaluation

The first level indicators of missile development are as follows:

(1) guidance performance: the performance of the seeker is reliable.

(2) control and navigation performance: control and navigation system is able to successfully complete the task.

(3) image / instruction transmission performance: the image / instruction transmission system communication is smooth, reliable.

(4): the dynamic performance of the engine thrust, fuel consumption rate is normal.

Analysis of the relevant test parameters, the two indicators of the missile analysis are as follows:

Guidance performance of the two level indicators include LOS angle speed precision, stable platform isolation, heading, pitching axis drift, light missile axis angle accuracy and other indicators. The accuracy of line of sight is higher, and the precision

of seeker is higher, which can improve the hit precision of missile;

The stability platform isolation is good, which can improve the hit precision of the missile;

The technical indexes for the drift of the optical axis of the pitching open loop are the key indexes;

The precision technology index of the angle precision of the optical elastic axis is a general index.

Control and navigation system, two indicators, including the heading angle and attitude angle accuracy, angular velocity range, zero angular velocity, position precision, air data system is tight, air data system height accuracy, radio altimeter altimetry precision, radio altimeter sensitivity index. The heading angle accuracy is high, which is helpful for the missile to fly in the planned route and improve the hitting accuracy of the missile.

The position accuracy is high, it is helpful for the missile to fly in the planned route, and improve the hit precision of the missile.

The technical index of the angular velocity range is a general index.

The technical index of the zero position of the angular velocity is a general index.

The air data system has good air tightness, which is helpful for the missile to fly in the planned route and improve the hit precision of the missile.

Air data system measurement accuracy is high, there is help to missile according to a predetermined plan flight routes, improve the missile hit precision. The index as the key indicators.

Radio altimeter altimetry, help to missile according to a predetermined plan flight routes, improve the missile hit precision. The index as the key indicators.

The radio altimeter has high sensitivity, which is helpful for the missile to fly in the planned route and improve the hit precision of the missile. The index is the key index.

The image / instruction transmission system includes two levels: transmission power of the image transmitting device, transmission delay of the image transmission system, and the sensitivity of the instruction receiver.

The increase of transmission power of image transmitting device is beneficial to the missile hitting target and improving the hit precision. This index is the key index.

The technical index of the delay of image transmission system is the general index. The higher sensitivity of the command receiver is beneficial to improve the hit precision of the missile, which is the key index.

Summary

Through the air to ground missile related data analysis and expert scoring, tentatively missile quality evaluation index system, taking into account the initial formulation of the index system of many indexes, each other also exist the phenomenon of information overlap, of quantitative indicators and qualitative indicators were screened by using the fuzzy analytic hierarchy process

(AHP), the missile quality evaluation index system was established, as a basis for quality evaluation of missile.

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