Research on Passenger Ship Form in the Upper Mekong River Basin

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ABSTRACT

With very rich tourism resources, bright and colorful exotic and subtropical scenery in the Upper Mekong River Basin, at present, the age of passenger ships in the Upper Mekong River is elder, with spotty quality, which have not yet developed serial passenger ship forms with international tourism and shipping characteristics in the Upper Mekong River. In view of this, this paper analyzes the development direction of passenger ship, and according to the characteristics of international waterway in the Upper Mekong River, on the basis of full reference for excellent ship forms of domestic and overseas similar rivers, the comprehensive evaluation indexes with multiple aspects including ship technology, economy, society and environmental protection are established, and the main dimensions of passenger ship form for high-grade foreign-related tourism are developed through studying the conformity of the waterway and market demand and meeting the tourism and comfort demands of international passenger transport in the Upper Mekong River.

1. Introduction

The tourism resources in the Upper Mekong River Basin are very rich[1, 2]. The capacity of Chinese passenger ships is around 50 to 250 passengers in the international waterway of the Upper Mekong River, with the navigational speed of about 20 to 30km/h. The length-breadth ratio (L/B) of the ships is between 5 and 6, and the breadth-draft ratio (B/T) is larger than 5 basically, so the ships belong to wide beam and shallow draft ship form. The design of deck and cabin is not very good to meet the tourism demand such as the sightseeing and leisure, and the ships' age is elder, with spotty quality, which has not yet developed serial passenger ship forms with international tourism and shipping characteristics in the Upper Mekong River.

In recent years, the passenger ship as ordinary passenger transport of daily transportation means is gradually withdrawing from the market, and the development direction of the passenger ship form is comfortable touring ship. For example, in Erhai Lake, Dali, in China, the catamaran cruise ship "Erhai No. 1" was put into operation in August 2005, its principal dimension has reached the overall length of 68.8 meters, with the breadth of 18 meters, the waterline breadth of 6 meters, the moulded depth of 2.7 meters and the draft of 1.7 meters, and it was the touring ship with the largest passenger capacity in the national lake regions at that time. At present, this excellent ship form has been used and promoted in the lake and reservoir regions of Yunnan Province in China, in addition to use in Erhai Lake, the catamaran cruise ship also covers Manwan Reservoir, Lubuge Reservoir and other lake and reservoir regions, which has become the leading ship form of tourism and shipping in Yunnan Province in China. Due to the stronger layout individuation of the touring ship, in order to adapt the development direction of comfortable tourist passenger transport in the Upper Mekong River, the passenger ship form for high-grade foreign-related tourism with the characteristics of international waterway in the Upper Mekong River and meeting the tourism and comfort demands of international passenger transport in the Upper Mekong River will be developed in the future to promote the development of international passenger transport in the waterway of the Upper Mekong River.

2. Main Dimension Series of Passenger Ships in the International Waterway

The passenger ship belongs to layout status type ship, for the passenger ships with the same capacity level, in order to satisfy different use

function, cabin standard, material, layout status and other demands, their dimensions will vary widely.

Following the formulating principle of main dimension series, according to the shipping conditions of the international waterway in the Upper Mekong River Basin[3] and ship form characteristics of the existing passenger ships in the Mekong River, in view of the research results of tourist passenger ship form[4], the evaluation indexes are determined based on the technical and economic calculation model established by the parent ship, and then the research work on main dimension series of the ship form is carried out.

(1) Determination of parameter variation range

Table 1. Variation Range of Ship Form Parameters

	Length h (m)	Breadth h (m)	Draft (m)	Per Capita Area (m ² /Person)	Power Per Unit (kW)
1	16~20	3~4			
2	25~30	5~7			
3	35~40	5~7	0.9~1.4	1~1.4	Main engine is equipped according to the navigational speed of more than 22km/h.
4	50~60	6~8			
5	50~60	10~13			

On the basis of comprehensively considering transport demand, ship parameter scale ratio, navigation facilities constraints, and the overall layout requirements of ships, the variation range of feasible ship form parameters is obtained as shown in Table 1.

(2) Main dimension optimization of ship form

The steps and method of optimization demonstration for tourist passenger ships with various capacity levels are similar in the Upper Mekong River Basin, and the steel double deck passenger ship in the Chiangsaen-LuangPrabang Waterway is selected as example to explain under the parameter range 2, and the optimization demonstration processes of other ship forms are omitted.

According to the necessary freight rate, the technical and economic indicators of the ship form scheme with minimum fuel consumption per unit turnover are as shown in Table 2. With better comprehensive performance, the scheme can be used as one of optimization schemes of the passenger ship form with 90 passenger spaces level in the Upper Mekong River Basin. Taking the best ship form scheme as the object, the cost structure is shown in figure 3. In the existing cost structure platform, the fuel cost accounts for the largest proportion of the entire transport cost. If the economy of ship operation is improved, the economic speed operation measures such as saving fuel cost, choosing main engine matching with ship form should be adopted to improve the economy of ship operation.

Table 2. Optimal Ship Form Scheme of Steel Passenger Ship (90 Passenger Spaces Level)

Length (m)	Breadth (m)	Draft (m)	Speed (km/h)	Total Power (kW)	Fuel Consumption on Per Unit Turnover (kg/1000 Persons.km)	Necessary Freight Rate (RMB/Person)	Per Capita Area (m ² /Person)
27.57	5.60	1.00	24.11	140.72	44.69	262.38	1.00

Figure. 3 Operation cost structureFigure. 4 Influence chart of parameter change of optimal ship form on necessary freight rate

(3) Sensitivity Analysis

Figure 4 shows the influence of the change in the economic parameters such as fuel price, ship price and operating cost on the optimal scheme, the operating cost and fuel cost have great influence on the necessary freight rate, followed by the ship price. Therefore, it has very important significance to improve the economy of ship operation through controlling the fuel consumption and strengthening the operation management, it should be noted that the necessary measures such as reasonable scheduling, reasonable design of liner and voyage No. and appropriate speed can be adopted to control the transport cost when carrying out the actual operation.

(4) Main Dimension Series of Tourist Passenger Ship Form

According to the same idea and method of determining the optimal ship form scheme of steel double deck passenger ships in the inland river under demonstration parameter range 2 in Table 1, the optimal demonstrations for other steel double deck passenger ships in the inland river under other demonstration parameter ranges are carried out. Following the research principle of main dimension series of tourist passenger ship form in the Upper Mekong River Basin, according to the optimal demonstration results of main dimensions of ship forms in various rivers, on the basis of sufficient consideration for different materials and layout status, under the premise that there is little effect on technical and economic performance of the ships, main dimension series of tourist passenger ship

form in the international waterway from China-Myanmar Boundary Marker 243 at Upper Mekong River to LuangPrabang, Laos are ultimately developed from the practical and operational perspective, as shown in Table 3.

Table 3. Main dimension series of tourist passenger ship form

Length (m)	Breadth (m)	Designed Draft (m)	Passenger Space Level (Passengers)	Total Power of Main Engine (kW)
18~20	3.8	0.9~1.0	30	72~78
26~29	5.6	1.0~1.2	90	140~165
35~38	5.6	1.0~1.2	130	175~200
48~53	7.0	1.0~1.2	250	215~285
53~56	11.2	1.2~1.4	350	325~415

3. Conclusion

(1)On the basis of mutual trust, mutual understanding and mutual benefit between contracting states, the international shipping conditions in the Upper Mekong River Basin will be improved day by day, with the development direction of comfort and tourism of passenger ship, and the development of tourist passenger ship will be considered first.

(2)According to the characteristics of international waterway in the Upper Mekong River, in consideration of the development demand of future market in the waterway, on the basis of full reference for excellent ship forms of domestic and overseas similar rivers, the comprehensive evaluation indexes with multiple aspects including ship technology, economy, society and environmental protection are established, and the main dimensions of passenger ship form for high-grade foreign-related tourism are developed through studying the conformity of the waterway and market demand and meeting the tourism and comfort demands of international passenger transport in the Upper Mekong River.

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5. References

References should be listed alphabetically by authors' last names at the end of the manuscript text. The format should conform to Harvard or APA style, as shown below. The references should be typed in 10-point Times New Roman, single-spaced.

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