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INTRODUCTION OF HIGH SPEED SHIPS INTO JAPANESE FERRY MARKET

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Abstract

This paper is concerned with the introduction of high speed ships into Japanese ferry market. There are two purposes that we try to explore. The one is aimed for characterizing Japanese coastal ferry operation. The other is for calculating practical models of high speed services based on the characteristics of those present operations. As a result of our analysis, we finally come to the conclusion that Japanese ferry market is now ready for introducing some new high speed ships.

Key Words: High Speed Ship, Coastal Ferry Operation, Replacement of Merchant Ship, Ship Design.

1. INTRODUCTION

There are two purposes of this paper that we try to explore. The one is aimed for characterizing Japanese coastal ferry operation. As same as European coastal countries, Japan also has huge demand for coastal sea transportation. Therefore there are many ferry services operated in the country that have already been used as the vital transportation alternative against the congested Japanese road network.

Despite those facts the outline of Japanese coastal ferry operation has not yet been well known in the world. We expect that this paper shows a better opportunity for those who wish to examine the characteristics of the Japanese ferry operator and the service.

The other purpose is aimed for calculating practical models of high speed services based on the present Japanese ferry operations. Although Japan is the most advanced and industrialized country all over the world, very few of high speed ship have been introduced into the coastal ferry operation. However as some European ferry operators already proved, there must also be possibility to achieve the successful introduction of the high speed service in Japan. We try to examine some feasible models for the possible faster operations assuming the conservative view of private operators who are not interested in the cruising speed itself but their customers.

2. JAPANESE COASTAL FERRY OPERATION

Japan is the one of the unique country in the would that is entirely surrounded by ocean and composed with many islands. Moreover the islands are all quite mountainous. Because of those topographical circumstances the concentration of population and industries in Japan has only been limited to locate along the long coast area. Therefore it is no wonder that the coastal ferry operation has been well developed in Japan and becomes the vital domestic transportation links against the road network. It also has the important role to connect among the four of Japanese main islands.

Figure 1 shows the Japanese long distance ferry operations that include 26 coastal routes and 15 operators involved. If we include shorter distance operations that are operated among archipelago, the number of routes and operators are counted to more than a hundred.

The names of the routes and the operators of the long distance ferry are listed in Table 1. The average capacity per ship is 11,065 tons, 768 passengers, 90 cars and 133 trucks respectively. The total capacity operated in Japan is 719,240 tons, 49,945 passengers, 2,790 cars and 8,618 trucks for each. This proves that Japan needs the heavy tonnage and the deck capacity in the coastal transportation to maintain its economic activities.

For example figure 2 shows the diagram of the ferry operation by KINKAI YUSEN that offers the service between Tokyo in the center island and Kushiro in the northern island (See route No.15 in figure 1 and table 1.). Despite the long distance more than 1,100 km they offer 4 round services a week by the relatively large sized two ships named Sabrina and Blue Zepha. Since the scheduled transit time is stated as 29 hours, the average cruising speed is about 20.7 knot including harbor access time.

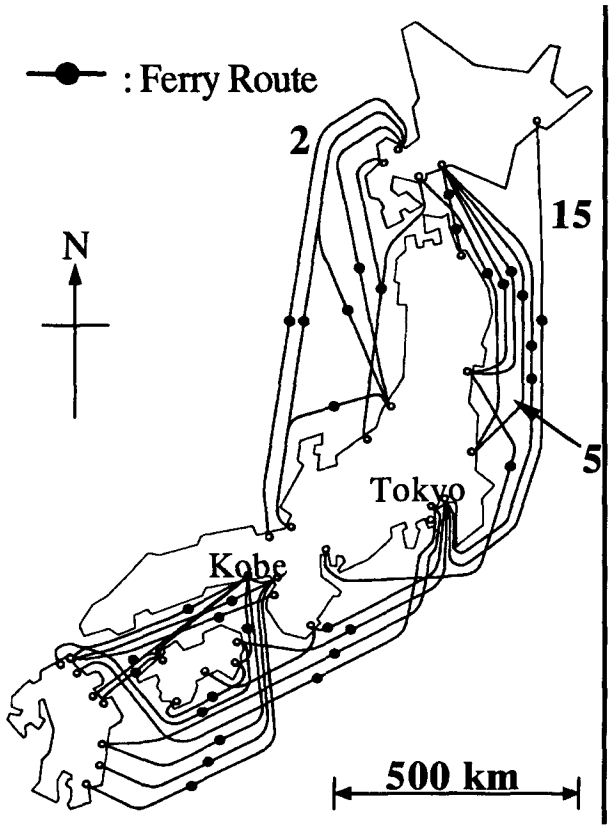

Figure 1. The routes of Japanese coastal ferry

3. HYPOTHESIS FOR INTRODUCTION OF HIGH SPEED SHIP

We must regard at first that any kind of merchant ship is just a tool for a shipping line. Only better tools can survive for a long period in a business field, and a high speed ship is not an exception. Therefore the hypothesis to introduce a high speed ship is fundamentally clear as long as a private ferry operator (i.e., not state controlled) is concerned. There are two of principles of it.

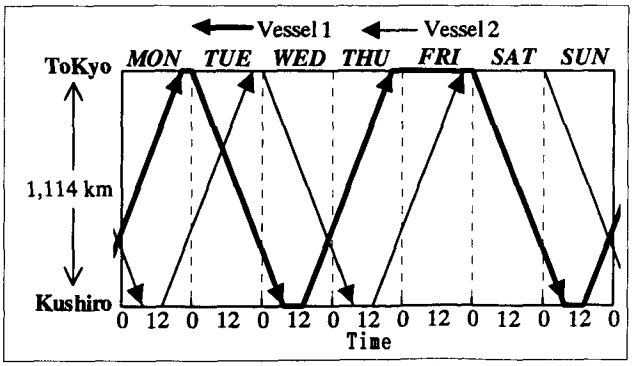

Figure 2. The diagram of the typical Japanese coastal ferry operation by KINKAI YUSEN (No.15 in figure 1 and table 1)

Table 1. The list of Japanese coastal ferry operators and the services

Operators	Routes					Capacity of ships				
	No.	Ports	Distance (km)	Transit time (hour)	Average speed (knot)	Name of ships	Gross tonnage	Passengers	cars	Trucks
Shin Nihonkai Ferry	1	Maizuru - Otaru	1061	29	19.8	New Acacia	19,796	800	80	186
						Ferry Lilac	19,329	788	55	186
						Ferry Lavender	19,904	796	80	186
	2	Turuga - Otaru	1024	29	19.1	New Suzuran	14,385	872	85	189
						New Yukari	14,375	872	85	189
	3	Nigata - Otaru	704	18	21.1	New Shirayuri	17,305	929	103	150
						New Hamanasu	17,304	929	103	150
Higashi Nihon Ferry	4	Iwanai - Muroran	721	18	21.6	Hermes	13,384	700	100	180
						Hakiyuri	13,403	703	100	180
	5	Oarai - Muroran	728	19	20.7	Bikutori	17,113	680	116	177
	6	Hachinohe - Tomakomai	242	9	14.5	Bega	6,340	600	20	96
						Ferry Hachinohe	4,967	520	93	57
	7	Sendai - Tomakomai	565	15	20.3	Baruna	16,725	680	90	135
Kawasaki Kinkai Kisen Silver Ferry	8	Hachinohe - Tomakomai	242	9	14.5	Silver Queen 2	4,821	468	83	59
						Ferry Hachinohe	4,967	520	93	57
Taiheiyo Ferry	9	Nagoya - Tomakomai	1,330	39	18.4	Kiso	13,730	850	120	176
						Kitakami	13,937	842	150	176
						Ishikari	14,257	854	150	176
Blue Highway Line	10	Oarai - Tomakomai	758	20	20.5	Sunflower Oarai	15,139	656	105	175
	11	Tokyo - Tomakomai	1,045	30	18.8	Sunflower Erimo	11,272	634	105	175
						Sunflower Sapporo	11,098	680	55	142
	12	Tokyo - Kouchi	726	21	18.7	Sunflower Tosa	12,572	1,170	94	111
	13	Osaka - Shibishi	580	15	20.9	Sunflower Osaka	13,321	1,170	94	111
						Sunflower Satuma	12,000	711	140	175
						Sunflower Kirishima	12,000	711	140	175
Blue Highway Line Kawasaki Kinkai Kisen	14	Tokyo - Tomakomai	1,045	30	18.8	Tomakomai Maru	6,739	12	40	154
						Tokyo Maru	6,738	12	40	154
						Hokkaido Maru	7,227	12	40	154
Kinkai Yusen	15	Tokyo - Kushiro	1,114	29	20.7	Sabrina	12,524	694	140	170
						Zepha	12,521	694	140	170
Ocean Tokyu Ferry	16	Tokyo - Kitakyushu	1,173	36	17.6	Ocean East	11,523	462	118	167
						Ocean West	11,522	462	118	167
						Marimo	9,627	350	80	100
Kyushu Kyuko Ferry	17	Oppama - Karita	979	34	15.5	Nissan Miyako Maru	6,531	12	-	142
Marine Express	18	Kawasaki - Huga	887	20	23.9	Pacific Express	11,580	660	90	141
						Takachiho Maru	9,537	978	150	62
						Phoenix Express	11,580	660	90	141
	19	Osaka - Miyazaki	515	13	21.4	Mimitu Maru	9,552	650	150	62
						Sentoporia	5,961	1,010	110	40
						Takachiho Maru	9,537	650	150	62
	20	Kobe - Huga	470	14	18.1	Ebino	6,837	898	105	67
						Miyazaki	7,053	692	80	90
Hankyu Ferry	21	Izumiotu - Shinmoji	471	13	19.7	Hankyu 32	6,951	950	38	114
						Hankyu 24	6,937	950	38	114
						New Yamato	11,919	711	75	166
						New Miyako	11,914	711	75	166
	22	Kobe - Shinmoji	465	12	20.9	New Harima	12,579	1,000	75	166
						New Seto	12,589	1,000	75	166
						New Nagato	14,988	1,066	110	180
						New Akashi	14,988	1,066	110	180
Meimon Taiyo Ferry	23	Osaka - Shimoji	457	12	20.6	Ferry Fukuoka	9,320	780	100	155
						Ferry Kyoto	9,320	780	100	155
						Ferry Osaka	9,306	689	100	160
						Ferry Kitakyushu	9,327	689	100	160
Kansai Kisen	24	Osaka - Beppu	446	13	18.5	Sunflower	12,130	1,148	201	98
						Sunflower 2	12,105	1,148	201	98
						Sunflower Kogane	9,684	942	60	100
						Sunflower Nishiki	9,684	942	60	100
						Queen Flower 2	6,823	1,305	54	10
						Kurushima 7	5,216	1,390	40	10
Diamond Ferry	25	Kobe - Oitta	410	12	18.4	Queen Diamond	9,022	942	50	105
						Ferry Diamond	9,023	942	50	105
						Bule Diamond	9,447	942	50	105
						Star Diamond	9,463	942	50	105
Muroto Kisen	26	Kobe - Ashizuri	362	10	19.5	Ferry Muroto	6,472	867	53	88

3.1 Departure and Arrival Time

The one is that any ferry operation must be scheduled to satisfy the user who wishes to be on board. Therefore departure and arrival time are a critical issue for the ferry management. For example, figure 3 shows the statistical distribution about the departure and the arrival time of Japanese ferry operations listed in table 1. There are evidently two of time groups in each of them. Since the major user of the coastal ferry service in Japan as well as Europe is truck and RO RO freight, this figure is supposed to reflect the driver's behavior before or after the sailing.

In Japan most of factories and manufactures are active in the day time. Contrary most of agricultural and fishery markets are active only in the early morning. Since the transportation industries that are partners of them must collect and deliver those products in such an active

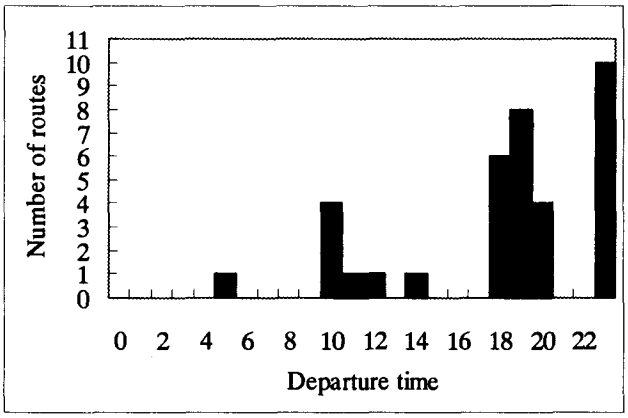

Figure 3.1 The departure time of Japanese ferry

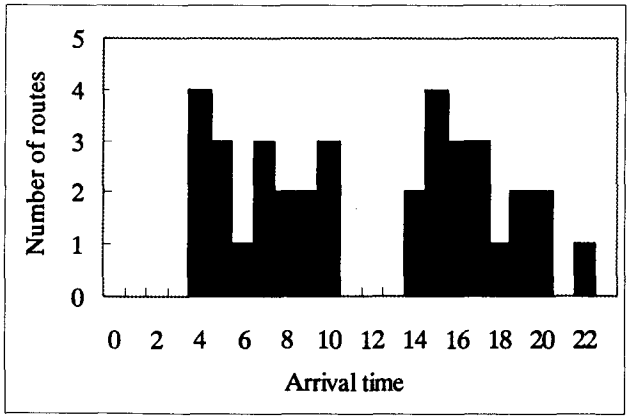

Figure 3.2 The arrival time of Japanese ferry

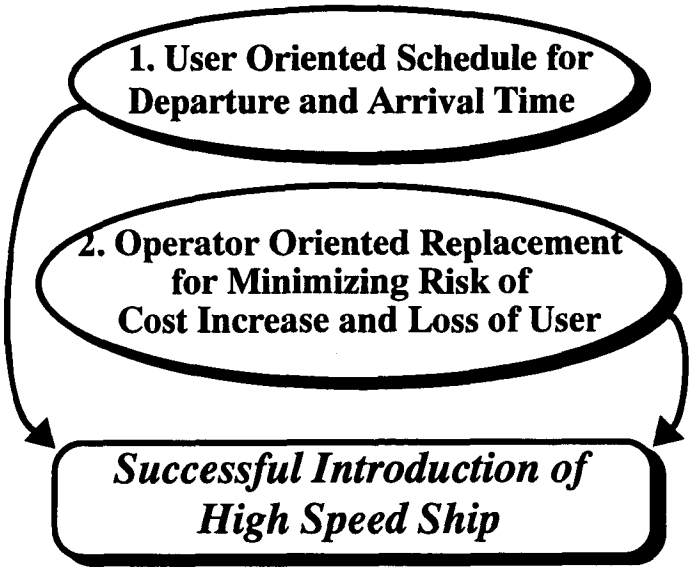

Figure 4. The hypothesis for introduction of high speed ship

time, they may have to transport their freight to another island within the other time. Then the driver must drive his truck overnight if he keeps going on road. As the most of Japanese roads are almost saturated by traffic and heavily congested all the day, it may not be a better choice to take a trip on such a road if the driver has to keep just in time delivery to his customer.

This is what the need for Japanese coastal ferry service is and because the departure and the arrival time are grouped in figure 3. For example it is quite likelihood in Japan that a truck loaded some fresh fishes at a fishery market can be driven in a couple of hours for a port after closing the market and then board a ferry about noon. If the ferry arrived at her destination in the next morning, the truck may deliver the fishes to a shopping center in time before the peak shopping hours in the afternoon. It is also very possible that a truck loaded some products at a factory in the afternoon can embark a ferry in the evening. The ferry may arrive at her destination in the next afternoon. Then the truck can deliver the products to a department store within the day.

Thus the cruising speed can not freely be set on a ferry route even though it is technically available. It depends on the desirable departure and arrival time at the port. This is the first hypothesis denoted in figure 4.

3.2 Characteristics of Ferry Operator

The other is the general characteristics of ferry operator. They are not interested in the cruising speed itself of a certain high speed ship but about whether it can attract and satisfy their customers who are drivers and passengers. It means that any sort of ship is available for the operation if it does not generate serious loss to the owners. High speed sounds exciting for engineers but no one can blame that real operators only want to survive in future keeping their business in good order.

We must regard that those conservative are also an essential hypothesis to introduce a high speed ship. As it is obvious that building a faster ship is more expensive than a conventional one, the ferry operator who introduces a high speed ship needs to revise the boarding tariff for higher level than before. However shorter transit time must be valuable especially for a long distance transportation if the schedule is maintained in an approving departure and arrival time as shown in figure 3. Therefore some present users satisfied with the faster service may accept paying more for boarding. Furthermore a few of unknown potential users can be attracted by the new high speed service. On the other hand there is also unknown risk that a few of present users may decide to leave the service disappointed about the increased price.

Although some demand analysis should be applied before the introduction of the high speed ship, very few operators can confidently believe the prediction that the demand for their ferry service will drastically be increased or declined after the replacement. Moreover any user of the service never wants the boarding price to be drastically increased. Therefore the operator must also pay a special attention for both the building and the running cost of the ship to minimize the price increase.

Consequently a better solution for those subjects is that the operator should concern that the total demand for the new high speed service is not so much different from the present one for the conventional slow speed service. If we accept this idea, the high speed ferry operation can not only improve the service but also contributes to minimize the cost increase. For example, the new high speed service needs less number or smaller capacity of the ships if the demand is kept as same as the amount for the conventional service. This is the second hypothesis stated in figure 4.

Table 2. A new Japanese ferry service versus the model service based on the hypothesis in figure 4

		Conventional service[1] (present operation)	New service[1] (coming in 1996)	Model service[1] (based on figure 4)
Departure per week/port		4	6	6
Number of ships		2	2	2
Transit time (hours)		29	21	22
Average speed (knot)		19.1	26.3	25.7
Capacity[2] (per ship)	Passengers	872	515	581.3
	Trucks	217	148	144.7
Capacity[2] (per week)	Passengers	6,976	6,180	6,976
	Trucks	1,736	1,776	1,736

1)Ferry route : The route applied for the comparison is indicated as No. 2 in figure 1 and table 1.
2)Assumption: The capacity is assumed to calculate that the deck space on board occupied by a truck is as same as the one by three cars.

4. RELIABILITY OF HYPOTHESIS FOR A JAPANESE HIGH SPEED FERRY

To verify the hypothesis showed in figure 4 it is quite fortunate for us that two of new Japanese high speed ships are going to be inaugurated this year on a ferry route between the center and the northern Japanese island. This route is indicated as No. 2 in figure 1 and table 1. The operator of these ships announced their scheme as shown in table 2 compared with the present ships. It is remarkable that the total transportation capacity a week offered by the new service is very close to the one by the present service. Furthermore the new ships are apparently smaller than those present ships.

These facts simultaneously appeared in the table evidently prove the reliability of the hypothesis in figure 4. To ensure our verification we calculate a model service based on the hypothesis assuming the operation on the same route. The result is also shown in table 2 on the right side and it is obviously clear that the planed new service and our model service are quite similar each other.

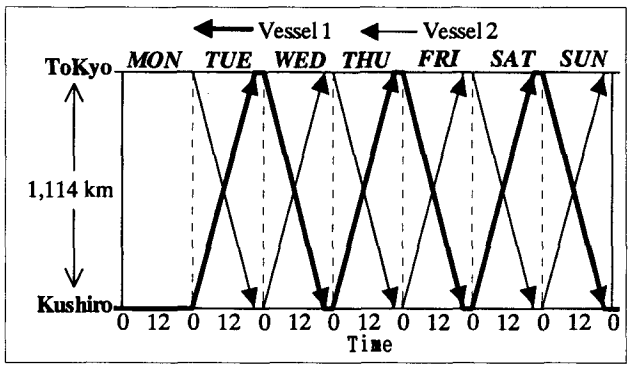

Figure 5. The diagram of the high speed service model for the case of figure 2

5. FEASIBLE MODELS OF HIGH SPEED FERRY SERVICE IN JAPAN

It is considered in figure 1 and table 1 that there are some conventional ferry routes as similar as the case of table 2. Therefore we can calculate some feasible models of high speed ferry service on those routes. Figure 5 and table 3 show the high speed service model against the present one shown in figure 2. The model service offers 28.6 knot average cruising speed and 6 departures a week, which is about 8 knot faster and added 2 more departures cutting 8 hours in the transit time. In contrast to those improvements of the service, the capacity of the ship becomes smaller than the present one because of the hypothesis in figure 4.

Figure 6 and table 4 show another possible model in Japan estimated by the same method. The model service offers 39.3 knot average cruising speed, which is about 18.6 knot faster cutting 9 hours in the transit time. Moreover

Table 3. The high speed service model to increase the departure frequency

		Conventional service[1] (present operation)	Model service[1] (based on figure 4)
Departure per week/port		4	6
Number of ships		2	2
Transit time (hours)		29	21
Average speed (knot)		20.7	28.6
Capacity[2] (per ship)	Passengers	694	462.7
	Trucks	216	144.0
Capacity[2] (per week)	Passengers	5,552	5,552
	Trucks	1,728	1,728

1)Ferry route : The route applied for the comparison is indicated as No.15 in figure 1 and table 1.
2)Assumption: The capacity is assumed to calculate that the deck space on board occupied by a truck is as same as the one by three cars.

this model shows the unique solution for introducing the high speed ship that can reduce the number of ships needed for the operation. In contrast to the present two ship's services, the model can only manage one ship keeping as same frequency as the present service. This is also happened because of the hypothesis in figure 4.

6. CONCLUSION

Both results showed in table 3 and table 4 should be the feasible alternatives against the present conventional services if we pay attention for some European high speed ferries that have already been operated for at least more than a decade. As long as the cruising speed is concerned, 28.6 knot and 39.3 knot can not be out of order for the commercial operation. For example, Sea Cat by Color Line offers 37 knot, Finnjet by Silja Line offers 30.5 knot, Aqua Strada by Tirenia offers 43 knot and HSS by Stena Line offers 40 knot.

In comparison with those European commercial situations, we come to the conclusion that Japanese ferry market is also ready for introducing some new high speed ships, and not only Japanese ship building industries but also any country's shipyards should contribute to it.

Reference

[1] Thorsten Rinman (1994): *RoRo Technology*, The Scandinavian Shipping Gazette, pp. 4-43.

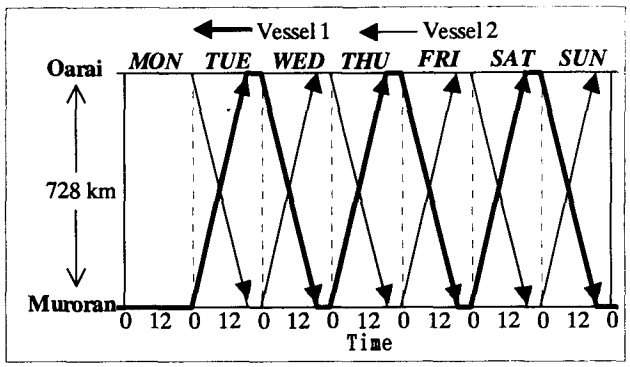

Figure 6.1 The diagram of the conventional ferry service by HIGASHI NIHON FERRY
(route No. 5 in table 1 and figure 1)

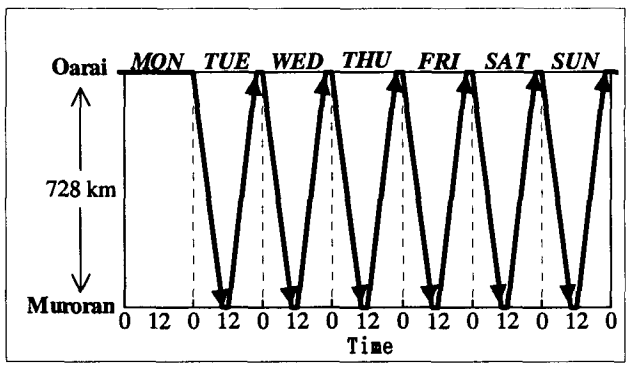

Figure 6.2 The diagram of the high speed service model for the case of figure 6.1

Table 4. The high speed service model to reduce the number of ships

		Conventional service[1] (present operation)	Model service[1] (based on figure 4)
Departure per week/port		6	6
Number of ships		2	1
Transit time (hours)		19	10
Average speed (knot)		20.7	39.3
Capacity[2] (per ship)	Passengers	680	680
	Trucks	215	215
Capacity[2] (per week)	Passengers	8,160	8,160
	Trucks	2,580	2,580

1)Ferry route : The route applied for the comparison is indicated as No.5 in figure 1 and table 1.
2)Assumption: The capacity is assumed to calculate that the deck space on board occupied by a truck is as same as the one by three cars.