

工學碩士 學位論文

A Study on the Development of Information Network for  
Maritime Traffic Safety Service

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LIST OF FIGURES .....	
LIST OF TABLES .....	
ABSTRACT .....	

<b>1</b>	.....	1
1.1	.....	1
1.2	.....	3
1.3	.....	3
<b>2</b>	.....	5
2.1	.....	5
2.2	.....	7
2.3	.....	9

3	.....	10
3.1	VTS .....	10
3.1.1	VTS(Vessel Traffic Service) .....	10
3.1.2	VTS .....	10
3.1.3	VTS .....	13
3.1.4	VTS/PTMS .....	13
3.1.5	VTS .....	16
3.2	AIS .....	17
3.2.1	AIS .....	17
3.2.2	AIS Transponder 4S AIS .....	17
3.2.3	AIS .....	20
3.2.4	AIS .....	21
3.3	.....	22
3.3.1	VTMIS-NET .....	22
3.3.2	BAFEGIS Project .....	24
3.3.3	SAFEMAR of MARIS .....	25
3.3.4	ARCHIPELAGO Project .....	27
3.3.5	POSEIDON Project .....	27

<b>4</b>	.....	<b>28</b>
4.1 Network	.....	28
4.2 IMT - 2000	.....	29
4.3	.....	33
<b>5</b>	.....	<b>35</b>
5.1	.....	35
5.2	.....	37
5.2.1	.....	37
5.2.2 ITMA	.....	41
5.3	.....	43
5.4 /	.....	51
<b>6</b>	.....	<b>55</b>
	.....	57

## LIST OF FIGURES

<Fig. 1>	Flow Chart of Study .....	4
<Fig. 2>	VTS/PTMS System Installation .....	14
<Fig. 3>	Wide Area VTS with 4S Method AIS .....	20
<Fig. 4>	Network System .....	28
<Fig. 5>	Korea Marine Safety Information Network .....	36
<Fig. 6>	Wide Area Information Network for Maritime Traffic Safety Service by VTS with AIS .....	37
<Fig. 7>	Composition of Information Network for Maritime Traffic Safety Service .....	38
<Fig. 8>	Flow Chart of Information Exchange and Traffic Management Flow by Internet. ....	41
<Fig. 9>	Traffic Management Flow in ITMA .....	42
<Fig. 10>	Masan Port Traffic Information Center HomePage .....	43
<Fig. 11>	Radar Information Screen around Gaduk Strait .....	44
<Fig. 12>	Radar Information Screen around Chamdo island .....	45
<Fig. 13>	Radar Information Screen of Masan Port .....	46
<Fig. 14>	Verification of Ship Information in ITMA .....	47
<Fig. 15>	Traffic Management in ITMA .....	48
<Fig. 16>	Weather of Masan Harbour .....	49
<Fig. 17>	ETA Information Board .....	50

<Fig. 18>	Main Page of 21st Century Marine Safety and Environment Protect HomePage .....	52
<Fig. 19>	Marine Environment Protection Page of 21st Century Marine Safety and Environment Protection HomePage	52
<Fig. 20a>	Marine Safety Page of 21st Century Marine Safety and Environment Protect HomePage(1) .....	53
<Fig. 20b>	Marine Safety Page of 21st Century Marine Safety and Environment Protect HomePage(2) .....	53
<Fig. 21>	Main Page of <a href="http://myposeidon.com">HTTP://MYPOSEIDON.COM</a> .....	54

## LIST OF TABLES

<Table 1>	Character of Traffic .....	6
<Table 2>	Purpose of Safety Management .....	8
<Table 3>	Three Basic Methods of VTS for Traffic Management .....	11
<Table 4>	Three Basic Service supplied by VTS .....	12
<Table 5a>	VTS/PTMS Main System Installation .....	15
<Table 5b>	VTS/PTMS Sub-System Installation .....	15
<Table 6>	Three Main Modules and Function of AIS Transponder .....	18
<Table 7>	Compare DSC/VHF Method with 4S Method .....	19
<Table 8>	Projects in the MARIS Framework .....	26
<Table 9>	Compare IMT -2000 with Second Generation Communication System .....	31
<Table 10a>	Global 3rd Generation Mobile Telecommunication User Prediction(Baskerville Prediction) .....	32
<Table 10b>	Domestic IMT -2000 Market Prediction .....	33
<Table 11>	Korea Information Infrastructure Budget Plan .....	34
<Table 12>	Benefit of Marine Traffic Management with Internet	40
<Table 13>	Composition of 21st Century Marine Safety and Environment Protect HomePage .....	51

A Study on the Development of Information Network for  
Maritime Traffic Safety Service

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**Abstract**

Globalization, internationalization and the rise in the standard of living have led to an increase in the use of world-wide transport by almost by ship. With the increase of sea transport, the number of maritime disasters also has been increased. The impact on the environment and local economies, when maritime disasters such as groundings of M/T Exxon Valdez or Sea Prince occur, are enormous, so it is urgent to improve accident prevention capabilities including VTS(Vessel Traffic System).

VTS currently operate on a local (e.g. port VTS) basis mainly and the safety information on marine traffics is almost transported to navigators by VHF. It is so difficult to exchange a lot of the

related information necessary for marine traffic service exactly and in real time.

In this paper, the author design the Wide Area Information Network for Marine Safety, the Information Network for Maritime Traffic Safety Service and the Advertising Homepage for Marine Safety and Prevention of Marine Pollution.

The improved dissemination of the real-time visualized traffic information and the Internet Traffic Management System enable us to establish the Information Network for Maritime Traffic Safety Service, where dynamic and diverse information is made available in real time.

Then the designed information network is applied to Masan port VTS, in which navigators can not only access the visualized information on port situation but also exchange the diverse data necessary for controlling traffics with marine traffic managers, and the designed Advertising Homepage has been serviced at <http://soback.kornet.net/~pst0849> since Feb. 2000.

The Information Network contributes to improve efficiency of VTS and enhances the interest of marine safety and environment protection.

# 1

## 1.1

2

가 .

, LNG

가

.

,

.

,

가

가 (Notices to mariners) ,

(Small Correction)

가

가

가

(Blind sector)

.

가

가

.

(Vessel Traffic Service, VTS)

가

가

가

(VTS/VTMIS : Vessel Traffic Service/Vessel Traffic Management and Information Services) Network

VTMIS-NET,

(Transponder)

가  
(E-Mail)

가

Archipelago Project

가

(United State Coast Guard, USCG)

San Francisco VTS,

Puget Sound VTS, New York VTS, VTS Sault Ste Marie, VTS/MAREX

LALB

가 VTS

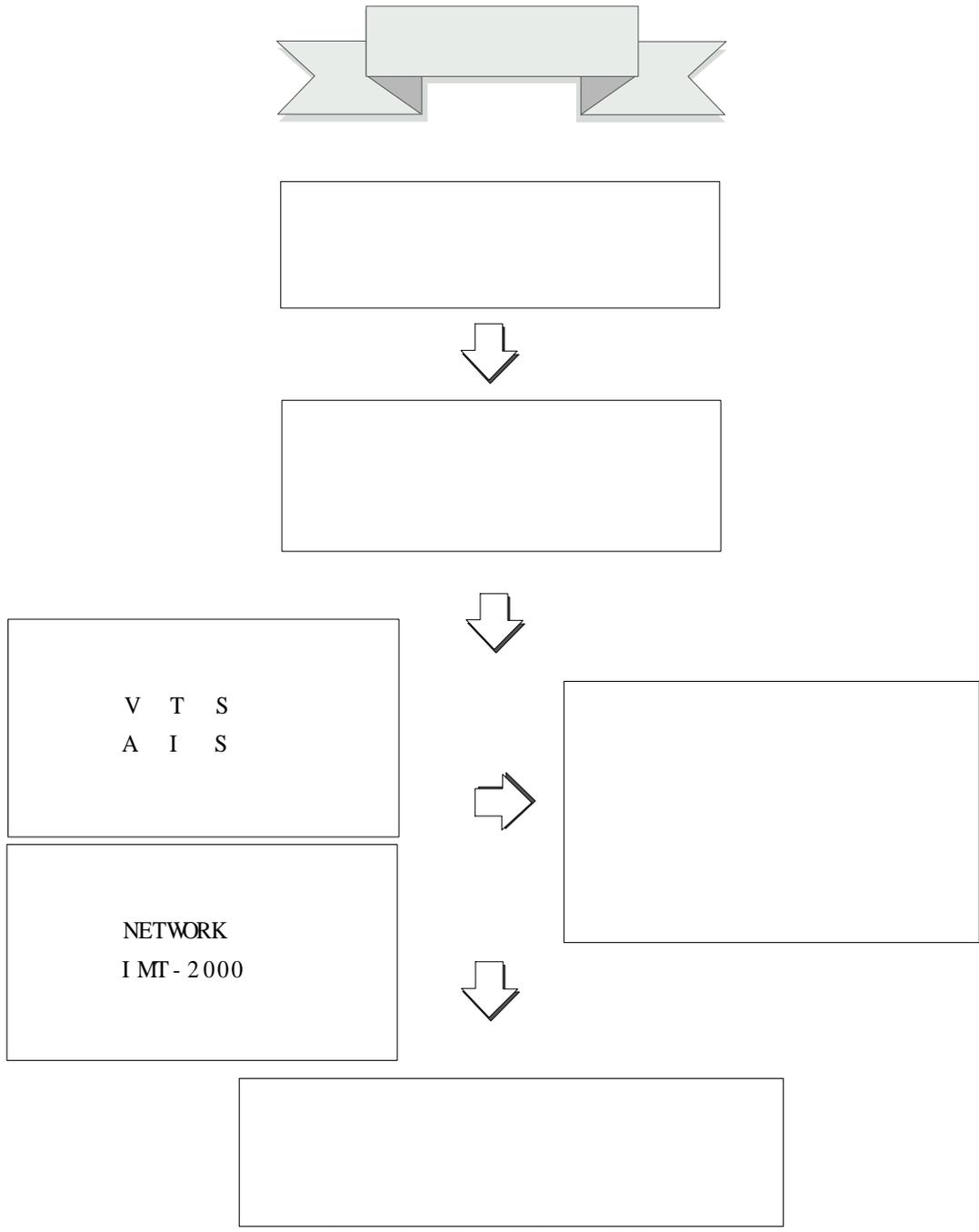
가 , 가 VTS  
ECDIS VTS AIS,  
가

### 1.2

### 1.3

VTS, AIS

<Fig. 1>



<Fig. 1> Flow Chart of Study

## 2

### 2.1

(廣義), (狹義), (最狹義), (最廣義),  
[1], (最  
狹義) (communication)

(way), (vehicle), (motive power) 3  
3 4  
가 .[2]

<Table 1>  
가 가

가 가 가 가 ,  
가 ( )  
가 .

1993 10 10 362 292

1995 7 23

443 5,600

가 , 가 가 .  
 가 가 가 .  
 가 .  
 가 .

<Table 1> Character of Traffic [3]

	가  가가 .	가 .  가가 . 가 가	가 .  가 가 .
	.	.( + )	.
	가 , . .	가 . .	가 . 가 가
	.	.	가가 .
	가 .  .	가 .  ( ) .	가  ( ) .



<Table 2> Purpose of Safety Management

	<p>(Safety Needs)</p> <p>가</p> <p>가</p> <p>가</p> <p>가</p>
	<p>-</p> <p>-</p>

.[8]

## 2.3

(International Safety Code : ISM Code)

(Traffic Separation Scheme,

TSS)

(Ship Reporting System,

SRS)

VTS

# 3

## 3.1 VTS

### 3.1.1 VTS (Vessel Traffic Service)

(IMO) VTS (Vessel Traffic Service) ‘ , (Competent Authority) , VTS Area , VTS , .[9]

### 3.1.2 VTS

VTS <Table 3> VTS가 가 , VTS (Geographical Area), (Traffic Density and Pattern) <Table 4> VTS .[10]

<Table 3> Three Basic Methods of VTS for Traffic Management.

(Geographical Division)	(Traffic Separation Schemes) , Navigational Pilots Charts .
(Time Separation)	VTS Sailing Plan .
(Distance Separation)	VTS Center . , 가 (Traffic Organization) .

<Table 4> Three Basic Service supplied by VTS

<p>(Information Service)</p>		<ul style="list-style-type: none"> <li>· VTS area</li> <li>( , , )</li> <li>· (meteorological and hydrological conditions), ,</li> <li>, ,</li> <li>,</li> </ul>
<p>(Navigational Assistance Service)</p>	<p>(monitor) ( VTS</p> <p>VTS</p> <p>.)</p>	<p>&lt; (Navigational Information) (Contribute)&gt;</p> <ul style="list-style-type: none"> <li>· Course and speed made good by a vessel</li> <li>· (Fairway axis) Way-point</li> <li>· , ( )</li> <li>·</li> </ul> <p>&lt; (Navigational Advice) (Participate)&gt;</p>
<p>(Traffic Organization Service)</p>	<p>VTS Area</p> <p>[ (the Forward Planning)</p> <p>.</p> <p>]</p>	<ul style="list-style-type: none"> <li>·</li> <li>·</li> <li>·</li> <li>·</li> <li>· VTS</li> <li>(System of Traffic Clearance)</li> <li>· VTS (Sailing Plans)</li> </ul>

### 3.1.3 VTS

VTS , (Radar)  
 (VHF-DF),  
 CCTV, VHF , VTS  
 , M/W  
 ,  
 ,  
 .[11]  
 VTS , , 3 . ,  
 CCTV, , (Real Time)  
 ( , , , NAVTEX  
 , SAR ) (Deferred Time)  
 VTS .  
 , .[12]

### 3.1.4 VTS/PTMS

VTS 1993. 1. , <Fig.  
 2> , / , , / , / , ,  
 , , , ,  
 VTS 1999 (Port Traffic Management Service  
 : PTMS)  
 VTS/PTMS <Table 5> .



<Table 5a> VTS/PTMS Main System Installation[13]

( : )

		/	/	/						
WS/DIS Sys.	3/9	3/9	2/4	3/9	2/3	1/3	2/6	3/9	1/2	1/3
RADAR Sys.	5	6	3	4	2	1	2	3	2	1
VHF Sys.	5	3	3	3	3	5	5	5	3	5
VHF-DF Sys.	2	3	1	2	1	1	1	1	1	1
CCTV Sys.	1	2	3	2	1	1	1	3	1	1
Sys.	1	2	-	1	-	1	1	1	-	1
Sys.	-	2	-	-	-	-	-	-	-	-

<Table 5b> VTS/PTMS Sub-System Installation

( : )

		/	/	/						
o M/W Sys.										
8 GHz	4	6	3	4	1	1	2	3	-	1
18 GHz	-	3	2	2	-	-	-	2	-	-
o O/F Sys.	-	-	-	-	-	-	-	-	1	-
o										
9.6Kbps	-	-	-	-	-	-	-	-	1	-
56Kbps	1	-	-	-	-	-	-	-	3	-



## 3.2 AIS

### 3.2.1 AIS

AIS(Automatic Identification System) (Ship to Ship),  
(Ship to Shore) , , ,

· ,  
· VTS(Vessel Traffic Service)  
(Search & Rescue : SAR)  
· [14]

### 3.2.2 AIS Transponder 4S AIS

AIS (VTS) 2S(Shore to Ship)  
DSC/VHF 4S(Ship to Ship, Ship to Shore) 가  
IMO/ 44 ('97) AIS 4S  
( Global Positioning & Communication : GP&C)

·  
4S (TDMA) ·  
4S  
(ECDIS) · <Table 6> AIS  
Transponder 가 · <Table 7>  
DSC/VHF 4S ·

<Table 6> Three Main Modules and Function of AIS Transponder

GPS	, , Time Sync Source
VHF	Maritime Mobile Band(VHF )
	가 GPS VHF VHF

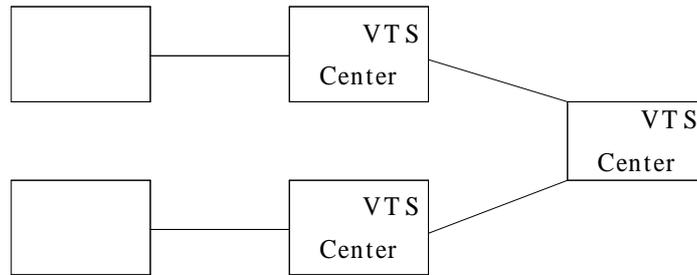
<Table 7> Compare DSC/VHF Method with 4S Method

	DSC/VHF Transponder	4S Transponder
	- VTS	,
	-	Broadcasting ( )
	Un- Coordinated	Self- Organizing Timeslot
가	가	가
Radio Channel	VHF Channel-70(GMDSS )	1 Channel
Radio Channel	30%	90%
(bit )	1,200bit ( 9,600bit )	9,600 bit
Redundancy		
-	, 20	, 2000

### 3.2.3 AIS

AIS (Automatic Identification System) is a system that provides real-time information about the location and movement of ships. It is used by VTS Centers (Vessel Traffic Service Centers) to monitor and manage vessel traffic in busy waterways. AIS data is transmitted via GPS (Global Positioning System) and is received by VTS Centers. The VTS Center then processes this data to provide information to the vessel, such as ETA (Estimated Time of Arrival) and other relevant data. The VTS Center also provides information to the vessel, such as ETA (Estimated Time of Arrival) and other relevant data.

. <Fig. 3> 4S AIS .



<Fig. 3> Wide Area VTS with 4S Method AIS



### 3.3

#### 3.3.1 VTMS - NET

VTMIS-NET (Vessel Traffic Management and Information Services - Network) VTS VTS (Vessel Traffic Management and Information Services : VTMS) Data (Local), (Regional), VT (MI)S Networks (European Commission) Project . VTMIS-NET (Local), (Regional), VT (MI)S VT (MI)S . , Data , Data , 가 가 .

VTMIS-NET Sub-Project VTS/VTMIS Network 가 (Demonstration) .

##### 가. The North Sea Channel Demonstration

(Le Havre), (Rotterdam), (Hamburg), (Southampton) (Virtual Port in Stavanger) VTS/VTMIS (ETA) . (PSC), (SAR), 가 .

. Oeresund Area Demonstration

Oeresund 가 (the North sea) 3  
 ( )  
 가 , Malome Copenhagen  
 VTS가 가 VTS ,  
 Network AIS- , (Presetation  
 Systems), AIS  
 VTS  
 ,  
 IMO ITU AIS , VTS AIS-  
 , VTMIS AIS , VTMIS  
 AIS , AIS VTS

. St. Petersburg Demonstration(AIS-Aided VTS)

St. Petersburg port VTMIS VTS  
 VTS 가 (28miles) (100m)  
 (Radar Pilotage)  
 가 ,  
 VTS ,  
 AIS ,  
 VTS AIS 가

. The Mediterranean Demonstrations(Italian Coast)

Rome Livorno Rome Demonstrator Napoles, Palermo,  
Eolie Capri Napoles Demonstrator ,  
VTMIS

Rome Demonstrator VTS 가  
(Navigation Information System in Advanced  
Technologythe : NISAT) ,  
, Napoles Demonstrator  
(Harbour Master), ,  
VTMIS E-Mail  
가

. Warnemuende Site Demonstration

(Electronic Chart Display and Information System : ECDIS)  
AIS BAFEGIS(Baltic  
Ferry Guidance and Information System) Project .

**3.3.2 BAFEGIS Project**

ECDIS AIS - (Ro-Ro  
Passenger Ferries) Project  
가 BAFEGIS(Baltic Ferry Guidance and Information System) Project .

### 3.3.3 SAFEMAR of MARIS

(Maritime Information Society, MARIS) 1995

G7

. MARIS

MARIS MARSOURSE, INFOLOG/MARTRANS,  
SAFEMAR, MARVEL, FEMAR, Maritime Tourism Sub-Project

MARIS (Contact  
Point)

. MARIS , , , , , /

Network

SAFEMAR MARIS

(Electronic Chart Display and Information Systems, ECDIS),

, (Automatic Identification System, AIS)

/ (Vessel Traffic Service/Vessel

Traffic Management and Information Services : VTS/VTMIS)

Project .

<Table 8> MARIS

<Table 8> Projects in the MARIS Framework

Sub-Project		Project
MARSOURCE		MARSOURCE Database
		Survey Design Project
		Data Analysis Tool
		Species Identification Program (SIP)
		New Technologies
		Fishing Industry Collaboration
		International Collaboration and Leverage Training and Communication
INFOLOG/MARTRANS		MARTRANS I
		COST 330: Teleinformatics Links Between Ports and Their Partners
		LOGIN (Logistics Information Network)
		INTRARTIP
		MARNET
		DELCOM (Delivery Communication System); continuation of BOPCOM (Baltic Open Port Communication System)
		Information Network for Global Distribution of Automobiles
		Container Cargo Tracking Project
		Marine Geomatics
	Information Seaway	
SAFEMAR		Maritime Information Gateway Server and Networking
		Feasibility Study
		Transponder Performance Standards
		COST 326: Electronic Chart Display and Information System
		BAFEGIS (Baltic Sea Ferry Guidance and Information System)
		INNAV
MARVEL		AIS (Automatic Information Systems)
		EDIMAR
		MARVEL OUS
		OPTIMISE
		SEA-NET
FEMAR		SEASPRITE
		MARITRAIN
MARITIME TOURISM		MARSK

### 3.3.4 Archipelago Project

가 2, 3  
(Transponder) , (E-Mail), 가  
가 가 Project  
.

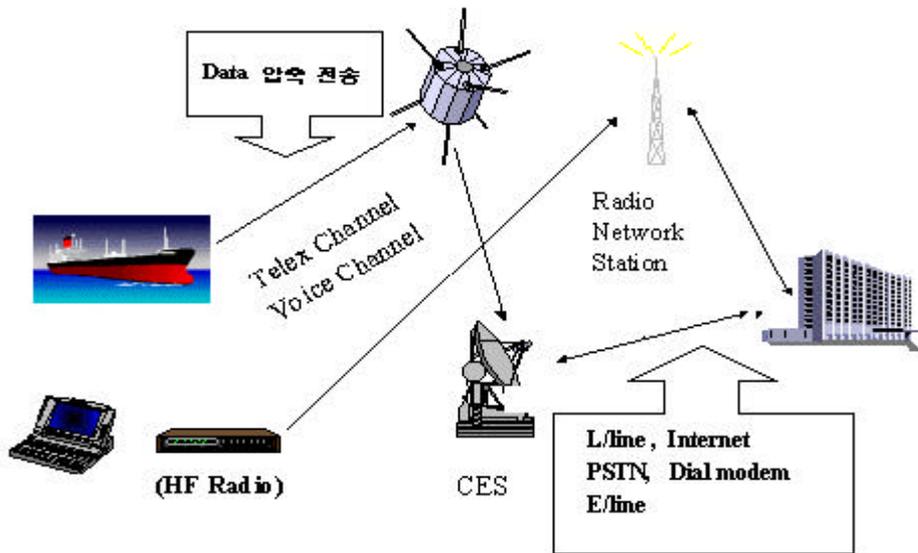
### 3.3.5 POSEIDON Project

, ,  
(Vessel  
,  
Traffic Management and Information Systems : VT MIS)  
, Project가 POSEIDON(the  
European Project On Integrated VTS, Sea Environment And Interactive  
Data On Line Network) Project .

MOVIT Project, PO Navigation System, INDRIS  
가 .

4

4.1 Network



<Fig. 4> Network System

Network

<Fig. 4>

INMARSAT

DBS(Direct Broadcasting Satellite)

가 .[15]

INMARSAT

(Coastal Earth Station : CES)

Telex Channel      Voice Channel

가 , (Coastal Earth Station : CES)

L/line, Internet, PSTN, Dial modem, E/line

Comsat, ZDB, HK telecom, France

telecom      Service      INMARSAT

(HF System)

INMARSAT      1/5 - 1/8      가 2.4kbps

Network      ,      3

IMT - 2000

가,      가 ,

Network

## 4.2 IMT - 2000

, <Table 9> 2

가

IMT - 2000(International Mobile Telecommunication-for the 2000s)

. IMT - 2000      384Kbps ,

2Mbps , ,

.  
 G3 PC  
 , ISDN  
 .  
 , , ,  
 , ,  
 .  
 , 8Kbps 32Kbps  
 , 1.9Kbps,  
 28.8Kbps, 64Kbps  
 .  
 128Kbps, 256Kbps, 384Kbps, 2Mbps  
 가 .  
 가 ,  
 , PDA(Personal Digital Assistant),  
 64Kbps 144Kbps  
 Web Phone, Notebook ,  
 , MP3 , MPEG4  
 , 384Kbps 2Mbps PC ,  
 Cable TV .

가

IMT - 2000

<Table 9> Compare IMT - 2000 with  
Second Generation Communication System

		PCS	IMT - 2000
	300MHz	1.7 ~ 1.8MHz	2GHz
	1.23MHz		5/ 10/ 20MHz
Vocoder( )	9.6Kbps 14.4Kbps	14.4Kbps	384Kbps 2Mbps
	6kbps (EVFIC) 13Kbps	13Kbps	8 ~ 32Kbps
			( , , )

<Table 10a> Global 3rd Generation Mobile Telecommunication User  
Prediction(Baskerville Prediction) [17]

		2001	2002	2003	2004	2005
3G 가 ( : )	/	0	0	0	0	252
	/	5,605	11,156	18,786	34,245	54,572
		0	10,088	27,322	46,392	69,252
		0	0	0	0	979
		0	3,588	8,166	18,775	31,063
		5,605	24,832	54,274	99,412	156,118
3G ( : %)	/	0	0	0	0	0.2
	/	0.15	0.29	0.49	0.88	1.39
		0	1.38	3.75	6.38	9.52
		0	0	0	0	0.18
		0	1.13	2.56	5.86	9.65
		0.09	0.39	0.84	1.52	2.36
3G ( : %)	/	0	0	0	0	0.2
	/	100	44.9	34.6	34.4	35.0
		0	40.6	50.3	46.7	44.4
		0	0	0	0	0.6
		0	14.4	15.0	18.9	19.9
		100	100	100	100	100

		2006	2007	2008	2009	2010
3G 가 ( : )	/	1,342	2,632	4,131	5,845	7,781
	/	104,197	141,449	162,275	169,587	172,118
		105,552	140,437	160,904	173,837	177,035
		2,850	4,963	7,298	9,670	16,584
		59,939	75,814	93,214	112,083	132,336
		273,880	365,345	427,822	471,022	505,854
3G ( : %)	/	0.12	0.24	0.38	0.53	0.70
	/	2.63	3.53	4.01	4.15	4.17
		14.53	19.34	22.16	23.92	24.41
		0.52	0.89	1.30	1.70	2.89
		18.52	23.30	28.50	34.10	40.05
		4.11	5.44	6.32	6.91	7.37
3G ( : %)	/	0.5	0.7	1.0	1.2	1.5
	/	38.0	38.7	37.9	36.0	34.0
		38.5	38.4	37.6	36.9	35.0
		1.0	1.4	1.7	2.1	3.3
		21.9	20.8	21.8	23.8	26.2
		100	100	100	100	100

<Table 10b> Domestic IMT - 2000 Market Prediction[18]

( : )

		2001	2002	2003	2004	2005
2 (CDMA)	가 ( )	23,831	24,031	24,216	24,337	24,410
	( )	5,190	5,814	6,395	6,907	7,321
	( )	3,866	4,601	5,382	6,190	7,119
3 (IMT - 2000)	가 ( )	-	643	729	1,604	3,868
	( )	-	244	428	735	4,090
	( )	-	623	1,093	1,486	4,349

가 : 2 CDMA PCS 가  
 3 IMT - 2000  
 : , , ( )  
 :

### 4.3

가

31.9

1995 2010

가

[19]

<Table 11>

가

<Table 11> Korea Information Infrastructure Budget Plan

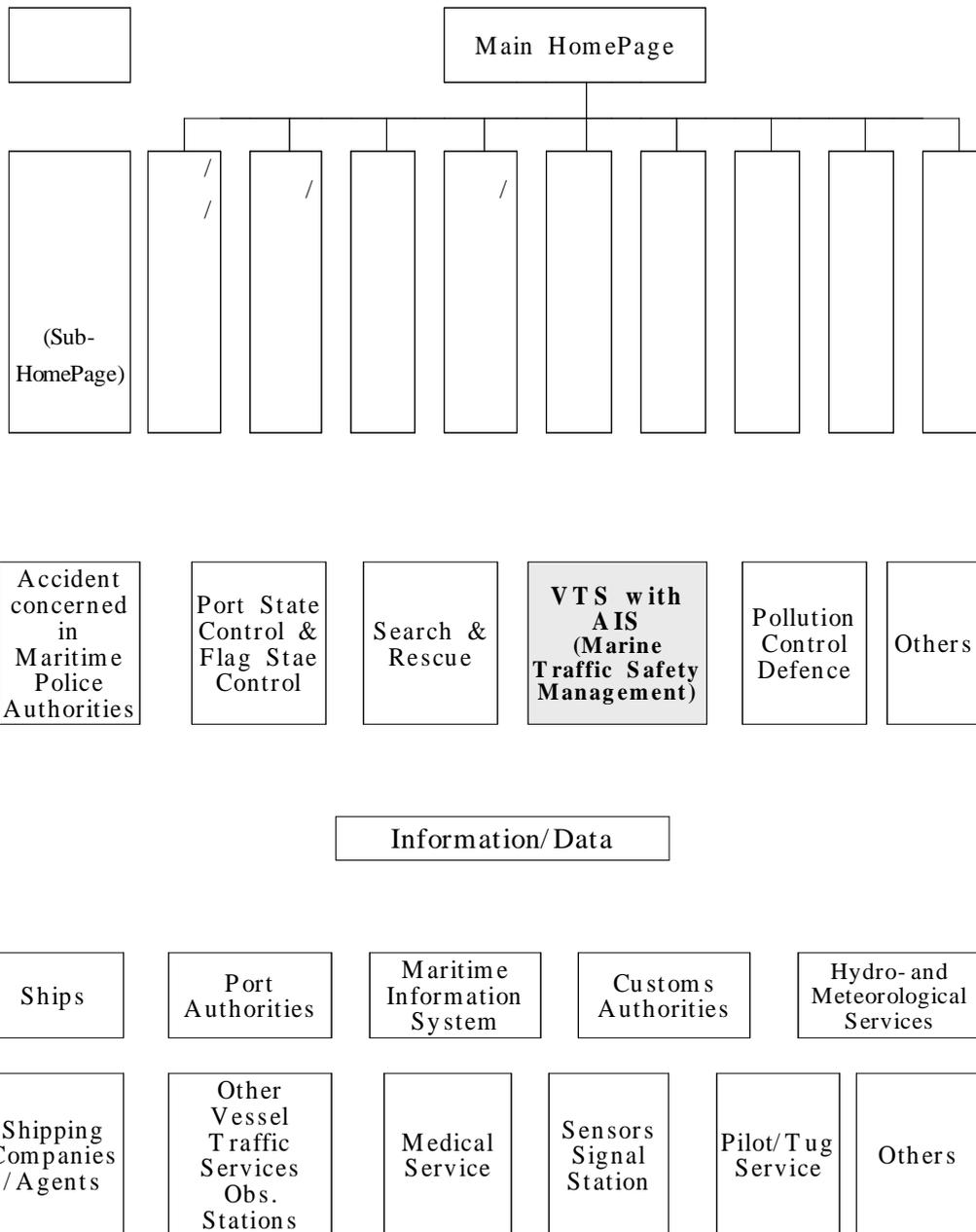
( : )

	1 (3 ) (1995- 1977)	2 (5 ) (1998- 2002)	3 (8 ) (2003- 2010)	
가	1,701	4,750	1,663	8,114
	4,028	38,814	222,283	295,125
CATV	-	600	1,200	1,800
( )	7,720	7,700	8,561	23,981
	12,449	71,864	233,707	319,020

# 5

## 5.1

,  
가 .  
<Fig. 5> .  
(Port  
State Control : PSC) (Flag State Control : FSC) ,  
(Search & Rescue : SAR) ,  
AIS VTS .  
(Sub-HomePage) ,  
Main-HomePage .  
Data Base .  
(User) Main HomePage , ,  
Sub-HomePage  
.  
가 가 ,



<Fig. 5> Korea Marine Safety Information Network

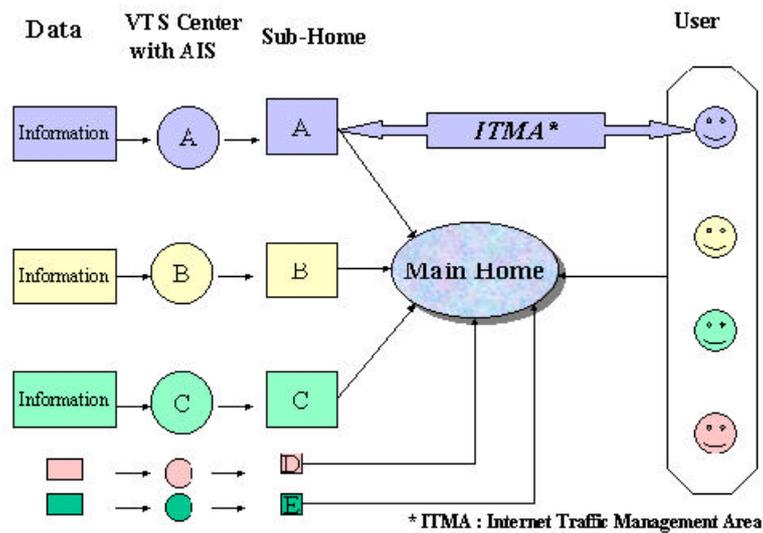
## 5.2

### 5.2.1

5.1

VTS Center

<Fig. 6>

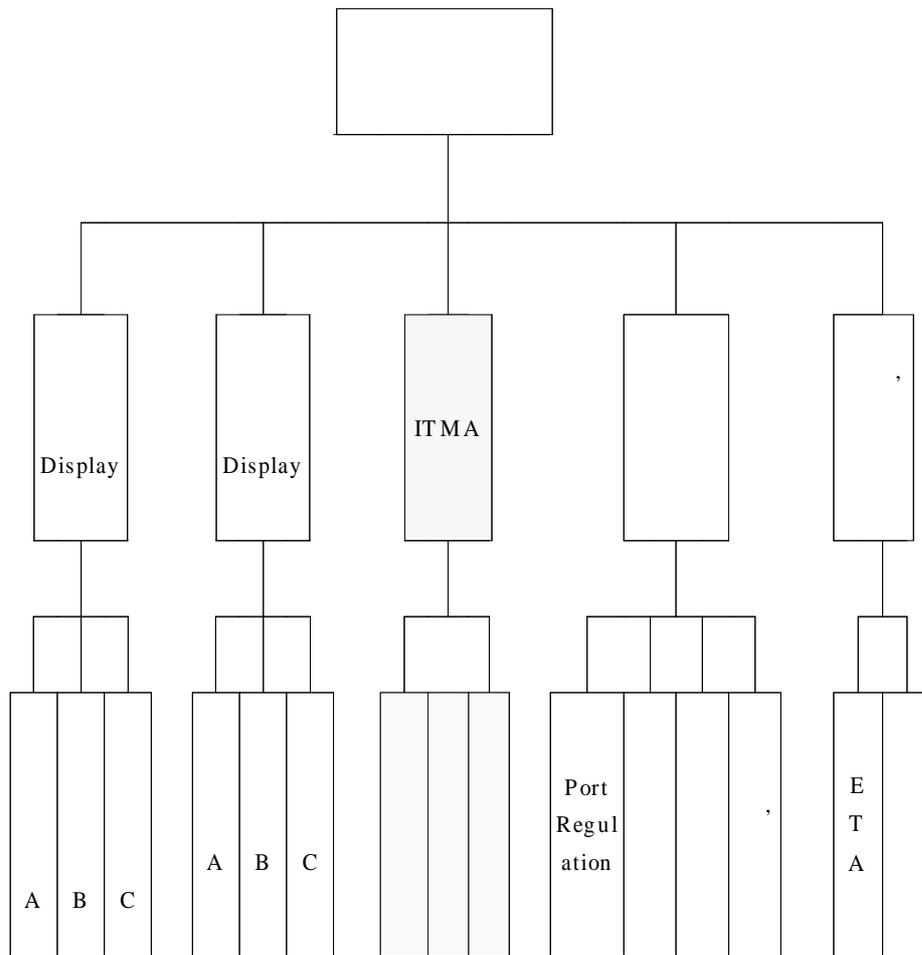


<Fig. 6> Wide Area Information Network for Maritime Traffic Safety Service by VTS with AIS

VTS Center

(Sub-HomePage)

(Main HomePage)



\* ITMA : Internet Traffic Management Area

<Fig. 7> Composition of Information Network for Maritime Traffic Safety Service

VHF

가

VTSS

AIS

, VTS  
ECDIS

Radar

Display

ARPA

가

가

,

. 4S(Ship to Ship

and Ship to Shore)

가

CCTV

(Internet Traffic Management

Area : ITMA)

. ITMA

(Internet Traffic

Management : ITM)가 가

<Table 12>

.[20]

<Table 12> Benefit of Marine Traffic Management with Internet

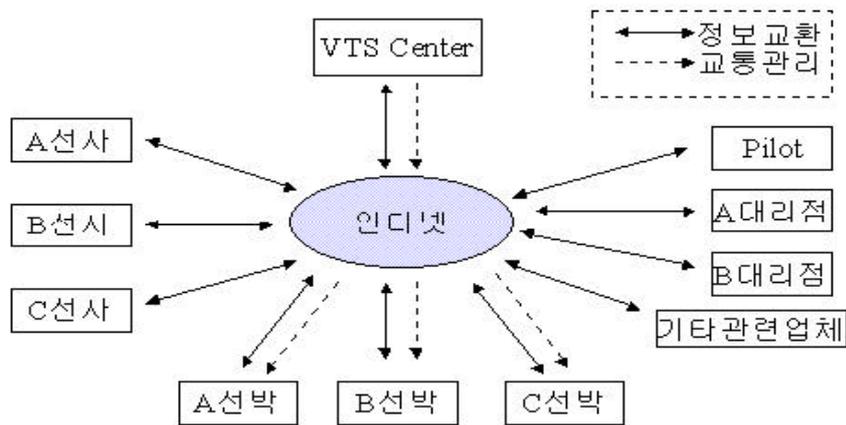
Internet	
VTS Monitor	Radar가 (Pilots, Agents, Tug) , ARPA 가 VTS Radar ( Navtex, N/M )
/	, ,
(Internet Traffic Management Area: ITMA)	VTS ( . , )
	Port Regulation ,
	ETA , ) ( , , , , , ) (Pilots, Agents, .

### 5.2.2 ITMA

ITMA VTS Center  
 Area ITMA  
 (Internet Traffic Management : ITM) . ITMA  
 , , .  
 , ITMA  
 . ITMA  
 ( ) ICON

<Fig. 8>

. VTS Group  
 가 IMTA , , Pilot,



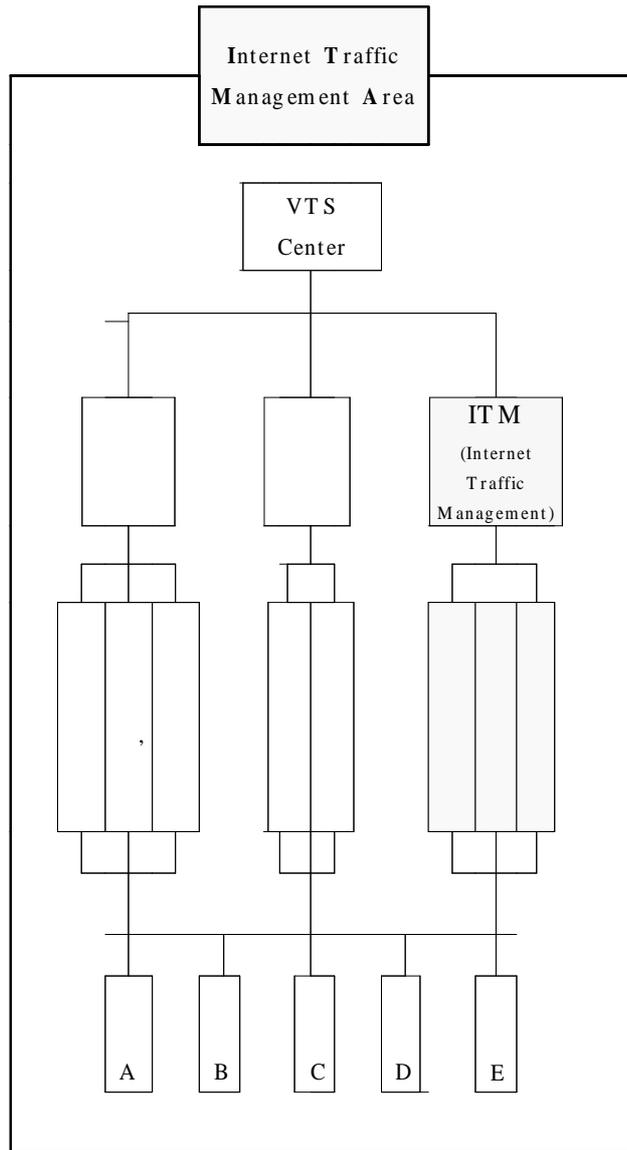
<Fig. 8> Flow Chart of Information Exchange and Traffic Management Flow by Internet.

<Fig. 9>

ITMA

Group

ITM



<Fig. 9> Traffic Management Flow in ITMA [21]

### 5.3

HomePage

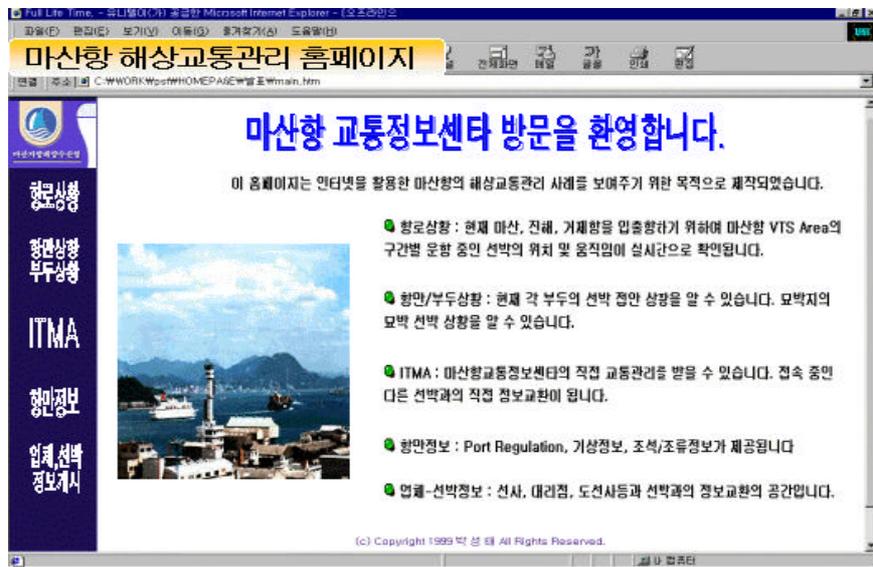
HomePage

(Sub-HomePage)

(VTS/PTMS )

VTS Monitor ,

Monitor , ITMA, , .



<Fig. 10> Masan Port Traffic Information Center HomePage

1) Monitor Page

Display

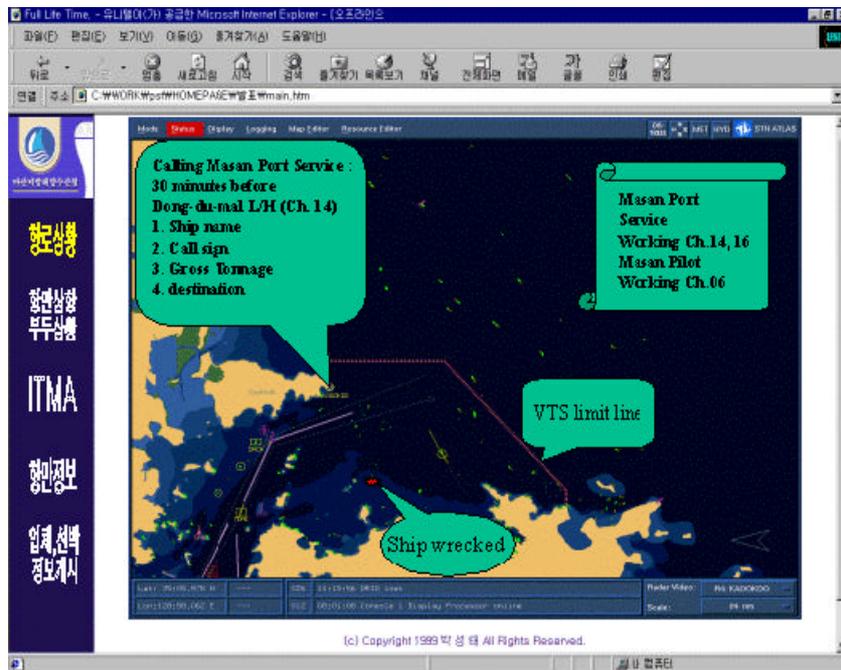
<Fig. 11> Radar Information Screen around Gaduk Strait

Reporting

(가) Monitor

2002 7 1 AIS (Automatic Identification System)

가 가

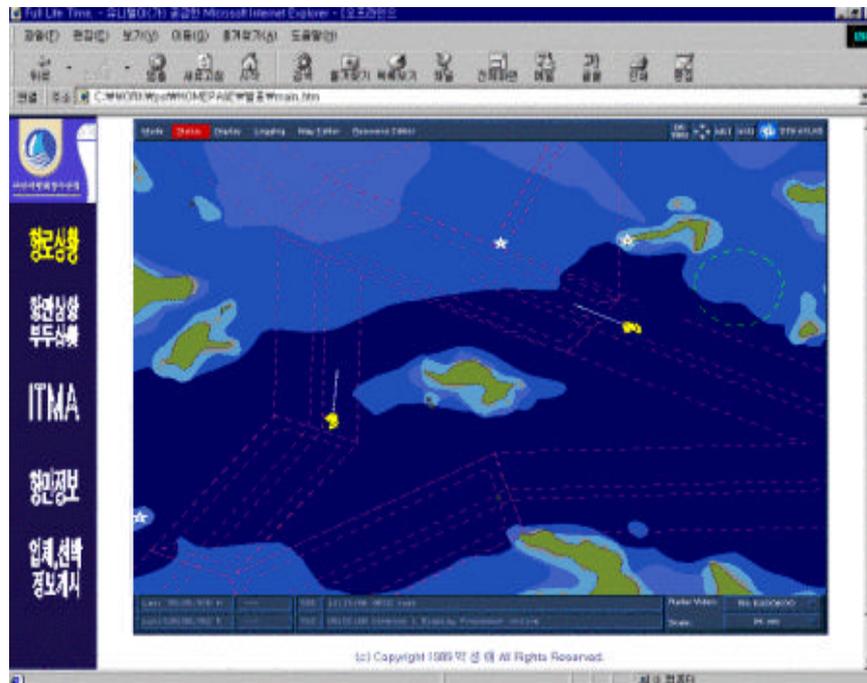


<Fig. 11> Radar Information Screen around Gaduk Strait

1) Monitor Page

<Fig. 12>

Monitor  
 가 (Blind Sector) 가  
 (Speed), (Course)



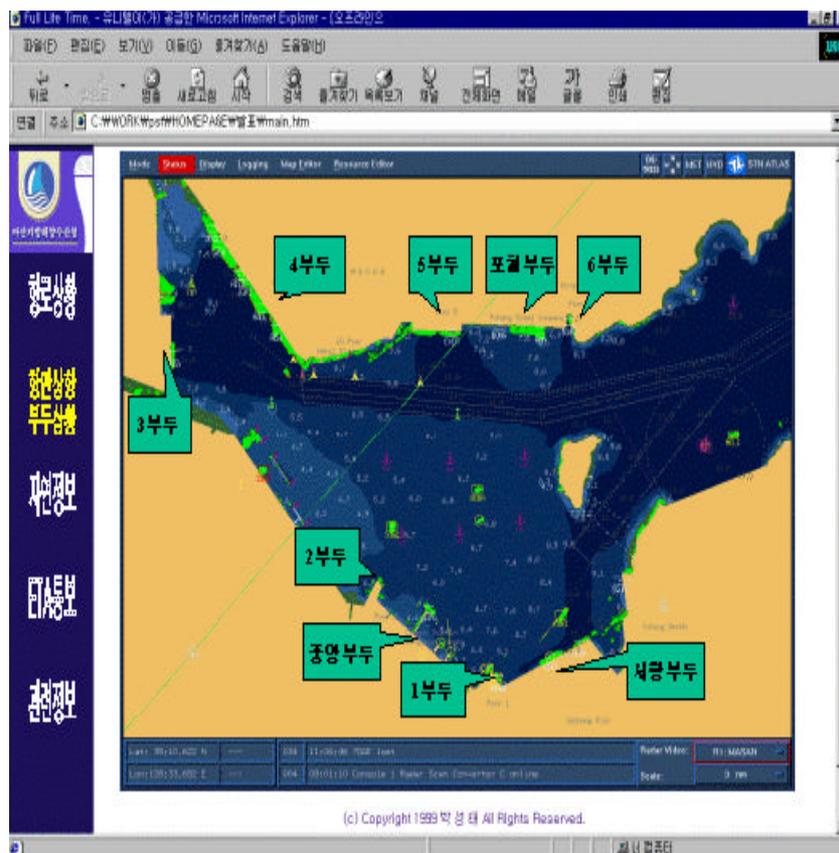
<Fig. 12> Radar Information Screen around Chamdo island

2) Monitor Page

Display

CCTV Display

가



<Fig. 13> Radar Information Screen of Masan Port

3) ITMA

Page

HomePage ITMA (Internet  
 Traffic Management Area) (Internet Traffic  
 Management : ITM) 가 .  
 Internet 가  
 ITM .

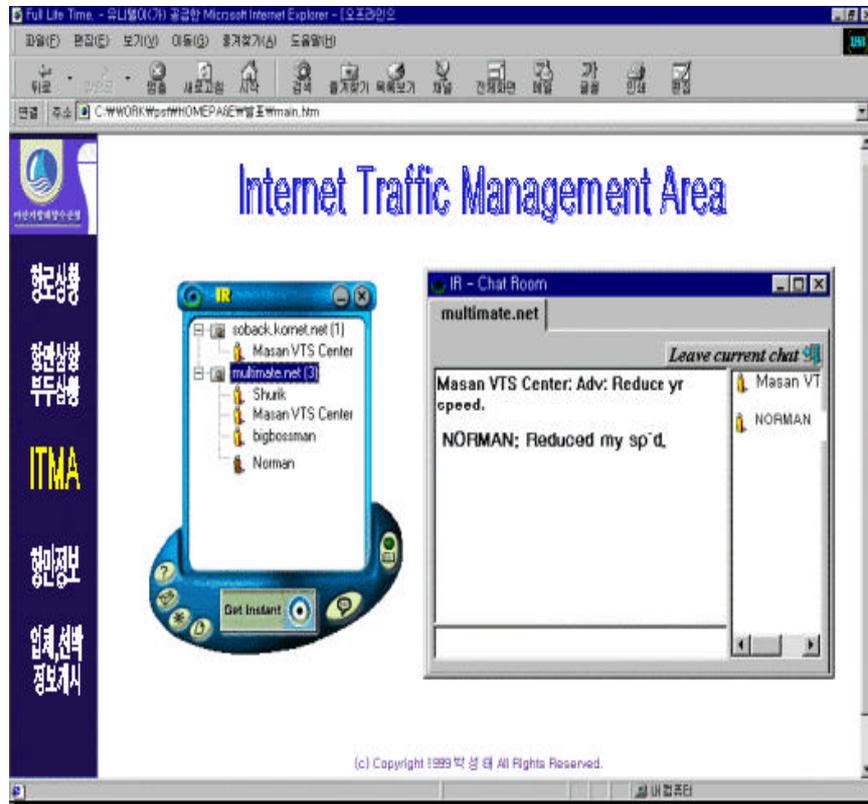
<Fig. 14> ITMA (Call Sign)가 3FIZ50, 34,250 ,  
 (Pure Car Carrier : PCC) Norman



<Fig. 14> Verification of Ship Information in ITMA

<Fig. 15> ITMA(Internet Traffic Management Area) ITM

Norman Speed  
 , Norman



<Fig. 15> Traffic Management in ITMA

ITM Program Multimate.net, Inc IR(Instant Rendezvous) Beta 1 Version

4) ( ) Page

Port Regulation, , , . <Fig.  
 16> Page .  
 가 가  
 가



<Fig. 16> Weather of Masan Harbour

5) Page

ETA

Page

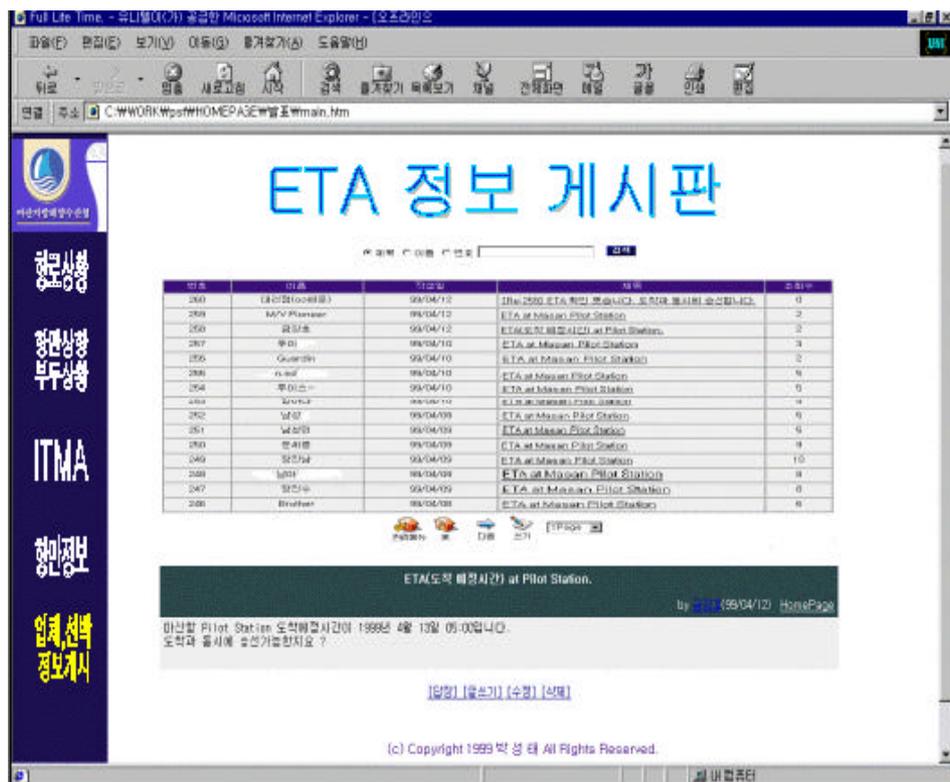
ETA

가

ETA

<Fig. 17> ETA

ETA



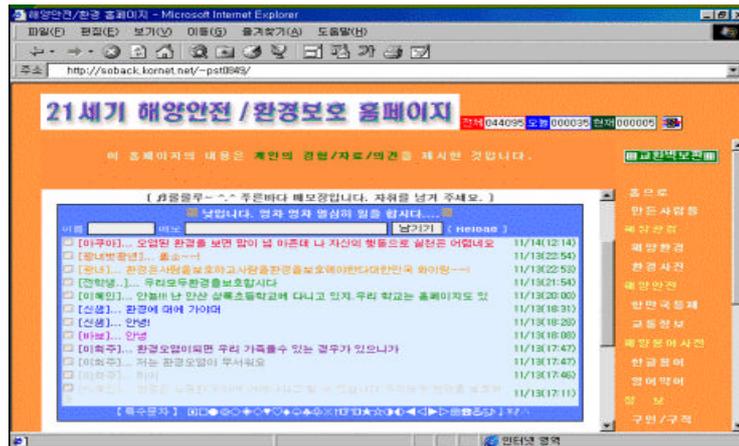
<Fig. 17> ETA Information Board

5.4 /

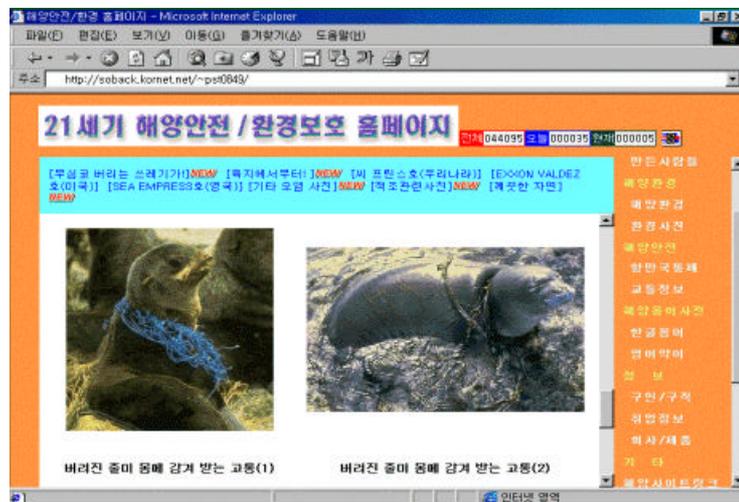
,  
.  
21 /  
2000 2 HTTP://SOBACK.KORNET.NET/ PST0849  
HTTP://MYPOSEIDON.COM .

<Table 13>

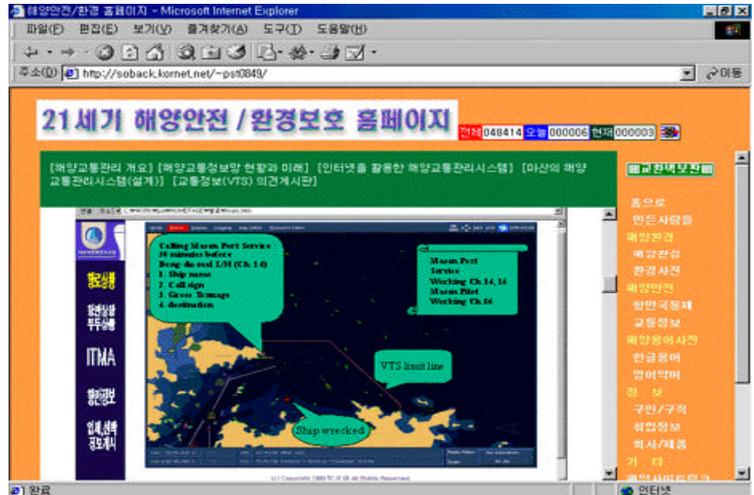
<Table 13> Composition of 21st Century Marine Safety and Environment Protect HomePage



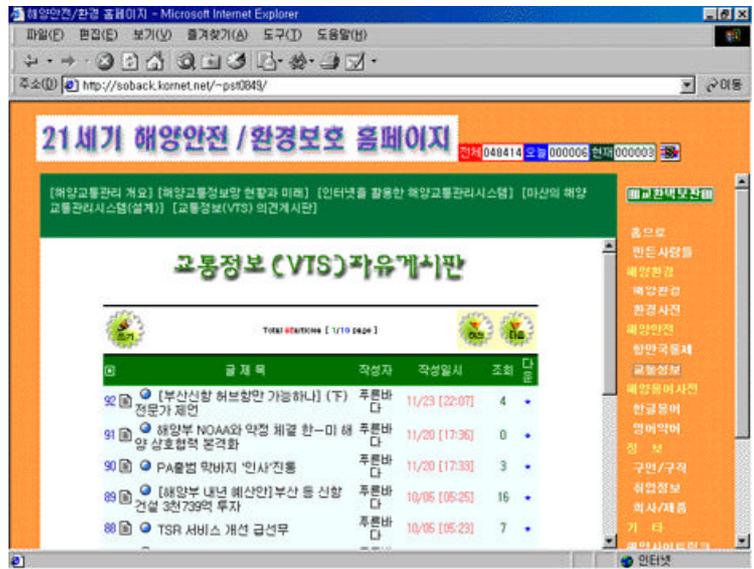
<Fig. 18> Main Page of 21st Century Marine Safety and Environment Protect HomePage



<Fig. 19> Marine Environment Protection Page of 21st Century Marine Safety and Environment Protection HomePage



<Fig. 20a> Marine Safety Page of 21st Century Marine Safety and Environment Protect HomePage(1)



<Fig. 20b> Marine Safety Page of 21st Century Marine Safety and Environment Protect HomePage(2)

HTTP://SOBACK.KORNET.NET/ PST0849

HTTP://MYPOSEIDON.COM /

<Fig. 21>

MYPOSEIDON.COM



<Fig. 21> Main Page of HTTP://MYPOSEIDON.COM

# 6

(ITM)

AIS VTS/VTMIS Network VTS/VTMIS

. . , VTS/VTMIS, ,  
가 .

1.

VTS, PSC, , SAR

가 .

2.

VTS

Display

가

가 가

(Internet Traffic Management, ITM)

VHF

가 가 .

Port Regulation, ,

ETA

가 가

3. /

HTTP://SOBACK.KORNET.NET/ PST0849 HTTP://MYPOSEIDON.COM

2000 2 21 /

. VTS Monitor

가

가

가

Surfing

가

(Look Out)

가

가

가

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