CHRIS/12/15A rev.6

12th CHRIS MEETING
Valparaiso, Chile, 23-25 October 2000

WORLDWIDE PRODUCTION OF ELECTRONIC CHART DATA

VECTOR DATA DEVELOPMENT

I. ENC DEVELOPMENT

AUSTRALIA
(September 2000)

ENC Production

1. Nearly three quarters of Australian Hydrographic Office (AHO) cartographic staff are engaged in ENC production.

2. Australia's ENC production programme remains in the first instance targeted to providing ENC coverage for those vessels and areas most likely to benefit from the early uptake of ECDIS. In Australia this is SOLAS class vessels transiting Torres Strait and The Great Barrier Reef Inner Route and those entering Australia's major ports. To this end the AHO's production priorities are primarily area based as follows:

   - North Eastern Australia (current focus of production)
   - Eastern Australia to the western entrance of Bass Strait
   - North West and Northern Australia
   - South West and Southern Australia and Papua New Guinea
   - Antarctica.

   Within each area priorities are assigned as follows:

   - Major routes and restricted pilotage waters
   - Approaches and Ports
   - Coastal
   - Remainder.

3. The AHO compilation strategy is to work "from the whole to the part". In other words firstly to create "small scale" wide area ENCs with "larger scale" priority areas set within them. Progressively, each ENC will contain more and more detailed data through revision and the completion of more and more priority areas. The first Australian ENC (ENC1) covers NE Australia. The "base" for ENC1 has been taken from existing 1:1,500,000 charting. More detailed coverage along parts of the Great Barrier Reef (GBR) compulsory pilotage route, its approaches and linking passages is being compiled from source survey and contains bathymetry at one metre contour intervals in the 5-20m depth band. Those parts identified for compilation with one metre contour intervals will be supplemented with data compiled from paper charts and beyond this RNC data.

4. AUS-ENC1 and more detailed coverage containing one metre contour intervals has been evaluated at sea as a beta version commencing in 1999, together with ENCs covering some of Australia's ports. These ENCs are now undergoing rigorous quality assurance. The first complete ENC route will cover the area between Weipa, on the west coast of the Gulf of Carpentaria, through the Torres Strait to Cape Grenville within the Great Barrier Reef. This will be completed and ready for release by Easter 2001 However, it will not be released commercially until the relevant national maritime safety authorities are happy to recognise the use of ECDIS.

5. The beta versions of ENCs are available to ships, organisations and manufacturers on request.

6. It is thought that there will be very small numbers of ECDIS users in Australia in the first instance. Furthermore, the initial limited ENC coverage will mean that ECDIS navigation in Australia will require both ENC and RNC. For these reasons ENC updates will initially be provided through total file replacements which will probably be bundled with the RNC update service which is already in place.

7. ENC data protection/integrity, pricing and distribution are all under consideration. A universal system of data protection common to all HO's remains the preferred method.

8. Comprehensive ENC coverage of the whole of the Australian charting area suitable to support continuous ECDIS navigation is unlikely to be achieved before at least 2005.

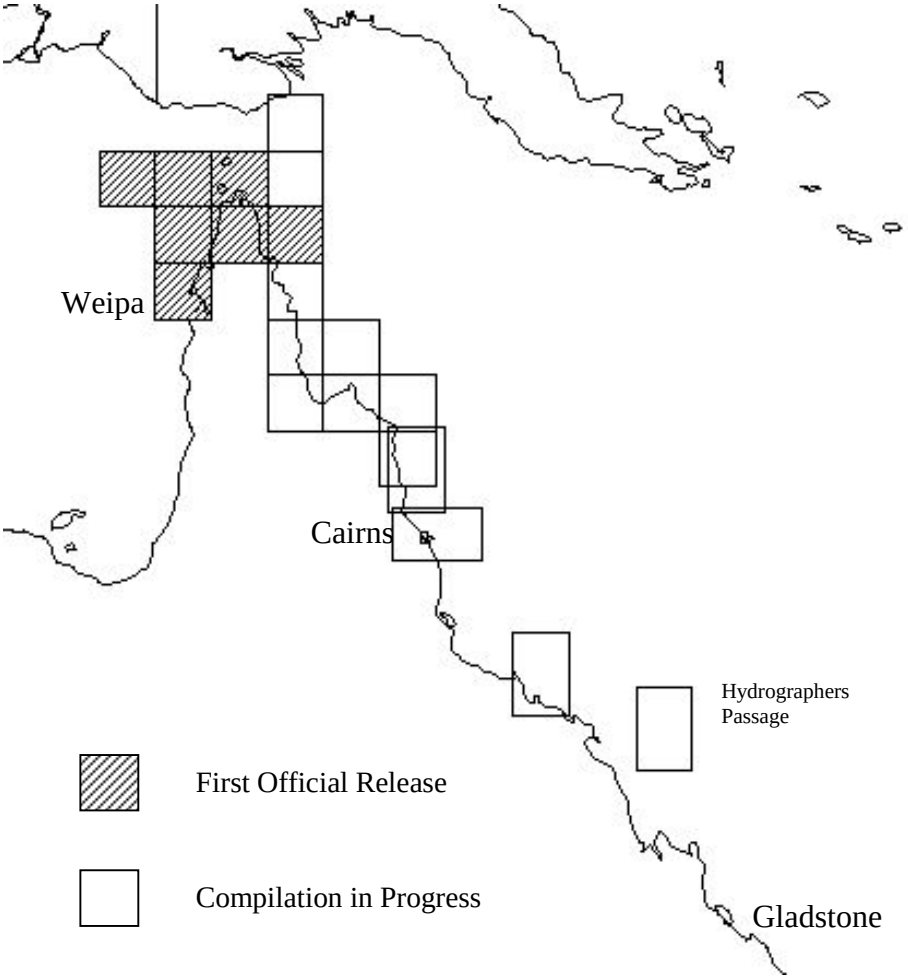
ECDIS Implementation

9. The Australian Maritime Safety Authority (AMSA), Australia's maritime colleges and the Australian Hydrographic Office are working closely together to develop mechanisms for the earliest possible introduction of ECDIS with the appropriate infrastructure and regulatory arrangements in place. The availability of up to date, quality assured ENC data in 2001 will be used by AMSA to develop specific mechanisms to regulate the use of ECDIS in waters under their jurisdiction. Work is proceeding to provide guidance on what will be accepted by AMSA as "*adequate back up arrangements*" and what is "*an appropriate folio of paper charts*".

10. Meanwhile, under the STCW code requirements, AMSA and the Australian Maritime colleges are ensuring that appropriate and relevant ECDIS training is available.

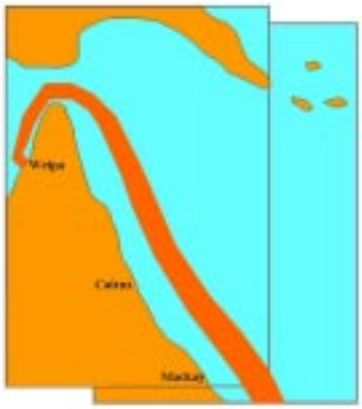
Progress Diagrams

AHO ENC Progress within the Great Barrier Reef (September 2000)

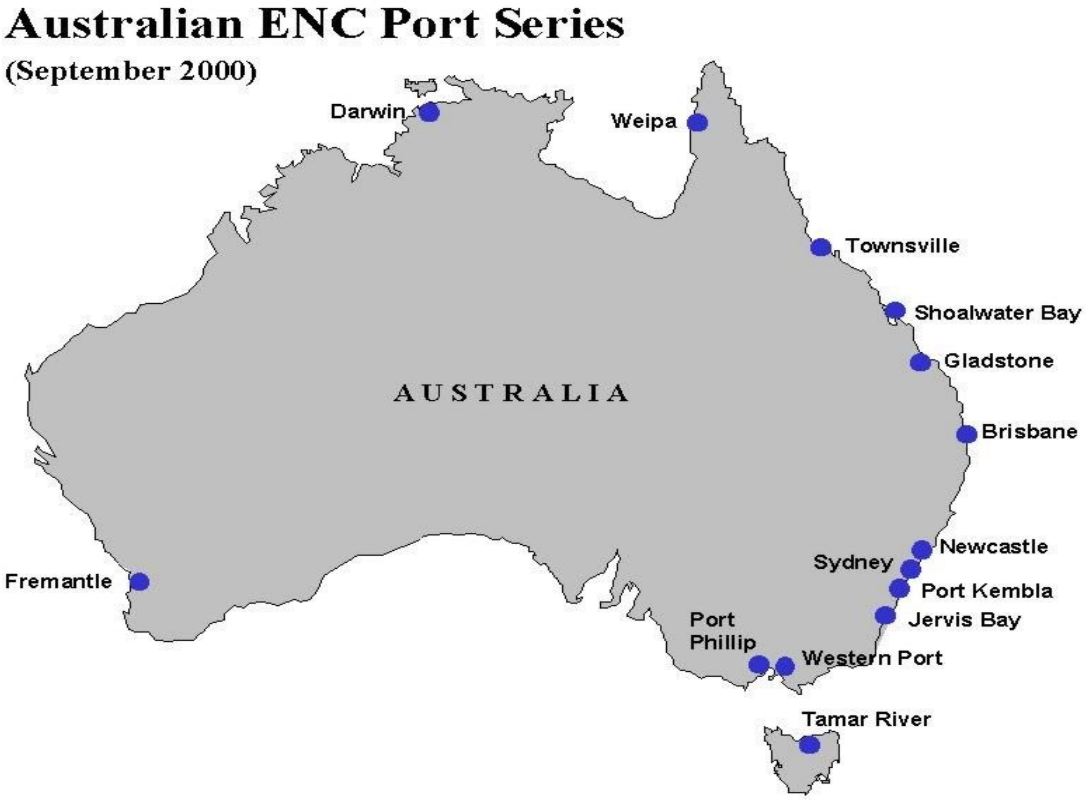


Progress Diagrams

PROGRESS OF DATA-RICH (1M CONTOUR INTERVAL) ENC OF GREAT BARRIER REEF INNER ROUTE



Port ENCs completed



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CANADA
(September 2000)

ENC Production in Canada

1) Canada has continued its ENC program at the same pace as in previous years, i.e. new ENCs are produced at the rate of approximately 15 per month. As of 13 September 2000, 464 ENCs from 249 paper charts have been produced, of which:

   - 73 ENCs are in their 2nd Edition;
   - 22 ENCs are in their 3rd Edition;
   - 9 ENCs are in their 4th Edition.

   In addition, 176 Update Messages have been published.

   Forecast Total ENCs for end-of-year 2000: 500 ENCs from 320 paper charts. Production Throughout is less than optimum since we are converting to ISO 9000/2000 Quality management System. It should be noted that Canada will not be converting all of its paper charts to ENCs as many charts cover Arctic and Frontier areas were there is little demand for ENCs.

2) Up to date information about the status of ENCs commercially available can be seen at the NDI web site : http://www.ndi.nf.ca/cats/

3) ENC's are produced using USL's CARIS Object Manager (OBMAN).

4) QA is done using a variety of packages including USL's ECVIEW and READS57 and dKart Inspector. Update messages are also verified by several viewers like TRANSAS Navi-Sailor and Q-MAR's Sailsafe.

5) Distribution is through NDI and certified distributors (approx. 8). An updating service is also available through NDI. At present, there is no North American RENC. ENCs are priced at US$50 per "paper chart equivalent" per year for full service. The ENCs are not encrypted.

6) A Security System (PKI) has been implemented on a trial basis between NDI and CHS HQ. ENCs are encrypted and Digital Signatures appended. Files are transmitted via the Internet. Work is underway to investigate implementation of the PRIMAR Security System. The goal is to determine overall costs to implement.

CHILE
(December 2000)

TASK	ADVANCE AT 31.DEC.99	ADVANCE AT 31.DECEMBER.2000
N° of ENC´s finished (S-57 Ed 3.0 files)	18 ENC's at different scales that compose two main continous routes	38 ENC's at different scales, composing four electronic routes
Electronic routes finished	Two whole continous routes: 1) Magellan Strait 2) Arica to Magellan Strait (scale 1: 500.000)	Four whole continuous routes: 1) Strait of Magellan (Punta Arenas harbour included) – 10 ENC's 2) Arica to Strait of Magellan (scale 1:500.000) – 10 ENC's 3) Arica to Taltal (main ports included) – 12 ENC's 4) Caldera to Valparaíso – 11 ENC's
ENC´s Routes released	Strait of Magellan	The four previously mentioned
QC Process	Production and QC Proceedings Manual in Spanish ready for release in digital format.	Production manual still under development
Hardware	N° of Vectorización stations: 2 N° of Atributation stations : 3 N° of Updating stations : 1 N° of QC stations : 2 Two ECS´s purchased to ICAN (one laptop + one desktop). This last one is going to be installed on board "Aquiles", transport Navy ship, during the second week of november	Vector = 2 Attributes = 5 Updating = 1 Quality Control = 2 ECS platforms under operation as mentioned
Software	CARIS: GIS = 5 NT + 1 Unix OBMAN: 5 NT + Sevencs checkers (Analyzer; Optimizer)	Only NT DKart Inspector checker from HydroService under purchasing process

ENC Tested at sea	Valparaíso ENC sea trails at Exponaval	ENC´s charged on board AP "AQUILES" to be tested before commercialization and release.
ENC Updating service	Yes. By e-mail	WEB based updating service under design. Currently by e_mail and floppy disks
DGPS Service	Not yet. The fisrt two antennas in Magellan Strait will be in service during the first semester of year 2000	DGPS project postponed due to selective availability removal. One DGPS antenna operating at the Strait of Magellan.
Training	Two additional drawers were trained to increase the vectorization capability; and an additional person was trained for the attributation task.	• One additional person was trained during January and February 2000 in paper and electronic cartographic production • During May 2000 two people from Ecuador were trained in administration, production and organization for paper and electronic cartographic production process
Personal involved in the production process	Vectorization : 2 Attributing : 5 Cartographic QC : 1 (*) Files structure QC + Adm : 1 Updating : 1 (*) (*): They also atribute	Without changes

Over the past year, focus has been on ENC production along two main continuous routes. Commercialisation of ENC's to start in January 2000, with price at US$35 per ENC per "paper chart equivalent". Distribution will be by Chilean HO (SHOA) using CD-ROMs. Updates will be sent by e-mail. Sea trials to continue on an ECS installed, from November 1999, on-board the Chilean Navy transport ship "Aquiles". 18 of the 33 ENCs that have been produced in 1999 are commercially available.

Chile's ENC Coverage
(October 2000)

CHINA
(March 2000)

China has digitized charts on its coastal and neighbour waters, according to the general requests of the ocean hydrographic database. The current scale is 1:250,000 or smaller. Because the format is different from S-57, China is developing the transformation software in order to transform the existing ones into S-57 format.

Furthermore, China has produced 81 coastal port and approach ENCs, with scale from 1:5,000 to 1:10,000, from north to south along the Chinese coast. These ENCs are being used in tenders, hydrographic ships, patrols on the waters. The date for ENC publication is waiting for confirmation.

CROATIA
(December 1999)

Status of ENC production in Croatia

1. Background

Hydrographic Institute of the Republic of Croatia (CHI) has been involved in an intensive process of transition to digital era since the early 1980s, by developing and using automated hydrographic measurement systems and equipment in hydrographic and oceanographic activities.

By the end 1980s, and in the first half of 1990s, facilitated by new fundamental technologies which have influenced modern hydrographic, cartographic and navigation activities, CHI recognized a great importance of hydrographic digital information for many applications.

Most of efforts have been done in developing GIS applications, and their services in the standard hydrographic activities and classic paper chart production.

In the last few years CHI has initiated some national projects related to the development of Croatian Hydrographic Information System (CROHIS)
Because of the known war activities in the Mediterranean region, and due to the budget financing problems, there is a great delay in these activities, so that these projects are still in their initial stage.

2. Status of technology development

CHI has developed an ENC production line based on the existing GIS ESRI Arc/Info and Intergraph Microstation software module and Oraclo software for developing database system.

We are aiming for implementation of more specific software modules for ENC production.
(CARIS, …)
In the project CROHIS we have just started the developing of some databases which should be supporting facilities for the future ENC production. Currently, in the process of development are databases for bathymetric survey information, navigation marks, lights, and the base of textual information for Notices for Mariners.

3. Current status of ENC production

Because of the lack of appropriate software for ENC production line, and the fact that we need a long period to develop adequate vector ENC data, yet to meet current requirements for digital chart data, CHI has started the developing of raster charts.

In the last several years CHI made contracts with some private firms for digitizing and delivering raster charts which are under CHI responsibility, but we have realized that such cooperation does not comply with our future plans for ENC production according to IHO standards.

4. Plans and Views on the development of ENC

In 2000, CHI intends to establish a working group, with the main objective to develop organizational and project fundamentals for establishment of ENC production.

Parallel with the project activities, we are planning to continue with intensive digitizing process. We intend to make contracts with some private firms for digitization and conversion to S-57 ENC, to accelerate the production of ENCs of our coastal charts, approach charts, and major harbour charts. These contracts will have to satisfy our ENC programs and policies. There are totally 109 nautical charts covering the Croatian waters that are to be digitized. In the first phase, in 2000, it is planned to digitize the 1:800 000 general chart, and all coast charts on scale 1:100000 and larger, as well as all charts of major harbours.

5. Other ENC/ECDIS related development

Since 1993, many interagency projects have been realized, and some are still underway, in which hydrographic data have proved to be important for many applications. Among them are projects for oil and gas exploration, projects for finding suitable areas for optic fibre and energetic cables, projects for coast management, etc. In all of these projects mainly GIS tools have been used, and the result are many GIS layers, which will be very useful for the future ENC production.

CUBA
(March 2000)

The Cuban Hydrographic and Geodetic Service has finished since the end of 1999 the complete nautical charts collection (portfolio of 144 Official nautical charts plus 67 charts specially designed for pleasure navigation) concerning the waters of our responsibility in Raster Format (BSB). We decided start to produce our charts in that format attending to the increasingly number of recreational boats navigating around Cuba, and the current price availability of navigational systems.

We has 5 nautical charts classified as prototype in vector format S-57 based, and now, the Cuban Hydrographic and Geodetic Service is looking for an technological alternative and know how, to face the production of the main nautical charts (S-57 cells) capable to guaranty the safe navigation in our waters.

DENMARK
(October 2000)

Status of the Danish ENC Production

This report provides a status for the Danish ENC production.

Contact persons are:
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Telephone + 45 35 87 50 99, Fax + 45 35 87 50 57, e-mail lab@kms.dk

Danish waters:

The area is covered by 306 cells and these were all available by the end of July 2000, this includes the following harbours:
ESBJERG, KØBENHAVN, AALBORG, KALUNDBORG
The ENCs are updated weekly and distributed through PRIMAR.
The remainding 15 large ports (prioritized by traffic and amount of goods) will be available during the next 6 months.

The ENC cell scheme is based on a regular grid much like the cell structure in S-57, version 2. Within the Danish area you will find cell sizes from 1 degree, 30 minutes, 15 minutes to 7½ minutes respectively, each covering the areas where chart data in the corresponding scales are available.

The source material is 56 traditional charts (incl. 28 INT charts), produced in accordance with international standards. These charts are all in digital vector format.

Verification:
For verification the DKHO is using the programs CARIS Ecview, dKart Inspector from Morintech and 7C's ENC Analyzer. A program from Transas Marine is being installed this autumn. These programs, together with manual inspection of the cell contents, present adequate information for quality assurance.

Greenland and Faeroe Islands:

There are no immediate plans for the areas.
During this year, methods and associated costs for changing from analogue to digital production as well as the production of ENCs has been examined. However no fundings have been found yet.
It is being concidered to let an external company produce S57 data for Greenland.

The Plans for the Remaining ENC Production

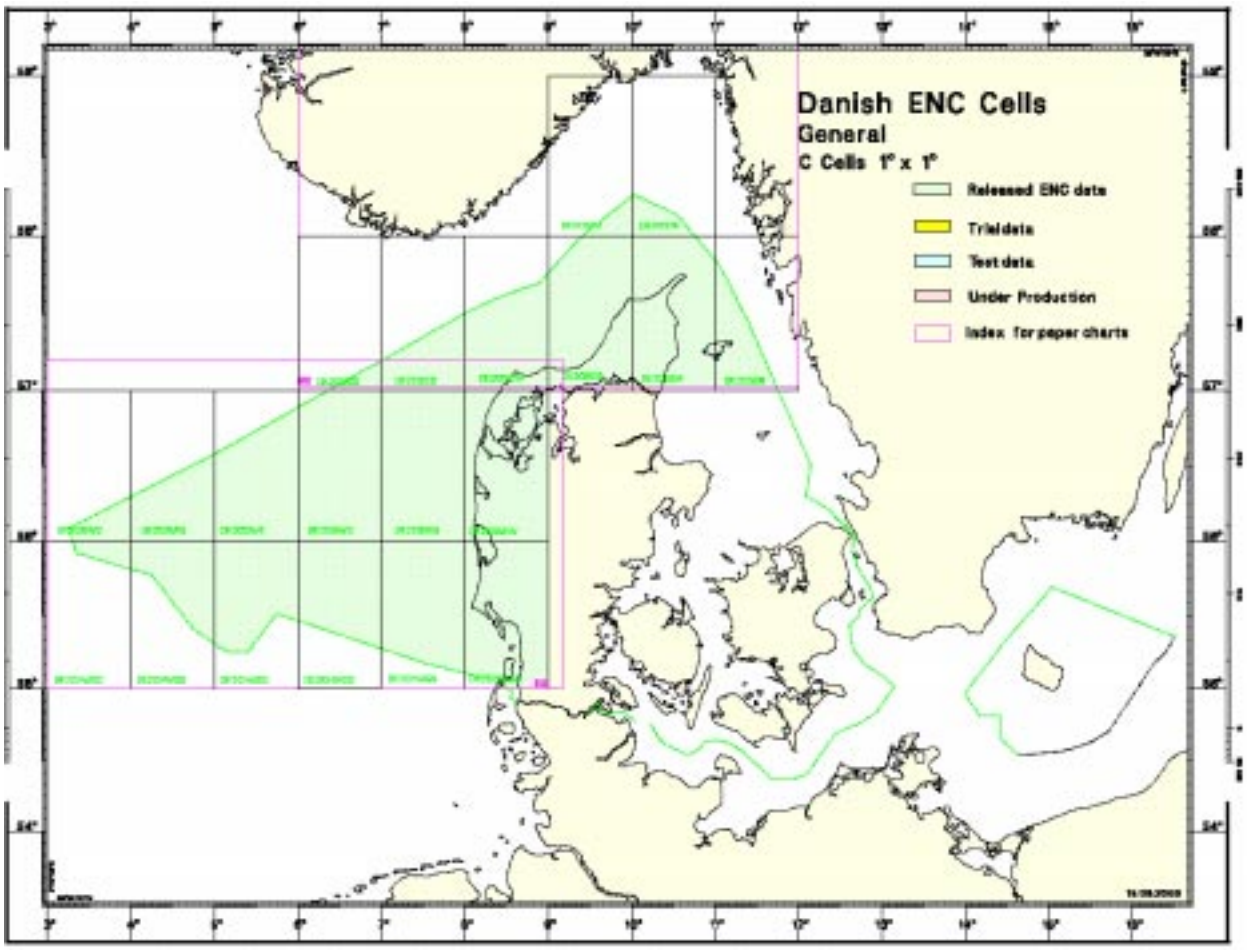
Danish waters:

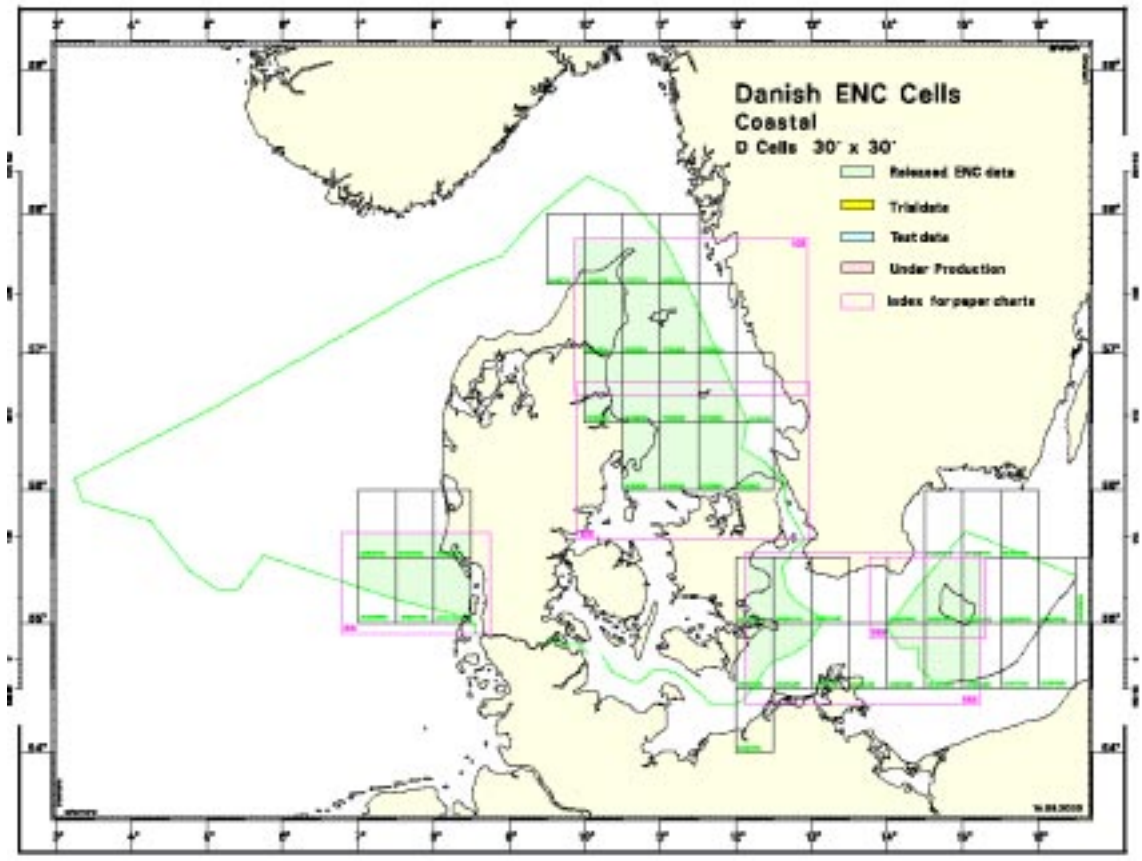
The next priority task is to include the CATZOC and SCAMIN attributes into the ENCs, followed by improvement in geometric accuracy by recompilation based on source material.
Finally the production of ENC data of the Danish harbour plans (368 minor ports and marinas) remains to be done. For the time being we are not able to assess the time consumption for this work.

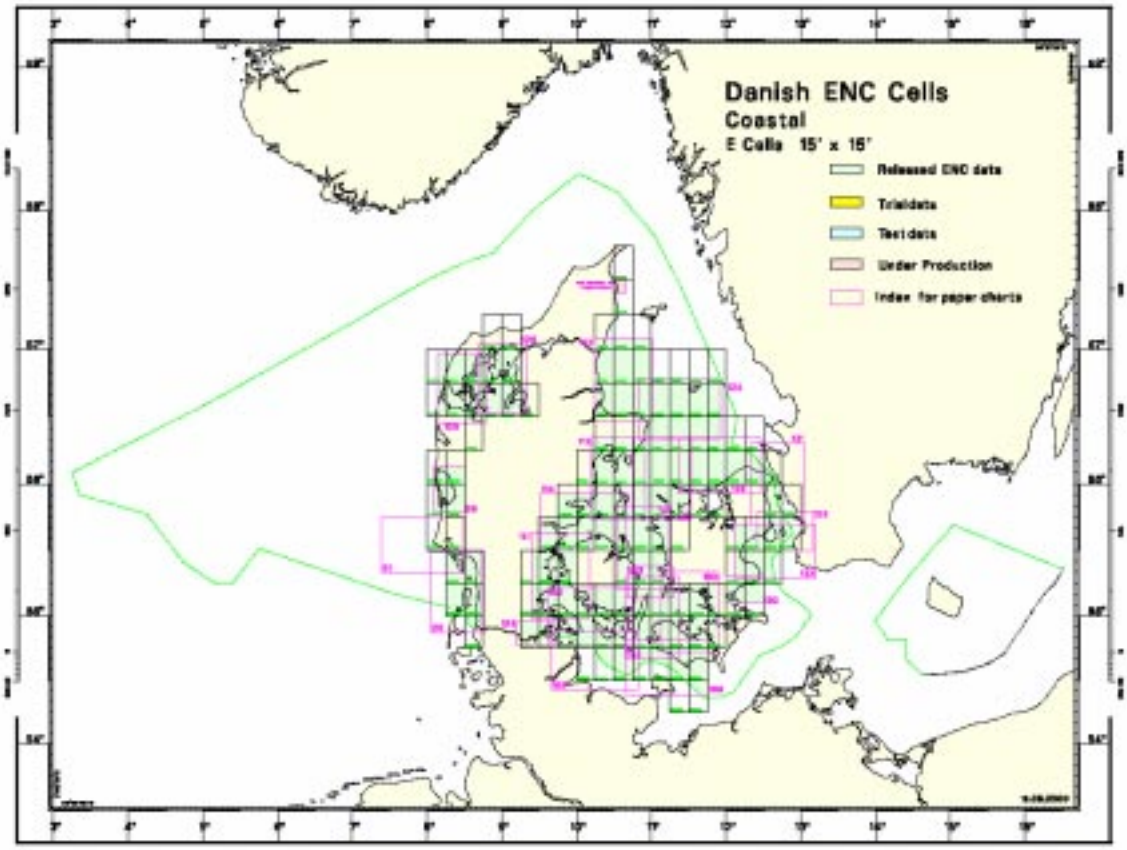
The production system

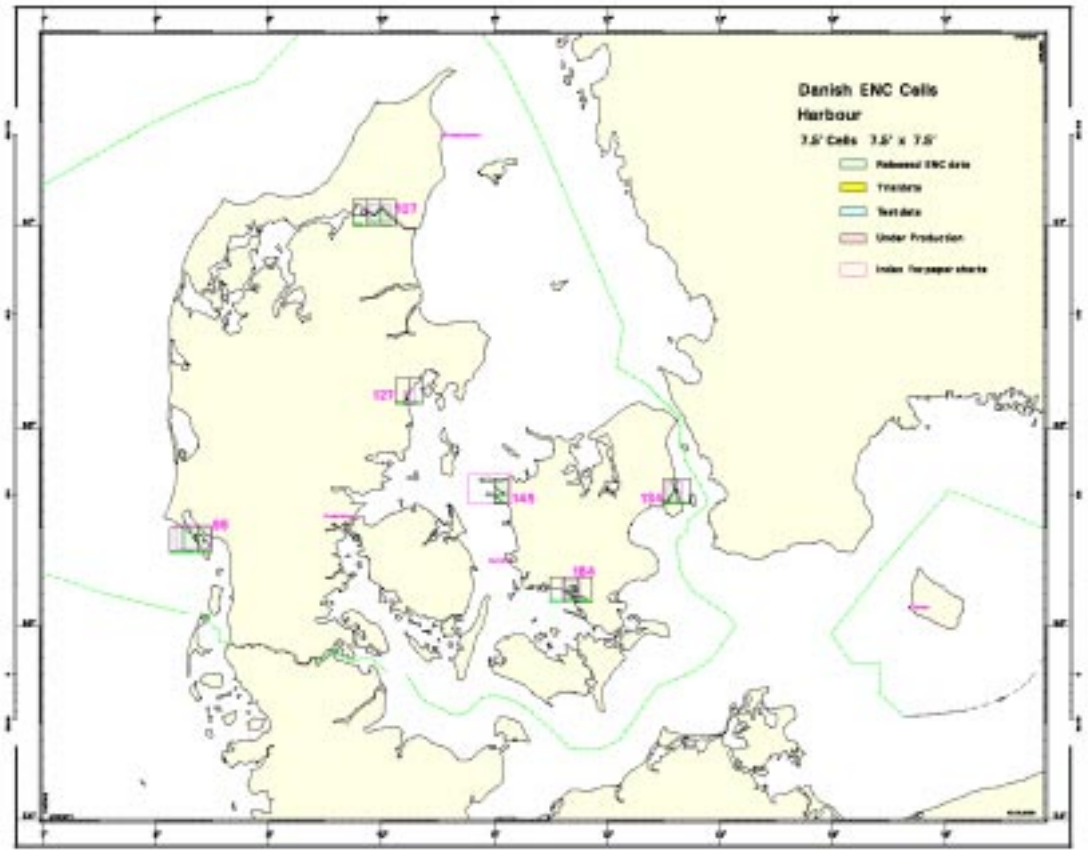
During 1999 the DKHO changed the production of ENCs from UNIX to Windows NT. The clients chosen were Dell 500 MHz Pentium II and the server was supplied by Intergraph. The shift to NT has shown considerable increase in performance.

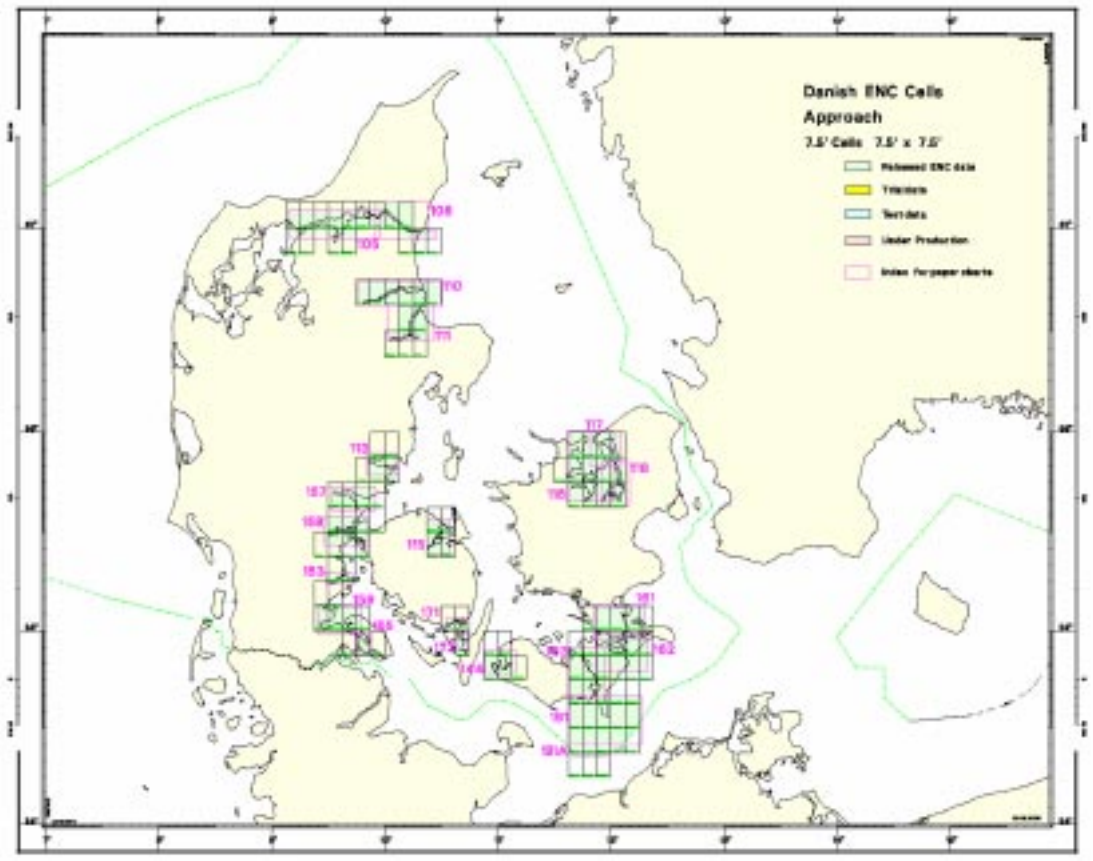
The full staff in the production line for charts (digital/analogue standard charts as well as pleasure craft charts) nautical publications and ENCs is 30, including support and development.
The Danish area of responsibility is Denmark, Greenland and the Faroe Islands.




Danish ENC Cells
Coastal
D Cells 30' x 30'
Released ENC data
Trial data
Test data
Under Production
Index for paper charts


Danish ENC Cells
Coastal
E Cells 15' x 15'
Released ENC data
Trial data
Test data
Under Production
Index for paper charts


Danish ENC Cells
Harbour
7.5' Cells 7.5' x 7.5'


Danish ENC Cells
Approach
7.5' Cells 7.5' x 7.5'

ESTONIA
(November 1999)

In a time being 9 charts in scale 1:100 000 prepared for the official release in S57ed3. The release is being planned in the beginning of the year 2000. 78 charts are converted into S57 version 2 format and will be converted gradually in the next two years. Meanwhile those data are available to the end users in internal format compliant with S57 and used for commercial distribution, test-beds and sea trials. For example, all Estonian hydrographic and coast guards ships and one coast guard helicopter are using those data on practice in ECDIS prototype systems on board. Updating service is being gradually implemented mostly within in-house production but also for customers in internal format too.

During 1999 effective data exchange for the purpose of new chart production was being established with Latvian HO in S57 format. At the same time Estonian National Maritime Board have published 8 new paper charts using corresponding S57 data sets by means of simple conversion from ENC to the printing originals.

In 1999 EMNB have been completing ENC data production and information system. this. For the next year the major objectives are digital Notice to Mariners and List of Lights publishing system.

FINLAND
(September 2000)

ENC Development

The Finnish Hydrographic Office has used its new Hydrographic Information System (HIS). HIS is based mainly on ESRI ArcView, ArcInfo and Oracle/SDE tools. The ENC Production line is based on this system and on S-57 Edition 3. Both EN and ER profiles can be produced, but only EN is currently operational.

Currently there is going on data loading from existing digital sources into HIS database. This includes data from the current paper chart production system (Fingis), navaids database (Oracle) and fairway database (Oracle/SDO). Main emphasis will be on the quality of the data. The quality, integrity and validity of the data will be checked and possible errors corrected before accepting it. The HIS system runs extensive validation checks before committing data into the database.

ENC cells can be produced out of the validated database. ENC cells are verified with Hydroservice dKart Inspector, Seven C's ENC Analyzer, ENC Inspector and ENC Designer, and Kongsberg Scanner nChart software. In addition, ASPO Navintra and Transas Marine Navi-Sailor Office type approved ECDIS software will be used.

ENC Production

Currently there are now 4 people involved directly to ENC production.

First nine official ENC cells on the Southern coast of Finland have been released during spring 2000 and eleven more on the Southwest archipelago will be released during autumn 2000. For more details see the attached table.

The distribution of the ENC cells will be carried out by PRIMAR. For the time being the updating of these cells will be done by PRIMAR. Possibilities to start of updating will be studied during autumn 2000.

Country: Finland
Date: 15.9.2000

Cellname	Cell Edition	Update Status	Production Status	Base cell Issue date	Priority	Chart Source Natl no.	Chart Source INT no.	Chart Edition	Scale	Chart Title & Area	Price Band L/M/S
FI4EIIQR	1	10	Completed	21.12.1999	1	18	1251	30.4.1999	50.000	Approach to Helsinki	M
FI4EIIQS	1	4	Completed	7.3.2000	1	18	1251	30.4.1999	50.000	Approach to Helsinki	M
FI4EIIQT	1	2	Completed	11.4.2000	1	17	1252	20.2.1999	50.000	Helsinki - Porvoo	M
FI4EIIQU	1	6	Completed	4.4.2000	1	17	1252	20.2.1999	50.000	Approach to Porvoo	M
FI4EIJUU	1	2	Completed	3.4.2000	1	17	1252	20.2.1999	50.000	Approach to Porvoo	M
FI4EIJUZ	1	5	Completed	20.5.2000	1	14	1254	20.2.1999	50.000	Approach to Kotka	M
FI4EIJV0	1	3	Completed	2.5.2000	1	14	1254	20.2.1999	50.000	Approach to Hamina	M
FI4EIJV1	1	2	Completed	22.5.2000	2	13		20.2.1999	50.000	Approach to Hamina	M
FI4EIKZ0	1	1	Completed	27.4.2000	1	14	1254	20.2.1999	50.000	Approach to Hamina	M

FRANCE
(October 2000)

ENC Production

1. The French hydrographic office (SHOM) is very concerned with the paper charts and ENCs dual production. Nearly 20% of SHOM cartographic staff is directly engaged in ENC production. However, it is not realistic to grow up the ENC production staff more due to the paper charts production service to maintain, the current heavy training load and the lack of feedbacks from mariners using ECDIS and ENC.

2. French ENC production plan is targeted, as soon as possible, to providing ENC coverage for SOLAS class vessels transiting “La Manche” and “Le Pas-De-Calais” and those entering major French harbours. Priorities are defined taking into account the traffic range and the navigation complexity of the areas. An harbour coverage is defined from coastal to harbour or berthing navigational purpose.

3. PRIMAR is distributing the 58 French official ENCs. Consequently, the coverage of La Manche by coastal ENCs is available within French waters while ENCs covering Le Pas-de-Calais are expected officially by end 2000. 42 ENCs are in production concerning main harbours and routes on French main land coast.

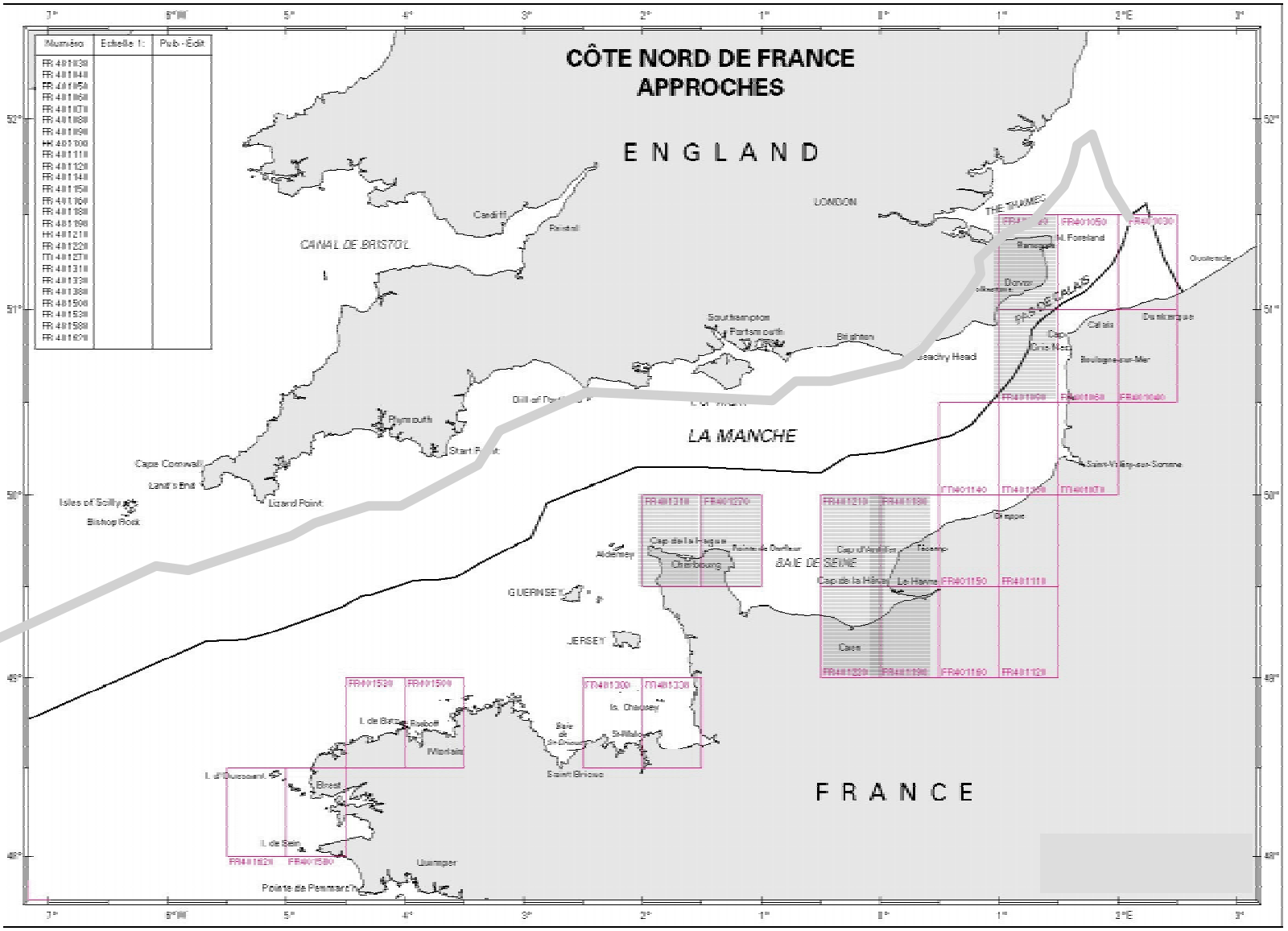
4. SHOM is not able to produce the ER files yet. Considering the NE RENC co-operating arrangement (COA), PRIMAR is producing them on behalf of France(more than 100 ER).

5. A release of the French paper charts and ENC production system which will be based on the present system and on the CARIS software is in progress and should be available and fully efficient by beginning 2001. Productivity improvement, training load decrease and ability to produce the ER files are expected.

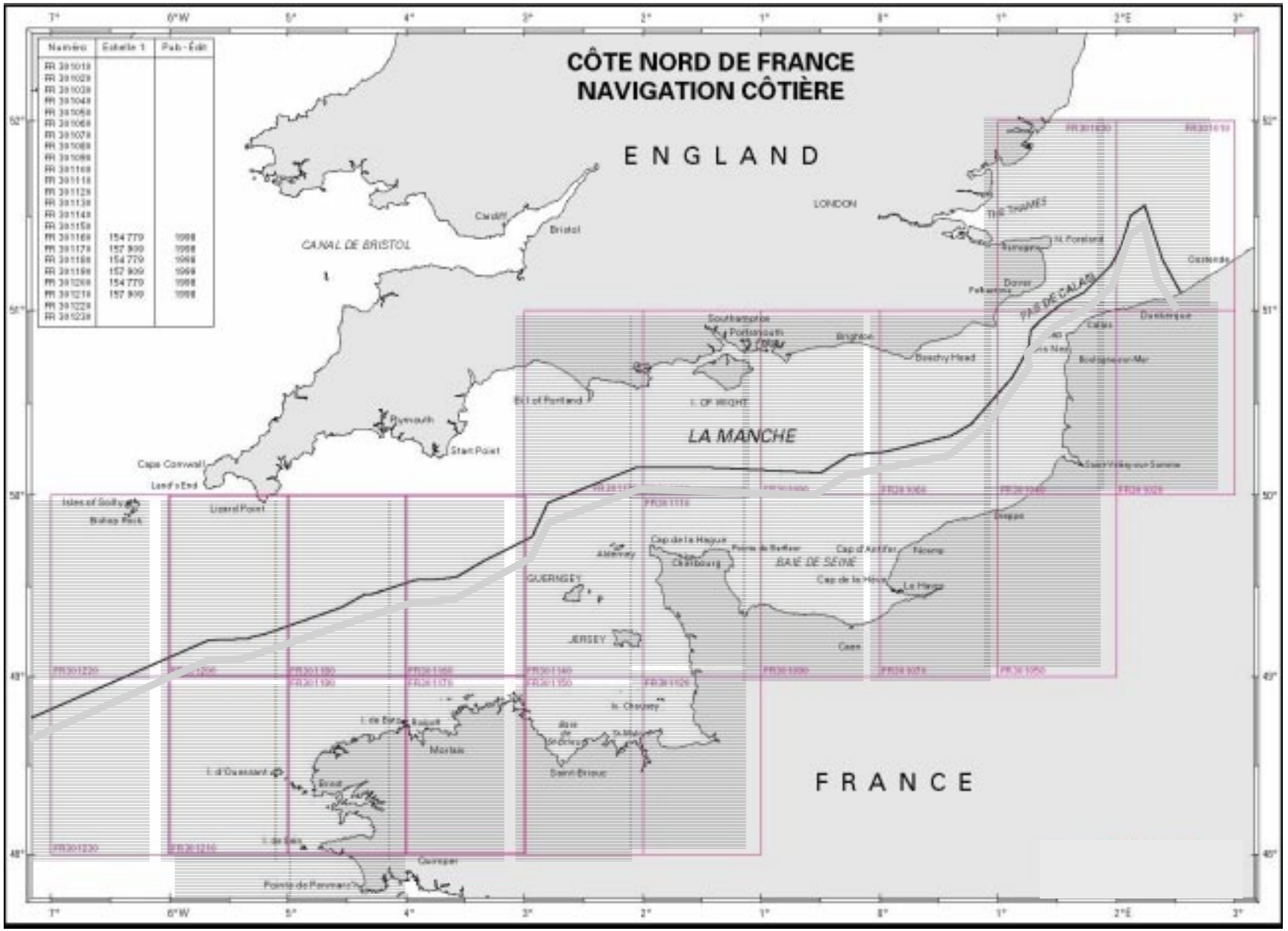
6. SHOM is concerned with the suitable contents of the ENC. Nevertheless, France is waiting at mariners’ and OEMs’ feedbacks before reconsidering the contents of the ENCs. The current SHOM strategy is to encode the ENC cells based on a mix schema (regular grid for coastal and approach cells ; paper chart set for harbour and berthing) from paper charts and hydrographic databases.

FRench ENC FR401xxx

CHRIS meeting October 2000

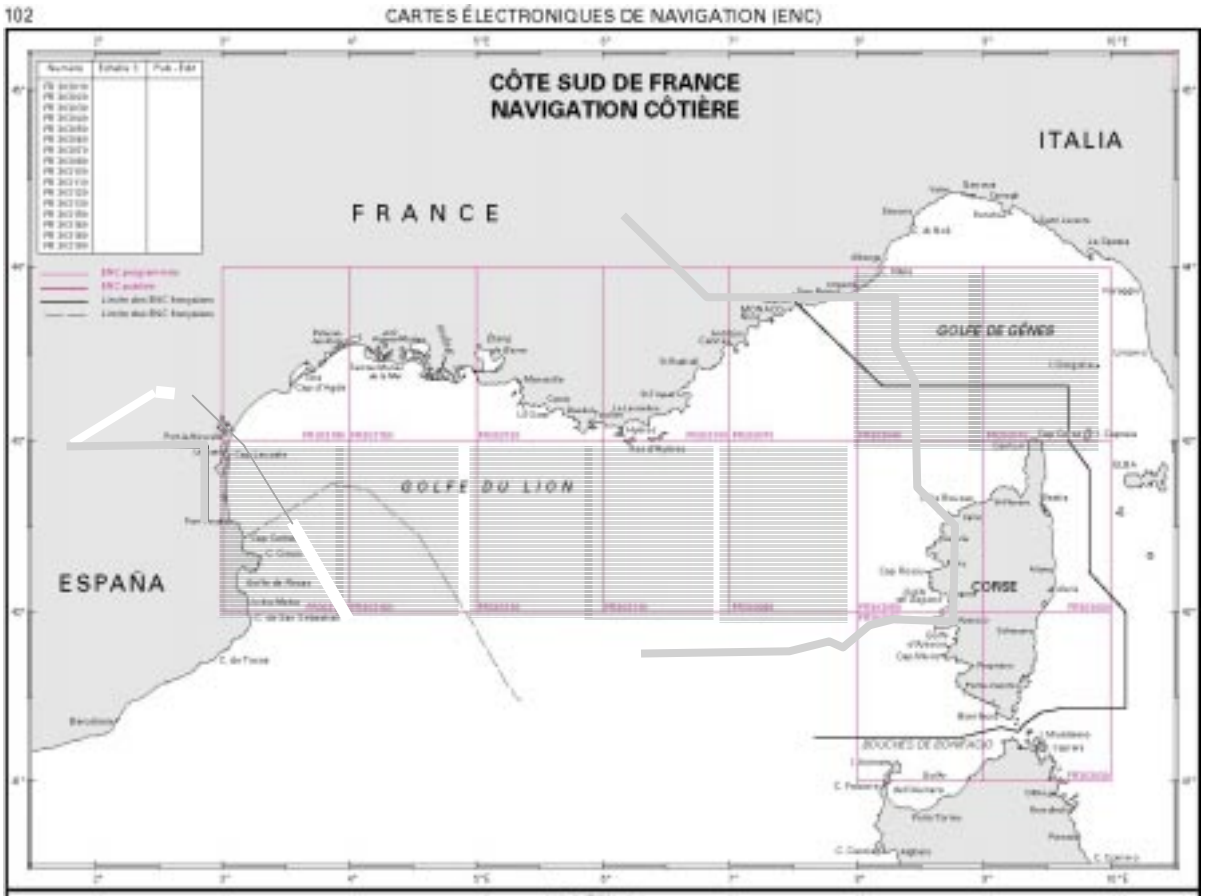


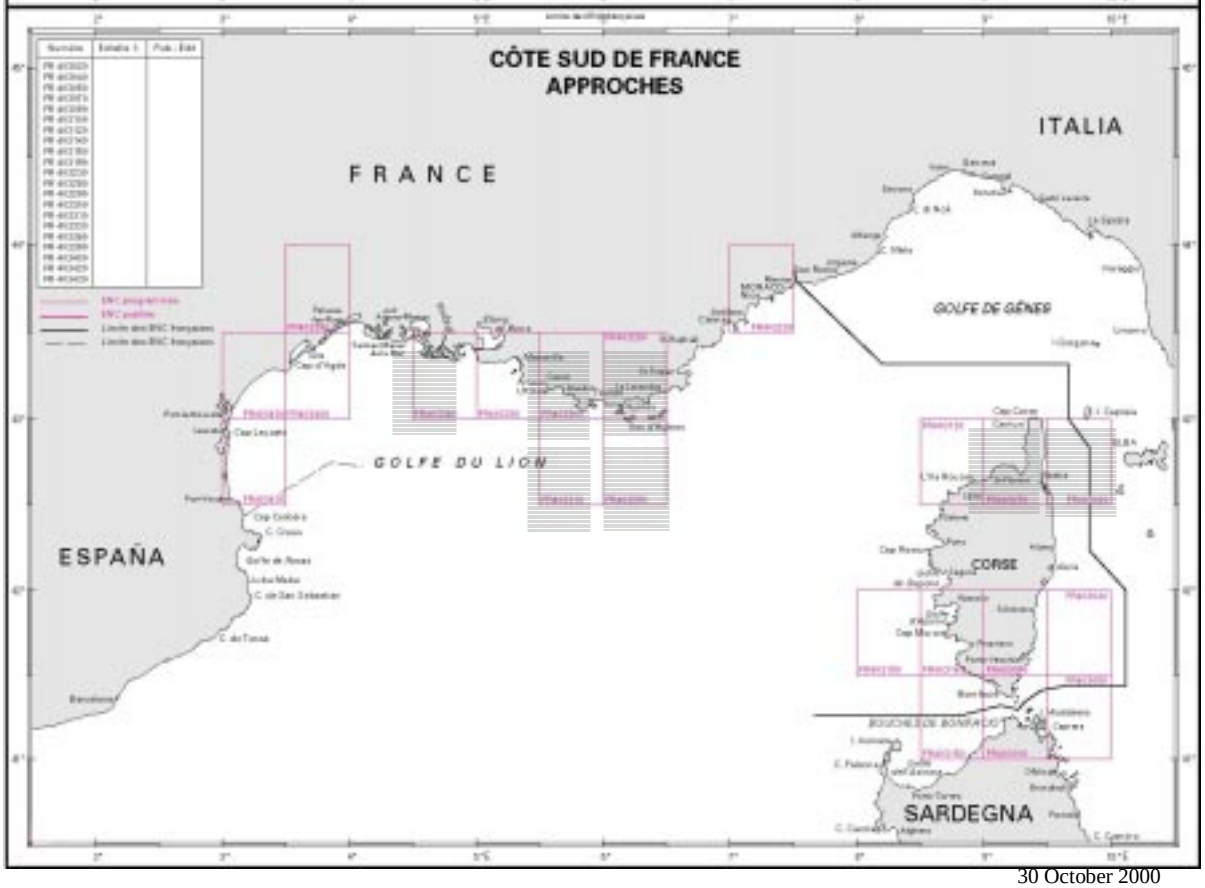
FRench Coastal - ENC FR301xxx -

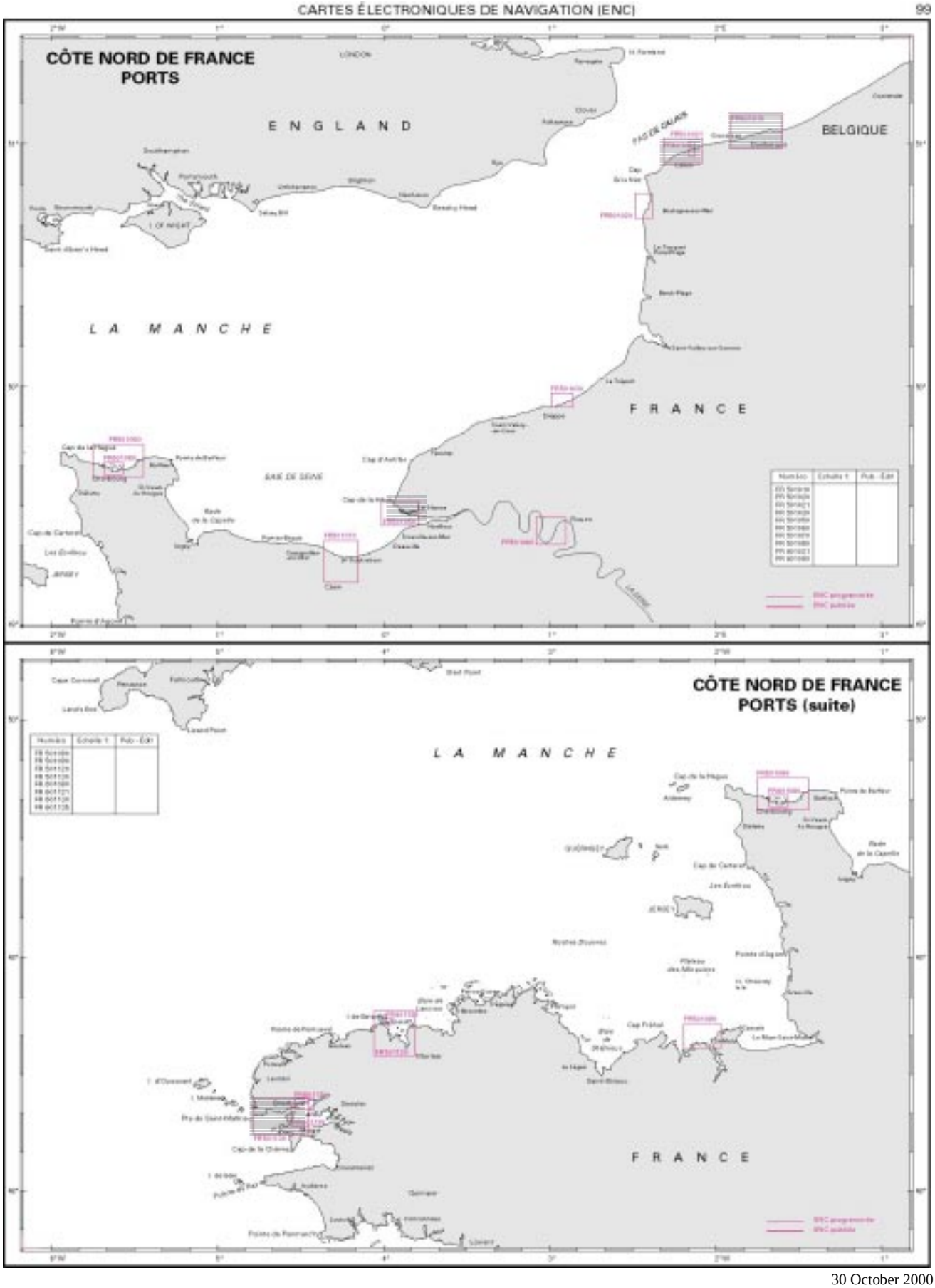


FRench ENC - Coastal - FR303xxx - FR403xxx CHRIS October 2000

CHRIS October 2000

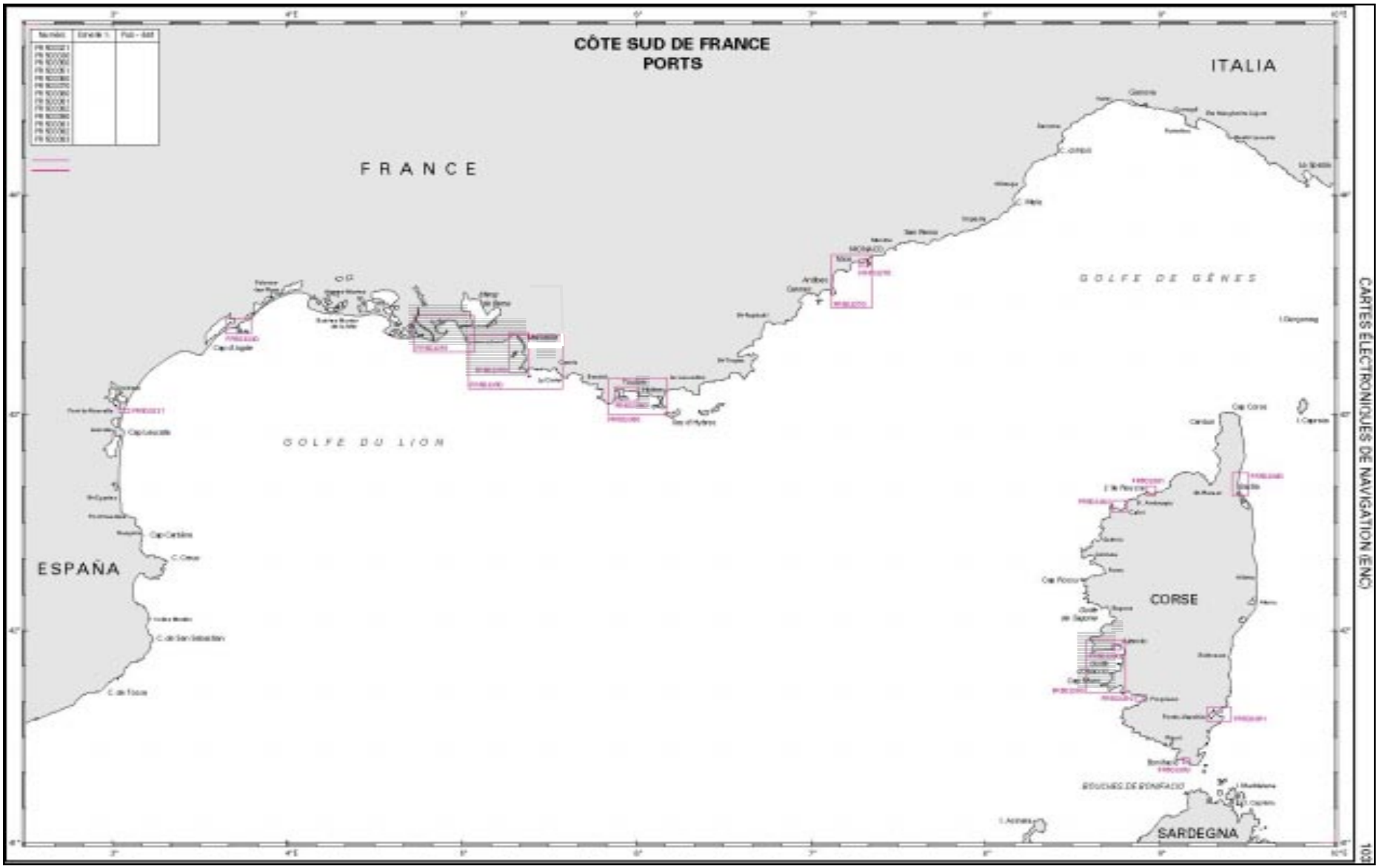





CARTES ÉLECTRONIQUES DE NAVIGATION (ENC)
99
CÔTE NORD DE FRANCE
PORTS
ENGLAND
BELGIQUE
PAS DE CALAIS
LA MANCHE
FRANCE
BAIE DE SEINE
CÔTE NORD DE FRANCE
PORTS (suite)
LA MANCHE
FRANCE

FRench ENC Harbour - FR503xxx-FR603xxx

CHRIS meeting October 2000



GERMANY
(October 2000)

1. Present Status and Planned Production till end of 2000

BSH is continuing producing ENCs as shown in the following table. Cell size corresponds closely to the corresponding paper chart which has been used as the basis, or – for large-scale harbour cells – to the corresponding harbour plan. All cells are regularly being updated up to the latest NtM. Updating of ENCs is completely synchronized with the NtM service.

All cells and updates to them are being distributed through PRIMAR.

2. Future Development

So far, ENC production at BSH has been concentrated on the Baltic Sea area where the ENCs have been derived from digitized paper charts. A fundamentally different approach will be adopted for the North Sea area of Germany (except for one small-scale overview). Because of the unstable sea bottom topography frequent resurveying is necessary resulting in a high volume of new survey data which have to be worked into the ENC databases. In addition, digital chart data are currently being requested for administrative purposes, such as coastal zone management. Already today some of these requests exceed what can be provided with digital data derived from digitized paper charts, both in terms of information content and positional accuracy. In conjunction with the development of the Nautical Hydrographic Information System (NAUTHIS) the need has been identified to compile the database for the German North Sea area completely from original digital source data, such as survey data, databases of aids to navigation, special surveys of pipelines and cables etc., providing for the best possible positional accuracy. The size of this task comes up to charting the German waters anew and digitally. The database can be used for both paper charting and ENC production.

Unfortunately, it will take some more time until this task can be finished. However, in 2001 the first large-scale data derived from digital source data will be available for the North Sea.

3. ENC Data Production

Country: Germany
Date: 00.09.13

Cellname	Usage Band	Update Status	Expected Delivery	Cell Scale	Cell description	Price Band L/M/S
DE516200	Harbour	12/00		6.250	*Kiel Harbours*	L
DE516210	Harbour	-	Dec. 00	3.000	*Marina Lippe*	S
DE516220	Harbour	-	Dec. 00	6.000	*Heiligenhafen*	M
DE516240	Harbour	-	Dec. 00	5.000	*Burgstaaken*	S
DE516270	Harbour	-	Dec. 00	3.000	*Marina Grömitz*	S
DE516280	Harbour	35/00		5.000	*Neustadt Harbour*	M
DE516290	Harbour	31/00		3.000	*Niendorf*	S
DE516300	Harbour	12/00		6.250	*Lübeck Harbours*	M

DE516400	Harbour	34/00		5.000	*Wismar Harbour*	M
DE516410	Harbour	-	Dec. 00	2.000	*Timmendorf*	S
DE516420	Harbour	-	Dec. 00	2.000	*Kirchdorf*	S
DE516500	Harbour	33/00		6.250	*Rostock Harbour*	L
DE516700	Harbour	35/00		5.000	*Sassnitz Harbours*	M
DE516800	Harbour	-	Dec. 00	3.750	*Greifswald Harbours*	S
DE516870	Harbour	-	Dec. 00	3.750	*Vierow*	S
DE416010	Approach	-	June 01	25.000	*Flensburger Förde*	L
DE416020	Approach	28/00		25.000	*Eckerförder Bucht*	L
DE416030	Approach	16/00		25.000	*Fehmarn Belt*	L
DE416040	Approach	35/00		25.000	*Lübecker Bucht*	L
DE416050	Approach	33/00		25.000	*Rostock Approach*	L
DE416075	Approach	16/00		12.500	*Sassnitz Approach*	L
DE416080	Approach	-	Dec. 00	25.000	*Stralsund East Approach*	L
DE316001	Coastal	16/00		50.000	*Waters north of Kiel*	L
DE316002	Coastal	35/00		50.000	*Mecklenburger Bucht*	L
DE316003	Coastal	32/00		50.000	*Waters west of Rügen*	L
Cellname	**Usage Band**	**Update Status**	**Expected Delivery**	**Cell Scale**	**Cell description**	**Price Band L/M/S**
DE316004	Coastal	33/00		50.000	*Waters east of Rügen*	L
DE221000	General	-	Dec. 00	187.500	*German Bight*	L

GREECE
(September 2000)

At it has been stated in previous reports, the Hellenic Navy Hydrographic Service (HNHS) has decided to produce ENCs for the area under its responsibility with the co-operation of a private company.

Following an invitation to tender and after the submission of proposals from private companies, a Technical Experts committee has conducted an extensive evaluation. Within the framework of this tender, every participating company has created two (2) ENCs as a pilot project for evaluation purposes.

At this stage, and after the completion of the financial evaluation, the project is under staffing by the Navy General Staff. Unfortunately, due to some bureaucratic procedures that have to be followed there is some delay in the commencing of the production.

It is worthwhile mentioning that, since the last CHRIS meeting, HNHS has taken the following actions:

(1) Re-surveying of selected areas in order to improve the quality of the available Hydrographic data
(In progress)

(2) Invitation for bids for the procurement of a multibeam swath system. The technical and financial evaluations have been completed.

INDIA
(March 2000)

Report on ENC Development in National Hydrographic Office

Introduction

The national Hydrographic office is pursuing its program of the production of ENCs in S-57 Edition 3.0 format incorporating the latest hydrographic data available. The paper chart production is expected to get a boost on installation of the Image Setter by the middle of the year. So far digitization for 100 ENCs covering our area of responsibility have been completed and QA/QC of 75 ENCs have been undertaken. Presently the office has not got any plan of producing raster charts since our present plan is to provide complete coverage of our waters with ENCs.

Progress of ENC Production

Production of ENCs of navigational purposes 3 (coastal), 4 (approach) and 5 (harbour) are in full swing. 100 ENCs of above purposes covering West Coast, East Coast, Lakshadweep Islands and Andaman and Nicobar Islands are at different stages of production. Most of the ENCs produced contain latest data and the new editions of the respective paper charts would be published soon. All the charts covered under INT Chart Scheming for area "J" are based on the revised INT limits.

Validation of ENCs

The Office has completed validation of about 75 ENCs. Manual and automatic modes are being used for validation. See my ENC, ECVIEW and Dkart inspector Software are also being used simultaneously for the validation of ENCs. In order to have an independent compatibility, 5 ENCs have been forwarded to PRIMAR which has kindly agreed for the validation and submission of reports free of cost. The validation report received has comments which are under implementation. The overall assessment is that the data is good, but needs some cleaning. It is observed that all the above Software do not display all the symbols mentioned in the latest edition of S-52. In order to resolve the above issue, it is felt that a comprehensive validation Software be produced under the authority of IHO to enable the National HOs to ensure reliable and systematic validation of ENCs.

Sea Trials

Sea trial reports received in respect of few ENCs are found to be quite encouraging. The difficulty in getting IMO compliant ECDIS systems has resulted in the delay of sea trials of our ENCs. A considerable number of ENCs are scheduled for sea trial during this year.

Marketing of ENCs

The official ENC services is likely to commence only on completion of further trials. Presently the office is investigating the modus operandi for marketing our ENCs. As regard encryption of ENC data sets, we are studying the encryption technology being followed by PRIMAR and others. We plan to market our ENCs at the appropriate time. Issues pertaining to costing of ENCs, payment of royalties and bilateral agreements are being studied.

ECDIS equipment

There are a very few manufacturers who produce ECDIS equipment meeting IMO/IEC specifications with due type approval from the competent authorities. Unless trade enlarges this aspect, the usage and economic viability of ENC program will be restricted.

RENC & WEND

The fact that a large number of ENCs are getting ready for marketing and the formation of North Indian Ocean Regional Hydrographic Commission might take some time, we are looking at the options of RENC vis-à-vis joining other RENCs for the exchange and marketing of ENCs and their updates. India is willing to consider its ENCs for use in the SHARED program. In all these a more transparent and remunerative returns based on principles of equity and justice is necessary, vis-à-vis the quality of data, for which some well set out mechanism may be required to be formulated at IHO/WEND.

ITALY
(October 2000)

ENC Development

1. Introduction

Since the end of 1999 Electronic chart division activity has been mainly addressed to the maintenance of ENCs and to the improving of the software tools used (dKart Editor) for compiling, updating, testing S-57 data sets and for exchanging data with other HO Division.

2. Present status

During the updating production activity to supply Italian navy vessels engaged with test-bed for ENC, software tools and tests generating and checking ER files have been refined.
409 ER files (3.11Mb data volume) has been generated on the basis of the Notice to Mariners book –let that has been published since June 1999.

It has been identified two compilation strategy to produce ENCs:

- Recent HO paper chart production, compilation from digital data by importing in S57 environment the digital sources of paper charts;
- Old HO paper chart production, digitisation of the paper charts.

Furthermore, the beginning of the constitution of a Bathymetric Information System will allow the compilation/substitution of coast line, sounding and depth contour S57 objects with more accurate data derived from survey fair-sheet digitazation or more recent digital source survey.
Enc data content validation, made out by qualified divisions, assures information correctness and completeness, and contemporarily allows the creation of the S57 objects checked database. This approach has the aim of producing a validated S57 objects database regularly maintained up to date (S57 Cartographic Information System project) in order to provide a unique source for "*on demand*" HO production of:

- ENCs/EN profile
- Paper charts
- Notice to Mariners and ENC updating/ER profile
- Nautical publications, List of Lights, etc.

3. Test-beds

Test-bed of the Navy for ENCs feed-back and for defining the Navy ECDIS minimum requirements for next equipment is still in progress and it will go on until the end of 2000.

ENCs Feed-backs received up to now are good.

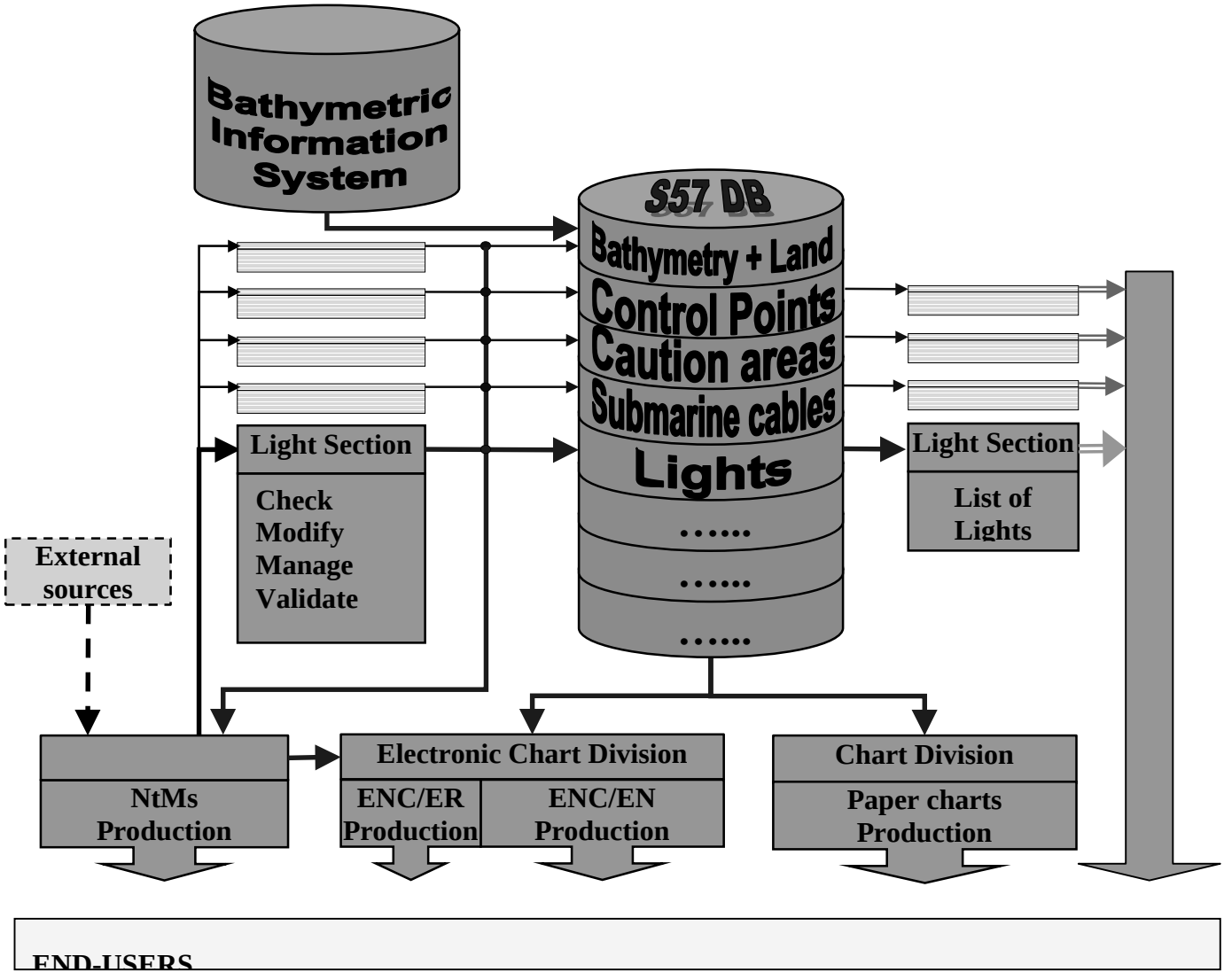
4. Work in progress

The availability in the ENC editing software of tools for importing/exporting files of various formats (DGN, DXF, and ASCII), make now possible the production of new cells, derived from digital data of surveys and paper charts.
We have first planned the compilation of harbour and approach purpose data sets, from which less detailed navigational purposes cells will be derived.
To speed up the ENC quality control and validation process, next year will be purchased new validation software.
The inclusion, within the existing coastal purpose cells, of almost all chart series of 1:100 000, derived from paper charts digitisation, is still planned and expected for next months.

The 56 ENC cells are related as follows:

Source paper chart	S 57 cell – Navig. Purpose	Coverage
1:1.000.000	General	all national waters
1:250.000	Coastal	all national waters
Litoral chart (various scale 30÷50.000)	Approach	major ports
Port chart (various scale 5.000÷10.000)	Harbour and berth	major ports

S57 Cartographic Information System and data flow



ISTITUTO IDROGRAFICO DELLA MARINA

ITALY's ENC Coverage

Navigational purpose : General

30 October 2000

ISTITUTO IDROGRAFICO DELLA MARINA

ITALY's ENC Coverage

Navigational purpose: Coastal - Approach - Harbour & Berthing

JAPAN
(September 2000)

ENC production

JHD publishes about 600 paper charts to cover Japanese waters. The paper charts are classified as shown in Table 1. Small scale ENC data are created from paper charts at the scale less than 1:80,000. ENC data for harbor and approach are created from harbor plans and approach charts. All small scale ENC data in S-57 Version 2 were revised into Ed3 by end of September of 2000. As a result, ENC data covered route for international shipping. By the end of FY 2002 or end of March 2003, JHD intend to complete ENC data for harbors for national trade. Local harbors and fishery ports will be remained to create ENC data at that time. ENC cell size is based on a regular grid of the cell structure in S-57, version 2. ENC distribution is to be made through the Japan Hydrographic Association.

Table 1

Paper Charts in Domestic Waters		
Harbor Plan		419
Coast Chart	122	
General Chart of the Coast	28	168
Sailing Chart	18	
Total		587

Table 2

ENC published by JHD			
ENC No.	Date	S-57	Referred paper charts
Small scale ENC			
E3001	Sep. 98	Ed. 3	38
E3002	Nov. 99	Ed. 3	45
E3003	Nov. 99	Ed. 3	46
E3004	Sep. 00	Ed. 3	58
Total number of paper charts at small scale in Ed. 3			187
Harbor and approach			
E3011	March 98	Ed. 3	16
E3012	Jan. 99	Ed. 3	13
E3013	March 99	Ed. 3	22
E3014	Aug. 99	Ed. 3	17
E3015	June 00	Ed. 3	23
E3017	Feb. 00	Ed. 3	17
Total number of paper charts at large scale in Ed. 3			108

Data Maintenance

"Notices to Mariners (in print)" includes small corrections for paper chart and ENC, and is issued every Friday. "Electronic Notices to Mariners (ENtMs)" is issued on the last Friday in every month. ENtMs include ER data to maintain ENC. ER data are created from small corrections and new editions of paper charts. Digital surveying data called "electronic smooth sheets" are used for compilation.

JHD issues EntMs since September 1998. Numbers of cells modified by ER data from January to September 2000 are shown in table 3. Cells for "approach" are modified most frequently every month.

Table 3. Cells modified by ER data in each month (January – September 2000)

Navigational Purpose	Overall number of Cell	Number of cells modified by ER data								
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.
Overview (1)	18	1	7	0	0	0	0	0	0	0
General (2)	38	5	19	8	3	4	1	5	9	1
Coast (3)	178	25	53	31	20	14	18	17	21	14
Approach (4)	39	4	11	22	7	9	7	10	13	10
Harbor (5)	69	9	17	48	9	15	14	15	11	17
Data Volumes (K byte)		642	1,285	2,317	663	329	1,708	678	1,086	978

KOREA (REP. OF)
(March 2000)

Plan and Views on Development of ENC

Since 1995, NORI conducted electronic chart and relative technical development in cooperation with institutes and private sectors. This project will be completed in 1999:

- Converting 205 charts to ENC and digital chart file;
- Digitizing 540 smooth sheets of hydrographic surveys;
- Technical development for user service of electronic and digital charts.

Annual Plan

Period	**Main Contents**	**Remarks**
1995-1996	Development of standard specification	Completed
	Test production of ENC and its development.	
1996-1997	ENC production of 60 charts.	Completed
	Digitization of 150 survey sheets.	
1997-1998	ENC production of 105 charts.	Completed
	Digitization of 70 survey sheets.	
1998-1999	ENC production of 40 charts.	Completed
	Digitization of 260 survey sheets.	
	Development of ENC distribution system.	
1999-2000	Digitization of 60 survey sheets.	Started in
	Technical development connecting with marine	December 1999

Period	Main Contents	Remarks
	information system. Updating of all the developed ENCs.	

Distribution Service Plan

- QC progress is undergoing till June and the sample data could be supplied by NORI upon request before 1 July 2000.
- The distribution system and regulations are under consideration together with the ENC price policy.
- It is expected that the official service will possibly start the 1 July 2000.

MALAYSIA
(March 2000)

1. **Electronic Charting in Malaysia**. Besides the joint production of electronic navigational chart (ENC) with the littoral states on the Malacca and Singapore Straits, the Hydrographic Department of the Royal Malaysian Navy (RMNHD) has embarked on the capacity building for in-house ENC production. The production of ENC for the Malaysian waters is carried out in accordance to areas of priority. Production works have started in 1998 with initial efforts being concentrated on coastal ENCs for the Straits of Malacca and followed by larger scale harbour ENCs between the Straits.

2. **ENC Production by RMNHD.** The RMNHD approached the ENC production with the view that the digital NTX chart files established over the years would be the foundation for the conversion to electronic charts. From these NTX chart files, pre-processing work, which includes the restructuring of thematic layers and topology of the data, was carried out with the *Computer Assisted Resource Information System* (CARIS). *"Object Manager" Module* (OBMAN) is then used to convert the restructured data to S-57 Edition 3 ENC.

3. **Production Progress.** Following the successful sea trial and the experience gathered, the construction of ENCs for other areas has commenced. Production works for 2 coastal ENC cells extend northwards of the One Fathom Bank (Joint ENC Project), which will provide a continuous coastal passage through the Malacca and Singapore Straits have been completed (Figure 1). This will be followed by other larger scales ENCs covering major ports in the Malacca Straits. A total of 3 cells for the larger scale ENCs will be included to complement different navigational purposes along the Straits.

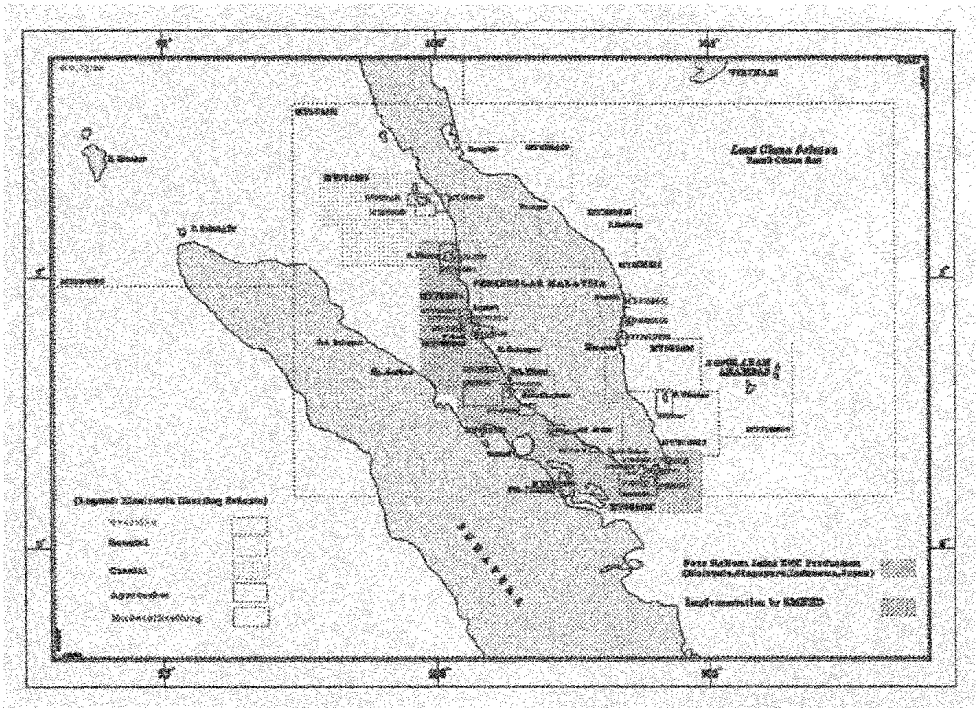


Figure 1

4. **Future Developments.** Besides the capacity building on the production of ENC, other aspect of development for the onwards implementation of ENC is essential. If data production was a problem in the past, nowadays it seems to be the distribution, updating and data encryption of the ENCs are the issues of concern which can hinder the onwards processes. Therefore, infrastructures on the update and distribution are necessary to be implemented. Capability such as sending of on-line updates information by RMNHD to the users is needed and has been planned to be implemented in 2000. Another aspect on data security such as encryption of ENC to protect the incentive of the data producer shall be looked into. Formulation of a standard on the encryption of ENC data by the International Hydrographic Organization (IHO) will greatly assist HOs and the users in the adoption of a common encryption system.

NETHERLANDS
(November 1999)

1. As reported at previous CHRIS meetings, the Netherlands HO is undergoing a major restructuring of its production facilities. This project is called SHIP (System for Hydrographic Information Processes). The first phase of this project was finalised in 1998 and comprised the complete automation of the paper chart production using the CARIS suite of products as the main tool. The production of the paper charts is supported by databases developed in house. Three different databases are in use. One for navigational marks, lights, obstructions and mining information, one for bathymetry and one for topographic information. Apart from technical improvements, the organisation was changed from being product based to a more process-structured organisation. This

has been done to prepare for the introduction of ENC production. It has always been the intention of the Netherlands HO to produce all of its products from the same source databases in a product independent way. The first phase of SHIP is a temporary solution necessary to free resources in the office and to await technical developments that would make integrated production based on source data possible.

2. To avoid white spots in the ENC coverage of the NE-RENC area, the Netherlands HO decided to have its ENCs produced by the RENC. Two charts of the Europoort area were given to the UK HO for conversion into ENCs.

3. The second phase of the SHIP project is intended to introduce the integrated production system from which all products, including ENCs, can be produced. Due to budget problems and the fact that the new system also includes facilities for the production of military information for which requirements had to be developed, the start of the second phase was delayed considerably. It is the intention to produce a set of documents, which can be used in a tender procedure. The documents will define, in detail, the functional and technical requirements for the new system. It is expected that these documents are ready and approved for release to the market late summer 2000.

4. Because of the Y2K problem parts of the system build for the first phase of SHIP had to be replaced this year. All production now takes place based on CARIS for Windows NT. All production personnel went through an extensive training program in order to familiarise them with the new system.
5. Due to capacity problems within RENC, the Netherlands HO has decided to begin in-house production. Production and validation of the ENC has proven to be very difficult and did not lead to the expected results. The ENC's already produced by RENC are withdrawn and will be reproduced by the Netherlands HO. For the time being, the ENC's produced by the UK remain within the UK HO's ENC portfolio.

6. For in-house ENC production, the CARIS Object Manager is used. It is expected that 4 ENC's will be produced and delivered to PRIMAR in 2000. In 2001 6 more ENCs will follow.

Other ENC/ECDIS related developments

Together with the Belgium HO (Antwerp and Ostend) and the department of transport of the Netherlands, the NL HO is participating in a project to asses the possibilities for providing carry-on-board ECDIS systems to pilots operating on the Schelde river and Antwerp harbour. The ECDIS will use ENCs with high-density bathymetry (1-meter contour interval). The ENCs will be based on the existing Product Specification making it possible to use today's ECDIS without additional software development.

The Schelde River is a fast changing area that is difficult to navigate due the many shallows and narrow channels. Surveys and dredging take place almost daily.

NEW ZEALAND
(March 2000)

ENC Development

New Zealand has captured three ENC cells. These are not updated. By 30th June 2000 nine more cells will have been captured. These cells will form the pilot project to determine the requirement for ENC's in New Zealand waters.

ENC Production

Chart Number	Chart Title	Scale	Date of Capture
NZ 6212	Port Underwood	1:35 000	30/6/99
NZ 6212	Kaikoura Peninsula	1:30 000	30/6/99
NZ 6212	Ingles Bay	1:10 000	30/6/99
NZ 4633	Wellington Harbour	1:25 000	30/6/00
NZ 4634	Entrance to Wellington Harbour	1:12 500	30/6/00
NZ 4634	Evans Bay	1:7 000	30/6/00
NZ 4634	Lambton Harbour	1:7 000	30/6/00
NZ 4634	Point Howard and Seaview Wharves	1:7 000	30/6/00
NZ 6153	Queen Charlotte Sound	1:36 000	30/6/00
NZ 6154	Tory Channel Entrance	1:11 000	30/6/00
NZ 6154	Picton Harbour	1:10 000	30/6/00
NZ 6154	Picton Wharves	1:3 000	30/6/00

Update (March 2000)

New Zealand commenced the rasterization of its charts in January of 2000. The entire folio of 165 will be completed by July 2000. Preparatory work on three ENCs has also commenced. During the next 18 months, work on a limited number of ENCs covering harbours, entrances and shipping lanes will begin.

Australia and New Zealand are well advanced on the concept of a "virtual RENC" to jointly distribute RNCs.

During the last 12 months New Zealand has transformed all source data from the Royal New Zealand Navy to Land Information NZ (LINZ). Consistent meta data for all records has been developed. A data model which defines the relationship between source data and hydrographic processes has also been completed. This is a necessary step towards the establishment of a future hydrographic data base and hydrographic chart data base.

NORWAY
(October 2000)

Status of ENC production in Norway

1. Main objective

The main objective for ENC production in Norway is to have complete ENC coverage of coastal waters within 2006. Due to the fact that a great number of the charts covering our coastal waters still are based on surveys using old technology, this task includes about surveying 19,000 km², and the production of ENC's corresponding to about 90 new paper charts in the scale 1:50,000.

A production of this magnitude will require considerably more capacity than the NHS has available today, and for this reason, a close co-operation with private industry will be necessary for the production of ENC's, as well as for paper charts. The NHS now has contracts with two different contractors, where the first ENC's will be delivered by end of October this year.

2. The Status for Technology Development

The ENC production line has been gradually improved, and very few problems with equipment and software are now reported. A contract has, however, been signed with the Intergraph Mapping and Information Systems (IMIS) in order to replace the current production line for S57 data, which is based upon Intergraph's DIXI translator and Sysdeco Dikas' S57 translator, with software only from Intergraph. Also, the production line for ER profiles will be improved and modified. Phase 1 of this project, which will include a fully operational capability for importing S57 data into the NHS's production system, will be completed by the end of October this year; while Phase 2, which will include a new production workflow for S57 data, including EN and ER applications profiles, will be completed by the end of February next year.

3 . The Status for ENC Production

The area, covered by about 40 paper charts in the scale of 1:50,000, based on a cell scheme on a regular grid like the cell structure in S57v2.0, and corresponding to about 100 ENC's in the Approach User Band (equal to D-cells in S57v2.0), will be available by the end of this year. In addition the conversion of 27, out of a total number of 42, harbour charts will be released this year. Updating via ER profiles is sequentially carried out in correspondence to the "Notice to mariners".

The status for ENC production in Norway is shown in Annex A and B.

4. Future plans

During 2001 the majority of charts based on modern surveys covering Norwegian coastal waters, will be converted to ENC's. (Mainly charts in the scale 1:50,000). The remaining area, corresponding to about 90 charts, must be resurveyed, or partly resurveyed, before the production of ENC's can take place.
To put it in another way, this means that the NHS now is about entering into a new phase of production based on an integrated paper chart and ENC production from source data.
In order to reduce the workload and to avoid double work in an integrated production line as mentioned, the compilation process for the two products will be co-ordinated, after which the data will be further processed to respectively ENC's and paper charts. A test production for an integrated paper chart/ENC production has now been started.

An integrated production line, as described here, has, however, raised the discussion: What should come first, the paper chart, or the ENC, and do the two products have to be issued at the same time? The background for raising this discussion is the fact that the NHS is using a grid scheme for its ENC production which is independent of the limitations of the paper chart. An ENC can thus be published before a new paper chart covering the same area is published. The aim is to start an integrated ENC/paper chart production in 2001.

5. The Norwegian Maritime Geodata Demonstrator (NMGD) Project

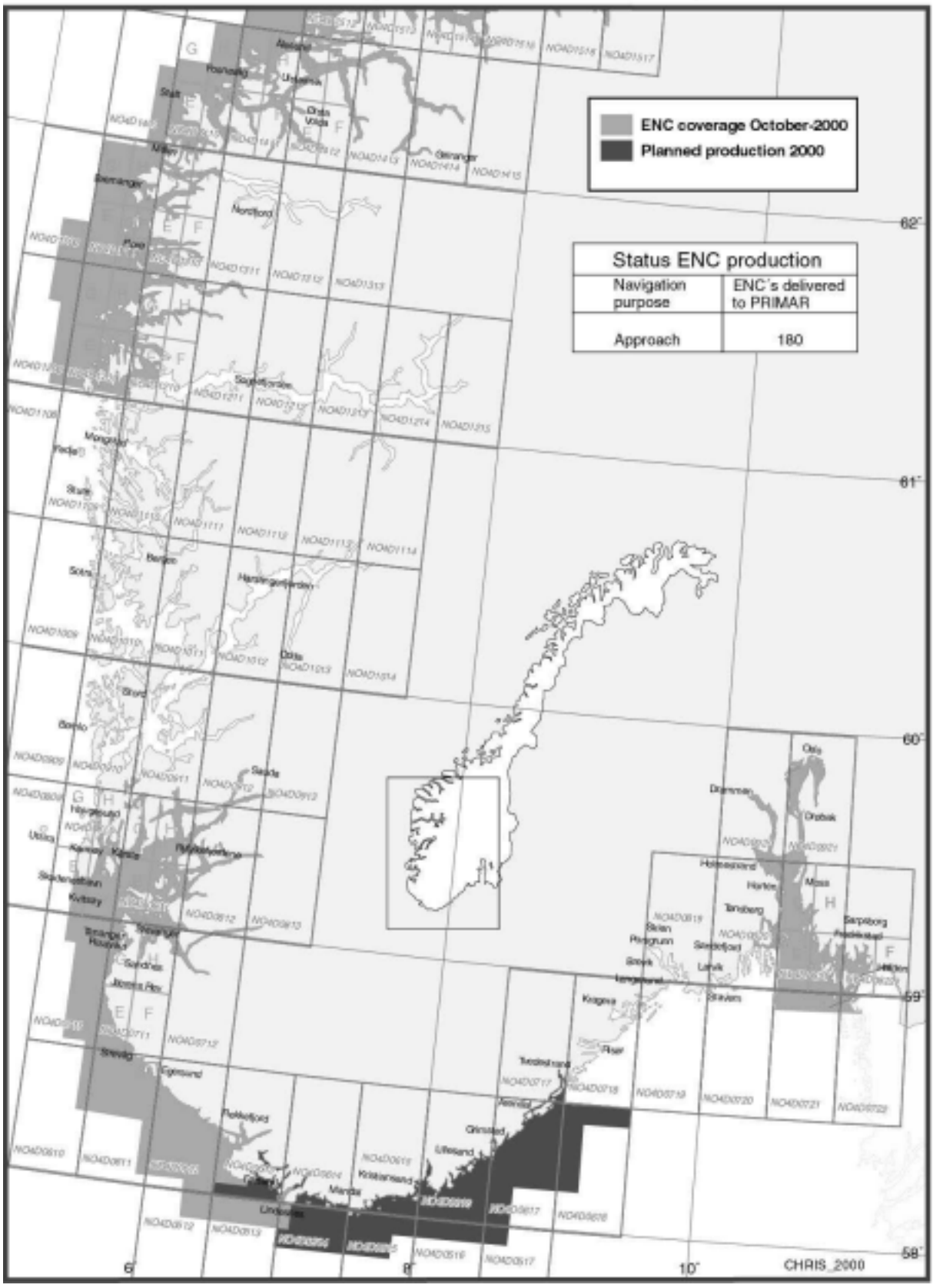
The Norwegian Maritime Geodata Demonstrator is a project initiated by the NHS in order to establish an operational maritime geodata service for Norwegian waters. NMGD is organized as a project with representation from companies and organizations with interests within the development and production of electronic chart systems and related activities. It is also a goal of the project to harmonize and integrate into the Demonstrator, other relevant research projects which are directed towards maritime activities. This is in order to utilize the resources in the most effective way.

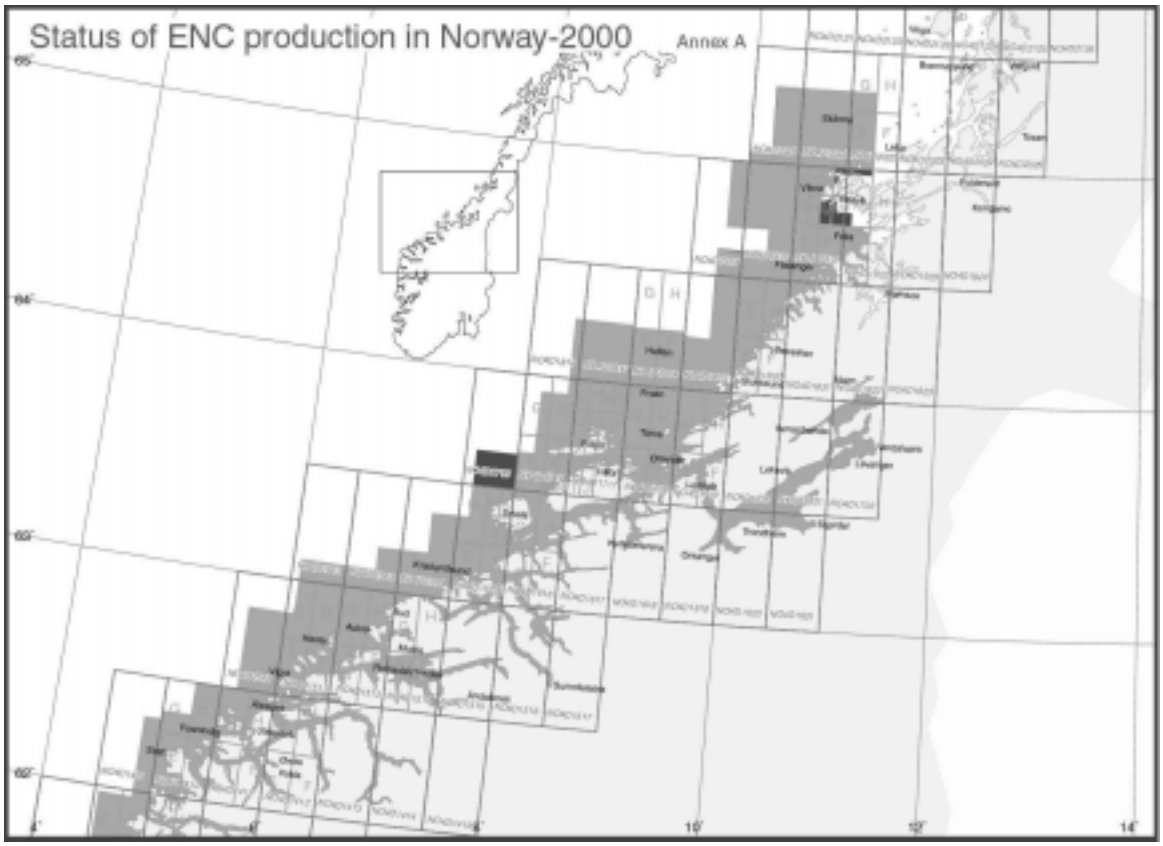
The project has now been running for about 2.5 years, and the project is now into Phase 2 with the main objectives being to:

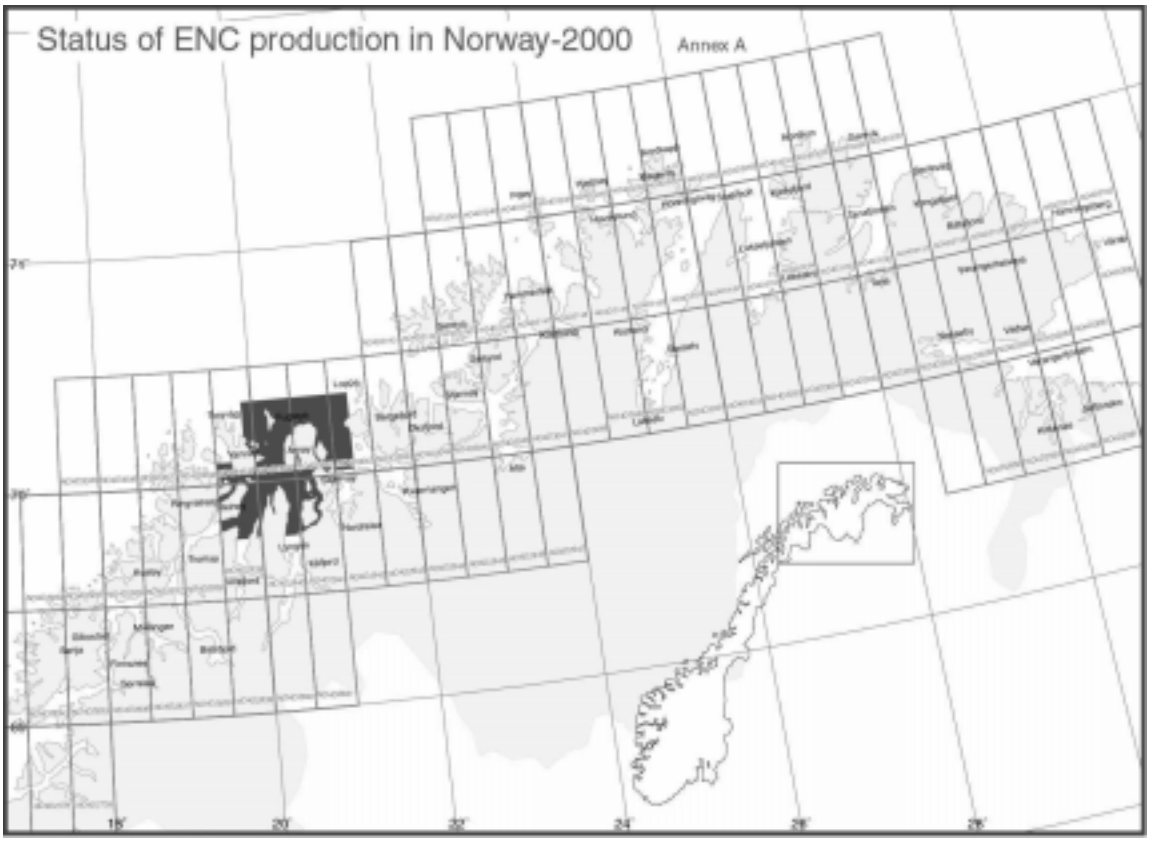
- Establish and demonstrate an operational real-time service on MIO objects such as tides, currents, wind and waves.
- And furthermore, develop and demonstrate the integration of AIS/VTS functionality in an ECDIS.

Status of ENC production in Norway-2000

Annex A

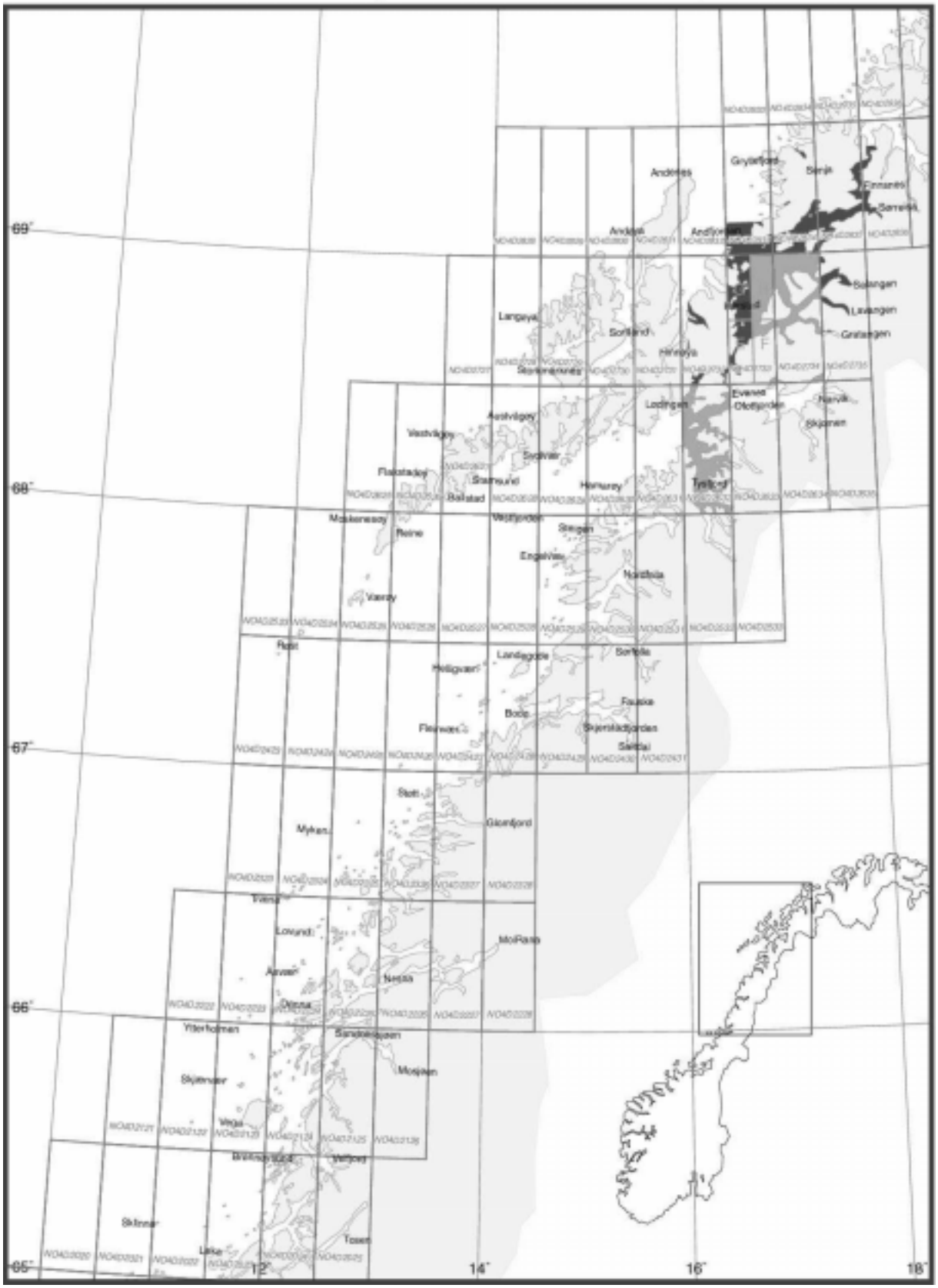



Status of ENC production in Norway-2000
Annex A


Status of ENC production in Norway-2000
Annex A

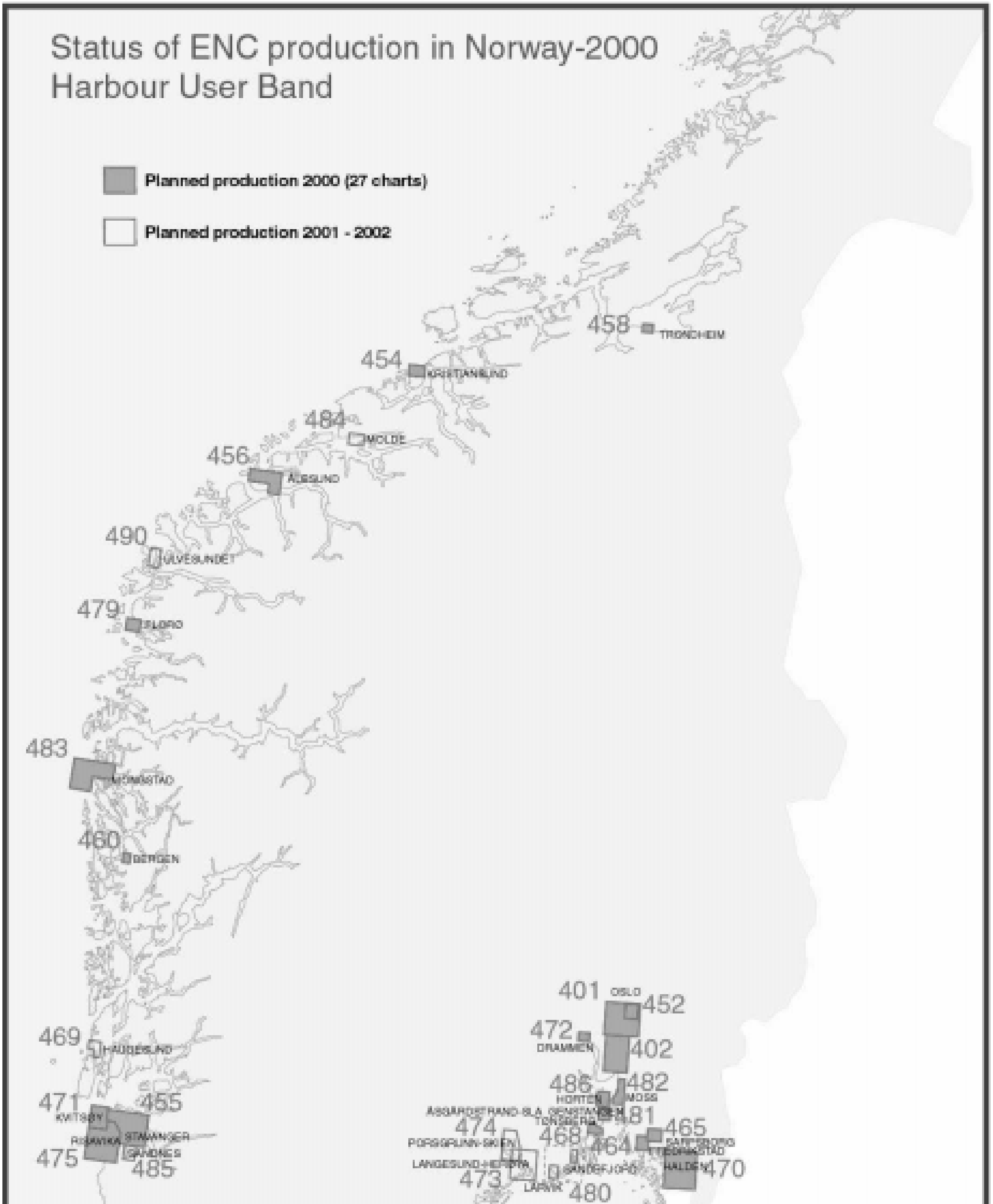
Status of ENC production in Norway-2000

Annex A



Status of ENC production in Norway-2000
Harbour User Band

Annex B


Status of ENC production in Norway-2000
Harbour User Band
Planned production 2000 (27 charts)
Planned production 2001 - 2002
458
TRONDHEIM
454
KRISTIANSUND
484
MOLDE
456
ÅLESUND
490
479
483
MONGSTAD
460
BERGEN
401
OSLO
452
472
DRAMMEN
402
486
HORTEN
482
MOSS
474
468
464
481
465
473
480
LARVIK
470
HALDEN
469
471
KVITSØY
455
STAVANGER
475
SANDNES
485
467
EGERSUND
478
FLEKKEFJORD
477
459
457
KRISTIANSAND
453
CHRIS_2000

PORTUGAL
(March 2000)

The project for ENC production in the IHPT started in March 1998, with two persons. Now (March 2000), there are six persons working at full time in the production and updating of ENC (three of them under temporary contract).

The IHTP uses two packages of software for ENC production:

-	CARIS (Obman)	-	one licence
-	SevenCs (ENC Designer, ENC optimizer)	-	three licences

For quality Control the IHPT uses:

-	CARIS (Obman, ECView)	-	one licence
-	SevenCs (ENC Analyser, ENC Simulator)	-	three licences
-	DKART (Inspector)	-	two licences

Whenever possible, the IHPT uses temporary licences for evaluation of production and updating techniques and also for ECDIS performance assessment (TRANSA MARINE, KELVIN-HUGHES, etc.), both in office and onboard. The final assessment of an ENC cell is achieved by visual inspection by at least one experienced cartographer.

QC showed to be a time consuming part in the ENC production. Initially, different errors were found if different softwares were used, what was very confusing. Now the situation seems to be in a stabilization process, as the software producers improve their products in face of several HO experience and complains.

The first two ENC cells by IHPT were validated by PRIMAR in February 2000 and were included in the PRIMAR CD-ROM an 21.02.2000 (PT 526306). These cells correspond to two Portuguese nautical charts of Lisbon harbour. A third cell for Lisbon harbour is under construction (PT526304), as well as two cells for the Azores islands (PT243102 and PT 24103). One cell for the south coast of continental Portugal (PT324206) is in the final QC procedures.

The production plan for 2000 includes the complete coverage of Lisbon harbour (base scale of 1:15000), the coastal waters of continental Portugal (base scale of 1:150000) and the Azores islands (base scale of 1:300000).

RUSSIA
(March 2000)

STATUS OF ENC PRODUCTION IN HDNO

Head Department of Navigation and Oceanography of MD RF (HDNO) is carrying out the works on creation of unified and continuously updated State ENC Data Base. HDNO is also engaged in development and introduction of navigation and information systems for different purposes, which include, as the components, ENC Data Bases, Pilot and Sailing Direction Data Bases.

Works are in a progress with regard to the establishment of the ENC System in Russia directed to raising the safety of navigation both for civilian and the Navy vessels and ships and they are carried out in three directions:

1. Development of the means and methods of digital cartography.
2. Creation of the ENC data sets and their updating.
3. Establishment of the ENC data sets distribution system .

HDNO produces the ENC data sets according to its own plan. Within the limits of this plan it is supposed to convert the whole HDNO's nautical chart collection (including the charts covering a zone of national jurisdiction of Russian HO) into digital (vector) form complying with S-57 ENC PS. (Totally about 6500 Admiralty Numbers of charts).

For the moment some results in ENC production have been achieved. And we may say about those results as a noticeable success.

For example, we have finished the work, that was begun in November 1998, on creation the ENC worldwide collection of 1: 500 000 scale. This collection numbers 1228 Admiralty Numbers of nautical charts.
We also have been finishing the work on creation the chart collection on a zone of national responsibility of Russian HO (Totally about 800 Admiralty Numbers of charts), including main ports, approaches and routes between them. The charts cover Baltic, Barents, White, Kara, Black, Azov, Caspian, Japan and Okhotsk Seas. Scales are from 1:5000 to 1:250 000. By 1st of November 1999 about 700 charts of this collection have been digitized. We suppose to finish digitizing up to the end this year. In the result the total collection will number more than 2000 Adm. Numbers of charts.

Now HDNO is working on conversion of ENC data from internal format into S-57 edition 3 data format. For the moment half of the ENCs collection on a zone of our national responsibility have been conversed.

Further, the HDNO's ENC production capacities will be engaged in continuation of digitizing worldwide paper chart collection and re-edition and new edition of ENC data sets (about 600 AN of charts per year), as well as in updating, ENC DB management, multiplying and providing the users by ENC data.

It is complicated and rather a resource-consumed task to maintain ENC DB both in technical and in organizational sense. For the moment, we propose two ways for ENCs updating. There are:

1. ENC updating by means of ECDIS editing facilities with use of paper Notice to Mariners issued by HDNO

2. ENC updating by means of ECDIS editing facilities with use of NM textual files transmitted by user's request via automated navigation information system. The system is working in "post box"

mode and uses traditional on-board communication systems. The system provides 'users' with NM, navigational warnings for charts, nautical publications and sailing routes.

In the near future we suppose to spread digital NM and to update ENC data in semi-automatic and partly in automatic form.

Distribution of official ENCs data produced by HDNO (as well as commercial deliveries) will be able when an appropriate data security scheme will be applied and ENC updating data will be produced on a systematic base. Today these matters are under development.

Update of Situation (as of 16 March 2000)

Russia completed creation ENC collection on our national waters and has just started elaborating the sys tem of organization of the ENC distribution, encryption, and updating. It stands to reason that a lot of effort is needed for this purpose. Therefore, we announced as the official 27 ENCs covering the approaches to St. Petersburg. Using this package, we have in mind to refine the process of distribution and updating.

SINGAPORE
(October 2000)

Singapore ENC

The Singapore ENC, covering the Singapore port waters and its approaches, which was officially released on 17th Mar 98, was updated. The use of ENC was further extended to other marine applications. In 1999, the Singapore ENC was successfully used as the base data for the electronic tide tables, the new Vessel Tracking Information System (VTIS) at MPA Port Operation Control Center 2 and contingency support systems such as oil spill modeling and search and rescues systems. With the ENC incorporated into these applications, major or incremental updates on marine features such as coastlines, depths, aids to navigation and anchorages could be easily updated.

Malacca and Singapore Straits' ENCs

Indonesia, Malaysia, Singapore and Japan jointly produced the ENCs covering the Malacca and Singapore Straits. Representatives from three coastal states, Indonesia, Malaysia and Singapore Hydrographic Offices met in Singapore from 22nd to 29th Mar 99 to jointly carry out quality assurance of the ENC.

Sea trials of the ENCs were carried out simultaneously by three coastal states in early 2000. The ENCs were also installed onboard the SHARED vessel "RSS Endurance", which circumnavigated the globe using ECDIS with official ENCs and raster charts from May to Sep 2000. Wireless updating through Internet and INMARSAT was tested during this sea trials.

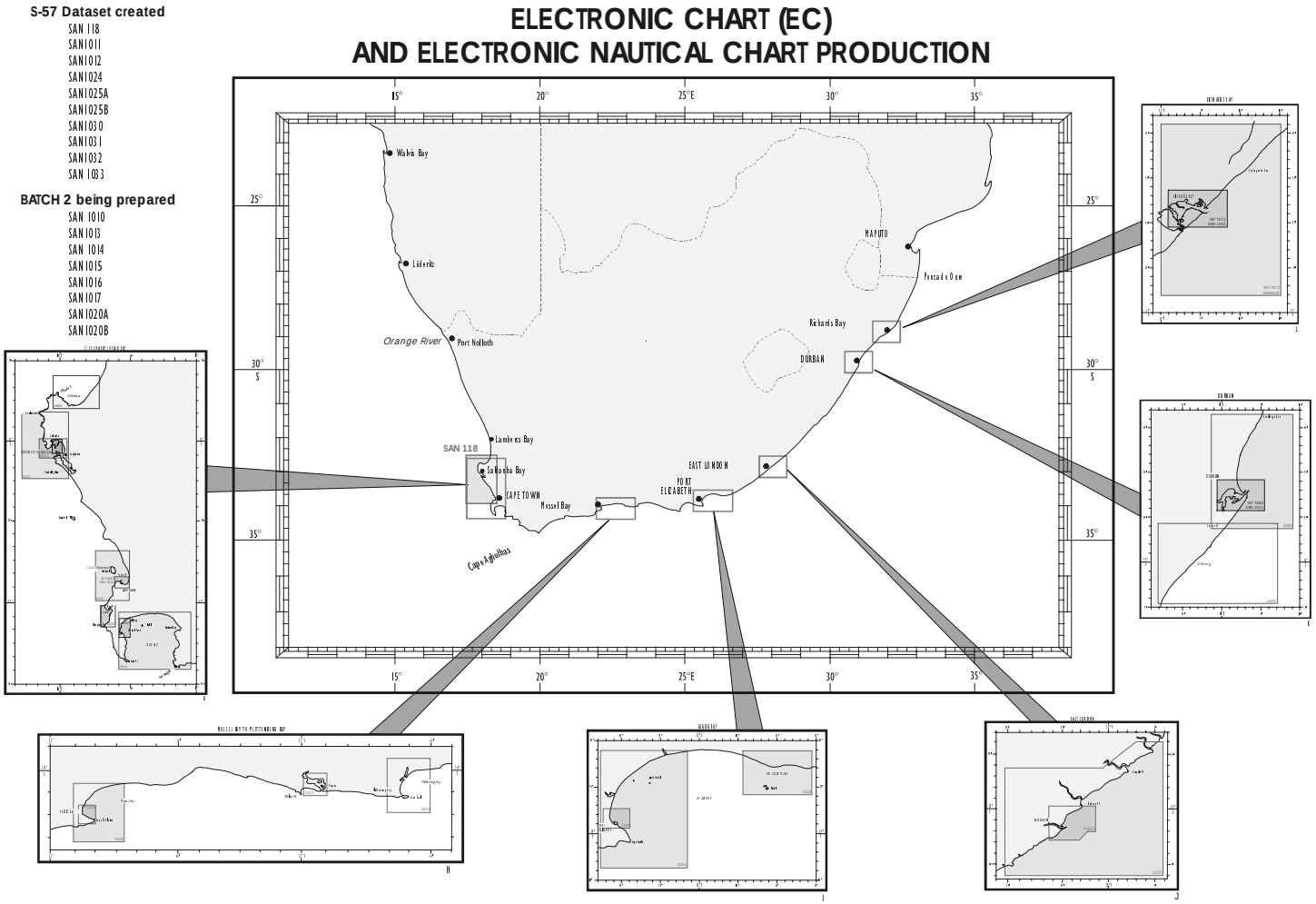
SOUTH AFRICA
(October 2000)

S-57 Dataset created

SAN 118
SAN1011
SAN1012
SAN1024
SAN1025A
SAN1025B
SAN1030
SAN1031
SAN1032
SAN 1033

BATCH 2 being prepared

SAN 1010
SAN1013
SAN 1014
SAN1015
SAN1016
SAN1017
SAN1020A
SAN1020B



SPAIN
(October 2000)

Developments

At the beginning of 1999 we completed the production of the first ENC in accordance with the Product Specifications. Also, we are capable of providing updates (ER).

We could do this by implementing CARIS-HOM in the production flow, trying to take advantage, when possible, of existing graphic files and data in existing GIS (MGE-ORACLE).

Once the production line was established, the need for improvement of in-house intermediate quality controls became evident, and for tools out of the production flow. So, both Analyzer and Inspector by 7Cs were purchased.

Production Plan

We are implementing a production plan, which intends to produce ENCs, purpose 4 (harbour) and 5 (approach), for the main ports of Spain, i.e. 56 ENCs overall. We have now completed 9 “port” plus 5 “harbour” cells.

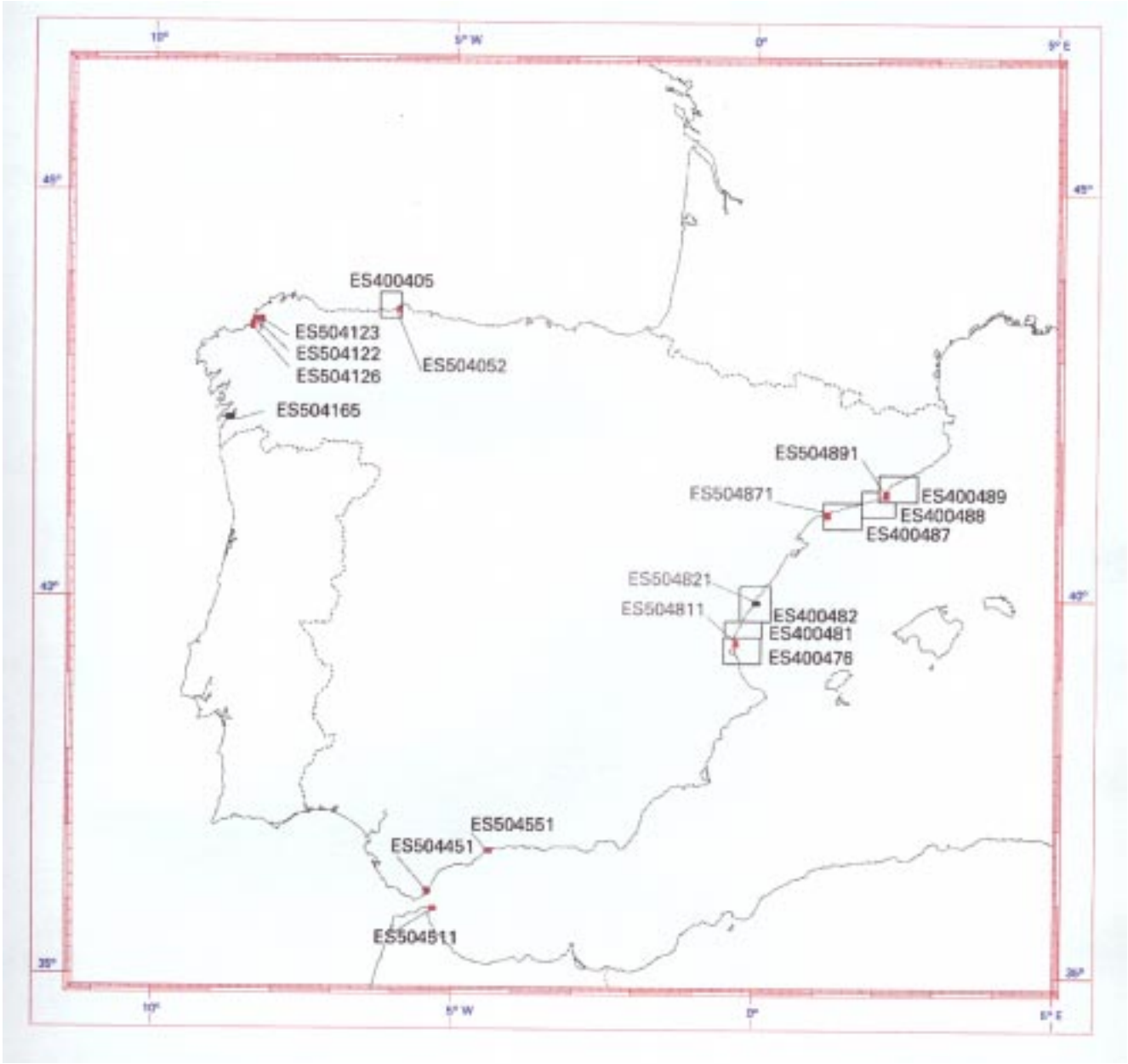
Also, there is a schedule for ENC purpose 3 (coastal) coverage, 16 ENCs overall. The production of coastal cells has started in the third quarter of Year 2000.

Considerations

Production and validation processes take longer than expected, and the structure of the production flow has been re-designed several times, to prevent errors in the finished product.

Nevertheless, we expect an increase in the number of ENCs produced in the near future, with the increase of manpower and consolidation of all phases in the production flow.

ENC distribution is to be made through the RENC-NE / PRIMAR, once our membership is approved by national authorities. Unfortunately, some delays have been produced in the approval process.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ES504451
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SWEDEN
(October 2000)

Swedish status report on chart digitising for ENC

Sweden has around 105 charts of a quality worth digitising. All of those charts have previous been digitised in a phase 1 describing 'the skin of the earth'. They will successively be completed in a phase 2 with full nautical information. At moment 70 charts are fully digitised. Of the remaining charts 31 are in the production line and are expected to be digitised before the end of this year.

The efforts in the Swedish HO have all since the digitising started in a full scale 1994 been to have one common database from which as well printed charts as ENCs should be produced. This has performed well. All charts digitised are printed out from the database. ENCs are produced from the same base. With that in mind also the charts not worth digitizing will still be digitized, which at moment is easier than producing new charts. The aim is to avoid manual maintenance of old printing originals.

Sweden has earlier only produced ENCs for test purposes. A production line for the ENCs is under development. At moment 36 ENC cells are delivered to PRIMAR. First in the production line are nautical charts in a scale of about 1: 250 000 covering the Swedish coastal waters. Also the charts in larger scale covering the Swedish side of the Sound have a very high priority. Sweden is producing the ENCs very slow, the background is that the Swedish HO is very much aware of the fact that the database has to be continuously updated for ENC production and the delivery of ERs. There is no capability yet to produce ERs, which means that the updates are sent as new editions. However, work is being done to create such a capability. The amount of cells planned for the next year is low because of a reorganisation in the office and lack of resources.

A new system is under development which is a further development of the earlier project HIS made in co-operation between Sweden and Finland.

For the verification Sweden is using the dKart Inspector and ENC Analyser. The cell scheme is based on the preparatory work of S-57 ed. 3, which is an amended version 2 scheme and which allows cell sizes between 8^{o} x 8^{o} down to 3.75' x 3.75'.

TURKEY
(February 2000)

Turkey established its Electronic Navigational Chart Production infrastructure in 1997. Existent database is being used to produce digital data in most common formats as well as ENCs in S-57 Ed. 3 and also traditional paper charts. Primary focus has been on INT Charts which are under responsibility of Turkey and cover the most important passages like Turkish straits and harbors where marine traffic is heavy.

5 ENCs have been produced at the moment. DNHO will contract a private company for the production of 30 ENCs which will be ready by the end of year 2000. The produced ENCs will be commercially available after 2001.

UKRAINE
(October 1998)

Report presented to the 7th Session of the "Baltic RECC"

The state Hydrographic Service of Ukraine was officially established on 6 June 1997. In 1998, the reorganization of the Hydrographic Service was completed, and from 3 March 1998, it is under the authority of the Ministry of Transport of Ukraine.

Ukraine is a maritime state. The length of the Ukrainian sea coast is 1750 km. Therefore, the development of hydrography and cartography is very important for Ukraine.

The Service consists of: hydrographic enterprises in Odessa, Nikolaev, Kerch' and Sevastopol, central Hydrographic Enterprise in Kiev, state enterprise "UKRMORCARTOGRAPHY" (Kiev), State Scientific and Research Center of Navigation, Hydrography and Oceanography in Sevastopol, and a plant of the navigational and hydrographic equipment "Etalon". In Odessa is operating a center for the collection, processing and transmission of navigational data.

By the end of 1997, almost all aids to navigation renewed their work, and the first hydrographic surveys were made in order to conduct cartographic works on the Ukrainian sea coast. In the beginning of 1998, the first Ukrainian navigational charts were issued. Also, the first buoys of the national construction and flashing apparatus were developed and made; an informational hydrographic data "bank" is being created now, thanks to the modern computer technologies. Ukrainian ship building plants started their work for the construction and development of small hydrographic ships for surveys.

After a considerably long break, due to the efforts of the State Hydrography, on 1 January 1998, the navigational warnings to the sea waters of Ukraine were transmitted through "Odessa-radio" and "Mariupol-radio" radiostations.

Today, we are trying to modernize and draft all the aids to navigation automatically. Software and technical complex for collecting and processing the navigational data were developed and, recently, its experimental exploitation started. Now, attempts are made to extend the electronic connection to all the Ukrainian ports.

Actions were taken to create inland coastal network of Control Correct Stations of the satellite navigational systems GLONASS (Russia) and NAVSTAR (USA) that work in the differential mode.

Up to this date, State Hydrography has issued 4 Admiralty's charts numbers for Kerch-Yenikalskiy channel; 6 other charts are at their final stage of discussion before being approved. 10 electronic charts were made, and specialists are working on 20 more charts. 2 issues of the "Notices to Mariners" were published. "Symbols and Abbreviations used on Navigational Charts", catalogues of the navigational charts, books, and guidance are available to the users. List of the armament of navigator and means of navigation are prepared for printing.

Ukrainian Hydrographic Service is very recent. We are trying to establish relationships with the Services of other countries, in order to share experience and knowledge. We established relationships with the coordinator of the NAVAREA III Region (Spain), to transmit navigational reports. Recently, a very important step was taken towards the achievement of this objective: in May 1998 Ukraine became the 56th Member State of the International Hydrographic Organization.

UNITED KINGDOM
(October 2000)

1. By 1 October 2000, the UKHO had completed the production of some 138 ENC cells. Of these 67 are being trialled in the Admiralty Digital Chart Service – Pilot and 26 have been released for sale in the PRIMAR Service. It is intended that all UKHO produced ENCs will be distributed through PRIMAR.

2. The geographical cover of UKHO production is mainly in UK waters, together with some other areas where UK provides the original charting, for example in parts of the Red Sea and Gulf. Two ENCs in Netherlands waters, providing large scale cover of Europoort and approaches, have also been produced on behalf of the Netherlands HO. The content of UKHO ENCs is essentially similar to that of the equivalent paper chart.

3. The UKHO's ENC production system is based on software produced by the British company Laser-Scan. Much of the initial data capture is now undertaken by means of a contract with the IIC company based in Hyderabad: the current contract production rate is 5 charts per month. The final stages of ENC production work, including quality control, is undertaken in the UKHO, together with the ongoing database management and update generation. ENCs are released when the quality of data is fully satisfactory and the associated updates can be provided on a regular and timely basis (ie weekly and in step with the issue of the equivalent paper chart Notices to Mariners).

USA (NOAA)
(September 2000)

Electronic Navigational Plans at the Office of Coast Survey

ENC Production Program

OCS has undertaken an ambitious program to create a digital, vector data base of nautical chart features using original source wherever possible. Work began on creating the database in January 1997. The electronic navigational charts (ENC) database covering the major U.S. commercial ports is now being loaded into the production system and will be used to create ENCs for use in Electronic Chart Display and Information Systems (ECDIS) in the International Hydrographic Organization S-57 format. In fiscal year 2000, 65 ENCs (of the originally loaded 190 ENCs) have been validated and are in continual maintenance for release to the Public. In fiscal year 2001, plans call for an additional 70 ENCs to be validated and brought into continual maintenance. Thus by the end of fiscal year 2001, a total of 135 ENCs covering some of the major U.S. ports will be in a state of continual maintenance.

About 20 ENCs have been made available through Maptech for system testing. An ENC for Tampa Bay, Florida, was produced for use in testing an Automated Identification System (AIS), being developed for the area. Another data set consisting of eight cells was delivered to the U.S. Coast Guard for testing AIS in the Lower Mississippi River from Head of Passes to above Baton Rouge, Louisiana. A third test data set was delivered to the Lake Carriers' Association for use in the St. Marys River on the Great Lakes.

Delimitation of ENC Production

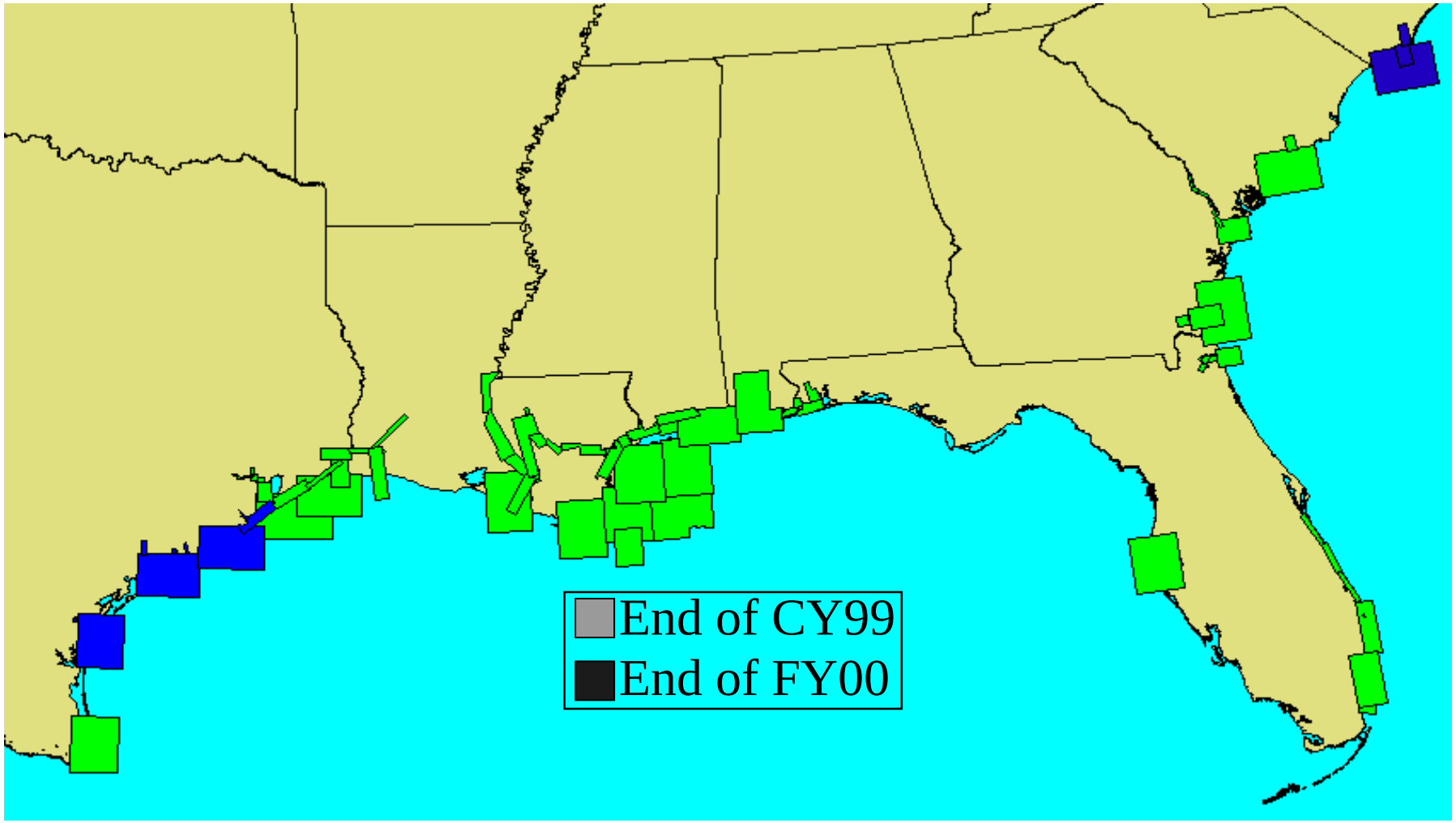
This is similar to the INT Chart program, which some HOs do not fully support. The problem is to define who will produce the ENC for an area where it is perceived that there will now be only one ENC. The Office of Coast Survey does not really have a big concern since we do not in general, venture outside of our own waters. This is potentially a NIMA issue.

Security Schemes

The area of encryption and security is very rapidly changing (both technically and legally). The IHO and Member States do not have the ability or resources to draft standards that can keep up with this rapid change. The economics of change make highly specified, engineer driven standards inappropriate. This is well proven by the failure of its ECDIS standards to gain commercial acceptance. After more than 10 years, only a handful IMO Type Approved Systems have been sold, and it is likely that very few will be sold over the next 3 years. Further, not much is different about the current issue that would improve the chances of success. In fact it is even more complex and rapidly changing.

Perhaps a more appropriate (and practical) role for IHO would be to draft "performance requirements" stating what the encryption systems need to accomplish (with respect to navigation safety and anti-piracy). Then let the "Industry" figure out ways of implementing these performance requirements with whatever technology is current at the time. This approach would ultimately serve our customers best, and the better we serve them, the more systems will actually sold and put into use.

ENC Coverage



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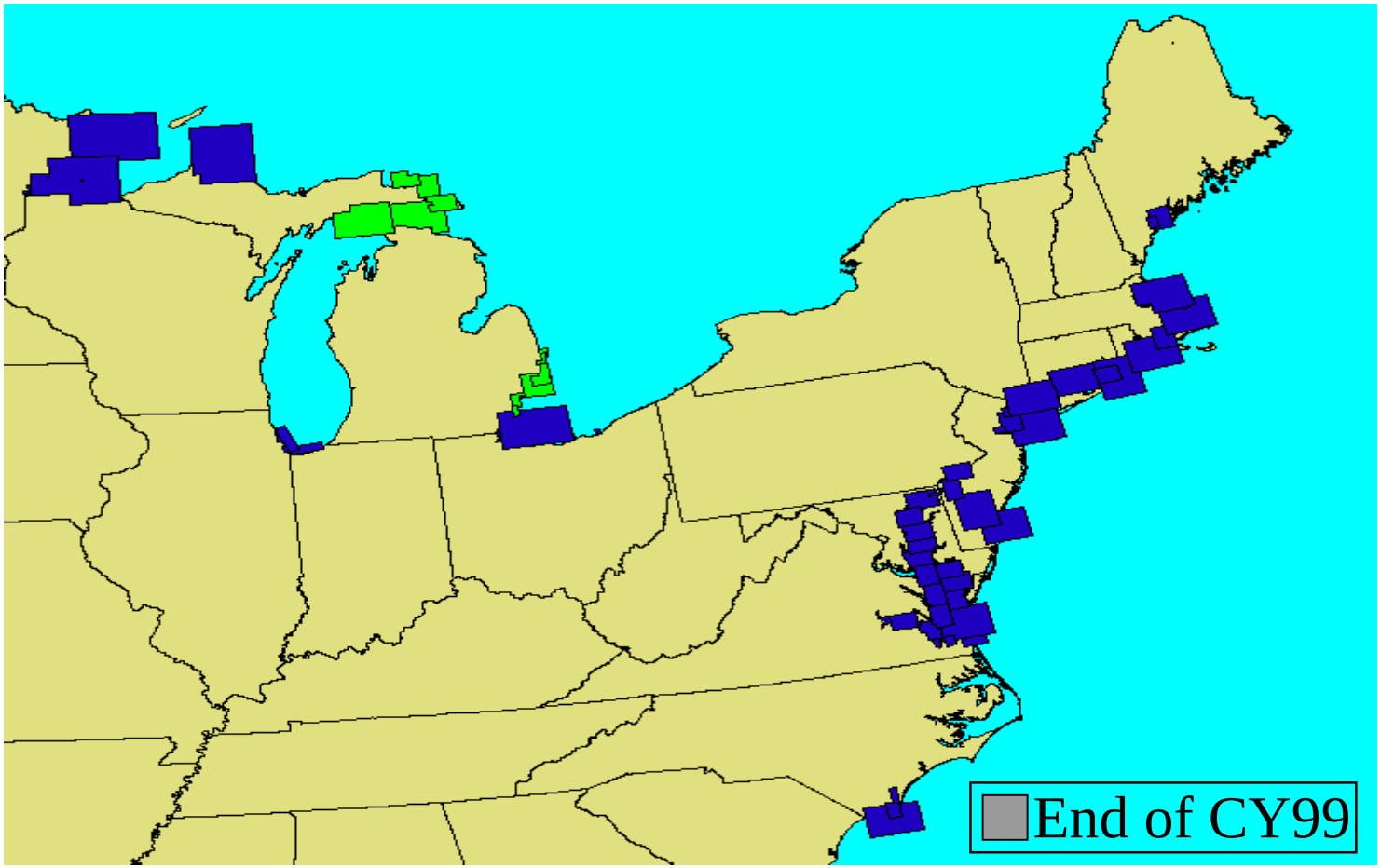

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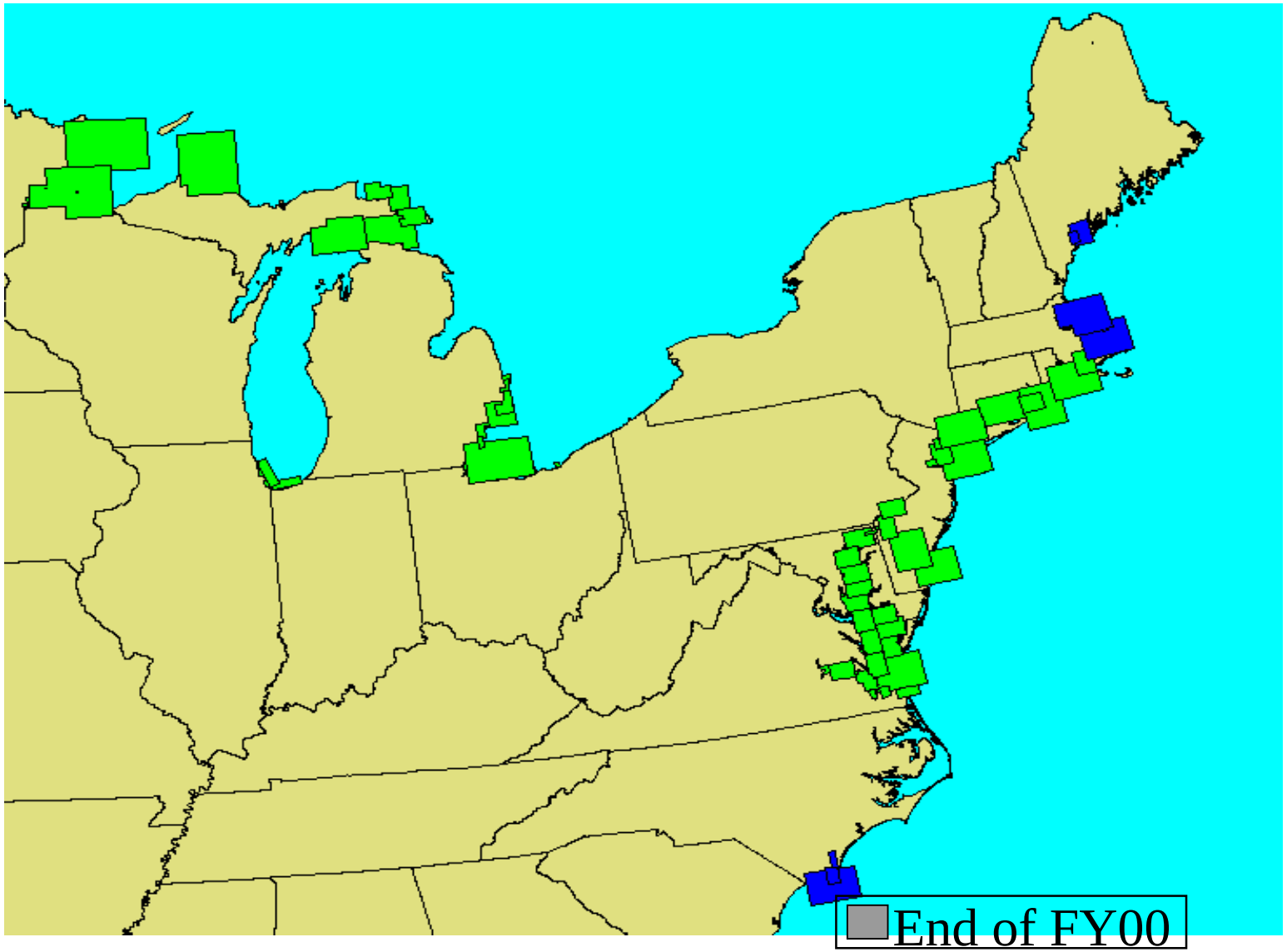

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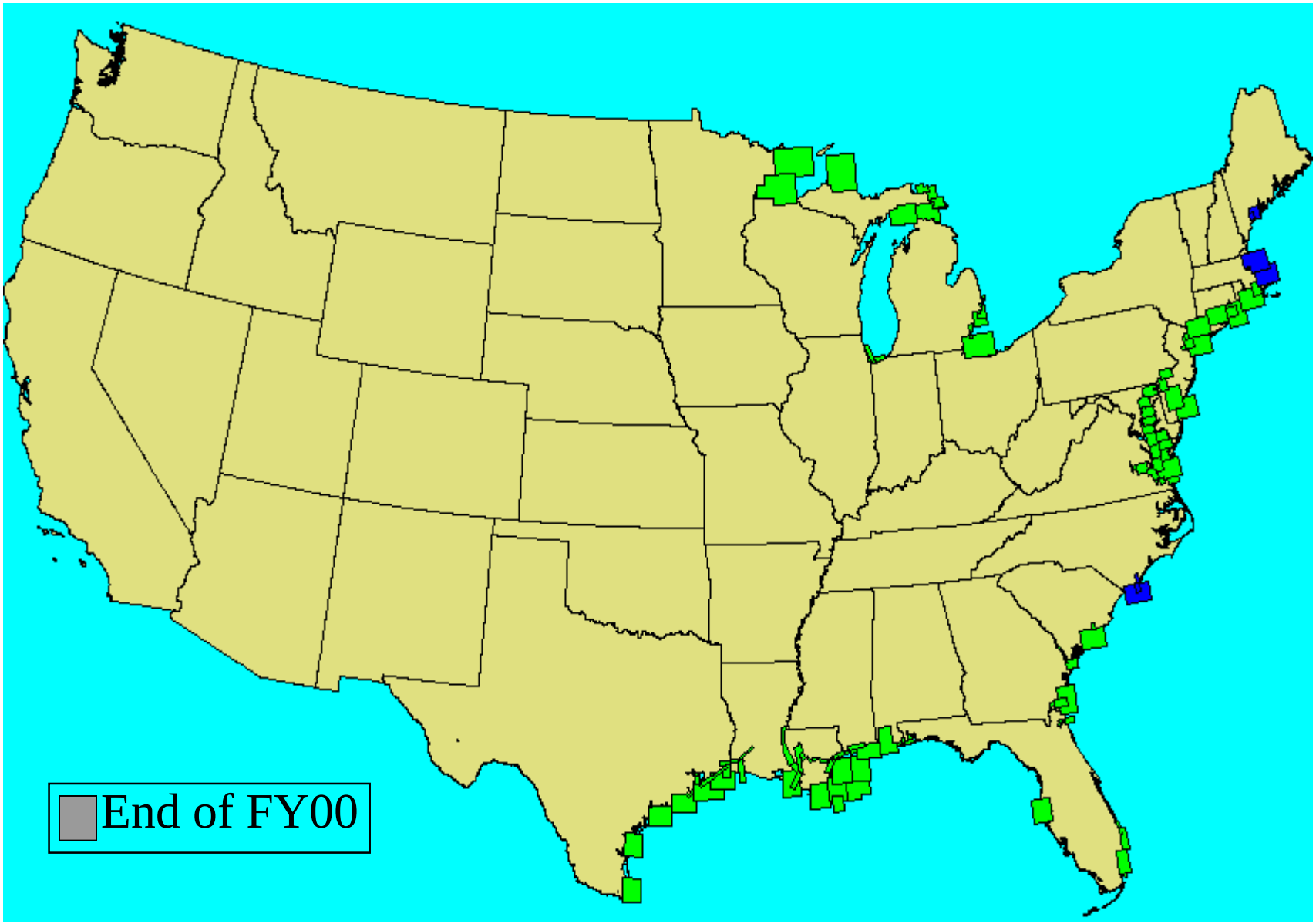

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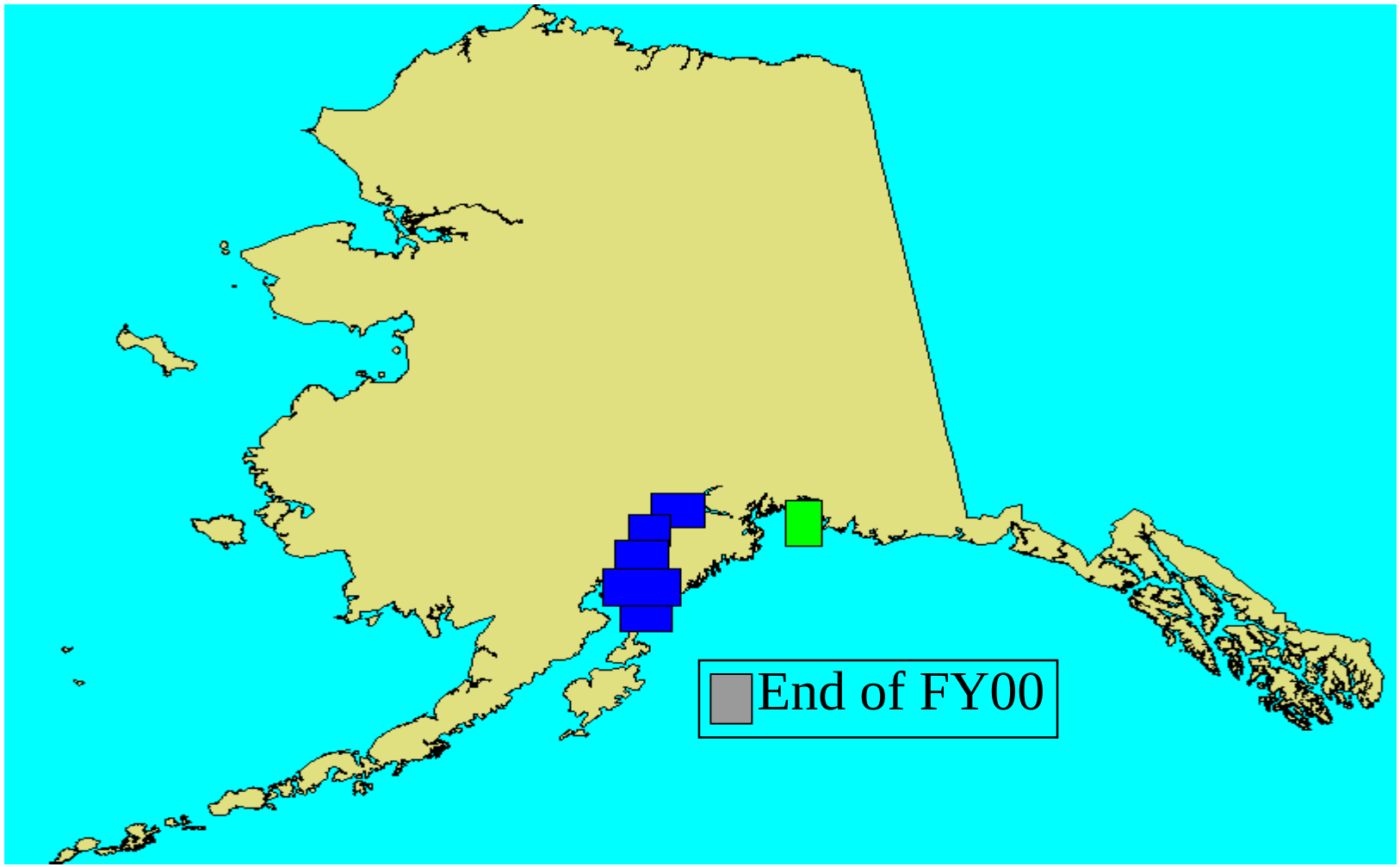

LATVIA
(Non-IHO Member State)
(October 1998)

National Report on intersessional activities,
presented to the 7th Session of the "Baltic RECC" - Cartography

Beginning with 1994 Latvian Hydrographic Service has put the main emphasis on implementation and application of new technologies and equipment for the surveying in the waters of our responsibility and further chart production from the surveyed data in ECDIS environment according to S-57 ver. 2.

In June 1998 Latvian Hydrographic Service purchased a new multibeam echosounder SEA BAT 8101. This multibeam echosounder meets all the requirements of IHO. Now it is used in the most important sea traffic areas for checking and correcting of existing charts and data collection for the new ones.

One more aspect of our work was digitizing the existing paper charts.

The year 1997 was the first year of success after a long period of the hard work done by our Service. Six new electronic charts were created from the surveyed data in ECDIS environment with further necessary preparations for publishing in printing.

At the end of 1997 the last problems were solved regarding publishing of our charts in printing house. In December we had presented our first issue (1251).

The year 1998 has been an extremely productive year. At the beginning of this year we have published two completely new paper charts never published before (3503 and 3280) and 6 new chart editions (2257, 2259, 3502, 1016, 1013, 3250) containing a lot of fresh information and changes, (see the enclosed Annex). Two of our largest and most important ports - the port of Liepaja and the port of Ventspils currently have got new approach charts. At present we are preparing charts for the port of Riga.

In April *C-Map* presented us their new CD-ROM with 11 our charts.

It is important to emphasize to be stressed once more that all our published navigational charts are available in S-57 ed. 3.

Chart No.	Title of Chart	Scale	Date of publication	New Edition
1011	Gulf of Riga. North-Eastern Part	1:100000		1999
1012	Roja Port to Port of Riga	1:100000	14.09.1994	1999
1013	Gulf of Riga. Irbe Strait	1:100000	15.12.1993	27.02.1998
1014	Irbe Strait to Port of Ventspils	1:100000	15.12.1993	1999
1015	Oviši Lighthouse to Pavilosta Harbour	1:100000	15.12.1993	1999
1016	From Pavilosta to Shventoji Harbour	1:100000	15.12.1993	23.01.1998
1017	Akmeņrags to Port of Liejapa	1:100000	18.08.1994	*
1018	Port of Liepaja to Shventoji Harbour	1:100000	30.05.1994	*

Chart No.	Title of Chart	Scale	Date of publication	New Edition
1022	Tahkuna Lighthouse to Oviši Lighthouse	1:200000	20.09.1994	*
1023	Oviši Lighthouse to Port of Klaipeda	1:200000	30.01.1994	*
1024	Pape Lighthouse to Gdansk Gulf	1:200000	30.01.1994	*
1051	Baltic sea and Western Part of Finnish Gulf	1:500000	15.09.1994	*
1052	Baltic sea. Southern Part	1:500000		2000
1251	Gulf of Riga	1:250000		06.10.1997
1252	Irbe Strait to Gotland Island	1:250000	30.01.1994	*
1253	Pavilosta to Klaipeda	1:250000	30.01.1994	*
2057	Eastern Part of Irbe Strait	1:50000	28.07.1994	*
2058	Western Part of Irbe Strait	1:50000	17.06.1994	*
2100	Port of Ventspils with Approaches	1:10000	14.09.1994	1999
2101	Pavilosta Harbour with Approaches	1:10000	12.09.1996	1998
2102	Port of Riga. Northern Part.	1:10000		1998
2103	Port of Riga. Southern Part.	1:10000		1998
2104	Mouth of Lielupe and Buļļupe	1:10000		2000
2253	Port of Riga with Approaches	1:25000	15.12.1993	1999
2257	Approaches to Port of Ventspils	1:25000	15.12.1993	1998
2259	Approaches to Port of Liepaja	1:25000	21.06.1994	01.12.1997
3210	Harbour of Skulte	1:2000		2000
3215	Port of Roja	1:2000	25.07.1995	03.02.1998
3220	Harbour of Daugavgriva	1:2000		2000
3230	Harbour of Lielupe	1:2000		2000
3240	Harbour of Engure	1:2000		2000
3250	Port of Mersrags	1:2000	19.01.1996	24.02.1998
3280	Port of Liepaja. Tirdzniecibas Channel	1:2000		15.01.1998
3500	Port of Ventspils	1:5000	18.04.1994	1999
3501	Approaches to Port of Roja	1:5000	22.02.1994	*
3502	Port of Liepaja	1:5000	01.09.1996	01.01.1998
3503	Port of Liepaja. Channel of Kara osta	1:5000		15.01.1998
3504	Port of Salacgriva	1:5000	1999	1999

* a special announcement will be given on the date of new edition

II. DNC DEVELOPMENT

USA (NIMA)
(September 2000)

Digital Nautical Chart (DNC®) Development

1. NIMA (National Imagery and Mapping Agency) completed the digitization of the worldwide Digital Nautical Chart (DNC®) folio of approximately 4,818 nautical charts in DIGEST C – Vector Product Format at the end of June 2000. This folio of priority DNC charts was digitized for support of the U.S. Navy's initial operational requirements. During the next couple of years, NIMA plans to expand the DNC folio by an additional 1,500 to 2,000 charts in support of added requirements. Currently the DNC is restricted from public distribution, principally due to copyright issues but also because the data have not yet been brought into routine updating. DNC data are routinely made available to the U.S. Navy and Coast Guard on 29 CD-ROMs and also are distributed on-line through a secure web site. These data are currently used for situational awareness in conjunction with up-to-date paper charts. At this time over 75% of the 4,818 charts have been distributed on CD-ROMs with the remainder of the data still subject to quality control within NIMA. It is planned to have 100% of these DNC data distributed to U.S. Government customers by the end of calendar year 2000.

2. NIMA has transitioned 100% of its nautical chart workforce to digital DNC production methods. NIMA work is currently concentrated on: 1) update of the DNC database since the time of original data collection, 2) development of methods for DNC updating, 3) improvement to methods for production of hard copy charts from the DNC database, and 4) integration of text and imagery with DNC.

3. DNC maintenance is being handled through a combination of in-house and contractor efforts. The first DNC CD-ROM brought up-to-date (DNC 17, about 175 charts covering the East Coast of the U.S. from South Carolina to Massachusetts) continues to be updated on about a monthly basis. Other parts of the U.S and a number of foreign areas now are being brought up-to-date and into regular maintenance. NIMA is working on technical developments to improve DNC maintenance procedures and is interested in bilateral agreements to provide for digital exchange of update data, preferably in VPF or alternatively S-57. In mid-2000, NIMA offered exchange of DNC (bilateral negotiations required) to NATO countries. The offer only proposes Government to Government exchange of data with no authorization for public release by either party. Discussions are in progress with a number of countries as well as with U.S. NOAA. NIMA projects that it will take at least 3 years to bring the full DNC database into routine maintenance.

4. During mid-year, NIMA and U.S. Navy suspended attempts to implement full file replacement as the method for DNC updating, principally due to the volume of data to be transmitted and the lack of necessary bandwidth for communications with some vessels. NIMA currently is focussed on two approaches to furnish the mariner with updating information. The first concerns linking the traditional Notice-to-Mariners (NtMs) to the DNC. NIMA has conducted initial tests for integrating NtMs from its web based Navigation Safety System (NSS) with DNC. Under this approach, each CD-ROM update of DNC would include all the NtMs since the last DNC update. Each DNC update would include symbols at the location of each NtM update. In this way, the mariner will know what has changed since the last edition of DNC simply by touching the symbol with the cursor to obtain a display of the text of the applicable NtM. NIMA is working to modify its DNC production system to accommodate this capability. Following this implementation, NIMA intends to work with DNC system manufacturers to integrate this capability into shipboard

systems. Using such a capability with support of the web based NSS, the mariner would have continuous access to NtM information integrated to the DNC display. U.S. Navy ships presently have "pull" access to NtMs from the NSS web site, and through a CRADA (Cooperative Research and Development Agreement) NIMA is also experimenting with "push" wherein the NtMs would automatically be received by the ship. "Push" has been successfully demonstrated.

5. NIMA has recently awarded a major contract for development of a "patch" method (the second update method being developed) for DNC updating wherein only changes to the DNC database would be transmitted to update DNC. NIMA still refers to this as VDU (VPF Digital Updating). This approach would reduce the size of the DNC update data set and therefore the bandwidth needed for fleet-wide communications. First trials using the patch method are planned for early 2001. NIMA is also very interested in a study contracted by the Canadian Department of National Defence to investigate possibilities for automated application of an S-57 incremental update as an incremental VPF update. This may be possible now that the attributes have been mapped from S-57 to VPF. NIMA itself has not yet focussed on use of S-57 data as an update for DNC but the Canadian study provides an initial step in this direction.

6. NIMA has a special production cell focussed on nautical product improvements. This cell is working with the Laser-Scan Lamps II system and has effected significant improvements with the object-oriented maintenance of DNC. Because of the large size of the DNC database, it takes a significant amount of time for transition to and from the relational VPF database of DNC and the object-oriented database (OODB) where DNC updates are applied. One means to avoid the time of translation would be to hold the DNC continually in object space for maintenance and download only when CDs are to be produced. This same approach of maintaining DNC in object space has been proposed by the Naval Research Laboratory, which has demonstrated that an up-to-date viewable OODB could be provided on-line without need for update patches. However, to do so with the current DNC database would take at least a Terabyte of memory. This will be further evaluated as NIMA moves to implement its HYDROVISION.

7. NIMA has been developing a method for printing hard copy charts from the DNC database. This involves some human interaction, e.g., text placement. Improvements have been made such that the hard copy product now can be produced from DNC in the range of 40 to 80 hours of a cartographer's time and process improvements continue to shorten this timeframe. This progress allowed NIMA to shift all nautical personnel to DNC support. A hard copy production system is needed as long as U.S. Navy ships have not completed the transition to electronic chart navigation. As reported previously, U.S. Navy policy is to transition from paper to digital chart navigation by the year 2007.

8. GeoSym (Geospatial Symbols for Digital Displays) Prototype 4 has been issued which contains all symbols used with NIMA vector products. A Draft Performance Specification, dated 5 June 2000, also has been produced. With this GeoSym Prototype, NIMA implemented the IHO symbols for nautical products. A couple of minor errors have been cited by one of the DNC system manufacturers and these will be corrected when the final version of GeoSym is issued. There are plans, not yet funded, to incorporate GeoSym 4 and VDU updating capability into the FUND (Full Utility Navigation Demonstration) software made freely available by NIMA for demonstration of DNC. FUND continues to be an important part of NIMA product development.

9. The DNC Test Data Set has been further developed to support testing of ECDIS functionality, and documentation of the DNC Test Data Set is being finalized for systems testing to transition to U.S. Navy. It is planned to write the documentation in three parts: basic ECDIS, ECDIS-N (Navy) additional tests, and testing of DNC Direct Read. Litton Marine, Offshore Systems Ltd,

and FUND meet the Direct Read requirement. If "patch" is implemented by NIMA as the update method, DNC users will have to maintain DNC in their systems without translation for updating to function.

10. Use of DNC within the U.S. armed services continues to expand. Navy is taking action to more widely deploy DNC for situational awareness. Expansion of ECDIS-N to submarines and surface ships continues as previously reported. During this summer the U.S. Coast Guard Cutter HEALY made a successful transit of the Northwest Passage to its homeport of Seattle, Washington using DNC (built in cooperation with Canada). Recently, the Naval Oceanographic Office (U.S.) conducted an experiment to use DNC as baseline digital data for input to survey operations they were conducting off the U.S. coast. It was possible for Navy, which uses the CARIS system, to compile DNC revisions using their digital survey data. Navy carried this further and translated DNC into ENC using a reasonable level of human intervention.

11. NIMA has modified U.S. legislation to allow compensation for royalty payments to be paid from public sales receipts. NIMA has drafted new wording for negotiation of bilateral agreements. There is quite a lot of work to be done for implementation, e.g., identify the sources used for compilation of each NIMA chart, change the way public sales receipts are handled by NOAA on behalf of NIMA, etc.

12. The U.S. Coast Guard is drafting the first changes to the U.S. Code of Federal Regulations to accommodate Government ship use of electronic charts in U.S. waters. NIMA has requested that the Regulations be modified to include authorization for use of NIMA charts. Currently, the Regulations authorize use of NOAA and equivalent foreign charts.

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