



Potential Markets for Electronic Charts

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Two main components are required before paper charts can be replaced on a ship's bridge with their digital equivalents. These are the hardware and software contained in ECDIS and the HO authorised ENC. Several companies now hold ECDIS Type Approval certificates. It is now a matter of providing adequate coverage of ENCs. However it is not rewarding to manufacture the ENCs to satisfy the ENC market only. The costs of such production will not be justified if the ENCs are used exclusively on the ENC market. This article considers some issues of the organisation of ENC production, distribution and sales, based on the experience of TRANSAS in this area.

Introduction

According to current international standards, in order that shipboard paper chart collections may be replaced with electronic charts, two mandatory components are to be satisfied. These are the availability of Electronic Navigational Charts (ENCs) and the availability of appropriate equipment for the processing and display of ENCs - the Electronic Chart Display and Information System (ECDIS). As far as the ECDIS component is concerned, a limited number of systems have now been type approved and are available on the market.

ECDIS Systems

In 1998, TRANSAS Marine Ltd. received the world's first ECDIS Type-Approval Certificate from the Maritime Administration of Russia and Russian Maritime Register of Shipping. The maritime community did not universally accept this Certificate. However in October 1999, TRANSAS received the world's first universally recognised ECDIS Type-Approval Certificate from the BSH (Bundesamt für Seeschifffahrt und Hydrographie, Germany).

Therefore, since that date, the problem of availability of suitable equipment for the display and processing of ENCs, which would enable them to be used without paper charts on board, has been solved at the international level. It is now the



Transas ECDIS used onboard



Bundesrepublik Deutschland
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Baumusterprüfbescheinigung Nr. 33 127

Type approval certificate * no.

aufgrund des Gesetzes zur Anpassung der technischen und steuerlichen Bedingungen in der Seeschifffahrt an den internationalen Standard (Seeschifffahrtsanpassungsgesetz) vom 09. September 1998 (BGBl. I S. 2860) in Verbindung mit der Ersten Seeschifffahrtsanpassungsverordnung vom 18. September 1998 (BGBl. I S. 3013).

based on the Act for the adjustment of the technical and fiscal conditions in shipping to the international standard (Seeschifffahrtsanpassungsgesetz) of 9 September 1998 (Federal Law Gazette, BGBl. I, p. 2860) in conjunction with the First Ordinance for the adjustment of the technical and fiscal conditions in shipping to the international standard (Erste Seeschifffahrtsanpassungsverordnung) of 18 September 1998 (Federal Law Gazette, BGBl. I, p. 3013).

Der nachstehend beschriebene nautische Ausrüstungsgegenstand
The navigational equipment

Elektronisches Seekartensystem ECDIS

Electronic chart display and information system ECDIS

mit der Typbezeichnung
with the type designation

NAVI Sailor 2400 ECDIS

ist entsprechend den Technischen Prüfungs- und Zulassungsvoraussetzungen
has been type-tested and approved in accordance with the technical test and approval requirements

- IMO Resolution A.817(19)
- IMO Resolution A.817(19), Appendix 7 (RCDS 1998)
- IEC 61174 (ECDIS 1998)
- IEC 61162-1 (Serial Interface)
- IEC 60945 (Environmental conditions 1998)

geprüft worden und wird als Baumuster für die Firma
for the company

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* Der deutsche Text ist verbindlich.
The german text is authentic.

ECDIS certificate

always the general charts which were scheduled for production first, then route charts at 1:200,000 - 1:500,000 scales, then charts of port approaches at scales of 1:50,000 - 1:100,000 and large scale port entrance charts and plans of the ports were the last to receive attention. It should be noted, that the most frequently visited large ports were selected first, followed by the minor ports. TRANSAS' chart sale statistics show that, for example, the general chart of the Baltic Sea is sold in much greater numbers than the chart of, say Kotka, as each ship which enters the Baltic Sea needs the general charts, whilst the chart of Kotka is required only by those who call at this comparatively small port. Even if, for example, the chart for the port of Kotka itself is not available on board, there are all the charts required for the approach to the pilot boarding area, the last one or two charts, which should be used, might equally well be paper charts. In this case, the ship will be able to use the ECDIS for the majority of the voyage. While HOs are generally not considered as commercial agencies, their main purpose in ENC production is to ensure safety of navigation by making ENCs available for use in the ECDIS. The fastest possible creation of conditions for the purchase of the ECDIS by ship owners is, in many respects, a matter of establishing priorities in the production of ENCs for areas, which are used by most vessels.

There are many HOs, which have not yet started to work actively on the production of the ENCs. These are mainly HOs in countries with shorter coastlines or island states. The number of ENCs required for the waters of such countries varies from several charts to perhaps a hundred. As a rule, the HOs in such countries have a small staff of employees, some of whom have no experience in handling a sophisticated standard such as S57. These HOs, however, are all full and equal members of the IHO, and will sooner or later wish to produce ENCs of areas for which they are responsible. TRANSAS is able to offer some assistance in the production of ENCs for such areas, including the training of specialists and digitising of

turn of Hydrographic Offices (HOs) engaged in the production of ENCs to deliver them to the market.

Electronic Chart Production Capabilities and Priorities

The world's major HOs have been engaged with the problem of ENC production for more than ten years. Now, at last, there is hope that ENC coverage of areas with the most intensive sea traffic will be achieved within the next two years. The HO of Russia has now officially announced, via the Notices to Mariners, the issue of the first 27 ENCs for the Baltic Sea. It is impossible for HOs to instantly reproduce the entire paper-chart folio in digital form. Accordingly, it becomes necessary to establish the priorities in ENC production. Judging by the first charts issued by the HOs, these are to be primarily large-scale ENCs.

TRANSAS has its own collection of digital charts, which comprises 6,200 non-equivalent electronic charts. During the years it took to produce this collection, the chart production priorities were a vital issue. TRANSAS is a commercial company, and chart production schedules are necessary to maximise chart sales. Each time the production of charts for any new area was started, it was

ENCs, together with one or more workstations. Later the HO will itself be able to quality control and authorise the charts, update them, introduce any changes, issue new chart edition and digitise new ENCs. TRANSAS employs the 'ENC Designer': chart production technology of Seven C's. At TRANSAS, the 'ENC Designer' has been found to be a high quality product, sold at a moderate price. The Russian HO successfully uses this technology. With a staff of 15 professional hydrographers and 20 operators with a long experience in the electronic chart production, TRANSAS is ready to help any HO in the manufacture of ENCs in the short term and at a reasonable cost. Many HOs, even the largest of them are looking for partners to assist in ENC production. The fastest possible global coverage of ENCs is to the advantage of everyone - IMO and HOs, National Maritime Administrations, Shipowners/operators and ECDIS manufacturers.

Need for Encryption System

Once produced, ENCs must be distributed and delivered to the user. A problem which arises in connection with ENC distribution is their protection from unauthorised copying. The S57 standard has been specifically developed as an information exchange standard, and is therefore 'open' by definition. TRANSAS, without violating any rules and acting in a strict conformance with the requirements of the IEC 61174, S52 and S57 standards, has successfully passed the ECDIS type approval procedure in two Classification Societies which were testing its ECDIS using S57 test files produced, without any encryption, by the UKHO under the IHO's aegis. For ECDIS to be capable of loading encrypted ENCs, a new module should be developed. There is a concern that many such coding systems will be developed by different companies and different HOs. The development of additional program modules requires time and money. Such problems should be solved by international co-operation. It is necessary to protect the ENCs from unauthorised copying. This should be done by changing the S57 standard and supplementing it with the description of the encryption. The technique developed by Primar (European Electronic Chart Centre) could be taken as the basis for amending the S57 standard, provided it is made accessible to all manufacturers without any copyright limitations, as is the practice with all international standards.

Choice of Distributors

Another question in connection with the ENC distribution, is - Who can become a distributor? Different HOs pursue different policies with regard to the selection of distributors. Some HOs grant the distribution to practically all those wishing. Some prefer to select a general distributor. The Canadian HO has exclusively chosen NDI (Nautical Data International). The Russian HO has made TRANSAS its exclusive distributor. Ten European HOs have given the exclusive distribution rights to PRIMAR. The exclusive choice of HOs is preferable. It is much better to deal with a single general distributor: let this distributor promote the ENCs on all the markets, require the reports and collect royalties and take care of the data protection. Today, PRIMAR as a general distributor has concluded more than 30 distribution contracts. This indicates that it has demanded no rigid requirements of its distributors. It has concluded that practically any company can be an ENC distributor. Is this good? Electronic chart distribution implies a technical service rather than a mere re-sale of CD ROMs and receiving an agreed percentage. This is satisfactory if the customer can smoothly load ENCs from a CD into the ECDIS. But what if there are some problems, failures, malfunctions? It is the author's opinion that a distributor is required to have amongst other things, experience in digital cartography, to be familiar with procedures for loading ENC's into various ECDIS systems and to know how the ENC's should be correctly displayed on the ECDIS screen. It has been noted that the UKHO has always been cautious when selecting distributors of its paper charts. This may be the reason why it is the leader in the sale of paper charts. It is obvious that the service involved in the distribution of electronic charts is more complicated than that required in paper chart distribution. The choice of distributors for ENC distribution is an important issue. It is on this choice,

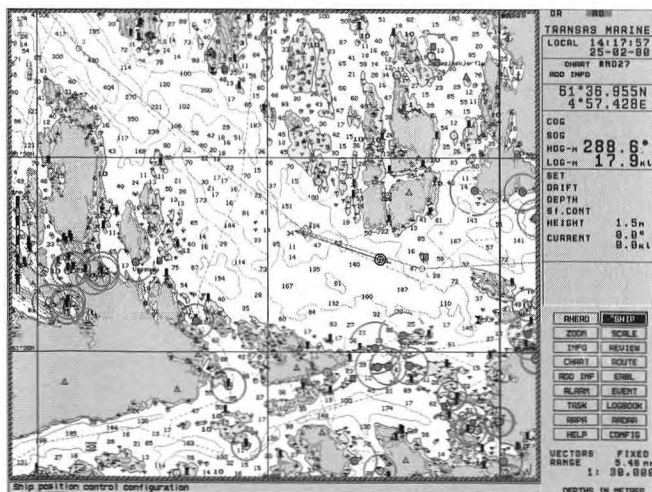
that the quality of services rendered to the customer, and their reluctance or otherwise to switch from the navigation techniques using paper charts to the ENC-based techniques will depend.

Distribution Format(s)

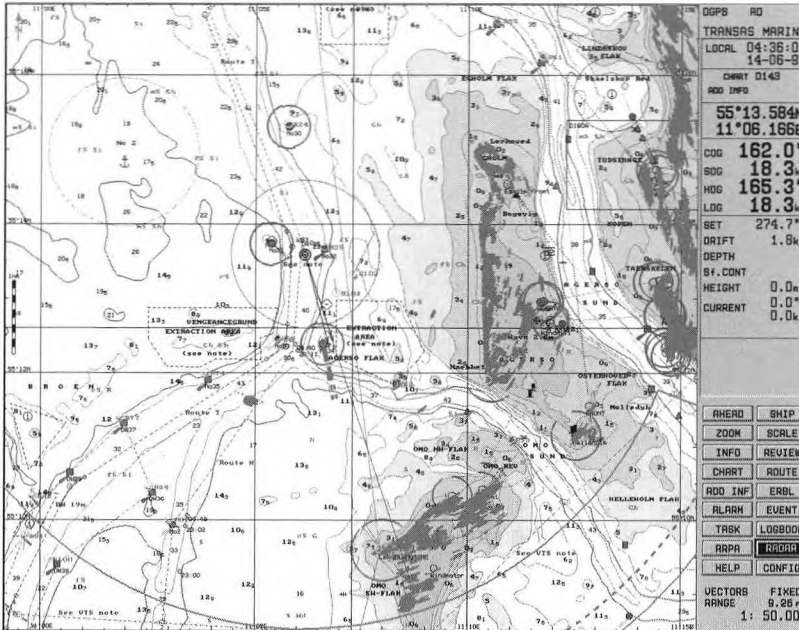
Another important issue to consider is the formats for the ENCs that will be allowed to be distributed to the ECDIS market. Will it be only S57 format, or encrypted S57? Or will it be permitted to distribute ENC's in some SENC (System ENC)? TRANSAS has its own SENC for ECDIS and uses it in TRANSAS ECDIS, which to date has an extensive and growing market. It also has several OEM (Original Equipment Manufacturer) packages where other manufacturers use TRANSAS software. If the ENCs are allowed to be distributed in SENC format for the TRANSAS ECDIS only, or the ECDISs using TRANSAS SENC, the charts received from, say, PRIMAR will be converted to SENC at TRANSAS technical Headquarters. Such conversions will be subjected to a thorough check of the ECDIS. After this, the SENC will be passed to TRANSAS distribution system where it will be protected from unauthorised copying, and where a complete report on the deliveries will be supplied. Such a scheme fully eliminates not only the problems of information security but also the lengthy procedure of converting ENC's to SENC on board ship and rules out any errors, which may occur during such conversion, as these will have already been identified during the conversion at TRANSAS technical Headquarters. The quality of service will only be improved. The TRANSAS ENC/SENC converter is in any event thoroughly checked during the ECDIS certification process. Needless to say, if an untrained shipboard operator is allowed to convert from ENC to SENC on board in rushed circumstances, during the time before the ship's departure, it is surely safer that the task be entrusted to a qualified hydrographer at the company office where this job can be done carefully and without haste. In this case the conversion will have to be carried out only once, and the SENC will be valid and may be distributed until the next ENC issue. Should the ENCs be distributed direct to the ship, the conversion will be repeated on each ship, which will result in much more work and cost.

The ECDIS Market

At which markets will ENCs be aimed? The ECDIS market is clear. As ECDIS systems are installed on ships, there will be a demand for ENCs. However, in the author's opinion, the ECDIS market will constitute only from 1 to 2 per cent of the total potential ENC market. The cost of an ECDIS is currently approximately 30,000 US dollars, and for two ECDIS (required for the redundancy) – not less than 50,000 US dollars, and the world's potential ECDIS market for the next few years is several thousand large ships. It is estimated that the total will be not more than 3,000 ECDIS systems. Assuming that each ECDIS has an average collection of 200 charts, the total would come to 600,000 ENC copies. With an average global collection of, say, 6,000 charts, which is very few (all the HOs taken together print 28,000 paper charts), it would equal an average of only 100 copies of each ENC. The HOs, which print paper charts, will agree that these are very small quantities. So would it be worthwhile to undertake all this because of 100 copies of each ENC, which it will take several years to sell? It is suggested that the production of ENCs is only



S57 chart in the Transas format for ECS



Radar overlay on the Transas chart

commercially viable if markets other than ECDIS are being considered.

The ECS Market

An additional and already existing market for the ENC is the ECS (Electronic Chart System) market. Although the requirement for ECS is not included in any IMO regulation, their use is widespread. ECS-related national requirements have been adopted by the Russian and German Maritime Administrations. An essential issue is which for-

formats the ENC distribution will be permitted for the ECS market. The conditions should, clearly, be absolutely different. An ECS installed on board is not a substitute for a paper chart. Therefore, a customer who buys electronic charts for an ECS has already paid for the official paper chart produced by the HO's. Besides, the ECS market is a market of small coasters, fishing boats, yachts and the like. Small craft owners are normally financially restrained. It is typical in the ECS market to carry a folio of 20-40 charts for an area. There are some larger folios, e.g., the North Atlantic folio includes more than 1,000 charts. Clearly, a fixed price for a chart, in the amount of 80 dollars a year as in the case of the NDI, will never be accepted in this market. Who is going to buy a folio for a small area at 2,000 US dollars, or a North Atlantic folio at 100,000 US dollars? A popular World Folio, according to TRANSAS statistics, would cost half a million dollars a year! Whilst even in the ECDIS market there are many large tramp ships, which would not mind buying a world collection. TRANSAS sells its World Folio for 13,000 US dollars, but even this price may be considered rather high for a ship owner.

Several times in the past the author has stated in his articles that his company is ready to replace all its charts with charts from HO's on the CDs, which it issues every 3 months for the ECS market. It remains only to agree upon the terms. TRANSAS specialists believe that there should be no fixed prices, and the royalty should be payable as a percentage of the net price. The chart's final price is very difficult to check and may vary in different countries. TRANSAS is awaiting suggestions and is ready for negotiations with the various HO's to begin. It is interested in using charts from the HO's, as this is the most efficient way. At the moment the charts are manufactured, updated, and new issues are provided by three agencies simultaneously - HO's, TRANSAS and C-MAP. A lot of time and labour is duplicated. It takes more than half of the total man-hours of the entire department to support and update the TRANSAS collection of 6,200 charts. There is a well-prepared and cultivated market for the ECS. The pricing policy has been refined over the many years of its existence. To change the prices now, and especially to have varying fixed prices for the charts from different HO's would seem quite unreasonable. TRANSAS has already sold more than 4,000 ECSs to the professional market and about 6,000 to the yacht market. There is no direct way for the HO-produced charts to reach these systems. Future sales to these existing customers are, therefore, guaranteed. This is a tremendous potential additional market for the ENCs produced by HO's. However, my company will have to continue supporting and selling its charts until an agreement with the HO's can be reached.

The Radar Market

The market in electronic charts for ECS is far from being the only additional electronic chart market in the immediate future. One such potential market, the one that holds a tremendous promise, is the market of ENC's for radars. Some time ago the IEC Workgroup on Radars permitted the display of some ENC elements on radar. These are the coastline, safety contour, nav aids, isolated dangers and some areas and lines. The aforementioned elements take up from 50 to 70 per cent of the total ENC elements. So far, there have been no commercially produced radars, which could display such ENC elements. However several companies have announced the emergence of computer radar where these capabilities are very easily implemented. TRANSAS produces an OEM kit on the basis of its Radar Integrator used for creating a radar computer display. Such display, among its many unique functions, also features all the capabilities connected with electronic cartography. It is clear that this market will soon be developing very actively. Navigators and ship's masters will, beyond any doubt, prefer radar with an electronic cartography input. In addition to the many obvious conveniences it offers, this radar will solve the main problem – that of mistrust of the reliability of satellite navigation. Those navigators and shipmasters will never fully trust the satellite ship positioning methods, no matter how accurate they are claimed to be. When the raw radar picture is combined with an electronic chart, it is possible to assess, at a glance, the correctness of the GPS operation, of the electronic chart referencing and of the gyro's readings. If the radar marks of the coastline, buoys, lighthouses, rocks and other point type objects coincide with their counterparts on the chart, the captain may be at ease. If all the radar images are shifted a certain distance in the same direction, the captain can visually compare this distance with the width of the ship's safety lane and assess the degree of danger. The radar picture turned relative to the chart indicates a gyro error. Nowadays thousands of radars are produced every year. Charts for this market, just like for the ECS market, should be sold at a price different from that used in the ECDIS market. The radar does not replace a paper chart and this is a more extensive market than the ECDIS market.

The Market for AIS Transponders

Another market with considerable potential and promise is that of AIS (Automatic Information System) transponder displays. Starting in 2002, all ships of more than 300gt will be, stage by stage, fitted with transponders. By installing a transponder on a ship the ship owner will formally fulfil the requirements of the SOLAS Convention, and will be broadcasting its ship data. The efficiency of such an installation is, however, rather low, as there would most probably be no facility for displaying all the received information about other vessels. So far, the IEC has specified that the ECDIS or radar should be used for such display. The ECDIS is too expensive as standard equipment for the great majority of ships of from 300gt to 3,000gt. Today, no commercially produced radar is capable of displaying transponder information. Therefore, by 2006 when the installation of transponders on all the ships will be completed, about 60 per cent of shipboard radars will be those produced in the year 2000 or before. This means that the owners of these 60 per cent of ships will either have to replace radar, or buy an ECDIS. It is believed that a third way could be found - to offer to the ship owners a small dedicated display for the AIS transponder, based on an ECS with a Radar Integrator, where the chart, radar and transponder information will be combined on a single screen. This kind of information is the most efficient. It is estimated that the potential market for such displays will be large.

An AIS transponder is a luxury for small fishing vessels, yachts, coasters and all the ships of less than 300 gt, for which the installation of such transponder is optional. But it would be useful for them, too, to know about the existence of radar targets in their vicinity. All the transponder manufacturers are planning to produce transponder information receivers only. Such devices are merely VHF receivers, which receive digital information and transmit it via the RS 232 output port in the ECS or other equipment. The receiver is not expected to cost more than 500 dollars. After buying such an AIS receiver the ship owner will be again faced with the problem of the transponder information display. Preference will most probably be

given to a low cost ECS, which would also require charts. The potential market here may be considerably larger than the market for transponder displays for ships of more than 300 gt.

The Personal Computer Market

Out of the millions of yachts in the world, 80 per cent are small yachts for which, due to their size and absence of power supply, a standard ECS cannot be installed. But the owner of a small yacht also wants to use electronic charts. The experience of dealing with the yacht market in the USA shows that an unexpected concept of electronic chart distribution for small yachts could satisfy the target. As a rule, the owners of yachts use a battery fed manual GPS. Many such GPS receivers already have an interface with a personal computer for transmitting the route. The idea consists of offering a yacht owner the software, which would load electronic charts in his PC, and would allow planning a safe route on an electronic chart before departure. This route could then be loaded in the manual GPS, and the owner would make a safe voyage following the route previously specified. Personal computers are now widely available. If such software costs about 100 dollars, and a set of 20 electronic charts is offered at approximately the same price, there is a potential market of hundreds of thousands of prospective customers.

The Non-Navigational Market

Starting from 1999, all the ships must be equipped with an INMARSAT-C station in compliance with the GMDSS Convention. There are many other up-to-date inexpensive global communication facilities. These systems permit the coordinates and other ship's data to be transmitted every hour, or over another time interval. Such information can be used by the ship owners, agents, brokers, maritime administrations, VTM services, Coast Guards and many other agencies. An electronic chart may be used for displaying information on the ship's position. Office systems performing these functions providing chart display for the analysis of accidents, viewing of approaches to the planned ports of call for the company's ships, are being actively used. Therefore the office of any major shipping company would, as a rule, require a world chart collection, as the ships are sailing in different areas. ECDIS systems are installed in the Maritime Schools for training purposes, and these would also require a world collection of electronic charts. It goes without saying that no ship owner or maritime college would buy such a collection. Given the prices quoted at present for ENC's. This market where the electronic charts are not used for navigation requires a very special price.

The Internet Market

Everyone knows how fast various Internet-based services are developing. The development of an Internet nautical chart service would seem only natural. The customer subscribing to such a service would cut out the area he needs from the map of the world, and a raster picture of chart combination for the area would be formed on the server and sent to the customer. The customer could then plot any information on this raster chart, use it for reference purposes and print it out as any other image, etc. The cost of such service should not be high, but the number of customers may be huge.

Conclusion

A brief analysis of only some of the potential electronic chart markets shows that the ENC's, produced by the HOs can be sold for many other applications and not for the ECDIS market alone. For the successful sales of ENC's in these markets, HOs and companies like PRIMAR will have to develop a flexible pricing policy, take advantage of the experience and marketing results of other private companies. It is

only then that we can hope for a broad distribution of ENC's in all the niches of the world's nautical electronic chart market.

Biography

Evgeny Komrakov graduated from the Admiral Makarov State Maritime Academy in St.Petersburg, Russia, in 1978. During the period 1978-1991 he has been serving as officer and captain on various vessels of the Baltic Shipping Company. From 1991 until the present Evgeny Komrakov is the Director General for Transas Ltd. in St.Petersburg.