Analysis and Excavation of the Design Concept of Special Sea Atlas

Caixia Yu1*, Yan Lu2, Haifeng Lin2, Jun Luan2, Shujun Li1
1 Dalian Naval Academy, Dalian, China
2 Chart Information Center, Tianjin, China

*Corresponding author e-mail: yucaixiaxj@163.com

Abstract: Atlas design is a creative mental processing, with few fixed ideas and patterns to follow. Taking “XXX Company’s Global Maritime Trade Achievements” as an example, this paper explores and mines the formation of design concept as well as the complementation process of design scheme of the special marine atlas, which can provide reference for the design of the special sea atlas latter.

1. Introduction
As the national “the 13th Five-year Plan” smooth finish, economic power onto a new stage in our country, especially with the implementation of the national strategy “Construction of the Marine power” and “Marine silk road”, demand for special sea atlas is blowout growth, special atlas become the new direction for mapping, also become the hot topic in the study of many scholars and industry experts. Technology of atlas compilation is paid more attention at home and abroad scholars, but usually only involves the atlas production of a certain link[1-3], or introduces the framework and content against a particular atlas (one published or finalized for publication)[4-8], or just discusses broadly about the content of atlas design[9-10], but little[11-13] or failed to analysis and mine deeply design concept reflecting the crest atlas, especially design concept of marine atlas. Marine atlas design is a systematic project, which integrates scientific, professional, practical, holistic, creative, innovative, artistic and other thinking activities. It is the primary and key prerequisite for the successful compilation of Atlas, and also the essence of marine atlas. This article, with one company global seaborne trade activities for the project, will emphatically analyze the “Global Seaborne Trade Achievement of XXX Company” (hereinafter referred to as “Achievement Set”) the design process from scratch, mine the formation of special chart atlas design concept and landing of design process, so as to provide reference for the design of the project chart atlas.

2. Design concept of special sea atlas
The term “design concept” is often used in the fields of space (interior) design, product design and so on. It is the thinking process and dominant thought that designers create design value, and the soul and core of the whole design. The essence is people-oriented, that is, fully to consider and pay attention to customer needs. This is exactly the same as the sea atlas design, which focuses on the “relationship between people and maps” and emphasizes the concept of “user-centered” or “user-oriented” in the whole design process. Designers in mapping task, must deeply dig and analysis the characteristics of the figure (such as with the psychological characteristics, image recognition level, etc.), fully consider the intention of the figure (such as needs and concerns, etc.), on this basis, understand and grasp the nature of the mapping tasks, and the purpose of the atlas of
requirements (such as the use of sea atlas occasions, usage, etc.), then refine to perform the design concept. It is to say that special sea atlas design concept is so important that it lead and influence the whole process of special sea atlas design and the performance of finished products.

Author team undertook the design and compilation task of “Achievement Set”, through the communication with the user unit, know that under the national “The Belt and Road Initiative”, the company’s global seaborne trade volume increased significantly, so “Achievement Set” is planned to compile to show the company’s global seaborne trade volume since 2018, and yet to show the company’s global trade power, in other words, “Achievement Set” is both for business summary and also providing convenient and accurate reference to trade strategy planning and task deployment. After defining mapping task and sea atlas uses, the author further analyses figures and their characteristic to realize that, they are mainly the leadership of the company as well as related business persons, they are familiar with company’s business and global sea situation, with a high level of chart knowledge and spatial cognition ability, they hope to clarify the completed trade voyage and the income effect from the “Achievement Set”, then can study the status quo of trade power of company on a global scale, in order to plan the future of the company global shipping deployment. Finally, according to the user’s demand for chart information and further feedback, the design concept of “Achievement Set” is finally refined and formed, that is, “based on the present situation, facing the future, opening up new strength”.

3. Design ideas of special sea atlas

Sea atlas design is a complex and complicated system engineering, around the design concept of “basing on the present situation, facing the future, opening up new strength”, the author applies chart cartography scientific principles (including map design theory and the atlas design principles, etc.) and technical experience to create, to form the overall design ideas of the “Achievement Set”. First of all need to fully study mapping areas, at the same time, to collect and analyze cartographic data, then to design overall, including mathematical foundation determined, sheet design, contents selection design, features expression design, the structure of layout design, etc. The next step is to verify the feasibility of the overall design through the sea atlas, if the test is not reasonable, it needs to improve or optimize the design, if successful, it can be presented as the design scheme for the guidance and basis of the “Achievement Set”. The entire process is shown in Figure. 1.

3.1. Realization of Design Concept

Under the guidance of the design concept of “Achievement Set”, the author and the team fully integrate the design theories such as map transmission, spatial cognition theory, map perception theory and aesthetic design theory, meanwhile comply design principles to implement the design concept and form the overall design idea of “Achievement Set”. 
3.1.1. Theory of Map Design. According to the map transmission theory, the purpose of “Achievement Set" is to transmit information between the designer and the user. The whole transmission process includes two important transformations: one is the transformation from objective reality to “Achievement Set”, that is, the mapping process (visualization process) of “Achievement Set”; the second is the transformation from “Achievement Set” to the application effect, that is, the interpretation process (cognitive process) of “Achievement Set”. These two processes are exactly two processes of opposite execution directions and interaction, and the intermediary of connection is the mental map.

The first transformation is the process of creative thinking, in order to design to produce “Achievement Set” successfully, the first thing is the hard map spatial cognition, to preview the work in mine, to establish the “model” of “Achievement Set”, just as mental maps which may be varied, and then by integrating varieties of factors, to analyze, compare and evaluate (such as which one can transmit information smoothly) to entertain the final mental map, which can be visualized by special symbols to form graphics used in daily, that is, “Achievement Set” of symbol model.

The second transformation is to read, analyze and interpret the spatial geographic information of “Achievement Set” by spatial cognition method in the view of users, then to convert into mental map, so as to build a bridge between “Achievement Set” and the objective reality. Of course, the information acquisition process also depends on the user’s perception of “Achievement Set”, including use’s visual perception of graphics and images, as well as psychological factors, which also affect the effect of map information transmission.

Therefore, when designing “Achievement Set”, the author and team should not only increase the information as much as possible to meet the actual and potential needs of users, but also fully consider the spatial cognitive ability and map perception of users to strengthen the effective transmission of information to achieve the best transmission effects as much as possible.

3.1.2. Principles of Atlas Design. When designing “Achievement Set”, the author and team mainly followed four design principles: the first is to ensure the integrity, all the maritime trade scope involved in recent years are included in the mapping area. The second is to focus on practicality, highlight special features, briefly downplay other non-key features, and at the same time try to maintain the continuity of the route. The third is to emphasize the scientific nature, in the basis of considering the convenience, strive to be scientific, rigorous and reasonable. The fourth is to pay attention to the artistic, in the form of expression, symbol design and color use, to express the beauty and artistic of “Achievement Set”.

Figure 1. Flow of Design Idea
3.2. Overall Design Idea

Overall design of “Achievement Set” needs studying and analyzing the mapping area to grasp the regularity and characteristics, at the same time, it also can’t be completed without the study and selection of cartographic data, including mapping data collection, analysis, selection, and so on, which directly influence the quality of the atlas. Meanwhile, the author and team also consider all the factors that restrict the design of sea atlas, such as the use of the sea atlas, the mathematical basis, the complexity of the sea atlas contents, the quality of cartographic data, and the characteristic of users, and so on, then form the best design in the end.

3.2.1. Sheet Design and Mathematical Foundation Determined. Different from shingle sheets or series of charts (generally full-width and seldom half-width), the map area specifications of the atlas are generally small, with 8-width, 16-width and “expansion page” specifications in the majority, which mainly depends on the use and convenience of the atlas. For the “Achievement Set”, according to its use and purpose, it is determined to be 8-width, and the size of book is 420mm×297mm. At the same time, in order to use conveniently, it should be banner sheet as far as possible, less straight sheet.

Design of sea atlas should reflect the systematicness and consistency of the atlas as well as its integrity and flexibility. In order to express the design concept of “basing on the status quo, facing the future, opening up new strength”, the author and team design four levels of map groups, including “general map, trade area maps, outcome maps and main maritime passage maps”.

(1) General map
The general map is a global map, in order to reflect the integrity of “Achievement Set”, the design method of circling the earth and having overlapping areas is adopted, so as to give users a complete global perspective. The scale designed is 1:116 000 000, which is intended to present the total coverage of the company’s maritime trade in the world, meanwhile, this level is also the first level index map, showing the range lines of each subdivision of trade area maps (as the second level).

(2) Trade area maps
Trade area maps are the second level group, according to the characteristics of the world’s oceans and cartographic data, the author and team has designed 6 partition maps, which respectively are China sea and adjacent sea, north Pacific, South Pacific, Indian Ocean, the south Atlantic ocean and north Atlantic ocean, with scale of 1:10 000 000 to 1:50 000 000, to express further each trade area information, such as business scope and trade time, etc., at the same time, the group map is also the secondary element figure, to show the scope and number of the outcome maps (as the third level). In order to reflect the practicability of “Achievement Set”, each division is designed with overlapping areas to maintain the continuity of the navigational lines as much as possible, meanwhile, the “Pacific South” division is reserved to provide space for the later revision of special features, which also reflects the company’s “facing the future” design concept.

(3) Outcome maps
Outcome maps are the third-level map group, and also the main part of “Achievement Set”. It mainly reflects the design concept of “basing on the status quo”, expresses the specific information of achievement in detail, and provides the user with detailed trade status and relevant information of the company. According to the situation of cartographic data, this group map is not for navigation, so the author and team tries to design no-overlapping area, or a small amount of overlapping area. In the scale design, considering the total number of maps, map load and available data, the scale is set as 1:5 000 000.

(4) Main maritime passage maps
Maritime trade is bound to pass through some major maritime channels, so the forth level- major maritime passage maps are designed to further enlarge and supplement outcome maps, and present the relevant information of outcome in more detail, which can provide reference for users to clarify, analyze and deploy the business plan of the company. In the scale design, considering the numbers of maps, map load, the existing base map data and the geographical situation of key channels, the scale is designed as 1:1 000 000, of course, some one can be adjusted appropriately according to the data situation.

Mathematical foundation is an important guarantee for the scientificity of marine atlas, which mainly includes determining the scale, projection and coordinate system of each map. The coordinate
system of “Achievement Set” is unified as CGCS 2000 coordinate system, while the scale and project should be considered in the same way as sheet design. Scale design is mainly restricted by chart purpose, mapping area, generalization, accuracy and so on many factors, because of “Achievement Set” sheet size has been identified as eight-wide, so it can be designed mainly by extent of mapping area to be the forth different levels of scale above as mentioned. The choice of projection is usually closely to the extent and shape of mapping area, as well as atlas purpose. “Achievement Set” mainly reflects the company’s maritime trade results, that is to say, it is closely related to navigation activities. Mercator projection is very suitable for presenting the information of “Achievement Set”, because it has the characteristic of projecting the shipping line into a straight line and equal angle. After analysis and comparison, Mercator projection is selected, and the benchmark parallel is the mid-latitude of the map.

3.2.2. Content selection and presentation design. Different from general charts, chart atlas contents should be selected from more complicated, miscellaneous and numerous cartographic data to ensure the aim and purpose of atlas, as well as integrity, comprehensiveness, relevance and optimality of the sea atlas. As a special chart atlas, “Achievement Set” mainly presents the company’s global maritime trade results. Therefor, the base map mainly focuses on global sea areas and sub-regional sea areas, while the special elements mainly focus on shipping scope and trade results.

When contents of atlas are determined, it needs to be visualized, it can be said that content presentation design is the way to present design concept perfectly through symbol and color design, it is both the guarantee of highly transmitting chart information, and embodiment of atlas artistry, but also the reflection of designers’ the atlas design sills and artistic level. Generally speaking, content representation design id not absolute, but can be influenced by the preferences of the designers and the trend of the atlas design. For “Achievement Set”, the author and team prefer soft, fresh and elegant, so on the base map, the light blue background is for the sea part, while the light yellow background is for the land area. For the special features, low saturation tones are used to represent regional features such as general dyeing zone and table background color, high saturation tone represents regional range line,trade results and others, in order to make the whole atlas harmonious and unified in tone and highlight the key points, special features of different years are represented by different colors with high contrast, and those of different years are represented by the same color system. Finally, it is necessary to determine the content representation scheme through the sea atlas test.

3.2.3. Arrangement structure. In order to reflect the scientificity and integrity of the atlas, the structure arrangement of the atlas should conform to a certain logical relationship, and generally adopt the arrangement from macro to micro, and from whole to part. The author follows the rules of spatial cognition, and arranges the structure of “Achievement Set” in the perspective of “whole-to-part” and “far-to-near”. It not only reflects the independent and related logical relations among the four groups, but also highlights the inherent primary and secondary relations among the contents of “Achievement Set”.

3.3. Atlas Test and Design Scheme

In order to verify the feasibility of the overall design of sea atlas, it is better to carry out related sea atlas tests if conditions permit, which can be carried out from legend, representation, method, sample map(comprehensive sample map and color sample map) and map margin decoration and others. The author and team made several sample maps of general map, trade area maps, outcome maps and main maritime passage maps, Figure 2 is some sample maps. Then contrasted, compared and modified to get the better one, of course, the team should communicated and negotiated with the user unit to optimize and improve the overall design repeatedly, so as to achieve the best information transmission effect.
After the success of the atlas test, the overall design of the atlas was finally as a design scheme. It can be said that the design scheme is not only the result of designer’s work, but also the guide document for “Achievement Set” production. Through the design scheme, the mapper can understand accurately all the intention of the designer, and apply creatively it into the production.

4. Conclusion
Atlas design is a creative mental process, and there is no set pattern to follow. In the paper, based on “Achievement Set” design, the thinking process of sea atlas design concept and overall design grow out of nothing is explored, striving to mine the “inexpressible” mysterious special sea atlas design to show the tip of the iceberg. With the implementation of Maritime Power Strategy of the new era, the special atlas design are faced with new challenges, only by constantly research, deepen the modern cartographic theory and technology, and integration of psychology, design art multidisciplinary contents, can special sea atlas be scientific, practical, more artistic, and yet more become the new way for presenting marine result.

5. Acknowledgments
This work was financially supported by National Natural Science Foundation(41871295).

References
[1] Zhen Huang . The design and key production technology of “ the First National Survey Atlas of Hainan Province”[J]. Surveying and Mapping Geographical Information, 2018,41(11): 252-253,256,259.
[2] Mingxiao Liu, Yongyong Wang . Research on the method of atlas compilation under the background of GIS technology[J]. Geomatics and Spatial Information Technology, 2020,43(6): 101-104.
[3] Ye Wang. Discussion on the characteristics and attention problems of the compilation of atlas[J]. Geomatics and Spatial Information Technology,2016,39(11): 216-217,221.
[4] Lei Cao. Design and Compilation of “ Shenyang urban atlas”[J]. Urban Geo-technical Investigation & Surveying, 2019(2): 139-142.
[5] Ling Meng. Design and Compilation of the silk road opening situation atlas of Xinjiang Uygur Autonomous Region[J]. Geomatics and Spatial Information Technology,2019,42(4): 181-183.
[6] Wenlong Zhang, Xing Pan. An exploration on the compilation of provincial monitoring results atlas[J]. Surveying, 2019,42(2): 81-85.
[7] Wenhong Cui. Research on content structure design of regional comprehensive atlas[J]. Geo-science Information,2019,17(9): 53-55,122.
[8] Kemao Ding, Datao Hui. Research and implementation of “Arctic Navigation Electronic Atlas”[J]. Information System Engineering, 2017(8): 32-35.
[9] Jialan Hu. Research on Compilation and Design of Marine Economic Atlas- A Case Study of Hebei Province[D]. Master’s Degree: China University of Geosciences( Beijing), 2019.
[10] Qianlan Tan. Research and Development of Atlas Integrated Compilation System[D]. Master: Southwest jiaotong University,2018.
[11] Chunju Li, Yujie Zhang, Guimin He, etc. Research on general design content and technical method of ocean atlas[J]. Marine Surveying and Mapping, 2016, 36(3): 48-51.

[12] Xiaoping Sun. Design and development of ocean atlas[J]. Marine Surveying and Mapping, 2016, 36(3): 48-51.

[13] Daichao Li, Yingjie Wang, Jing Cui, etc. Design and compilation of “the World Heritage Atlas of China”[J]. Science of Surveying and Mapping, 2018, 43(7): 156-163.