

THE STUDY ON APPLICATION MODE OF GIS ASSISTANT DEMARCATION SYSTEM

Guizhi Wang

The National Geomatics Center of China, No.1 Baishengcun, Zizhuyuan, Haidian District, Beijing 100044, China
wangmiaojie@163.com

KEY WORDS: Application Mode, Demarcation System, GIS, Boundary, Dispute Regions, Negotiation

ABSTRACT:

The administrative demarcation work among countries, provinces, cities are a complex, important and urgent task. First, author briefly talk about the main content, the basic task, the spatial behavior process on the administrative demarcation, and the application functions and the characteristics of the administrative demarcation system based on GIS in this article. Then, emphatically introduce the application mode of the administrative demarcation system. The presentation would be divided into three phases which is before, in and after negotiation. Finally, summarize the application benefit acquired by using the demarcation system.

Before negotiation, mainly prepare and analyze the materials for next turn of negotiation, study and set down multi-set, feasible plans for the negotiation. In negotiation, mainly inquire and search the materials for negotiation making use of the special negotiation tools, express demarcation standpoint, advance reason of demarcation standpoint, make and plot thematic map, apply the analysis functions and so on. After negotiation, clear up negotiation summary, white book and treaty, print attached drawing of treaty.

1. BRIEF INTRODUCTION OF ADMINISTRATIVE DEMARCATION AND GIS ASSISTANT DEMARCATION SYSTEM

1.1 The Main Content of Administrative Demarcation

On account of two power departments have different opinion on the boundary between adjacent administrative regions, both parties need to negotiate in order to make sure their confirmed boundary.

With the precondition of respect history, the two parties of demarcation put forward respectively own boundary claim-line and compare them. Coincident boundary segment reform confirmed boundary, inconsistent boundary segment reform dispute block. Represented in Figure 1:

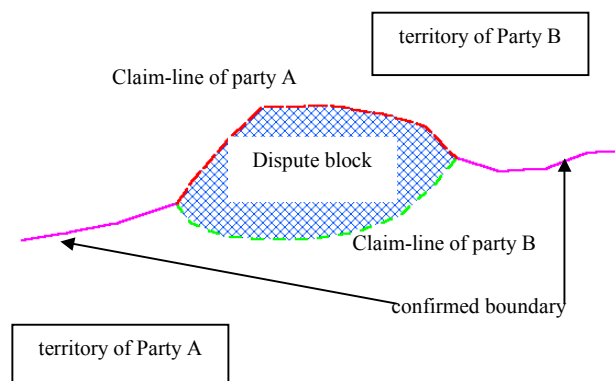


Figure 1: constitution of boundary dispute

During the negotiation, the two parties refer to a great deal of boundary materials and resolve these dispute blocks. Finally,

the whole boundary line is reformed, which is accepted by the both parties.

1.2 The Basic Task of Administrative Demarcation

The basic task of administrative demarcation is that confirm the spatial trend of administrative boundary lines in the dispute regions and definitude the spatial popedom of the both parties on administrative management. The idiographic handling object is dispute block.

During the demarcation, the both parties negotiate about (consult with) the dispute regions one by one. In order to come into being same opinion, one side, need to analyze various resources of dispute region and put forward own claim with the precondition of striving for ultimate profit. On the other hand, need to analyze various historical materials, domination situation, law code and search the gists for own claim.

1.3 The Spatial Behavior Process of Administrative Demarcation

Definition: the spatial behavior sequence of leading administrative boundary to change in spatial trend constitutes the spatial behavior process of administrative demarcation. Among them, the spatial behavior process indicates the management, the analysis and the decision activities that demarcation professional have carried through. Strictly speaking, the spatial behavior sequence is the processes from the analysis of spatial data one by one to the visual expression of administrative boundary spatial trend. Simulating the spatial behavior process of administrative demarcation is virtually simulating the dispose steps that make up of the spatial behavior process of administrative demarcation. Because the task which every spatial behavior would complete is different and the operation which it would progress is independence relatively, the whole spatial behavior process of administrative demarcation may be divided different sub-processes in term of

the spatial data content of administrative demarcation. Represented in Figure 2:

sub-process	operation
Inquiry of the demarcation information on the dispute region	Selecting the various materials of demarcation
Demarcation analysis on the dispute region	Contrast analysis of profit distribution on the different boundary
	Contrast analysis of the claim-line with the domination-line
	Contrast analysis of the claim-line with the historic boundary line
	Contrast analysis of disagreement between the historic boundary line
	Reason analysis of disagreement between the text illumination and the map
Visual expression of demarcation opinion on the dispute region	expression of the claim-line analysis conclusion and the conclusion gist (demarcation standpoint)
	expression of the trend analysis conclusion (advancing reason of demarcation standpoint)

Figure 2: Primarily breaking down on the spatial behavior process of administrative demarcation

1.4 The Characteristic and Application Function of GIS Assisted Demarcation System

Aiming at practice demand of the boundary negotiation, The land boundary system of negotiation and management has been designed and established. It includes the boundary database with hypermedia structure and the application functions of assistant boundary negotiation.

Realized integrative management of the fundamental geographical information, the demarcation material, the related treaty and law statute in the boundary belt. They are the data of multi-scale, multi-time and multimedia. Among them, the multimedia data type includes vector graph, raster image, real landscape photograph, aviation photo, three-dimensional digital elevation model, text material, video and radio material. The multi-scale data includes 1:10000-scale, 1:25000-scale, 1:50000-scale, 1:1000000-scale topographic maps. The multi-time data includes the treaty and attached drawing 100 years ago, the topographic maps in various time after establishing R.P.of China, the aviation photo in the near future, and so on.

Develop the application functions assisted boundary negotiation such as the information inquiry functions based on “card” and “node” of hypermedia database, the statistical analysis functions, the demarcation analysis functions based on the digital maps considering area, the visual expression functions of demarcation opinion and claim, the manufacture functions of thematic map about demarcation and negotiation result, etc..

2. THE APPLICATION MODE OF DEMARCATION SYSTEM

2.1 The Three Phases of Applying Demarcation System

The demarcation system, it is demanded, meet the staggered requirement of boundary negotiation because it go along turn by turn. To meet the imminence requirement of the boundary negotiation, on the principle that the system tryout is began when the system development is going on, firstly establish a rudiment system that would be used and verified in the negotiation. Then the system functions are improved on and the system interfaces are perfected aiming at the questions found and the advice advanced in negotiation, supplement the new content at the same time which would be demanded in next turn negotiation.

Through the application and practice of the system, had groped a suit of effective application mode. It is divided into three phases. They resolve the problems before, in and after the negotiation. Before the negotiation, mainly prepare and analyze the materials for the negotiation, study and set down the plans for the negotiation. In the negotiation, mainly inquire and search the materials for the negotiation making use of the special negotiation tools, express the demarcation standpoint, put forward the reason of demarcation standpoint, make and plot the thematic map, apply the analysis functions and so on. After the negotiation, clear up the negotiation summary, the white book and the treaty, print attached drawing of the treaty. Represented in Figure 3:

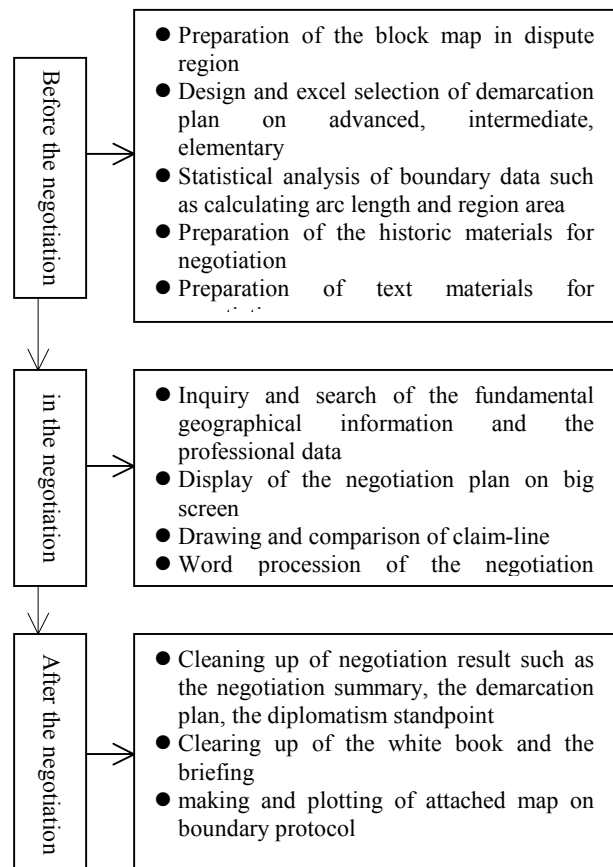


Figure 3: 3-phases of system application mode

2.2 Clearing Up Information and Preparing Plans Before the Negotiation

2.2.1 The Preparation of Negotiation Arguments: Because the negotiation standpoints and the negotiation plans of our Party should be confirmed in according to the schedule of negotiation, need to clear up related fundamental geography data, the demarcation plans, the negotiation arguments, the negotiation documents and form special spatial database for the negotiation in notebook computer in order to take and refer in the negotiation.

The general negotiation arguments mainly include the agreement documents of both Parties, the claim-line exchange maps of both Parties, the block maps in dispute areas, historic treaty and attached drawing, the real landscape photographs, the newest aviation photo, the mere stone photographs, the video and radio boundary material, the reference text for negotiation, the negotiation outline and so on.

2.2.2 The Fast Referring of Boundary Information: To refer to the boundary information related to the negotiation as fast as possible, have developed a series of the special buttons in the system. They are the special buttons for anyone material of a dispute area and for several usual materials of anyone dispute area.

For example, the special button for the block map, for historic maps, for the real landscape photographs, for the aviation photo, for the mere stone photographs, for the video and radio material and for the reference text in one dispute area.

For example, because always refer to the exchange map and block map of a area when discuss dispute areas one by one before negotiation, have developed the special buttons for the exchange map and block map of the area of one or more from this area forth or backwards. Due to using the special buttons, greatly improved the work efficiency.

2.2.3 The Analysis of Negotiation Standpoint and the Preparation of Negotiation Plans: Using graphics contrast and overlay functions in the system, analyze the claim-lines trend difference of both Parties and the reason engendered difference, find out the negotiation arguments benefiting to our Party in comparison with historic treaty and attached drawing. For example, aim at the contradiction between different historic maps (some of the contradiction is consistent in terrain but disagreement in boundary trend, some of the contradiction is disagreement in terrain but consistent in boundary trend), utilizing the map grooming function in the system draw the comparison maps between the related treaty attached drawing and the claim-line exchange maps of both Parties. Then, find out the places in which there are contradictions, study and analyze the advantages and disadvantages relation between the various maps. Finally, find out the arguments benefiting to our Party from them and confirmed the negotiation plans, the negotiation standpoint of our Party.

Making use of the area analysis function in the system, on the claim-line exchange maps or the dispute block maps, combine the various boundary lines such as the claim-line of A Party, the claim-line of B Party, the practice domination line, the treaty line, the demarcation plan line and calculate the different areas. These are the gist of ensuring demarcation plan on advanced, intermediate, elementary so that hold measure and adjust plans at any moment in the negotiation.

Analyze and collect a great deal letter material and maps on any dispute region. Concluded negotiation outline serve for the important arguments which the head negotiation delegate hold in the negotiation.

2.3 Inquiring Information and Assisting Decision-making in the Negotiation

Need to search for the various fundamental materials, the plans and the arguments at any moment in the negotiation process. Simulate the demarcation plans based on the digital maps at the negotiation site and carry out assistant demarcation analysis.

2.3.1 Inquire and Search the Negotiation Material: Base on the negotiation course, inquiry the prepared fundamental material, the plans and the arguments at any moment. They include the treaty letter and attached drawing, the photograph of dispute region, the aviation photo, the three-dimensional digital elevation model, the text material, the video and radio material in order to explain and confirm our negotiation standpoint.

There are various inquiry functions based on the hypermedia database. For example, from node symbol to node content: from issue area symbol on 1:50,000-scale map to issue area card, continual to issue block map or issue area photography and so on; from node content to node content: from block map of certain issue area to three-dimensional digital elevation model of the same issue area and so on; from Menu to node content: from issue block item and three-dimensional item on menu to issue block map and three-dimensional digital elevation model, thus, every node can be take for start-node; from button to node content: When push any one of special purpose button bar for quick-inquiry, we can call-out the corresponding material.

2.3.2 Display the Negotiation Standpoint and Arguments of Our Party: Display at any moment the claim-lines of both Parties, the treaty line, the practice domination line, the plan line expressed our Party standpoint, the place of mere stone on the 1:50000-scale claim-line exchange maps of both Parties or dispute block maps. Refer to the multimedia information related with the negotiation. The condition of anyone area can be clear at a glance, very definitude and reality. It is easy for the both Parties to negotiate and discuss. It had brought into active play for the negotiation work group to analyze the boundary condition, discuss the negotiation plan, finally confirm the negotiation standpoint.

2.3.3 Simulate the demarcation plans at the negotiation site: The instance which both Parties contest endlessly or our Party is difficult to express own standpoint often occur in the negotiation process, therefore, using the system functions fleetly exhibit the standpoint of our Party with computer so that advanced the negotiation course.

For example, on the exchange maps or the dispute block maps, simulate the demarcation plans at the negotiation site using the special cartographic tools. That is drawing the demarcation standpoint of one Party or both Parties and carrying out explain, analyze, confirm, modify in the computer in order to understand opposite standpoint one another and manage to come into agreement.

2.4 Suming up the Result after the Negotiation

2.4.1 Sign of the Negotiation Conclusion: Using the drawing tools of the system, draw the negotiation conclusion on the digital maps. Some of them need to be printed out.

Mainly draw the boundary lines on digital maps. Besides set the type, the color, the size of the boundary line according to the request, can adjust and edit formed boundary line so that change the trend of boundary or combining or splitting boundaryline.

Can label the symbols of mere stone and the annotation on the digital maps, also intercalate their color, type(font), size.

Manufacture the thematic map about negotiation result and print out. It includes the layout of map-face, the selection of content, the grooming of map-outside and so on.

2.4.2 Updating of the Database: In any turn negotiation, the problem which would be resolved is different. Therefore, need to update database constantly and prepare the new information for next turn negotiation.

2.4.3 Process and Printing of the Negotiation Document: After the negotiation, need to process or print a lot of negotiation document such as the negotiation summary, the white book, the agreement, the demarcation plans, the diplomatism standpoint, the negotiation briefing, the report and so on.

2.4.4 Archives Management of the Negotiation Result: The conclusion of this turn negotiation would be clean up and archived by kind so that serve as the origin gist for next turn negotiation.

3. CONCLUSIONS

The system mainly serves national charge department of foreign affairs administration. Its economic benefit is hard to calculate, but its societal benefit is very markedness. The system had been used for the land boundary negotiation between both countries since October, 1996. Along with continuance improvement of the system functions, the system have taken a play more and more in the negotiation and gradually become the absolutely necessarily work system for boundary negotiation and management.

This is first special land boundary system in our country so far. It have become a pilot for wide application of GIS technology in boundary management in the future. Through studying and development of the system, have summarized a suit of advanced technology method and effective application mode. The lucubrating and practising had been done in spacial decision support system, hypermedia database, entity-relation model, multimedia information processing, visual expression.

Because the system was used to assist the land boundary negotiation, our country greatly improved the work efficiency and the work plane of preparating plan before negotiation, the reliability of expatiating argument in negotiation, the velocity and quality of clearing information after negotiation. Thus, picked up negotiation course and improved on our diplomatism negotiation work from traditional handwork operation to modern technology means.

Acknowledgments:

The author is grateful to the leaguers of this project.

References:

HaiQing Wang, 1998, Research for GIS-aided Administrative Demarcation Based on Spatial Behavior Process(graduate student paper).

GuiZhi Wang, 2000, Boundary Management Database based on Hypermedia, International Archives of Photogrammetry and Remote Sensing. Amsterdam. Vol. XXXIII, Part B4/3. Commission IV.1146-1152.

Jun Chen, 1995, the Concept and Question of GIS Special Data Model, the Integration and Application of RS, GIS, GPS, the Publish House of Surveying and Mapping

Fuling Bian, 1996, the Principle and Method of Geographical Information System, the Publish House of Surveying and Mapping.