Challenges for Surveying in the Establishment of International Borders

William Alexander ROBERTSON New Zealand

Key Words Surveying Challenges, International Borders, Delimitation, Demarcation

SUMMARY

This paper examines the role and challenges of surveying in the delimitation and demarcation of international borders and the contribution to capacity building in the nations concerned. The importance of well established international boundaries is now widely accepted as a stepping stone to social stability and economic development. The role of surveying is highly significant but it needs to be managed and exercised as integral component of a complex political/judicial/professional process. The perspective taken is in regard to the determination of international borders where there has been some dispute. The samples of international borders considered are Iraq/Kuwait, Eritrea/Ethiopia, Cameroon/Nigeria and the Abyei area of the Sudan. Three of these borders have been determined after wars. In the case of Eritrea/Ethiopia and the Sudan, there have been long drawn out civil wars and the boundary determination has been written into the peace agreements. With regard to Iraq/Kuwait the very existence of a national border was considered problematical by one party and contributed to the first Gulf war. The Iraq/Kuwait Boundary Demarcation Commission was one of two Commissions to facilitate keeping the peace after the war. With the Cameroon/Nigeria border there was a serious dispute over a significant part of the boundary which was initially resolved through a judgement from the International Court of Justice (ICJ) which provided a confirmation of the delimitation of this international boundary. Subsequently a tripartite arrangement established by the Secretary General of the United Nations and the presidents of Cameroon and Nigeria for the demarcation of this boundary. In all of these cases surveying has played an important role in assisting their delineation and demarcation. However, as the delimitation process has a substantial legal/political basis the contribution of surveying at this stage is confined by legal protocols. The role is largely related to the degree of relevance of historic geographic material and the relation of physical and cultural features to the boundary. Initially it involves the analysis of map and other reference material, interpreting the geographic signatures and relativity significance of the various documents. The delimitation may then require surveying interpretation to define the limits as specified and this can include the indicative location of the border along ridges and rivers and around or through settlements and towns etc. At the demarcation stage the surveying contribution can involve a complete suite of survey phases from provision of geodetic datum and referencing, medium and large scale mapping and imagery and, field assessment, surveying for placement of pillars, as built survey and quality assurance of all surveying activity. Although all surveying phases are involved from first principles to the highly technical the context remains a political and legal one and the role of surveying needs to be accomplished in relation to this

demanding environment. This involves special challenges to the surveyors in working with in the legal limitations applying in each individual terms of reference. Qualities such as professional and technical integrity, independence, objectivity and collaboration are important features of the surveyors exercise of his/her responsibilities. In the discussion the role of surveying is examined in relation to the demands of the strict political/judicial process and sensitive partisan environment which accompanies disputed international boundaries.

Challenges for Surveying in the Establishment of International Borders

William Alexander ROBERTSON New Zealand

INTRODUCTION

There are major challenges in the surveying role in the establishment of international boundaries where the process arises through major differences or disputes between the two sovereign Parties. Where the sovereign Parties are in agreement and jointly delimit and demarcate their international boundaries cooperatively the role of surveying is a reasonably straight forward technical and professional exercise. A big advantage in these cases is that issues of delimitation or further clarification can be readily referred to the sovereign Parties for clarification. However in cases of major disagreement or dispute a formal judicial process is likely to be invoked at least partially. The implementation of the demarcation then requires sensitivity in executing the surveying role in relation to observing the judicial and political framework to which applies in each case. Strict legal, access to material and the field and security limitations may apply. Such challenges can require the basic techniques of surveying to be augmented with innovative techniques and technology such as sattelite imagery, relief models GPS etc. in non traditional ways. With the capability of new spatial technology continually developing the capacity of surveyors to harness it becomes a valuable asset in progressing otherwise intractable boundary problems.

My own experience in establishing disputed international boundaries extends back two decades and involves varying roles in four international boundary determinations. I acted as Commissioner for the Iraq/Kuwait Boundary Demarcation Commission (IKDBC), 1991-1993, as a Special Consultant for the Eritrea/Ethiopia Boundary Commission, 2001-2007, a Senior Consultant for the Cameroon-Nigeria Mixed Commission, 2003-Present, and as a Independent Expert for the Sudan Tribunal, 2009. All of these roles required high level surveying and cartographic capability but also presented a range of political judicial parameters and challenges for the surveyor. This role requires insight, discretion and observance of the wide reaching and complex public political/judicial process which is the norm for international boundary determination in the modern world.

BACKGROUND

Although conflict may not always mark international boundaries which are referred to third Parties for full or partial resolution major disagreement will normally be a feature of events leading up to this referral. Where conflict has occurred then the delimitation or demarcation or both, of the borders, will be a subject of the ensuing peace agreement and some parameters for the execution of this will be included in the relevant section of that agreement. The resolution of subsequent boundary issues will probably involve reference to the International Court of Justice (ICJ) or to a specially established Boundary Tribunal or Commission. Inevitably a specific legal structure will be provided for the boundary

determination and this will frame the order and process of the surveying component. This will be in addition to the hierarchy of delimitation and demarcation which applies generally to the establishment of any international boundary. Delimitation being a sovereign and political process which may through inability to achieve agreement be delegated in whole or in part to a established or specially constituted judicial or quasi-judicial body. Delimitation determines in general terms where the boundary is intended to lie although specific detail may not be given in great degree. This is particularly true if the delimitation is based on historic treaties or agreements. It may employ a general identification traversing topographic features such rivers, mountain ranges, hills and ridges, references to existing markers or cultural features or the exclusion of these.. Demarcation is a secondary phase involving accurate and unequivocal determination of where the position of the boundary as previously delimited. Traditionally it has involved the emplacement of boundary monumentation or employed detailed definitions of defined topographic features such as rivers or mountain ranges, ridges etc or various combinations of these.

In many cases of disagreement the related delimitation in full or in part dates back to colonial boundaries and may be vague or ambiguous. The challenge can be to establish the adequacy of delimitation in the face of two contradictory interpretations of historic material. Where a third judicial party is referred to it may be given the power to delimit the boundary, to clarify and confirm an existing delimitation or simply to execute the demarcation often with powers. This third party may be subject to a right of appeal although often it has the power to make a final decision. The circumstances of each international boundary situation have their individual particular difficulties and the surveyor will often be faced with a range of challenges arising interpretation of the delimitation as well implementing the demarcation. These arise commonly in relation to historic or disputed delimitations or where legal, political or security constraints limit the demarcation process. Insight and often innovative surveying thinking and applications will then help to move the demarcation process forwards.

The surveyor is an important technical advisor in the determination of the position of the boundary and may have to exercise responsibilities assigned through servicing the boundary commission as well as his operational surveying responsibilities. All surveying phases are involved from first principles to the highly technical tasks. This will involve a complete suite of survey phases from provision of geodetic datum, medium and large scale mapping and imagery and, field assessment, surveying for placement of pillars, as built survey and quality assurance of all surveying and demarcation activity. Nevertheless the overarching context is a political and legal one and the surveying role needs to be accomplished in recognition of this demanding environment.

GENERAL BOUNDARY DEMARCATION TECHNICAL CHALLENGES

The demarcation of international boundaries requires a wide range of high level boundary surveying expertise and capability. The accurate fixing of all boundaries requires application of standards of accuracy that will enable relocation or reinstatement of international boundaries to the precision determined and documented in their demarcation. In this regard relationship to a sound and accepted boundary datum is essential. Although each Party to the boundary determination will have their own national datum these a seldom satisfactory for the boundary project. They may have a less than acceptable accuracy or be derived from traditional methodology and not provide the standard of reference frame demanded of the international boundaries. In any event the establishment of a new specific boundary datum has the advantage that it is not the datum of either Party and can be seen as an objective basis for coordinate reference for all future boundary surveying activity.

The standards for survey positioning are steadily improving with new technology and specifications for surveying and mapping need to reflect these changes and the current capability of the technology. GPS positioning continues to improve in cost effectiveness and surveying specifications. Specifications for international boundary surveying need to output oriented and be sufficiently flexible to accommodate this continual rate current practice and methodology and innovative technology.

Usually the mapping coverage of the boundary will be historic and modern mapping of variable quality and limited in coverage. Satellite imagery provides great opportunities to source preliminary mapping coverage. This will enable the delimitation and demarcation planning an preparation to be fully supported by good quality geographic information. The standards of initial geo and ortho rectification are improving steadily and good quality preliminary image maps are able to be sourced economically. Getting suitable stereo and DEMs is more difficult but with the provision of free Space Shuttle DEMs there are good opportunities for alternatives to costly acquisition of conventional topographical mapping information. The compilations of imagery and DEMs into three dimensional relief models of boundary areas offer reconnaissance, planning and demarcation preparation material never previously available.

In difficult country the emplacement of boundary pillars of conventional design and structure becomes uneconomical and alternative approaches are needed. These include the drilling of pillars with provision of strength and durability through high tensile steel and portable drilling and construction equipment.

A major challenge is to establish procedures and protocols for all aspects of demarcation, collaboration with the Parties and dispute resolution in a proactive way rather than as ad-hoc responses after difficulties are encountered. This requires good anticipation by the Boundary Commission and early establishment of demarcation directions which detail

the managing of the range of circumstances likely to be encountered in the implementation of the demarcation. Through establishing processes and procedures prior to field work there are the means of resolving issues and preventing unforeseen problems jeopardising the demarcation as whole.

CASE STUDIES

Iraq/Kuwait International Boundary

Agreements on this boundary dated back to the Ottoman Empire and the Sultanate of Kuwait. The boundary was formalised in the post World War I agreement in Lausanne in1922 as part of the post war break up of the Ottoman Empire. The delimitation wording (formula) was brief and couched in general terminology. It described the boundary as running up the Wadi Al Battin (long flat valley) to a point east of a notice board placed about a mile south of the village of Safwan and then running in a straight line to the intersection of the Khors (tidal steams at the head of the Persian Gulf) and then out the Khor to the open sea.

Political Challenges

The Government of Iraq (GOI) position under Saddam Hussein was that there was no international boundary and that Kuwait was the Nineteenth province of Iraq. On the other hand the State of Kuwait (SOK) strongly maintained its history and recognition as an independent sovereign state. The occupation of Kuwait by Iraq then led to the first Gulf War. After this war the United Nations as part of their long term peace keeping programme established two Commissions These were the Nuclear and Chemical Arms Commission and the Iraq/Kuwait Boundary Demarcation Commission (IKBDC).. However, despite the authority given to the IKBDC by the United Nations the GOI as a defeated nation was not necessary a willing partner in the demarcation. Although the GOI representative participated in the land boundary deliberations it was not possible to achieve unanimity for Commission's decisions. This meant the surveying and cartographic activity operated in a climate of continued critical scrutiny in regard to all survey advice, deliberations and the implementation of demarcation. When the demarcation of the Maritime Boundary was undertaken the Iraqi Commissioner with drew for that section of the demarcation At the same time the Chairman of the IKBDC resigned. This necessitated the appointment of a new Chairman. Although the United Nations Convention of the Law of the Sea (UNCLOS) was followed as both Parties had acceded to this convention Iraq did not respond to the IKBDC request for GOI definition of the baseline. Kuwait provided its definition of the base line on the Kuwait coast line. This required the Commission to determine a base line along the Iraq coastline which was in terms of what would best suit Iraq's interests. These political circumstances required the highest level of professional and technical integrity in discharging surveying responsibilities.

Delimitation Challenges

Because the Iraq/Kuwait Boundary Commission (IKDBC) was a demarcation Commission it could only proceed to demarcate the boundary if it was satisfied there was an adequate delimitation. The delimitation of the Wadi Al Battin was clarified after the initial agreement with letters between the UK and the Prime Minister of Iraq which identified the Thalweg (line of lowest point along the Battin) as the boundary.

Interpretation Challenges

Usually the surveyor is faced with an immense amount of documented mapping and survey material of different authenticity, quality and significance which presents a variable collection of cartographic and surveying evidence.

In the Iraq/Kuwait border it was necessary to establish the location of an old sign post placed without an accurate measurement in 1922 about a mile south of the old Turkish fort at Safwan. It was removed briefly in 1932 replaced questionably and then removed permanently in 1939. In establishing the location of this boundary turning point it was necessary to inspect historic maps, building plans, sequential historic sets of aerial photography, local knowledge and ground inspection and early survey fixes. In some situations (as it happened in this case) it is not possible to identify a location exactly and then a range of positions can be identified with the mean position being taken as the fairest treatment for each Party. Averaging the difference in between two alternative positions is also a transparent public acknowledgement of the inability through the passage of time to identify a boundary position exactly. This approach of halving substantiated differences then enables an authorative demarcation to proceed.

Another challenge can arise through errors in the old maps or survey material. A good 1:250,000 base map for the Iraq/Kuwait was found to have a structural error arising from poor registration of the plan table topographic information with the coastal hydrographic information. The result was a displacement of the intersection of the Khors by 1 kilometre. Undetected this mapping error would have lead to a major displacement north of the international boundary line through the southern end of the port town of Umm Qasr.

Technical Challenges

A major challenge was implicit in the United Nations Security Council instruction to the IKBDC that the position of the demarcated boundary would be established through coordinates determined by the IKDBC and lodged with the Secretary General of the United Nations. This effectively reversed the traditional legal hierarchy of boundary positions in that the coordinates (measurements) would be the predominant evidence of the boundary not the boundary pillars. As a result it required a tight discipline on the survey and accurate emplacement of the boundary pillars (in this case huge monuments of some 9 ton) to ensure that the pillar exactly reflected the position defined by the recorded boundary coordinates. Heavy land mining was both a challenge and hazard along most of the boundary and imposed additional security and surveying discipline. It

is understood the Iraqi government used international consultants to review the integrity of the demarcation and associated processes without identifying technical flaws.

Maritime Boundary Challenges

With regard to the boundary seaward from the intersection of the Khors there was no detail in the delimitation formula. This was said to be a significant issue by both the representative of Iraq and the Chairman of the Commission with the former withdrawing from the Commission and the later resigning from the commission for the maritime boundary deliberations. Nevertheless because of the accession of both Iraq and Kuwait to the United Nations Convention of the Law of the Sea (UNCLOS) and the work of an Iraqi commissioned expert independent consultant the Commission was satisfied that there was sufficient evidence to establish that there was a delimitation along the median line of the Khors.

Confidence Building Features

Over the years the delimitation of the boundary was sufficient indication of the position of the boundary for the administrators in both countries. However the recognition of this boundary became increasingly problematical under the regime of Saddam Hussein with frequent encroachment in relation to Iraqi oil drilling and military activities. This led to considerable uncertainty about the extent of each country's sovereignty. There were major incidents and incursion along the boundary and severe restrictions on Kuwait' ability to administer and manage security along its border area. With the demarcation of this boundary a clearly marked boundary was reinforced by supporting earthworks and border installations. The implementation of the demarcation removed all ambiguity about the location of the border and the GOI then began to observe the border in the farming area. There still remains a small area of existing urban housing south of Umm Qasr which is across the border and is the remaining settlement to be resolved. Currently the United Nations, the GOI and the GOK are undertaking a joint exercise to upgrade the maintenance of the boundary pillars and associated witness marks. Since the completion of the demarcation in 1993 the boundary has been clearly defined and enabled stable administration and peaceful settlement along the border area.

Eritrea/Ethiopia International Boundary

Treaties for this boundary dated back to the Italian administration of Eritrea and the Emperor of Ethiopia in the early twentieth century. The delimitation wording (formula) was general in terminology with references to a map attached to one of the Treaties. Details on this boundary are covered in the paper by Belgrave to this session so I will be brief in referring to the description and challenges of this international boundary. The Eritrea/Ethiopia Boundary Commission (EEBC) was established to both delimit and demarcate the boundary under the Algiers Peace Agreement. The EEBC was given terms of reference related to the three Treaties and appropriate international law. They were precluded from considering current human geography.

Political Challenges

Although this boundary determination was fully authorised by both Parties through the Algiers Peace Agreement its background from the long war of independence left a sensitive and complicated situation for the delimitation and demarcation. After both Parties accepted the EEBC delimitation it became evident that the expectations of one Party for adaptation of the boundary at the demarcation stage were far beyond what was established legal doctrine and demarcation practice. As the delimitation decision of the EEBC was final there was no room for material changes at the demarcation stage. This tension resulted subsequently in difficulty of access for reconnaissance and complete restriction of access for pillar emplacement.

As the UN Headquarters was in Asmara the capital of Eritrea Ethiopia was initially prone to see an alignment of the EEBC staff with Eritrea and sought more involvement of the EEBC in Ethiopia. This was achieved through the opening of an EEBC administration office in Ethiopia in Addis Ababa and a field office in Adigrat close to the border. While it was agreed that neither Party would be involved in the demarcation field work this lack of involvement built up some disaffection with the work method and the lack of knowledge about field activity. This issue was resolved by the appointment of Field Liaison Officers by each Party who were assigned to field parties with observer only responsibilities. A programme of regular briefing visits to each Party was initiated so that the Special Consultant could keep both Ethiopia and Eritrea up to date with overall progress and current issues.

Delimitation Challenges

The EEBC was faced with confusion of the actual geographical features and positions referred to in the original Treaties. The river names used at the beginning of the century in the Treaties were subsequently changed or different names were given to different parts of the same river. There had been much population growth in the border region over the last century with the settlement pattern badly impacted by a 35 year war of independence.

Interpretation Challenges

Both Parties had the opportunity to provide three consecutive tranches of material in submission, counter submission and responses and this provided diverse and contradictory information for examination and analysis. The location of a tributary and adjacent Mountain which provided for a turning point for a line across the Badme plains was interpreted very differently by each Party. The boundary here was related to the inclusion of a local tribe the extent of whose territory of which was very difficult to determine a century later. In two cases cities belonging to each Party had to be circumscribed to ensure they were included with their environs on the correct side of the boundary. Establishing an equitable boundary around these two cities was a testing exercise in survey, mapping and collaboration with the Parties.

Technical Challenges

These included the description of moving river boundaries which were defined by the lowest point of the streams of greatest flow and the intersection of these with straight line boundaries. Minefields were present in a large section of the boundary and required carefully managed systems to ensure security for survey and pillar emplacement personnel. As mentioned by Belgrave the big challenge was that the EEBC was not permitted access to emplace the boundary pillars. The use of the new computer technology including 3D relief imagery was applied to provide a new demarcation based on coordinates.

Confidence Building Features

After the Algiers Peace Agreement to settle the 30 years war of independence the UN established a 30 k wide demilitarised zone along the border to separate the armed forces of both countries. The area along the border remained badly affected by the war with deserted and damaged villages and many displaced people and refuges, damaged buildings and property. Although both parties fully accepted the EEBC delimitation decision the expectation of the Government of Ethiopia (GOE) was that major adjustments could be effected during the demarcation. However, unilateral adjustments of this materiality are not authorised during the demarcation process and the demarcation is unable to resolve the major differences that GOE had in regard to the boundary. These differences were unable to be resolved bilaterally. The innovative demarcation by legal coordinates has completed the demarcation and this and political developments has led to the departure of the UNMEE from Eritrea. Thus the demarcation has removed all technical ambiguity and equivocation about the exact position of the boundary. However as GOE has yet to formally accept the implementation of the demarcation the administration of each country's territory up to the boundary remains at an impasse.

Cameroon-Nigeria International Boundary

Agreements on this boundary go back to the Anglo and German administrations pre World War I and Anglo French administrations post World War I. After almost 100 years the interpretation of these agreements was difficult and confused in some situations and there was strong disagreement between both Parties regarding the boundary in relation to the Bakassi Peninsula. To settle these differences both Parties agreed to put their cases to the International Court of Justice (IJC). This resulted in a lengthy hearing and a decision by the ICJ which confirmed the delimitation of the Colonial Administration and which clarified the points of difference in the original agreements submitted by the Parties. Initially there was resistance to the ICJ ruling by one Party. However the intervention of the Secretary General of the United Nations led to a tripartite arrangement headed by the Secretary General and the Presidents of Cameroon and Nigeria administered by a Cameroon-Nigeria Mixed Commission for the demarcation of this boundary.

Political Challenges

Despite the initial difficulties in agreeing on the interpretation of the historic agreements and residual tensions in some parts of the border the tripartite involvement provided a very sound basis for consensus and effective and efficient demarcation. The Mixed Commission delegated technical responsibilities to a Sub Commission on Demarcation, field responsibilities to a Joint Technical Team (JTT), responsibilities for the Maritime boundary to a Maritime Boundary Working Group and settlement issues to a Working Group on Affected Populations. The workings of the Mixed Commission and its sub groups required significant early efforts to get consensus on the wide range of issues, standards and specifications etc. This took considerable deliberations and time. However, once this consensus had been worked up it led to a remarkable capability to progress the demarcation and to resolve difficulties at they arose in the field. It is clear that tripartite participation of the Parties and an independent authority has much merit in achieving a successful implementation of boundary delimitation and demarcation.

Delimitation Challenges

Although the early agreements had references to specific geographic features the identification of these posed some major problems. Most of these were raised with the ICJ and dealt with. However, even after the ICJ clarifications differences in the I interpretation of Mountains Rivers etc arose in the field and required careful and studied examination an collaborative resolution.

Interpretation Challenges

There was a significant amount of historic mapping and reference material which required careful interpretation. Differences of opinion on the location of the boundary arose in the field and required careful consideration and study of the decisions of the ICJ and of the evidence presented by the Parties to the ICJ. Much of the boundary involved watersheds and rivers and careful cartographic interpretation and tracing was necessary to establish the watershed specified in the delimitation.

Technical Challenges

The joint working on all technical issues had major advantages but required coordination and transparency and collaboration on geodetic and surveying calculations, positioning and adjustment and field assessment. Not only were technical issues in need of high quality resolution but this resolution was required from a consensus of the experts of the Parties and the UN. This was initially time consuming but allowed for robust and efficient field demarcation activities to progress once agreement was reached.

Maritime Boundary Issues

A section of this boundary proceeded from a river mouth past the Bakassi Peninsula and out to the open sea. Both parties had already agreed to the delineation of the boundary in for the inlet section from the mouth of the river. The ICJ confirmed these two earlier agreements but then fixed by coordinates the departure point for the loxodrome boundary extending seawards from the middle point of the baseline at the mouth of the inlet. The

references were all to an old British Admiralty chart which had no planimetric datum and for which there was no mathematical way of calculating a datum correction for GPS measurements. This demanded an empirical correction method involving survey measurement of fixed points on the chart and the derivation of a correction factor from a comparison of the field survey and the chart positions.

Confidence Building Features

From the establishment of the Cameroon-Nigeria Mixed Commission by the Secretary General of the United Nations and the Presidents of Cameroon and Nigeria a robust confidence building pathway for the demarcation was established which has continued to this day. The joint working of both Parties with the UN has built a high level of confidence and respect for each other. Through the joint working and resolution of problems and issues a good level of understanding and effective administration of the boundary demarcation issues has been achieved. This has included demarcation of the land boundary, delineation of the maritime boundary and the communication with and management of affected populations and resettlement. Although the collaborative boundary demarcation process is initially time consuming the tripartite cooperative approach has been a major factor in the access to member countries funding and the impressive progress in the implementation of this boundary. Initial delegations from the Mixed Commission were welcomed by the people in the border area and it was stressed that all wanted the boundary demarcated and stability and peace established. This aspiration is being steadily realised with the good progress on demarcation of this difficult and demanding international boundary. The delineation of the Maritime Boundary was approved by the Mixed Commission in 2008. This now positions both Parties well for management of their maritime territory and joint management and use of oil and other resources along this maritime boundary.

Abyei Boundary Sudan

This boundary is currently a portion of an internal boundary between north and south Sudan. However there is the potential for this boundary to become and international boundary in the near future. The North and the South have fought a 35 year war for control of Sudan and this ended in 2008 in a Peace Agreement. The agreement recognises a significant degree of autonomy for the South with an agreed division along provincial boundaries. However the boundary for the Abyei area was not finally established. There is to be a referendum for the Abyei area to determine if it aligns to the north or south. In 2011 there is also a referendum in the south to determine whether the south remains part of Sudan or it becomes a separate sovereign state. Thus, the determination of the boundary to the north of the Abyei area is critical to progress on the future effective government of Sudan.

Political Challenges

To resolve the boundary in the Abyei area the Government of Sudan (GOS) and the Peoples Liberation Army (PLA) of the South established an Abyei Boundary Commission (ABC) of experts with power to make a final decision on the location of the boundary. The terms of reference of the ABC required it to determine the extent of the Ngok Dinka people at the time of the change to the Kordofan Provincial Boundary in 1905. The boundary runs through an area containing significant oil resources. The Government of Sudan objected to the report of the ABC and sought a Tribunal hearing on the grounds that the ABC had exceeded its mandate. The Sudan Tribunal was subsequently established in 2008 with terms of reference requiring it to determine if the ABC had exceeded its mandate and only if it had to delimit the boundary of the Abyei area.

Delimitation Challenges
Although there was relevant map and field reports of the area there was little specific evidence regarding the precise location of the boundary. The Sudan Tribunal had the legal task of deciding whether the ABC had exceeded its mandate in its delimitation.

Interpretation Challenges
The wording of the terms of reference raised the issue of the extent of the Ngok Dinka people and their territory. The Ngok Dinka people were herd's people who moved seasonally with their cattle. Their territory overlapped with the Mysseria people of the north who were much more nomadic in their livelihood. The interpretation of the Ngok Dinka territory was complicated by a range of cultural, geographic and climatic factors.

Technical Challenges
The process of the Tribunal was strictly a judicial and delimitation function. The role of the surveyor was strictly limited to providing factual map information and presenting the Tribunal's findings. The demarcation yet to come will require the surveying and demarcation of lines latitude and longitude.

Confidence Building Features
The peace agreement establishing the procedure for self determination and the relevant areas for this set up a process of restoring peace and stability in Sudan. Establishing the boundary of the Abyei area is a critical part of defining the potential areas of the extent of the referendums and the areas of sovereignty of both Parties. The finding of the ABC introduced a disagreement from the GOS and interfered with implementation of the peace process. The decisions of the Sudan Tribunal in July 2009 were accepted by both the GOS and the Peoples Liberation Army (PLA) of South Sudan. The delimitation and the pending demarcation have been important milestones in the journey towards a peaceful and stable future for the people of Sudan.

DISCUSSION

The surveying role reflected in the four international boundary determinations referred to provide a reasonable sample on which to base some findings in relation to the surveying challenges of disputed international boundaries. Although the author has examined the challenges from the perspective of survey support for the Boundary Commissions in each case the surveyor's involvement is of course much wider. National surveying organisations belonging to each Party are involved throughout the long process of advising their governments and preparing successive material for the various stages and hearings of the political and judicial processes involved. As well as this surveying and cartographic experts along with many other human or physical geography experts serve the various Parties and counsel. Surveyors present crucial surveying and cartographic evidence and are highly respected by the Commissions and Tribunals irrespective of the testing advocacy environment that inevitably applies and subjects their work and evidence to the closest of scrutiny

The surveying capability of those involved in international boundaries requires the highest quality and performance. The political, judicial and technical processes and the associated constraints within which the boundary determination is taking place provide most testing of environments. The survey role and functions reflect the historic documentation used in the terms of reference the prior case history and the legal framework and instructions given for delimitation and/or demarcation. The survey role is not simply a technical one but requires a careful consideration of the role of surveying and cartographic advice and servicing in the specific political and legal environment that is applying in each individual international boundary case. The performance of the surveyor in this role is highly transparent and accountable. He/she needs to negotiate the range of expert evidence submitted and provide independent, reliable and consistent material and advice. This requires a level of insight, maturity of judgement and expertise at a higher level than that required in normal cadastral surveying. International boundaries epitomise the ultimate in the demarcation of people's administrative, social and legal rights and as such are of prime significance to relevant populations, communities, administration and governments. Survey advice and services required for the demarcation of international boundaries must be of the highest quality and reliability. This not only includes the accuracy and integrity of survey work but also the perception and integrity of the interpretation of documents and maps and how the surveyor handles and presents issues, problems and options.

The capability required of surveyors is a deep understanding of the wide gamut of surveying skills including geodetic referencing and positioning, sound cartographic understanding and interpretation, modern technological GPS and remote imaging applications as well as demarcation techniques and implementation. A broad vision of surveying is essential to accommodate the various political and judicial requirements and constraints. In short the successful demarcation and its implementation of international boundaries depends on a mature professional and comprehensive surveying and

cartographic understanding and insight as applied to the various stages involved in resolving delimitation issues and implementing demarcation.

This paper illustrates the importance of all round surveying capability and notes the importance of mature professional and technical integrity, independence, objectivity and collaboration. Surveying has historically and will continue to make an important contribution to the establishment of stable and generally accepted international borders and support confidence building, stability of administration and land use in border regions and the advancement of regional and national economic development.

REFERENCES

Cameroon-Nigeria Mixed Commission, Reports of 24 Sessions from 2002 to 2009.
Eritrea/Ethiopia Boundary Commission, "Decision on Delimitation of the Border Between Eritrea and Ethiopia", Permanent Court of Arbitration, The Hague April 2002.
International Boundaries Research Unit, "International Boundaries and Conflict Resolution", Conference Proceedings, University of Durham, 1990.
International Court of Justice, "Decision on Cameroon-Nigeria International Boundary'. The Hague, 2002.
Iraq/Kuwait Boundary Demarcation Commission, "Final Report on the Demarcation of the International Boundary between the Republic of Iraq and the State of Kuwait", United Nations May 1993.
Schofield R., "Kuwait and Iraq Historical Claims and Territorial Disputes"
Sudan Tribunal, "Final Award" Permanent Court of Arbitration" The Hague July 2009.
Tanja G.J., "The Legal Determination of International Maritime Boundaries", Kluwer, Boston, 1990.
United Nations, 'The Law of the Sea, Base Lines, National Legislation, United Nations, New York, 1989.
United Nations, "The Law of the Sea, Baselines", United Nations New York, 1989.
United Nations, "The United Nations and the Iraq-Kuwait Conflict 1990-1996", United Nations New York, 1996.

BIOGRAPHICAL NOTES

Bill Robertson ONZM,

Bill has had a long career in surveying and mapping. He served as Director General/Surveyor General of the NZ Government Department of Survey and Land Information for 9 years. Over recent years he has practiced as an independent consultant and has served as a consultant for NZAID, AusAID, World Bank, Food and Agricultural Organisation, Booze Allen Hamilton and Land Equity in land administration and management projects in Vanuatu, Zimbabwe, Pakistan, Cambodia, Philippines, China Albania, Thailand Australia and New Zealand. He has also served as a Commissioner on the Iraq/Kuwait Boundary Demarcation Commission in 1991-1993 as a Special Consultant to the Eritrea/Ethiopia Boundary Commission, 2001-2007 a Senior Consultant

to the Cameroon/Nigeria Mixed Commission, 2003-Present and as an Independent Expert for the Sudan Tribunal, 2009. He was made and Officer of the New Zealand Order of Merit in 2009 for services to Surveying.

He is a NZ Registered Professional surveyor and Fellow of the NZ Institute of Surveyors and a Fellow of the NZ Planning Institute of which he is a Past President. He is also a Past President of the Commonwealth Association of Planners. He is a foundation member of the Surveying and Spatial Sciences Institute of Australia and an Eminent Person of AURISA. He is an Honorary Fellow Otago University and holds a Diploma in Town Planning (Auckland) Master of Public Policy (Victoria) and Honorary Doctorate in Surveying (Melbourne). He is a past Chairman of NZ Aerial Mapping, Aspect North Lismore, NSW, and has been Chairman of Terralink International Limited since 2001.

CONTACTS

W.A. Robertson
Bill Robertson and Associates,
3 Eskdale Road,
Papakowhai,
Porirua 5024,
New Zealand
Telephone 64 4 233 1768
Fax 64 4 233 1762
E-mail billrobertson@xtra.co.nz