

# Field Techniques: GIS, GPS and Remote Sensing

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Published by Geography Outdoors  
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London SW7 2AR

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Website [www.rgs.org/go](http://www.rgs.org/go)

November 2005

ISBN **978-0-907649-88-5**

*Cover illustration: Where the barren sands of the Western Sahara meet the fertile floodplain of the Senegal River: the Mauritania-Senegal border zone, West Africa. This image was produced from Landsat Thematic Mapper imagery, using ER Mapper image processing software and a laptop computer. The image was produced in Mauritania, as part of a programme of natural resource mapping, technology transfer and training, funded by the Japanese International Cooperation Agency.*

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Having studied combined geology and astronomy at university, Martin turned these skills to remote sensing. Using satellite data he was involved in diamond / jade mineral exploration along the front of the Kunlun Shan and co-organised an expedition to Bogda Shan, Xinjiang, China. After returning from China he completed a DIC at Imperial College London. Subsequently he has led mapping projects in the Sierra Nevada and the Sorbas Basin testing the benefits of declassified US military data for geomorphological analysis. His current research interests include GPS techniques, image interpretation and photogrammetry. Martin has used GIS for many years and is a contributor to various EAC mapping unit activities and became a fellow of the RGS-IBG in 2003. Martin currently works for a major mining company and is studying a PhD at University College London.

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Currently an IT Engineer in South London, Dan trained as a geologist at Imperial College in the early 1990's and followed this up with a Remote Sensing MSc from University College London in 1996. He then worked in exploration geology in the deserts of South Australia for several months as well as building numerous GIS projects for a mining company in Perth, Western Australia. After travelling New Zealand and Australia Dan rejoined the remote sensing department of Imperial College and became involved in the Bogda Shan expedition to Xinjiang, China with Martin Whiteside.

# Preface

For many years now Geography Outdoors have run an autumn training weekend for people planning fieldwork and exploration projects. The authors of this handbook first met at these training weekends in the early 1990s, where they were making presentations on the uses of Geographical Information Systems (GIS), the Global Positioning System (GPS) and remote sensing – collectively known as Geographical Information Sciences (GISci). By the mid-1990s we realised that our collective experience could be developed into a manual for GISci usage in fieldwork. It has taken a decade to go from ideas developed in the aftermath of a training weekend (over a few beers in the Student Union bar of Imperial College), to the first edition of this handbook. That delay has nothing to do with too much beer, and everything to do with this project being carried out on a voluntary basis, amongst the many demands of full-time jobs.

Every year we hold a question-and-answers session at the RGS-IBG *Explore* training weekend. A brief review of the types of question that dominated over the past decade shows how rapidly the capabilities of geospatial technologies have changed. In the early 1990s, most of the questions were on GIS applications: GPS and remote sensing were of minor interest, due to their high costs and limited detail. By 2000 all that had changed: GPS accuracies had increased from +/- 100 m to +/-10 m and most of the interest was in GPS applications for navigation and mapping. Five years on, with low-cost or free satellite images and 3-D elevation models of the earth readily available over the Internet - plus computers getting more powerful, yet cheaper – the main interest is in how remote sensing can help exploration projects. Ironically, today, the main limitation on the more widespread use of geospatial technologies in exploration fieldwork is the relatively high cost of GIS software.

This handbook is designed to help explorers with their exploring; particularly the bits where you have to (delete as appropriate): decide on what you are going to survey, work out where you are, figure out where the feature to be surveyed is (and how to get there); sample and produce maps of said feature.

We welcome your comments and suggestions on how to improve the manual. As scientists with geological, geomorphological and ecological backgrounds, we are well aware of the lack of socio-economic and anthropological coverage in the handbook: we are keen to see more examples and case studies from those sectors of exploration – indeed, if there is anyone out there who would like to contribute a chapter on such applications for the next edition, please contact us.

Should you have any questions about GISci applications in exploration fieldwork that are not answered by this manual, please contact the RGS-IBG Geography Outdoors ([www.rgs.org/go](http://www.rgs.org/go)) – even if they cannot provide an answer to your question, they will probably be able to put you in touch with someone who can.

Finally, a big THANK YOU to all the people who have offered advice and examples over the years. Without the constant support and encouragement of Mrs Shane Winsor, the Expeditions Advisory Centre manager, this handbook would have remained as no more than a set of chapter headings on beer-stained notepaper. Many assistants in Geography

Outdoors have helped with earlier drafts, Christine Eriksen doing an excellent job formatting this edition. Professor Jonathan Raper (Information Science Department, City University, London) was very involved with the early stages of this manual and provided useful material for the GIS and surveying chapters. The later stages of the manual benefited greatly from the inputs of Dan Hourigan, who provided useful inputs on data sources, ancillary equipment and software, as well as Dr Nick Mount (Geography Department, Birkbeck College, London), who produced the 'virtual reality' conquest of Everest case study. Thanks also to Dr Steve Drury (Earth Sciences, the Open University), Dr Hazel Faulkner (Flood Hazard Research Centre, Middlesex University) and Dr Tim Stott (Geography Department, Liverpool John Moores University), for their helpful comments on an earlier draft of this handbook. Last, but not least, thanks to ESRI UK for generously providing sponsorship to help us include the colour illustrations at the centre of this handbook.

All feedback on this manual is most welcome: please email the RGS-IBG Mapping Unit with your comments ([go@rgs.org](mailto:go@rgs.org)). Particularly welcome are further references for the Bibliography, on GIS, remote sensing or GPS applications in fieldwork-based projects; two to three page illustrated case studies, for possible inclusion in future editions; and weblinks to useful internet sites.

Good luck with your endeavours!

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## **Figures and Plates**

The nature of Geographical Information Sciences requires the use of colour images. To help the reader visualise many of the concepts discussed, within, important colour images from the chapters have been moved into two sections of colour plates.

- The first section of colour plates (Plate 1 to Plate 20) can be found between pages 207 and 218.
- The second section of colour plates (Plate 21 to Plate 32) can be found between pages 322 and 328.

## **About GISci Acronyms & Terminology**

A common problem for novice GISci expeditioners consulting a textbook such as this one, is the ever present and growing use of acronyms. Hopefully each section of this manual should ease the user into the subject matter with clearly defined terms, however, if the reader encounters a term that has not been defined adequately we have included a brief acronym list / glossary at the rear of the manual. Obviously if after consulting this list the reader is still unable to find the required definition then they are welcome to refer to the RGS-IBG Expedition Advisory Centre. The EAC will then be able to direct the reader to an appropriate specialist who can offer further help. Also if a reader believes there is a problem with the manual or if terms are not well enough explained then they are welcome to contact the EAC and hopefully we can address the omission in a later edition of this manual.