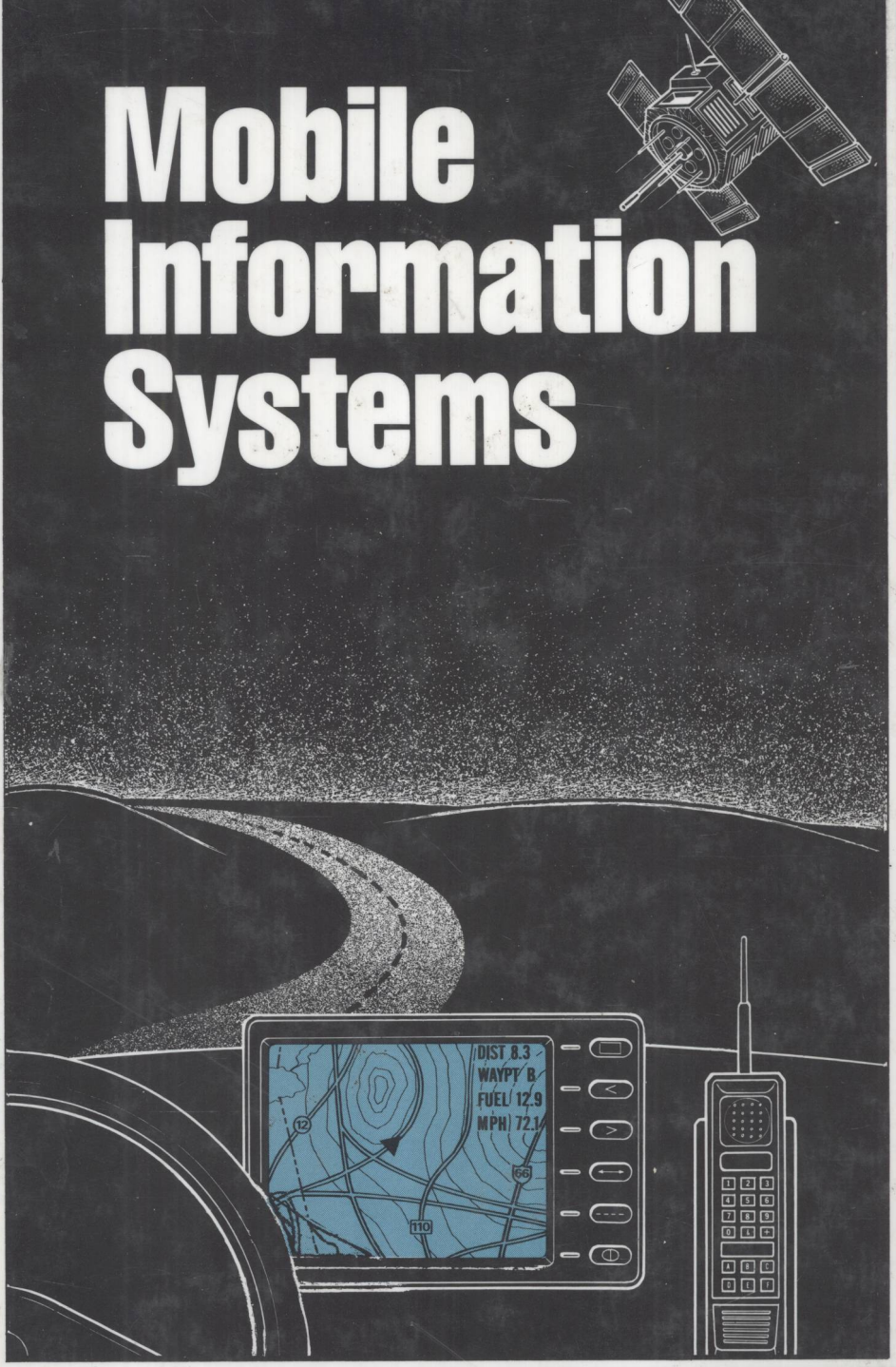
Mobile Information Systems



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JOHN WALKER

Editor

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MOBILE INFORMATION SYSTEMS

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Preface

Mobile information systems have been my major professional preoccupation since the early 1980s—because of Racal's involvement in cellular radio, *private mobile radio* (PMR), and radiopaging, and particularly because of my own involvement in the Mobile Information Systems Demonstrator project (which is partly funded by the Information Engineering Directorate of the UK Department of Trade and Industry).

The subject is diverse, and it is advancing and expanding at a remarkable rate, driven by developments in information technology, by increases in personal mobility (i.e., more people have cars), and by the willingness of governments and regulatory authorities to make more of the radio spectrum available for mobile applications. However, the radio spectrum is a very scarce and valuable resource, and we know that, unlike oil or minerals, there are no large deposits lying on or under the seabed waiting to be discovered (although perhaps an analogous process is occurring in that higher and higher frequencies are being brought into service, or proposed for new services, in order to relieve the congestion lower down in the spectrum).

There is a correspondence between spectrum congestion and road transport congestion in that the more traffic you permit—by opening roads or opening frequency bands—the more traffic you stimulate, so the congestion, in practice, is not alleviated. This is because there is a great deal of suppressed demand. We also do not generally realize how important the road transport sector is to the economy. The UK road transport industry is a $50 billion per year business, and 10 to 15% of the cost of any article you buy can be attributed to the cost of its transportation. We expect that similar figures apply throughout the developed world.

Congestion is bad news! So is the increased pollution from exhaust fumes and the increased costs and wasted time that result. So, too, are the increases in road accidents that occur because there is more traffic. The good news is that information technology and mobile communication can help (as they are doing) to alleviate some of these problems.

All these issues are considered in more detail throughout the book, which is aimed primarily at technical management as well as the professional engineer who

is new to the field and wants an up-to-date overview before plunging into the details. (To aid in this process, most chapters have a list of references and further reading.) We hope that the book will also be useful to the nontechnical executive who needs to know some of the technical background in the important and expanding field of *road transport informatics* (RTI), and to the layperson who is just interested.

Acknowledgements

The Racal authors are grateful to Racal Electronics PLC, and in particular to Mr. G.J. Lomer for permission to publish the book. However, the opinions expressed in Chapters 1, 3, 4, 8, and 11 are the personal views of the authors, and do not necessarily represent positions of Racal. We want to thank our colleagues within Racal who have helped in the book's compilation in various ways, by making diagrams and papers available, and by commenting on manuscripts: Terry Barwick, Ted Beddoes, Peter Blair, Tim Burnett, Alan Cox, Chris Gent, Nigel Morgan, Peter Munday, Jon Noble, Dave Targett, and Keith Thrower. In addition, we are grateful to Steve Hannigan, Val Herring, and Leela Damodaran of the HUSAT Research Centre at Loughborough University for the material on which is based the table on cellular data applications in Chapter 3.

I also want to thank the Society of Automotive Engineers and the Philips organization for permission to base Chapter 8 on papers published in their journals, and Mr. Aylot, Derek Wilsdon, and M.F. Zuurveen of Philips, who helped with other aspects of that chapter. Ron Tridgell (Chapter 2) wrote Appendix C and most of Appendix B.

I am grateful to all my colleagues within the Mobile Information Systems Alvey Demonstrator project, and to the UK Department of Trade and Industry's Alvey Directorate and its successor, the Information Engineering Directorate, for their indirect contributions to the book.

Finally, the book would have been impossible without the support, encouragement, and forbearance of my family; to Liz, Christopher, Nicola, and Stephanie, thank you.

JOHN WALKER
READING, BERKSHIRE, UK
AUGUST 1989

The Authors

P.D. Britten graduated in 1974 with an honors degree in electronic engineering from Surrey University. From 1974 to 1977 he worked for Decca Navigator Ltd. on the development of electronic navigation equipment. He earned an M.Sc. in cybernetics from University of London in 1978. From 1977 to 1984 he worked for Sira Ltd. on satellite payload development. He joined Racal Decca Advanced Development (now combined with Racal Research Ltd.) in 1984, and is now responsible for the aeronautical satellite communication and satellite navigation developmental activities in that company.

Ian Catling formed the Ian Catling Consultancy (ICC) in 1983, having previously worked in government and for a systems house, particularly on real-time and traffic-related systems. Under his direction, ICC has become established as a specialized consultancy in the application of information technology to road transport. He was responsible for the system design and software development of the Hong Kong Electronic Road Pricing pilot project, and ICC subsequently became the UK Department of Transport's consultant on Autoguide, coordinating the implementation of the London Autoguide Demonstration Scheme. He played an active role in the definition of the DRIVE workplan, and ICC became the prime contractor for two DRIVE projects, concerned with the development of the Integrated Road Transport Environment. Mr. Catling has also been active throughout the PROMETHEUS project, and is the deputy international coordinator of the PRO-GEN subprogram. He has acted as specialist adviser to the Dutch and Swedish governments on the implementation of road-based advanced technology systems, and is active in similar developments in the US.

S.R. Ely graduated with first class honors from the University of Liverpool in 1972 and remained there to work for his doctorate on error statistics and error control in high-speed data communication. He joined BBC Research Department at Kingswood Warren in 1975, and worked in the Carrier Systems Section on the development of the radio-data system now known as RDS. He was responsible for the development and execution of the mobile measuring techniques and statistical analysis used by

the EBU in the field tests of 1980 and 1982, which led to the design and optimization of RDS. He was one of the principal authors of the EBU's RDS specification document. He is currently Head of the Carrier Systems Section at BBC Research Department and Chairman of EBU Specialist Group (R/RDS), which has responsibility for further technical development of the RDS system. He is UK representative on CENELEC TC107, which is preparing a European standard for RDS. Dr. Ely is a chartered engineer, a member of the Institution of Electrical Engineers (IEE), and a member of Professional Group E14 (Television and Sound) of the IEE.

Brian Gardner earned a second class honors degree in physics from Oxford University in 1969. Since then he has worked for several companies in the Racal Electronics Group, concentrating mainly on the field of communication. His early experience was in the design of an HF radio, which won him a Queen's award for technology. Subsequent work centered mainly on military topics involving the design and development of surveillance and direction-finding equipment; systems for electronic countermeasures and counter-countermeasures; and secure, survivable communication networks. Since 1986 he has been a Technical Manager at Racal Research Ltd., working on many aspects of civil communication, such as cordless telephones and the forthcoming pan-European cellular radio system. Mr. Gardner holds numerous patents, ranging over all the fields in which he has worked.

K.W. Huddart graduated in physics and was trained as an electrical engineer with Reyrolle, a switchgear firm, and subsequently worked on power transmission for the Central Electricity Generating Board. He joined the Greater London Council in 1966 specifically to install traffic control systems, including area traffic control. By 1986, as Chief Traffic Engineer, he was responsible for design, maintenance, and operation of most of London's 2200 traffic signals and their supporting computer systems. He was also responsible for all specialist traffic engineering, including bus priority, cycling schemes, road safety, and traffic order-making. During this time, he also worked as a consultant for the World Bank, specifying and reviewing traffic management projects, mainly in the Far East, including the traffic signal systems of Manila, Bangkok, and Calcutta. He reviewed Australian traffic signaling for the Australian Research Board. More recently, Mr. Huddart has specified traffic signaling for a new light rail system in Hong Kong, reviewed and introduced novel schemes for improving traffic flow of two major tunnels in Hong Kong, and devised an alternative system of direction signing for London. He was involved in managing the DRIVE project for the Commission of the European Community.

D.J. Jeffery joined the UK government's Transport and Road Research Laboratory (TRRL) in 1962, and was sponsored by them to work for his B.Sc. in physics and technology of electronics at the Polytechnic of North London. After graduating, he returned to join the Drivers Aids and Abilities Division, where he worked on a range of research topics, including fog detection, driving simulators, and the development of systems and instrumentation for driver's aids. In 1976 he became head of the

Driver Information Systems Section in the Highway Traffic Division of TRRL, where he led a team investigating the potential of the Information Technologies for developing improved traffic control systems, and in particular for providing dynamic information and guidance advice for drivers. His work culminated in 1988 with proposals for AUTOGUIDE, an electronic system of in-vehicle route guidance in London, and RDS-TMC, a pan-European system for broadcasting traffic information. He then spent six months in Brussels helping to launch the EEC's DRIVE program before returning to TRRL at the beginning of 1989 to become head of the Vehicle Safety Division. He is a member of the IEE and serves on Professional Group C12 for Transport Electronics and Control. He has been a member or chairman of several international committees set up by the OECD and the EEC to coordinate international work on driver information and guidance systems. Mr. Jeffery is the author of numerous papers on the subject.

J.G. Schoenenberger graduated in 1977 with an honors degree in electronic engineering from University College London. From 1977 to 1982 he carried out bistatic radar research at University College London, having gained his Ph.D. in 1981. He joined Racal-Decca in 1982, working on side-looking airborne radar, HF radar, and military satellite communication. Dr. Schoenenberger joined Racal Avionics in 1986, with responsibility for the commercial aeronautical satellite communication products development in that company, including data, voice, and voice plus data equipment and associated antennas. He joined PA Consulting Group in 1989, with responsibility for business development in the aerospace sector.

M.L.G. Thoone graduated in 1978 with a degree in electrical engineering from the Eindhoven University of Technology, the Netherlands. After military service in the Dutch Royal Navy he joined Philips Research Laboratories in Eindhoven where, in 1984, he was named leader of the CARIN project, a research and development project coordinated jointly by Philips Research Labs and their Product Division Consumer Electronics. Since September 1989, Mr. Thoone has been the manager of the Philips pre-development activities on Car Information Systems in Wetzlar, West Germany.

R.H. Tridgell joined the British Post Office Research Station in 1942. Projects included protection of cables against induced voltages, telegraphs, and automatic character recognition. In 1963, he moved to BPO headquarters to lead engineering development of telegraphic ARQ and data transmission, in which position he led the UK delegation to CCITT on data transmission during the period when many of the early CCITT V-Series Recommendations were drafted. From 1973, he led the Post Office (later British Telecom) engineering development of mobile services. This included implementation of the BPO national radiopaging system, and a radiophone system. While in that position, he instituted the Post Office Code Standardization Advisory Group, and attended CCIR as a UK expert in radiopaging. He retired from BT in 1984, and currently chairs a committee drafting the UK standards for private

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mobile radio trunked systems. Mr. Tridgell gained a degree in electrical engineering in 1949, and is a member of IEE.

John Walker has a first degree in physics from Oxford University, an M.Sc. in applied solid state physics from Brighton Polytechnic, and a Ph.D. in solid state physics from Reading University. He spent 18 months as a Royal Society European Programme Research Fellow with the Solid State Physics Group of the Ecole Normale Superieure, at the University of Paris VII. His industrial experience includes three years at GEC-Marconi in the 1960s, as well as a period in technology consultancy and microprocessor training. Since 1980, he has been a Technical Manager with Racal Research Ltd, the research company of the Racal Electronics Group, working on various projects, including the early phases of cellular radio in the UK. In 1983, he was the joint proposer, and subsequently the Project Manager, of a project titled "Mobile Information Systems," which is partly funded by the UK Department of Trade and Industry under its Alvey Programme. He is also the manager of a new project to apply artificial intelligence and natural language understanding techniques to the field of traffic information broadcasting. Dr. Walker has published numerous technical papers. This is his second book.

M.H. Westbrook is Manager of the Technological Research Department of Ford of Europe. He is a graduate in electrical and electronic engineering from the University of Southampton, where he is now a Visiting Professor in the Department of Mechanical Engineering. Mr. Westbrook is a Fellow of the IEE, IMechE and Institute of Physics, a Past Chairman of the IEE Computing and Control Division, and was Chairman of the Organizing Committee of the IEE/IMechE International Automotive Electronics Conference in 1976, 1979 and 1987.

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